

ADDENDUM NO. 1

DATE: *September 30, 2025*

TO: *All Bidders*

FROM: *David H. Melvin, P.E.*

PROJECT NAME: *Marianna Emergency Shelter & Multi-Purpose Facility*

PROJECT NUMBER: *FLORIDA COMMERCE: CDBG MT137 & CV #H2492*
DHM PROJECT NUMBER: MAR22ME

BID DATE: Thursday, *October 23, 2025, by 2:00 PM CT (NO CHANGE)*

Please note the following clarifications, corrections, or supplemental information in regard to the above project:

1. This Addendum is posted on the OneDrive link under Addendum & RFIs > Addendum #1. The OneDrive link is the original link containing the Plans & Specifications. If you do not have the link, please request the link from martivickery@melvineng.com.
2. RFI are listed on the OneDrive link and are constantly updated.
3. Request for approval of product substitution will also be posted on the site.
4. This is a Threshold building and the owner will hire and pay for Threshold Building Inspector. The Contractor shall include in their bid, arranging and paying for ALL material testing required.
5. Division 2 Civil Specifications are posted on the OneDrive link and attached.
6. Specification for Vibro Replacement Stone Column is posted on the OneDrive link and attached.
7. The Geotechnical Report is posted on the OneDrive link and attached.

8. Revised sheets C4 and C4.1 are posted on the OneDrive link and attached.
9. Bid Item "A6" Page 00410-2 will be deleted. This item is a duplicate of Bid Item "B16"
Parking Lot Lighting.
10. Donofro Architectural Addendum information attached.
11. The AutoCAD for site work is posted on the website for use in providing earthwork quantities.

Attachments:

1. Donofro Architectural Addendum
2. Division 2 Civil Specifications
3. Vibro Replacement Stone Column Specifications
4. Geotechnical Report
5. Revised Sheets C4 and C4.1

**MARIANNA EMERGENCY SHELTER -
MULTI-PURPOSE FACILITY AT THE M.E.R.E.**

BID DATE: October 23, 2025
BID TIME: 2:00 p.m. Central Time

The attention of all Bidders is directed to the following changes in the Drawings and Specifications, which amend and become part of them. It is requested that this Addendum be attached to the Specifications.

Item 1: Addendum	Drawings, Sheet A-2.1, Enlarged Partial Floor Plan Concession Room 102, Refer to Call out that reads: Freezer - See specs food service item A CHANGE to read: Refrigerator - See specs food service item A
Item 2: Addendum	Drawings, Sheet A-2.2, Interior Elevation 10/A-2.2 Refer to Call for Freezer CHANGE to read: Refrigerator.
Item 3: Addendum	Drawings, Sheet A-3.0 and A-3.1, Exterior Elevations, Refer to Call out that reads: Prefinished 16" wide metal wall panels. CHANGE to read: Prefinished 12" wide metal wall panels.
Item 4: Addendum	Drawings, Sheet A-4.0, Roof Plan Refer to Roof Plan Indication Symbol over Main Gym Roof CHANGE ¼ in 12 TO ½+/- in 12
Item 5: Addendum	Specifications, Section 7B, Membrane Roofing, Subsection 7B-23, Warranties, Paragraph A, Manufacturer's Warranty ADD: In addition to the 20-year no dollar limit system warranty, the manufacturer shall also provide a 120-mph wind speed warranty as part of the 20-year no dollar limit manufacturer's warranty.
Item 6: Addendum	Specifications, Section 8A, Glass, Glazing, Aluminum Windows, and Curtain Wall, Subsection 8A-10, Glazed Aluminum Curtain Wall, Subsubsection B, Products, paragraph 5(v) Accessory Materials ADD the following sub sub paragraph (c) Versoleil™ SunShade – Outrigger/Single Blade System: An aluminum sunshade (consisting of outriggers, louvers, and fascia which may be selected from standard configurations, modified configurations, or customized) that is anchored directly to the vertical curtain wall mullions. Outriggers shall be painted (Select from Kawneer's standard paints and colors.). Louvers and fascia shall be painted or anodized (Select from Kawneer's standard paints and colors or Kawneer's anodized finishes).

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Item 7: Addendum	Specifications, Section 9C, Gymnasium Wood Flooring System, Subsection 9C-06, Volleyball inserts CHANGE to Read: Provide and install new 3.5" floating floor socket with high strength brass floor plate as manufactured by Volleyball USA, and at locations as noted on the drawings. The cover plate shall be premium quality 8" outside diameter with 6" inside diameter with ¼" thickness made of solid cast brass. The hinged floor plate shall have a 1" wide hinge. Set top plate so finish with top of hardwood playing floor. Provide 1 year warranty. The volleyball pole standard mounting sleeve shall be 12" deep x 3 ½" diameter made of seamless anodized aluminum with powder coated finish for two layers of rust protection.
Item 8: Addendum	Specifications, Section 10A, Miscellaneous Specialties, Subsection 10A-05, Aluminum Letters, Paragraph A, Second sentence CHANGE to Read: Letters should be 8" high, cast aluminum Helvetica Medium No. 521, all upper case as noted below: Paragraph B, CHANGE to Read: Letters shall read and be located as follows: Wall mounted above entrance from lobby to vestibule 103 – "MEN" Wall mounted above entrance from lobby to vestibule 104 "WOMEN" Wall mounted above at north wall of foyer 122, west of EWC – "WOMEN" Wall mounted above at north wall of foyer 122, east of EWC – "MEN" Wall mounted above at east wall of vestibule 129, north of door 126 – "WOMEN" Wall mounted above at east wall of vestibule 129, south of door 127 – "MEN" Wall mounted above at north wall gymnasium above entrance to locker room 125 – "LOCKER ROOM D" Wall mounted above at north wall gymnasium above entrance to locker room 121 – "LOCKER ROOM C" Wall mounted above at north wall gymnasium above entrance to foyer 118 – "LOCKER ROOM A/B"
Item 9: Addendum	Specifications, Section 10A, Miscellaneous Specialties, Subsection 10A-19, Concession Appliances, Item A (2 required), GE Series 31.8 cu. ft. counter depth side x side refrigerator: CHANGE 31.8 cu. ft TO 21.8 cu. ft
Item 10: Addendum	Specifications, Section 11C, Gymnasium Equipment ADD the following subsection 11C-07 – Roll-up Gymnasium Divider Curtain

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11C-07. GYMNASIUM ROLL UP DIVIDERS:

1.1 SUMMARY

- A. Section includes: Electrically operated fabric gymnasium divider.

1.2 SUBMITTALS

- A. Submit in accordance with Section 00 20 00 – Instructions to Bidders:
1. List of proposed products and product data.
 2. Loads to be transmitted to building structural members and requirements for supplementary bracing and structural support members.
 3. Shop drawings showing layout, elevations, dimensions, fabrication details, method of attachment and electrical wiring diagrams.
 4. Manufacturer must provide calculations and reports for tests performed by an independent testing laboratory accredited by the American Association of Laboratory Accreditation (A2LA) that clearly demonstrate compliance with minimum safety factors included in product specifications.
 5. Certificates for Divider Curtain Vinyl and Mesh to prove they meet the requirements of GreenGuard Gold.
 6. Samples of fabric [for selection by Architect].
 7. Manufacturer's installation and maintenance instructions.

1.3 QUALITY ASSURANCE

- A. Source limitation: All components including curtain, suspension system, electric winches, and controls for divider shall be products of a single manufacturer.
- B. All welding to be performed by personnel having passed Welder Qualification testing in accordance with American Welding Society (AWS) code D1.1 or higher. Manufacturer to provide certification and test results upon request.

1.4 DELIVERY, STORAGE, AND HANDLING

- A. Do not deliver divider until building is enclosed and other construction within gymnasium is substantially complete.

PARTS 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Draper®, Inc., 411 South Pearl Street, Spiceland, Indiana 47385-0425; 765-987-7999.
- B. Manufacturers of equivalent products submitted and approved in accordance with Section 00 43 25 - Substitution Request Form.

2.2 GYMNASIUM DIVIDER

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- A. Type: Electrically operated, roll-up gymnasium divider including motor, belts, controls, clamps for attachment to building structure, threaded rod supports, and other components required for complete functional installation; Roll-Up Gym Divider as manufactured by Draper, Inc.
- B. Operation: Curtain rolled up and down by belts wound onto overhead rotating drive pipe operated by electrical motor.
- C. Configuration: Rectangular shape with straight bottom and extending across room as indicated on Drawings.
 - 1. Maximum dimension of stored divider: [2 feet] from bottom of structural support to bottom of rolled curtain.
 - 2. Minimum required clearance between vertical curtain edges and adjacent fixed objects: [6 inches] .
 - 3. Provide [36 inches] space between curtain ends and walls or fixed objects to allow passage space around divider.
- D. Operating mechanism: Drive pipe winch powered with 3/4 HP, 110VAC, 60-cycle, single-phase, reversible capacitor, C-Face motor with thermal overload protection. Winch assembly shall carry a five-year warranty. Provide with load holding worm gear reduction and integral limit switches to control curtain travel. Drive pipe shall rotate in pipe support assemblies spaced at approximately [9 feet] [2.7 m].
- E. Attachment: Attach to structural support with beam clamps, hanger brackets, and [1/2 inch] [13 mm] diameter threaded rods. Attachment clamps designed to be capable of supporting a minimum of 5,000 lbs. each and provided in sufficient number to provide a combined minimum 45:1 attachment point safety factor.
- F. Hoist belts: [5 inches] [127 mm] wide white polyester webbing attached to drive pipe, passing under bottom batten, and terminating at top batten. Space belts at approximately [15 feet] [4.6 m].
- G. Bottom roller: [4 inches] [102 mm] diameter steel pipe with aluminum strip for attachment of curtain.

2.3 CURTAIN

- A. Bottom [8 feet]: Opaque solid vinyl coated polyester fabric:
 - 1. Weight: [18] ounces per SY.
 - 2. Resistant to rot, mildew, and ultraviolet light.
 - 3. Flammability: Rated self-extinguishing in accordance with California State Fire Marshall Title 19.
 - 4. Color: [White] [Red] [Yellow] [Dark blue] [Marine blue] [Beige] [Grey] [Black] [Forest

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green] [Orange] [Maroon] [Selected by Architect from manufacturer's standard range.]

- B. Upper curtain section: Vinyl coated polyester mesh.
 - 1. Weight: 9 ounces per SY.
 - 2. Resistant to rot, mildew, and ultraviolet light.
 - 3. Flammability: Rated self-extinguishing in accordance with California State Fire Marshall Title 19.
 - 4. Color: [White] [Red] [Yellow] [Blue] [Grey] [Black] [Selected by Architect from manufacturer's standard range.]
- C. VOC Emission: Divider Curtain Vinyl and Mesh to be low emitting and certified to meet all of the requirements of the GREENGUARD Gold certification program. GREENGUARD Gold requires emissions of total volatile organic compounds $\leq 0.22 \text{ mg/m}^3$, formaldehyde $\leq 0.0135 \text{ ppm}$, total aldehydes $\leq 0.043 \text{ ppm}$, individual volatile organic compounds $\leq 1/1000 \text{ TLV}$ and $\leq \frac{1}{2}$ chronic REL and total phthalates $\leq 0.01 \text{ mg/m}^3$. Vinyl and Mesh must be evaluated to indoor air quality evaluation (IAQ) using a GREENGUARD product evaluation protocol following the requirements of The GREENGUARD Product Certification Program, ASTM Standard D5116 and the United States Environmental Protection Agency and modeled based on GEI requirements for a standard gymnasium loading and ASHRAE 62.1 – 2004 ventilation conditions. Manufacturer to provide certificate and/or test results upon request.
- D. Seams: [Horizontal] and electronically welded with [1 inch] [25 mm] full contact weld.
- E. Outer edge hems: Turned with double welds.
- F. Top edge: Solid fabric in triple thickness and double welded to [mesh] [solid curtain fabric] to form [6 inches] [152 mm] wide pocket for top pipe batten.
- G. Bottom edge cut square for attachment to roller pipe with aluminum stop strip.

2.4 CURTAIN SAFETY DEVICE

- A. Provide Draper Model 504321 Curtain Lok safety device. Curtain Lok to be directly speed sensitive to automatically lock divider curtain in position at any time during storage or operation. In the event of an over-speed situation (greater than [1.5 feet] [45.7 cm] per second) caused by malfunction of the hoisting apparatus, whether sudden or gradual, device will immediately activate.

2.5 CONTROLS

- A. Provide key lock, 3-position, momentary contact wall control switch to lower, raise, and stop gymnasium divider. Provide with switch box and plastic cover plate.
- B. User Interface: Draper Model No. 503357 EZ-Pad 3.0 Color Touch Screen
 - 1. Size: 7" dia. touch screen with trim ring.
 - 2. Communications: Ethernet communications requiring CAT-5e or better cable – by electrician. Touch screen must be within 300' of a relay box.

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3. Input Power: Power over ethernet supplied by relay enclosure.
4. Mounting: Flush Mounted to standard 5-5/8" x 4-1/2" x 2-1/2" electrical box (RACO Box #942 or equivalent)
- C. Relays: Draper Model No. 503358 EZ-Pad 3.0 Realy Box
 1. Enclosure: Surface mounted 16" x 12" x 4" hinged steel box.
 2. Configuration: Each Relay Box includes two banks of relays. Each bank includes sufficient relays to operate four directional devices from input voltage and one on/off auxiliary device with an outside power source.
 3. Input Power: Each Relay Box receives 2 (one for each bank of relays) dedicated 30-Amp Circuits.
 4. UL Listing: Relay enclosure is listed as a complete assembly as meeting requirements of UL Standard 66010-2-201-Standard for Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use.
- D. Password Protection: Control system is protected by multi-level password protection
 1. User password only allows someone to operate devices individually or groups as defined in system programming.
 2. Administrator password allows same function as user password plus allows initial set up and other program modifications. Administrator password also allows user to name connected devices, name relay boxes, define and name groups, define timeout period and change passwords.
 3. System includes a hard coded backdoor password that is available from manufacturer to use should other passwords be lost or forgotten.
 4. Touch Screen automatically returns to inactive mode if inactive for more than the user defined timeout period.
- E. Networking:
 1. Relay Boxes can be combined in unlimited quantities to operate as many devices as may be required.
 2. Each Relay box can operate up to two touch screens
 3. All communications over ethernet connections using CAT-5e or better cable.
 4. Relay boxes must be within 300 feet of another relay box and touch screens must be within 300 feet of relay box to which it is connected
- F. Programming:
 1. All programming can be done from touch screen or from realy box interface
 2. All programming is soft coded, there are any dip switches to address devices to be set during system set up.
 3. System allows for creation of up to 64 unique and namable groups.
 4. System will allow groups of up to 8 devices to run simultaneously. System includes logic that prevents the creation of groups that might overload input circuits. To do this it will allow no more than two devices connected to any relay bank and a maximum of 4 devices in the same relay box. To have groups of 8 devices, two or more relay boxes are required.
- G. Emergency Operation: System allows for devices or groups to be operated from relay panel if touch screen(s) were to become disabled. Devices are operated following instructions on LED screen and push buttons located on relay box control boards. User defined password(s) are required to operate devices from relay panels.
- H. ELECTRICAL CONTRACTOR SHALL PROVIDE AND INSTALL: All conduits, wires (including low voltage), touch pad mounting box and programming.

3.1 PREPARATION

- A. Coordinate support of gymnasium divider with roof structure to ensure proper distribution of loads and adequacy of attachment points. Ensure that building structure has been designed

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for loads of specific gymnasium divider to be provided. Provide additional structural framing members as required in accordance with

- B. Coordinate configuration, size, and installation of gymnasium divider with height, slope, and type of building structure and lighting fixtures, mechanical equipment, ductwork, fire-suppression system, bleachers, athletic equipment, and other potential obstructions.
- C. Field verify dimensions prior to fabrication.
- D. Coordinate electrical requirements for motorized operating mechanism to ensure proper power source, conduit, wiring, and boxes for keyed switches. Prior to installation, verify type and location of power supply.
- E. For installations made after wood gymnasium flooring is installed, provide protection and exercise care not to damage flooring.

3.2 INSTALLATION

- A. Install in accordance with manufacturer's written instructions and shop drawings.
- B. Install even and level with curtain hanging [2 inches] above floor in down position.
- C. Install control switch such that operator has view of complete gymnasium divider during lowering and raising.
- D. Adjust limit switches of electric winch to ensure accurate position in both stored and lowered positions.

3.3 TESTING AND DEMONSTRATION

- A. Operate divider curtains to ensure proper lifting and lowering. Adjust as required to ensure smooth operation and accurate positioning.
- B. Demonstrate to Owner's designated representatives' complete operation and required maintenance.

END OF ADDENDUM

SECTION 02100

SITE PREPARATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section covers clearing, grubbing, and stripping within the construction sites, complete as specified herein.
- B. The Contractor shall clear and grub all of the area within the limits of construction as required to complete the Work.
- C. The Contractor's attention is directed to any soil erosion and sediment control ordinances in force. The Contract shall comply with all applicable sections of these ordinances.

1.02 MEASUREMENT AND PAYMENT

- A. No separate pay item is provided for Site Preparation, thus the cost will be included in the Total Bid price for this contract.

PART 2 – PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CLEARING

- A. The surface of the ground, for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish, and all other objectionable obstructions resting on or protruding through the surface of the ground. Where construction necessitates the removal of trees, the Contractor shall obtain all required permits. Removal of trees shall be only as directed by the Engineer. Clearing operations shall be conducted so as to prevent damage to existing structures and installations, and to those under construction, and so as to provide for the safety of employees and others.
- B. As determined by the Engineer, where excavation, tree removal, stripping or trimming may result in damage to existing trees, shrubs or bushes, the Contractor shall employ a licensed tree surgeon/service to oversee the work and provide protection of the trees.

3.02 GRUBBING

- A. Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes which are resting on, under or protruding through the surface of the ground; removal shall be to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for or by the removal of such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

3.03 STRIPPING

- A. Topsoil shall be stockpiled on site as directed by the Engineer. Stockpiled topsoil shall be protected until it is placed as specified. Any topsoil remaining after all work is in place shall be disposed of off site by the Contractor, unless otherwise directed by the Engineer.

3.04 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

- A. The Contractor shall 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 at no additional cost to the Owner.
- B. Burning of combustible materials removed by clearing and grubbing operations will be allowed providing the Contractor obtains such permits and approvals required by local authorities. The Contractor will be responsible for controlling fires in compliance with all Federal, State, and Local laws and regulations. The securing of necessary burning permits shall be the responsibility of the Contractor. All burning is subject to the permission of the local Fire Department and/or Fire Marshall and in accordance with their requirements. No burning within limits of paving or buildings shall be allowed whatsoever. All burning shall be under the constant care of competent watchmen. Any remaining material and debris shall be properly disposed of in accordance with paragraph A above.

3.05 PRESERVATION OF TREES

- A. Those trees which are designated for preservation by the Engineer shall be carefully protected from damage. The Contractor shall erect barricades, guards, and enclosures as required for the protection of the trees during all construction operations.

3.06 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

- A. The Contractor shall exercise extreme care to avoid unnecessary disturbance of developed private property as applicable. Trees, shrubbery, gardens, lawns, and other landscaping, which in the opinion of the Engineer must be removed, shall be replaced and replanted to restore the area to the condition existing prior to construction; such work shall be at no additional cost to the Owner.
- B. All soil preservation procedures and replanting operations shall be under the supervision of a nursery representative experienced in such operations.
- C. Improvements to the land such as fences, walls, outbuildings, and other structures which of necessity must be removed, shall be replaced with equal quality materials and workmanship at no additional cost to the Owner.
- D. The Contractor shall clean up the construction site across developed private property directly after construction is completed upon approval of the Engineer.

3.07 PRESERVATION OF AGRICULTURAL PROPERTY

- A. When the route of the construction crosses agricultural property, pastures, fields under cultivation, and related areas, the Contractor shall take care to damage as little of the property as possible. Upon completion of the construction and approval of the Engineer, the Contractor shall restore the damaged area to the conditions existing prior to construction at no additional cost to the Owner. Replanting of pastures and crops shall be in strict accordance with accepted local

agricultural practices as defined by the Engineer.

- B. Should it be necessary to remove fences to facilitate construction, the Contractor shall employ the use of temporary restraining devices to prevent the ingress and egress of animals through the section of fence removed. After construction is completed, the Contractor shall restore the fence to its prior location and condition at no additional cost to the Owner.

3.08 PRESERVATION OF PUBLIC PROPERTY

- A. The appropriate portions of Paragraphs 3.05, 3.06 and 3.07 of this Section shall apply to the preservation and restoration of public lands, parks, rights-of-way, easements, and all other damaged areas.

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.1 SCOPE OF WORK

The work includes all clearing, excavation, borrow, filling, backfilling and grading indicated on the Drawings and necessary for the proper completion of the project, including for pipes, structures, and pavement.

1.2 MEASUREMENT AND PAYMENT

No specific payment shall be made for items covered in this section unless that item is listed in the Bid Schedule. Compensation for work not listed shall be included in the appropriate pay items for piping, manholes, pumping stations, etc., with which they are associated.

The basis of payment for unsuitable soils excavation, replacement and compaction shall be the unit prices contained in the Bid, or if these are not available, then payment will be determined in accordance with applicable provisions of the General Conditions. Quantities for unsuitable soils excavation, replacement and compaction for water and sewer pipelines will be computed using the following table regardless of the actual quantity of backfill material used. No consideration will be given to the number of truckloads of backfill delivered not the actual dimensions of the trench that is backfilled. Backfill quantities will only be based on the depth and lineal feet of the pipeline constructed. No consideration will be given for the number of manholes, sewer service laterals, or valves required.

Use of these standard table is for quantity computations purposes only and does not restrict the Contractor from following OSHA guidelines for trench excavations.

<u>DEPTH OF CUT TO PIPE INVERT</u>	<u>PAY QUANTITY IN CUBIC YARDS PER LINEAL FOOT OF PIPELINE</u>
2' to 4'	0.40
6' to 8'	0.80
8' to 10'	1.30
10' to 12'	1.90
12' to 14'	2.50
14' to 16'	3.30
16' to 18'	4.20
18' to 20'	5.20
20' to 22'	6.20
22' to 24'	7.40

1.3 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

All work shall be performed in accordance with Florida Department of Transportation standards, specifications and indexes and in accordance with other state and local requirements.

Current editions or revisions of the following specifications and standards will apply unless specifically noted otherwise herein or on the Drawings.

A. American Society for Testing and Materials (ASTM) Standard

ASTM C 33-85	Concrete Aggregate
ASTM D 698-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures, Using 5.5 lb. (2.49 Kg) Rammer and 12 in. (304.8 mm) Drop. Standard Proctor.
ASTM D 1556-82	Test Methods for Density of Soil in Place by the Sand-Cone Method.
ASTM D 1557-78	Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10 lb. (45 Kg) Rammer 2 and 18 in. (457 mm) Drop. Modified Proctor.
ASTM D 2487-83	Classification of Soil for Engineering Purposes
ASTM D 2922-76	Density of Soil and Soil-Aggregate in place by Nuclear Methods (Shallow Depth)
ASTM D 3017-78	Moisture Content of Soil and Soil-Aggregate in place by Nuclear Methods (Shallow Depth)

B. American Association of State Highway and Transportation Officials (AASHTO) Standards

AASHTO T-99	Standard Proctor
AASHTO T-180	Modified Proctor

1.4 SUBMITTALS

Contractor shall have reports submitted to the Engineer as required in the testing portion of this Section.

1.5 RELATED WORK

- Gravity Sanitary Sewer Systems
- Pressure Sanitary Sewer Systems
- Water Distribution Systems
- Asphaltic Concrete Paving

- Testing

1.6 SITE CONDITIONS

A. Character of Excavation Material: Prior to submitting his bid, the Contractor shall satisfy himself as to the character and amount of different soil materials, groundwater and the subsurface conditions to be encountered in the work to be performed. Information and data, when furnished, are for the Contractor's general information. However, it is expressly understood that any interpretation or conclusion drawn therefrom is totally the responsibility of the Contractor.

B. Subsurface Investigation: If subsurface information is included as an appendix of these specifications it is the results of soil borings and soil classification and testing made at the exact locations only. While the soil borings and information are representative of subsurface conditions at their respective exact locations, local variations in soils and groundwater will be encountered.

C. Existing Underground Facilities: Underground structures and utilities shown on the drawings are located according to the best available records. However, it shall be the Contractor's responsibility to acquaint himself with all information, and to accurately locate and uncover all underground structures and utilities along the line of work in order to avoid conflicts with existing facilities. Underground utilities shall be located by the Contractor far enough in advance of the trench or site excavation and pipe laying operations to assure ample opportunity to make the necessary adjustments to avoid conflicts. The Owner shall not be held accountable for inaccuracies or omissions in the locations or grade of facilities of this type.

D. Conflicts: Where actual conflicts are unavoidable, work shall be performed so as to cause as little interference as possible with the service rendered by the facility disturbed. The Owner may require the Contractor to work in off hours (i.e. 1:00am or Holidays) in order to minimize disturbance. Facilities or structures damaged in the prosecution of the work shall be repaired immediately in conformance with the best standard practices or according to the direction of the owner of such facility, to the extent required, including replacement, at no cost to the Owner.

PART 2 - MATERIALS AND EQUIPMENT

2.1 BACKFILL

The following shall define the terms used in the plans and specifications.

A. Topsoil - shall be the upper most layer of soil usually dark in color and approximately 6 inches thick, rich in organic matter.

B. Gravel Bedding - Gravel bedding shall consist of well-graded crushed stone or crushed gravel meeting the requirements of ASTM Designation C-33, Graduation 67 (3/4-inches to No. 4). Air cooled blast furnace slag, alone or in combination with crushed stone and/or crushed gravel, conforming to ASTM C-33 requirements may also be used.

C. Select Backfill - shall be a select granular material free from organic matter and of such size and gradation that desired compaction can be readily attained. Select backfill is

defined as those complying with AASHTO soil classification Groups A-1, A-3, and A-2-4 having a maximum size not to exceed 3 inches with at least 95% passing the 1 1/2 inch sieve and not more than 15% passing the No. 200 sieve with a coefficient of uniformity of six or greater. The liquid limit shall be less than 15. In most situations the existing backfill will not meet these requirements, therefore, select backfill is material which must be transported to the site from an approved borrow pit.

D. Suitable or Common Backfill - shall be a satisfactory soil material free from organic matter, muck, marl and rock exceeding 3 inches in diameter. At least 95% shall pass the 1 1/2 inch sieve. Common backfill shall comply with AASHTO soil classification Groups of A-2-5, A-2-6, A-2-7, A-4, A-5, A-6, and A-7 providing that the liquid limit shall be less than 35. Suitable backfill is usually considered on site material that meets these requirements.

E. Existing or Unsatisfactory Backfill - shall be material obtained from the Contractor's excavations to be used in areas not requiring specific compaction densities. This material shall not be used for pipe bedding nor under streets, street shoulders, or structures. Such backfill shall be free of debris, deleterious materials and shall contain no material larger than 6 inches. Under no conditions are destroyed pavement materials, curbs, broken concrete, etc., to be included in the backfill.

F. Concrete Encasement - shall be of portland cement type with a compressive strength at 28 days of 2500 psi.

G. Clean Sand - shall be a quartz material with less than 5 percent of the soil particles finer than the No. 200 mesh sieve, a uniformity coefficient greater than 1.5 and an effective grain size of 0.20 to 0.55 millimeters in diameter. Clean sand is required for filter material requiring good permeability.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Safety

In the Contractor's use of streets and highway for the work to be done under these Specifications he shall conform to all City, State, and local laws and regulations. The Contractor shall provide, erect, and maintain effective barricades, danger signals, and signs on all intercepted streets or highways for protection of the work and safety of the public rights-of-ways shall be provided with lights which shall be kept burning at all times between sunset and sunrise. The Contractor shall be responsible for all damages resulting from any neglect or failure to meet these requirements. Where conditions require the presence of a watchman to fulfill the requirements stated herein, same shall be furnished without extra cost to the Owner.

1. Access to Fire hydrants shall be maintained at all times. Do not block or barricade with spoil, materials or equipment for any period of time.

B. Maintenance of Service - Traffic

The Contractor shall arrange his work to cause minimum disturbance of normal

pedestrian and vehicular traffic and will be held responsible for providing suitable means of access to all public and private properties during all stages of the construction. A minimum of one lane of traffic shall be maintained at all times. Contractor shall keep all disturbed roads graded smooth and passable. If the road becomes impassable, the Contractor shall stabilize with dry, select backfill. The Owner may require the Contractor to work in off hours (i.e. 1:00am or Holidays) in order to minimize disturbance.

C. Maintenance of Utility Services

Should the construction work require repairs, changes or modifications of other utilities, it shall be the responsibility of the Contractor to provide for the maintenance of continuous water, electric, telephone, and gas as well as sewage and other utility services to all present customers of such utilities, unless approval in writing is secured from the utility company for interruption of such service.

Where existing septic tank service is disrupted due to construction work or is to be abandoned after connection to a new sanitary sewer system, Contractor shall provide uninterrupted service to all current septic tank users by providing pump-out of affected septic tanks if required, **at no additional cost to the Owner**. Septage pumping and disposal shall be by a licensed septage hauler.

The Owner may require the Contractor to work off hours (i.e. 1:00 a.m. or holidays) in order to minimize disruption of utility services.

D. Limits of Construction

In locations where the work is to be installed in streets or road rights-of-way the activities of the Contractor shall be confined to these public properties. Where the use of private property is deemed necessary by the Contractor to facilitate construction work arrangement for such use with the property owner shall be the responsibility of the Contractor. The Contractor shall save the Owner harmless from all claims by adjacent property owners for trespassing or damage due to the activities of the Contractor in the prosecution of the work.

E. Existing Utilities

The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition and extent of all such installations and structures as may be encountered and as may affect the construction operations.

All existing improvements such as pavements, conduit, poles, pipes, overhead wires and other structures, shall be carefully supported and fully protected from injury. The Contractor shall be responsible for damages to these existing utilities and shall, in case they are damaged, restore them to their original condition at no cost to the Owner.

Contractor shall give written notice to the Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of work. This can be accomplished by making the appropriate contact with the utility companies listed on Sheet 2 of the Construction Drawings.

F. Property Protection

Trees, fences, poles, and all other property shall be protected unless their removal is authorized; and any property damaged shall be satisfactorily restored by the Contractor at the Contractor's expense to a condition equal to or better than that existing prior to beginning the work.

3.2 CLEARING AND GRUBBING

On all areas within limits of clearing and grubbing indicated on the Drawings or specified where earthwork is to be done, all timber, brush, stumps, roots, rubbish, and unsuitable material shall be removed to a depth of not less than one foot below the ground surface. Sound trees and shrubs which do not interfere with the construction and are elsewhere indicated or directed not to be removed, shall be protected properly from damage. The surface shall be plowed to a depth of not less than six (6) inches and all stumps, roots and other perishable matter thus exposed shall be removed to a depth of not less than one foot. Any deposits of muck, peat, bark or trash occurring within the limits of clearing and grubbing or where directed by the Engineer shall be removed to their full depth and backfilled with suitable backfill as specified herein. Material removed during clearing and grubbing shall be hauled to the County landfill in accordance with local laws and regulations. Landfill fees shall be paid by the Contractor. All shrubbery, ornamental trees and other such plantings including those within construction area shall be fully protected. If it becomes necessary to remove any grass, shrubbery or planting to accomplish the work, it shall be satisfactorily replaced before the work will be accepted. All areas disturbed during construction shall be restored to a condition equal to or better than that existing prior to beginning the work.

Trees and shrubs selected for preservation shall have their root systems protected from construction traffic, surface storage of materials, and any type of land disturbance within the drip line of the tree or shrub. The drip line of a tree or shrub is the outer outline of the tree crown where it intercepts the ground. Barricade all trees or tree groups which are selected for preservation if the possibility of root damage, surface soil disturbance within the drip line, soil compaction, or impact with construction equipment is prevalent. Barricading shall consist of continuous wood fencing constructed to the outline of the tree crown and shall be sturdy, highly visible and shall be maintained during the construction.

3.3 EROSION AND FLOODING CONTROL

During construction operations, the Contractor shall install and maintain temporary erosion and flooding control features to the extent necessary to prevent pollution of streams and lakes, detrimental effects on public or private property adjacent to the construction or damage to work on the Project. Additional erosion control devices may be requested by the Engineer to protect the property described above. This shall be done immediately when directed by Engineer at no additional cost to the Owner.

The Contractor shall attempt to limit the surface areas of erodible earth exposed by clearing and grubbing, excavation or filling operations.

Temporary features may include, but not be limited to silt fences, temporary grassing, sodding, mulching, sandbagging, slope drains, sediment basins, sediment checks, artificial coverings or berms. All City, County, State and Federal ordinances will be complied with.

The contractor shall comply with The Florida Development Manual -- A Guide to Sound Land and Water Management, Department of Environmental Regulation -- Stormwater Management Practices.

3.4 DUST CONTROL

If, in the opinion of the Owner or the Engineer it is necessary to control dust during construction period, the Contractor shall furnish and spread water or calcium chloride at points where dust is a nuisance, or as directed by the Engineer, at no additional cost to the Owner.

3.5 PAVEMENT AND SIDEWALK REMOVAL AND REPLACEMENT

A. Pavement and sidewalk shall be removed and replaced as follows unless shown otherwise on the Drawings.

B. Pavement, which is to be removed for open-cut trenching, shall be cut vertically with a power-driven friction saw prior to removal. The surface shall be scored to sufficient depth to provide uniform, straight break lines. All removal of pavement shall conform to local, County, State or Federal requirements where applicable. **Under no condition shall pavement be cut with a trenching machine, power shovel or backhoe.** Width of cut of pavement or sidewalk shall be two feet wider than top of trench, one foot on each side of trench. In the event that trench excavation becomes wider than initial cut, pavement or sidewalk shall be recut to at least one foot back from all edges of actual excavation by the Contractor at his own expense.

All cut lines shall be parallel to or at right angles to the longitudinal axis of the pipeline.

C. Pavement, driveway or sidewalk material shall be separated from other excavated materials and shall not be placed in backfill, but shall be satisfactorily disposed of by the Contractor. Base materials may be salvaged and stockpiled for reuse, but such reuse of base materials shall be subject to the review of the Engineer.

D. All pavement and sidewalk removed shall be replaced with base and surface materials which conform as closely as possible in thickness and quality to materials removed. Refer to construction drawings for pavement replacement requirements. If details are not shown in the construction drawings, the minimum pavement and pavement base replacement shall consist of 1 1/2 inch of Type S-1 asphaltic concrete surface with a 6 inch limerock base (LBR 100 compacted to 98% Modified Proctor). All painted street markings and other traffic control devices shall be restored to former conditions. Use Safety Coatings Co. Roadrunner Traffic marking paint, or approved equal, and Ferro Co. glass spheres or approved equal. Pavement with traffic control devices and sidewalks shall be replaced as soon as practicable after compaction of backfill. Replacement pavement shall be tapered at curb.

E. Workmanship and materials shall be in accordance with best standard practice for work of this type, and shall conform to the requirements of Section 330-12, Surface Requirements of Florida Department of Transportation Road and Bridge Manual.

F. All necessary barricades, detours, lights and other protective measures shall be

provided for protection of both pedestrians and vehicular traffic and shall conform to Florida DOT specifications where no local agency has specifications.

3.6 STATE HIGHWAY AND RAILROAD RIGHTS-OF-WAY

Pipe crossings and installations along all railroads and State highways shall be in accordance with the applicable portions of American Railroad Engineers Association (AREA) Specifications for "Pipeline Crossing under Railroad Tracks for Non-Flammable Substances" or Florida DOT "Utility Accommodation Guide" and with details shown on the drawings. Verify the existence of a formal permit to work on the right-of-way at each specific location prior to any work at that site and notify the owner of the right-of-way as required by that permit. Furnish the Engineer and the Owner with a copy of any separate certificate of insurance that is required by the owner of the right-of-way.

3.7 CURB AND GUTTER REMOVAL REPLACEMENT

Curb or curb and gutter removal, where required in construction of this work, shall be held to a minimum. Curb and gutter material to be removed shall be carefully separated from trench excavation material and shall be satisfactorily disposed of by the Contractor.

The Contractor shall replace all curb or curb and gutter which has been removed. Curb or curb and gutter shall be replaced as soon as possible after backfill is placed and compacted and shall be a duplicate in all respects to original construction. Workmanship shall be in accordance with the controlling agency (City, County, State).

3.8 RESTORATION OF ROADWAY CROSSINGS AND DRIVEWAY CROSSINGS

Clay, marl, shell or similar roadways and driveways that are crossed or traversed by trenches shall be restored to existing conditions prior to excavation. The Contractor may reclaim existing material, or he may furnish and compact new material. There will be no additional compensation for this type of restoration unless specifically called for in the Special Provisions or on the Bid Proposal.

Final and complete restoration of crossings in existing public roadways shall be completed not more than 24 hours subsequent to the final lift of the backfill.

3.9 EXCAVATION

A. General

Excavation shall be performed in accordance with all State, County and local regulations. Blasting will not be permitted except by written approval of the Engineer for each specific location where it is to be performed. Excavation shall conform to the dimensions indicated or specified for the pipeline or structure and topography and subgrade conditions encountered.

The Contractor shall notify the Engineer in due time to permit him to inspect completed excavations, and no pipes or concrete shall be placed in excavations or upon subgrades until they have been approved by the Engineer.

In areas where excavation may endanger existing structures, roads or utilities,

Contractor will provide suitable support to these existing facilities so as to insure that damage will not occur. Contractor shall submit proposed method of support of these facilities to the Engineer for approval. The Contractor shall obtain written approval from the facility concerned before proceeding with any construction which might undermine or endanger existing facilities.

B. Control of Water

Furnish, install and operate all necessary machinery, appliances and equipment to keep excavations free from water during construction. Dewater and dispose of water so as not to cause injury to public or private property or to cause a nuisance or a menace to the public. The Contractor shall at all times have on-hand sufficient pumping equipment and machinery in good working condition for all ordinary emergencies and shall have available at all times competent workmen for operation of pumping equipment. Dewatering systems shall not be shut down between shifts, on holidays or weekends, or during work stoppages without written approval from the Engineer.

Control of ground water shall be such that softening of the bottom of excavations or formation of "quick" conditions or "boils" shall be prevented. Dewatering systems shall be designed and operated so as to prevent removal of natural soils.

Static water level shall be drawn and maintained one-foot below bottom of excavation so as to maintain undisturbed state or natural soils and allow placement of backfill to required density. Dewatering system shall be installed and operated so that ground water level outside excavation is not reduced to extent that would damage or endanger adjacent structures or property.

Release of ground water to its natural static level shall be performed in a manner so as to maintain undisturbed state of natural foundation soils, prevent disturbance of compacted fill or backfill and prevent flotation or movement of all structures and pipelines.

Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.

C. Shoring, Sheet piling and Bracing

Excavations shall be shored and sheeted in accordance with requirements of the Department of Labor Occupational Safety and Health Administration (OSHA) with members of sizes and arrangement sufficient to prevent injury to persons, damage to structures, injurious caving, or erosion. They shall be designed, furnished, placed, maintained and removed by the Contractor. Sheet piling and shoring design shall be submitted to the Engineers as a shop drawing prior to installation and shall bear the seal of a structured engineer registered in the State of the job site.

Design, planning, installation and removal of all sheeting, shoring, sheet piling and bracing shall be accomplished in a manner so as to maintain required trench or excavated section with an undisturbed state of soils at and below excavation bottom.

Sheet piling and timbers used in trench excavations shall be withdrawn in such a manner so as to prevent subsequent settlement or misalignment of pipe or additional backfill loadings which might overload pipe. Where, in the opinion of the Engineer,

removal of sheeting and shoring will or may cause damage to the work or to adjacent buildings, utilities or property, the Engineer may direct Contractor to leave all or a portion of sheeting and shoring in place. Sheeting and shoring shall also be provided as necessary to keep excavations within the available right-of-way.

The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on his part to issue orders, and his failure to exercise his right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

D. Excavation for Pipe System

1. Common Excavation

Machine excavation shall be carried to a depth above final pipeline grade that will allow final grading using hand tools, as indicated on the Plans. Care shall be taken to not excavate below required depth. If excavations is carried below required depth, overcut depth shall be backfilled with select backfill material or gravel bedding material furnished at Contractor's expense and compacted to provide pipe support at least equal to that of original material.

Contractor may, at his option, elect to overcut trench and backfill with select backfill or bedding material. If Contractor so elects, depth of overcut shall be such that a minimum of two inches of compacted backfill material will result under lowest projection of pipe bell. **No additional payment** will be made for this overcut or for furnishing and placing of the required backfill material.

The Contractor shall exercise sound construction practices in excavating trench and maintaining it so no damage will occur to any foundation structure, pole line, pipeline or other facility because of slough of slopes or from any other cause. If, as a result of excavation, there is a disturbance of ground that endangers other property, the Contractor shall immediately take remedial action at his own expense. No act of the Owner or his representatives shall in any way affect liability of the Contractor for damages, expenses or costs that may result from trench excavation.

Trees, stumps and roots within limits of trench excavation shall be removed to a depth of at least 12 inches below bottom of trench.

2. Trench Requirements

Width of trench banks from bottom to 12 inches above top of pipe shall not exceed 18 inches nor be less than 12 inches on each side of the pipe with the exception of preassembled pressure pipe in non-paved areas for which the minimum trench width shall be pipe diameter plus 1 inch on each side of the pipe.

Trenches for gravity sewers shall be of such depth that the invert of pipe will be at elevations shown on the plans, or as may be determined by the Engineer. Trenches shall provide a minimum cover of 36 inches for water mains and 48 inches for sewage force mains over barrel of pipe, except as otherwise

shown. Greater depth may be required to accommodate appurtenances or avoid obstruction.

Excavation for appurtenances shall be made to a size that will allow at least 12 inches between their outer surfaces and embankment or shoring.

The trench shall be **dry** when the bottom is prepared. A continuous trough shall be excavated by hand to receive the bottom 120 degrees of the pipe barrel. In addition, bell holes shall be excavated so that only the barrel of the pipe receives bearing pressure from, and is uniformly supported by, the bottom of trench. Preparation of trench bottom and placement of pipe shall be such that final position of pipe is true to line and grade and uniformly supported throughout barrel of each pipe length. When pipe is placed in select backfill over rock or other overdepth, additional backfill of same material shall be tamped on each side of barrel to height of spring line, thus forming a trough of firm, compacted bedding.

3. Pipe Interferes and Encasements

In no case shall there be less than 4 inches between any two pipelines or between pipelines and structures. Pipe deflections shall be performed in accordance with the plans and as contained herein. Wherever there is more than 4 inches but less than 18 inches clearance between sewers, sewer house laterals, force mains and water mains or water services, then a concrete encasement shall be provided for a distance of 10 feet on each side of the obstruction pipe. Wherever there is more than 4 inches but less than 1.0 foot clearance between any two pipe lines, other than water or sewer, or between pipe lines and structures, then a concrete encasement shall be provided for a distance of 3 feet on each side of the obstruction pipe.

The Engineer shall have full authority to direct the placement of the various pipes and structures in order to facilitate construction, expedite completion and to avoid conflicts.

E. Excavation for Structures

Conform to elevations and dimensions shown within a tolerance of plus or minus 0.10 feet, and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction, and for inspection, or as shown on the Drawings.

In excavating for footings and foundations, take care not to disturb bottom of excavation. Excavate by hand to final grade just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive concrete.

In areas underlain by expansive clay, undercutting or excavation of clay pockets will be required beneath footings and slab areas as may be shown on the drawings and directed by the Engineer. Post-hole diggers may be used to determine the depth to the clay materials in all of the footing bottoms. Heavy clay that is encountered within a zone that is four (4) feet below the bottom of any footing or floor slab should be undercut and

replaced with suitable or common backfill material. The width of undercutting in the footing should extend at least four (4) feet beyond the edge of the footing or slab to provide a non-expansive water barrier above the clay. Other clay pockets discovered during construction may also require complete removal upon the recommendation of the geotechnical engineer.

F. Unsuitable Material

Unsuitable materials are soils exposed at the bottom of excavations that are compressible, expansive, contain extraneous rubble, or offer uneven foundation support. Unsuitable materials/soils will include, but not be limited to, mulch, peat, expansive clays, boulders, rubble, any portion of trees or similar vegetation, wood, or unyielding material such as rock.

The Contractor shall notify the Engineer immediately when unsuitable material is encountered. The Engineer will investigate questionable material to determine its suitability. Should the Engineer require soils testing be performed to aid in his determination, then tests revealing suitable materials shall be paid for by the Contractor.

Where the Engineer determines that unsuitable material is present below the excavation which will not provide adequate support the Contractor shall remove the unsuitable material as directed by the Engineer and replace the unsuitable material with Select backfill. Prior to the excavation of any unsuitable material, written approval must be obtained from the Engineer. The approval shall state the linear feet of excavation. No payment shall be made for the removal of any unsuitable bedding material if prior approval is not obtained.

3.10 BACKFILL AND COMPACTION FOR PIPES

A. General

Contractor shall not perform any backfilling operation other than that necessary to hold pipe in place until the locations of connections and appurtenances have been recorded on the "as-built" drawings and the line has been inspected and released for backfilling. Backfill and compaction shall be performed as specified herein and as shown on the drawings. Backfilling of trenches shall progress as rapidly as the construction, testing and acceptance of work permits. In areas subject to traffic temporary backfill or base material is required to provide a smooth stable driving surface until final base and/or pavement can be constructed.

B. Haunching and Initial Backfill

After pipe has been properly laid and inspected backfill shall be carefully placed and compacted around the pipe in loose horizontal layers not exceeding 6 inches loose depth, equally on both sides of pipe and shall be spaded (walked in) and compacted with hand tampers to obtain the required density. This shall continue to a level of one foot above the top of the pipe.

C. Subsequent Backfill

Above the level of initial backfill, the trench shall be filled in horizontal layers and mechanically compacted to the density required up to 3 feet below the base of pavement

or structures, up to 6 inches in areas to receive topsoil, seeding, or soiling and up to final grade in non-paved streets.

D. Backfill and Compaction Requirements for Pipe (unless shown differently on the plans)

1. Paved Areas

- a. Initial - Select backfill in 6" lifts at 100%.
- b. Subsequent - Select backfill in 8" lifts at 100%.
- c. Top 3 feet below road base - Select backfill in 6" lifts at 100%.

2. Unpaved Street and Street Shoulder Areas

- a. Initial - Suitable backfill in 6" lifts at 95%.
- b. Subsequent - Suitable backfill in 8" lifts at 95%.

3. Off Street Areas

- a. Initial - Suitable backfill in 6" lifts at 95%.
- b. Subsequent - Unsuitable or existing backfill in 18" lifts compact till firm.

NOTE: Density listed are maximum dry density in accordance with AASHTO T-99 Standard Proctor Density.

3.11 BACKFILL AND COMPACTION FOR STRUCTURES

For the area under the structure and within a 2 foot of the perimeter, compact the top 12 inches of subgrade and each 6 inch layer of select backfill or fill material to 100% Standard Proctor density.

3.12 GRADING

Grading shall be performed at such places as are indicated on the drawings, to the lines, grades, and elevations shown or as directed by the Engineer and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

Grade all areas as indicated. Fill shall be brought to finish grades shown and shall be graded to drain water away from structures.

Overall area grading for which no grades are indicated within the limits of construction and outer limits of clearing and grubbing, all holes and other depressions shall be filled, all

mounds and ridges cut down and the area brought to sufficiently uniform contour that the Owner's subsequent mowing operations will not be hindered by irregular terrain. This work shall be done regardless of whether the irregularities were the result of the Contractor's operations or originally existed. Permanent ponds or other permanent water areas, as so designated by the Engineer, will not be required to be filled.

3.13 TESTING

A. General

Contractor shall comply and pay for the services of an independent testing laboratory in accordance with Section 01410 "Testing and Laboratory Services" to perform testing specifically indicated herein.

Exact location of the test shall be selected by the Engineer or his representative. If the Engineer, after being notified by the Contractor, is unable to be present during the test, the laboratory personnel shall randomly select testing locations that are representative of the work being tested. All cost of this testing and providing of certificates shall be a subsidiary obligation of the Contractor with the cost included in the item for which the testing is associated.

The minimum testing rate shall not prevent the Contractor nor the testing laboratory from performing additional testing to insure the construction is in accordance with the plans and specifications.

A minimum of two (2) copies of reports of test results of all maximum dry density and optimum moisture content determinations and all in-place density tests shall be submitted to the Engineer. Reports must be signed by a registered Professional Engineer.

The Contractor shall repair all test holes and borings resulting from the testing and retesting of his work at no cost to the Owner.

Any areas failing to pass the tests as called for, and interpreted by the Engineer, shall immediately be brought into conformance with these Specifications at the Contractor's expense.

B. Minimum Schedule of Test Required

1. Determination of the soil classification for each type of soil material used to determine its suitability for use as defined herein and in accordance with the AASHTO or Unified Soil Classification System.

2. Determination of maximum dry density and optimum moisture content for each type of soil to be compacted to a specified density. At least one determination will be made for each soil used. Tests shall be performed in accordance with the appropriate ASTM or AASHTO Standards.

3. In-place (insitu) density test shall be made in accordance with ASTM and AASHTO Standards and shall be made at a frequency to assure contract requirements are met but in no case less than the following:

- a. Pipeline backfill at the rate of one test for each 50 linear feet of trenchline for each backfill lift. A backfill lift shall never be considered to be greater than one foot in thickness. In unpaved areas, testing rate by be reduced to one test for each 150 lineal feet of trenchline for each backfill lift.
- b. Structure backfill at the rate of one test for each 2000 square feet for each backfill lift (maximum lift of 12 inches).
- c. Pavement, sidewalk and curb backfill at the rate of one test for each 50 lineal feet of street for each backfill lift (maximum lift of 12 inches).

3.14 MAINTENANCE

Protect newly graded areas from traffic and erosion. Keep free of trash and debris. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify surface, reshape, and compact to required density prior to further construction.

END OF SECTION

SECTION 02566

MANHOLES, WET WELLS AND VALVE CHAMBERS

PART 1 - GENERAL

1.1 SCOPE

A. Description Of Work

1. Provide all labor, materials, tools and equipment necessary to furnish and install manholes, wet wells and valve chambers as indicated on the Drawings, Construction Details and as herein specified.
2. Throughout this specification section where the word "manhole" is used it shall mean "manholes, wet wells and valve chambers."

B. Coordination

1. If pumps are proposed for installation in a wet well, the Contractor shall have the manufacturer of the pumps, verify that the wet wells specified herein and detailed on the Drawings are sized to suit his equipment.

1.2 MANHOLE TYPES

- A. Manholes shall be made up of precast concrete sections. Bottom section shall also be precast concrete unless used for a "doghouse" manhole, shown otherwise or approved otherwise by the engineer
- B. Pumping station and valve chamber walls shall be made up of precast concrete manhole sections. Top and bottom sections shall also be precast unless shown otherwise or approved by the Engineer.

PART 2 - PRODUCTS

2.1 BRICKS

- A. Bricks shall be made of clay or shale and none but whole, sound, burnt hard entirely through, straight brick, uniform in structure, with true even faces, free from stones, pebbles, masses of lime, cracks and checks extending into the body of the bricks shall be used. Brick shall not be salvaged or reclaimed.
- B. Brick shall comply with "Specification For Building Brick (Solid Masonry Units Made From Clay or Shale," (ASTM C62). The bricks shall be tested by an independent laboratory for compression and absorption in accordance with "Brick, Sampling and Testing," (ASTM C67).

2.2 MORTAR

- A. Composition of mortar shall conform to "Mortar For Unit Masonry," ASTM C270, Type N.

2.3 GROUT

- A. Grout shall be "Masterflow 713 Grout" manufactured by Master Builders, or "Non Shrink 5 Star Grout" manufactured by U.S. Grout Corporation or equal. Grout shall be capable of meeting test requirements of ASTM C827.

2.4 MANHOLE STEPS

- A. Manhole steps shall be cast into the walls of risers and conical top sections at the factory, and shall be aligned vertically and spaced so as to be on equal centers in the assembled manhole at a maximum distance apart of 12 inches and extend out of the wall a minimum of 7 inches for cast-in-place walls and minimum 6 inches for precast manholes. Steps shall be located a minimum of 6 inches from the ends of riser and top sections, and shall be securely embedded in manhole risers and tops.
- B. The manhole step shall be constructed from a copolymer polypropylene plastic (CPP) with a 1/2 inch diameter, grade 60 steel reinforcing bar embedded inside. An acceptable manhole step is M.A. Industries Inc., Type PS-1, PS-2, or equal. Steps shall conform to the requirements of ASTM C478.

2.5 MANHOLE FRAMES, COVERS AND FLOOR DOORS

A. General

- 1. Castings shall be heavy duty gray cast iron, meeting ASTM A-48 Specifications, designed for H-20 loading as designated by AASHTO.
- 2. Castings shall be free from cracks, holes, swells and cold shuts. All manhole castings shall be made accurately to the pattern and to the dimensions as specified, and shall be machined to secure perfectly flat and true surfaces. All lids which "rock" and do not lie solid will not be accepted and must be replaced by perfect lids.
- 3. No plugging, burning in or filling will be allowed. Covers must fit the frames in any position.
- 4. The covers shall have non-penetrating pick holes.

B. Standard Type Manhole Frame and Cover

- 1. Shall be model number USF 170-E as manufactured by U.S. Foundry and Manufacturing Corporation or equal. A label saying "SANITARY" shall be cast on the cover. Two (2) non-penetrating pick holes shall be located diametrically opposite.

C. Watertight Covers

- 1. Manholes at specific locations indicated on the Drawings shall each be equipped with a watertight cover. The cover shall be model 170-E-BWTL as manufactured by U.S. Foundry and Manufacturing Corporation or equal.
- 2. A label saying "SANITARY" shall be cast on the cover. Frame and Cover shall be watertight type with stainless steel bolts, machined bearing surfaces and flat gasket.

D. Floor Doors

1. Floor doors shall be provided for the pumping stations as specified on the drawings.
2. Floor doors, for valve chambers and in other locations that are called for on the Drawings, shall be as specified on the drawings.

2.6 PRECAST CONCRETE MANHOLES AND COMPONENTS

A. Aggregate

1. All coarse aggregate shall be made from 100 percent calcarious rocks. The contractor shall furnish manufacturer's certificate stating the type of aggregate used in the manufacture of the manhole.

B. Sections

1. The sections for manholes shall be a minimum of 4 feet in diameter for pipe sizes up to, and including 24 inches internal diameter. For pipes with an internal diameter between 24 and 36 inches, the manhole shall be 5 feet in diameter, unless otherwise noted.
2. The sections for the wet wells and valve chambers shall be of the size indicated on the Drawings.
3. The Sections shall conform to the requirements of "Specifications For Precast Reinforced Concrete Manhole Sections" (ASTM C478), except that the joints shall be of the tongue and groove joint type and sealed with a preformed flexible plastic gasket. No other type of manhole joint will be accepted. Face of tongue and groove shall be sloped and not perpendicular to manhole wall.

C. Risers and Top Sections

1. The top of base walls, the ends of reinforced concrete risers and the bottom ends of precast tops shall be so formed that when risers and tops are assembled with the base, they will make a continuous manhole. The tongue and groove joints shall be of such design as will permit effective joining and placement without irregularities in the interior wall surface of the manhole.
2. Precast barrels shall consist of riser and top sections. The top section of manholes 6 feet or greater in depth shall be an eccentric conical section with thickened upper walls with the smallest inside diameter equal to 24 inches, to receive the manhole frame and cover. Top sections or manholes less than 6 feet in depth shall be flat concrete slabs. No more than two (2) lift holes shall be cast in each riser or top section. Lift holes shall be nonpenetrating.
3. Precast riser and top sections shall be designed, manufactured, tested, finished and marked in accordance with this specification and "Specifications For Precast Reinforced Concrete Manhole Sections" (ASTM C478 Latest Revision).

D. Precast Manhole Bases

1. The bases shall be integrally cast and shall consist of a manhole bottom and a wall which shall extend a minimum of 6 inches above the top of the highest inflowing sewer. The top of the base section shall be carefully formed to receive the tongue of the barrel section. There shall be a minimum distance of 4 inches between the

invert of the lowest outflowing sewer and floor of the precast base to provide for the construction of a formed invert and bench wall within the manhole. No more than two lift holes shall be cast in the bases. Lift holes shall be non-penetrating.

a. Manholes 4 feet in diameter shall have a bottom at least 8 inches thick and a wall at least 5 inches thick.

b. Manholes 5 feet in diameter shall have a bottom at least 8 inches thick and a wall at least 6 inches thick.

E. Joint Material

1. The joint material shall be a preformed flexible plastic gasket such as Ram-Nek manufactured by the Henry Company or equal. It shall consist of hydrocarbon plastic and vulcanized rubber and shall be capable of meeting the following conditions:

a. Hydrocarbon plastic content 50-70% by weight per ASTM D297

b. Volatile matter 2.0% max. by weight per ASTM D6

c. Specific gravity, 77 deg. F-1.20 to 1.35 per ASTM D71

d. Ductility, 77 deg. F-5.0 cm min. per ASTM D113

e. Softening Point, ring and ball, 320 deg. F min. per ASTM D36

f. Penetration, cone 77 deg. F, 150 gm, 5 sec., - 50-120 per ASTM D217

g. Flash point, C.O.C., 600 deg. F min. per ASTM D92

h. Fire point, C.O.C., 625 deg. F min. per ASTM D92

i. Inert mineral filler 30-50% by weight

j. Material, when in place, shall not leak at joints while being subjected to 10 PSI test for a 24-hr. period.

k. No sagging of vertical and overhead 1 inch wide joints shall be detected while being subjected to temperature of 135 deg. F for period of 5 days.

l. No visible deterioration of compound when immersed separately in solution of acid, alkalis and saturated hydrogen sulfide, for a period of 30 days.

2. Sealing compound shall be supplied in extruded rope-form of suitable cross-section and of such sizes as to seal the joint space when the sections are set in place. The sealing compound shall be protected by a suitable removable two-piece wrapper. The two-piece wrapper shall be so designed that one-half may be removed longitudinally without disturbing the other half to facilitate application of the sealing compound.

3. Joints of manholes shall not be sealed with grout.

F. Non-penetrating lifting holes

1. Lifting holes shall be constructed using plastic inserts cast into the manhole, stopping short of extending all the way through the wall. Plastic inserts and lifting eyes shall be as manufactured by Press-Seal Gasket Corporation or equal.

G. Pipe Connections To Precast Manhole Bases and/or Sections

1. A flexible pipe-to-manhole connector shall be provided with the manhole. The connector shall provide a water tight seal and accommodate ground movement to prevent pipe shear. All clamps and miscellaneous metal shall be type 304 stainless steel. Connectors shall be installed in accordance with manufacturer's recommendations. No inlet or outlet piping in manholes, valve chambers or wet wells shall be at a manhole section joint. A minimum space of 6 inches from the joint shall be provided.

2.7 RECTANGULAR PRECAST MANHOLES **(Not Applicable to this project)**

- A. The rectangular precast manholes shall be constructed to the sizes detailed on the Drawings.
- B. Manholes shall be designed in accordance with the Building Code requirements of ACI 318 and AASHTO H20 truck loading.
- C. The materials shall conform to the following standards:
 1. Concrete shall be 4000 psi using ASTM C150 Type 11 cement.
 2. Wire mesh shall conform to ASTM A185.
 3. Reinforcing rods shall be ASTM A615 grade 60.
- D. Cover shall be cast with the floor door in place. Floor door shall be as specified on the drawings.

2.8 HDPE MANHOLE LINERS **(Applicable for Sewer Lift Station Wet-Well Only)**

- A. The sewer lift station wet well is required to be supplied by the precast manufacturer with HDPE liners on all interior concrete surfaces. The liner shall be furnished with anchors to securely attach the liner to the interior of the precast concrete manholes. The wet well shall be supplied with AGRU Sure-Grip type HDPE liners, or pre-approved equal, and shall meet or exceed specifications listed in the following table.

Property	Test Method	Minimum Average Values
Thickness (nominal), mil (mm)	ASTM D5199	120 (3.0)
Density, g/cc, minimum (yellow/other)	ASTM D792, Method B	0.935
Tensile Properties (ave. both directions) Strength @ Yield (min. ave.), lb/in width (N/mm)	ASTM D6693, Type IV 2 in/minute	264 (46)
Elongation @ Break (min. ave.), %(GL=2.0in)		300
Pull Out Resistance psf (kN/m2)	ISO 4624	16,500 (800)
Back Pressure Resistance long term	SKZ-Test 700mm x 700mm	1,000 hour at 1.5 bar (21.76 psi)

PART 3 - EXECUTION

3.1 GENERAL

A. Ground Water

1. All ground water shall be kept away from newly poured concrete, or freshly laid brickwork, until concrete has properly set, and a watertight job is obtained. Manholes which admit ground water after completion, must be repaired to the satisfaction of the Engineers.

B. Line and Grade

1. Where manholes occur in pavements, set top of frame and covers flush with finished surface. Where manholes occur in dirt roads, set top of frame and cover 6 inches below finished surface. Elsewhere set top of frame and cover 3" above final grade, unless otherwise indicated.
2. Care shall be taken to have all pipes to and from manholes laid to correct lines and grades as established for the project.

C. Drop Manholes

1. Where shown, drop manholes shall be constructed in accordance with the details shown on the Drawings.

3.2 PRECAST MANHOLES

A. Handling

1. All precast manhole components shall be lifted and moved by use of lifting eyes that are slipped into the insert which are cast into the manhole. The lift system shall not damage the precast manhole.
2. All damage to precast sections shall be thoroughly repaired in the presence of the Engineer. Repair and patching of minor breaks shall be done by chipping and scarifying the defective area before application of grout. Sufficient time shall be allowed for curing before the precast sections are put together. Concrete cast-in-place bases shall be specially formed and keyed to accommodate the bottom precast section.

B. Site Inspection of Precast Sections

1. Precast sections shall be subject to rejection on account of failure to conform to any of the specification requirements. In addition, individual sections of manhole sections may be rejected because of any of the following:
 - a. Fractures or cracks passing through the wall, except for a single end crack that does not exceed the depth of the joint.
 - b. Defects that indicate imperfect proportioning, mixing, and molding.
 - c. Surface defects indicating honey-combed or open texture.
 - d. Damaged or cracked end, where such damage would prevent making a satisfactory joint.

- e. Any continuous crack having a surface width of 0.01 inch (0.25 mm) or more and extending for a length of 12 inches (305 mm) or more, regardless of position in the section wall.

C. Bitumastic Coating

1. Prior to setting the precast sections in place each section shall have the exterior concrete surface blown free of all dirt and debris and brushed clean and then coated with bitumastic. As an alternative, the bitumastic coating may be applied at the manufacturer's plant in accordance with this Specification.
2. The coating shall be Bitumastic Super Service Black as manufactured by Kop-Coat, a Division of Carboline Co., equivalent of Valspar Corp., or equal.
3. At least three (3) coats shall be applied giving a total dry film thickness of a minimum of 32.0 mils.
4. After installation, damaged surfaces including plugged lifting holes, shall be recoated in accordance with the coating manufacturer's recommendation to give the required 32.0 mils dry film thickness.
5. The Contractor shall provide a certification to the Engineer stating that he has installed the exterior manhole, wetwell and valve chamber coatings in accordance with the manufacturer's recommendations and that there is a minimum of 32.0 mils of material on all component structures.

D. Placement

1. Manhole sections shall not be set by wedging or placing shims to secure proper level and manholes shall not be backfilled without the permission of the Engineer.

E. Masonry Work

1. The top of all precast manholes may be brought to proper grade for receiving manhole frames after paving has been replaced on paved streets by using not more than two courses of brick. In lieu of brick, precast manholes may be brought to grade by the use of no more than two precast concrete extension rings. The total depth of the rings shall not exceed 6 inches. The construction shall be performed by experienced and qualified workmen only. All work shall be laid plumb, straight, level, square and true. Brick or rings shall be laid in full beds of mortar and shoved into place. All joints shall be full and not more than 1/2 inch in thickness. The Contractor shall set in place and bond in the masonry all necessary steps and miscellaneous items specified elsewhere. The masonry walls shall be parged on the outside with a one-half inch coat of Portland Cement mortar.
2. Mortar used in brickwork, setting manhole frames, and parging, shall be prepared by thoroughly mixing: One (1) volume of Type II Portland Cement with three (3) volumes of sand and sufficient clean water to produce a rich mass of uniform consistency. Mixing mortar on the ground or any paved surface shall not be permitted. Sand to be used in making mortar shall be clean, well graded, and shall pass a standard No. 4 sieve.
3. All mortar shall be a mixture of non-shrink grout.

4. Masonry shall not be constructed during cold weather (air temperature below 40 Degrees F.) unless necessary precautions are observed as permitted by the Engineer.

3.3 FLOW CHANNELS AND BENCH WALLS

- A. The method of constructing flow channels and bench walls is dependent on which manhole base has been installed.
- B. In precast bases, the flow channels and bench walls in each manhole shall be carefully formed of mortar and brick, or concrete. Precast inverts will not be accepted.
- C. The minimum depth of flow channel shall be equal to 3/4 the diameter of the largest sewer in the manhole to which it connects. The channel shall be graded to give a smooth, uninterrupted flow through the manhole.
- D. Bench walls shall be pitched a minimum of 1 inch but not more than 2 inches per foot from the inside periphery of the manhole to the edge of the flow channel.

3.4 TESTING

Manholes shall be constructed to be completely watertight. The contractor shall test the manhole by one of the following methods: (1) Infiltration Test: If the manhole is located below the groundwater table, the inverts shall be plugged and the infiltration into the manhole shall be measured after a 12-hour period. If any visible infiltration has occurred into the manhole, visible by wet walls or any accumulation on the bench, the infiltration shall be considered excessive. (2) If the manhole is above the current groundwater table, an exfiltration test will be conducted. All incoming sewer lines shall be plugged and the manhole filled with water to a level above the highest section joint. If the water level drop exceeds 1/8" per vertical foot of manhole depth in 30 minutes, the manhole shall have failed the test. (3) Manholes may be tested for leakage by Negative Air Pressure (Vacuum) Test as prescribed in **ASTM C 1244** to demonstrate the integrity of the installed materials and the construction procedures. This test method shall be used for testing concrete manhole sections utilizing mortar, mastic, or gasketed joints and is intended to demonstrate the condition of the concrete manholes prior to backfill. In accordance with the ASTM C 1244, the test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations. A vacuum of 10 in. Hg shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for the vacuum to drop to 9 in. Hg. The manhole shall pass if the time for the vacuum reading to drop from 10 in. Hg to 9 in. Hg meets or exceeds the values indicated in ASTM C 1244 Table 1, shown below. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

TABLE 1 Minimum Test Times for Various Manhole Diameters in Seconds

Depth (ft)	Diameter, in.								
	30	33	36	42	48	54	60	66	72
Time, in seconds									
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	39	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

END OF SECTION

SECTION 02665

WATER DISTRIBUTION SYSTEMS

PART 1 - GENERAL

1.1 SCOPE OF WORK

Work under this section consists of furnishing all materials, supplies, equipment and labor in accordance with the requirements set forth herein and as shown on the drawings. All work shall be performed and tested in accordance with applicable AWWA standards and manufacturer's recommendations.

1.2 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The work under this contract shall be in strict accordance with the following codes and standards:

- Local, county and municipal codes;
- American Society for Testing and Materials (ASTM);
- American National Standards Institute;
- American Water Works Association (AWWA);
- American Association of State Highway and Transportation Officials (AASHTO);
- Florida Department of Environmental Protection (FDEP)
- Florida Department of Transportation Specifications (DOT);
- Federal Specifications;
- United States Department of Commerce Commercial Standards (CS); and
- All local government rules and regulations.

The latest revision of referenced codes and standards in effect at the time of submittal of the Bid Proposal shall govern.

1.3 CONTRACTOR LICENSE

Contractor and Subcontractor shall possess valid licenses required by state and local codes. All water main work shall be performed by a State of Florida licensed Underground Utility Contractor. All plumbing work on private property shall be performed by a licensed plumber.

1.4 SHOP DRAWINGS AND SUBMITTALS

A. Shop drawings shall be submitted for items included under this Section and shall include the following minimum information:

- Full details of pipe, fittings, special joints, and assembly thereof, including manufacturer's name;
- Joint materials and details;
- Catalogue cuts, dimensions and full details of all castings, valves and appurtenances;
- Certifications as specified herein; and
- Reinforcing steel bending and setting drawings.

B. Furnish sworn certificates in duplicate that all tests and inspections required by the Specifications under which the materials were manufactured have been satisfied.

1.5 RELATED WORK

- Testing
- Earthwork
- Boring and jacking

1.6 INSPECTION

All pipe and fittings to be installed under this Contract may be inspected at the site of manufacture for compliance with these Specifications by an independent laboratory selected by the Owner. The manufacturer's cooperation shall be required in these inspections. The cost of inspection by an independent laboratory will be borne by the Owner.

1.7 MANUFACTURER TESTING OF PIPE AND FITTINGS

Each joint of pipe 6 inches in diameter and larger shall be hydrostatically tested at the point of manufacture as required by the appropriate AWWA Standard. Owner may request that certificates of compliance be furnished with the material.

All ductile and cast iron fittings to be furnished under this Contract shall be inspected and tested at the foundry as required by the AWWA Standard C-110, Section 10-10.

Provide letters of certification of all tests.

1.8 MEASUREMENT AND PAYMENT

A. GENERAL

Payment for items covered in this section shall be in accordance with the Bid Proposal. When quantities are listed in the Bid Proposal, the quantities shall be determined in the following manner. However, if items are not specifically listed in the Bid Proposal, such items are considered to be included in the unit price of the item of which they are associated.

B. WATER MAIN PIPING

1. MEASUREMENT - The length of water mains to be measured for payment will be the laying length in linear feet, actually installed, measured along the horizontal projection of the centerline of the completed pipe with no deductions made for those spaces occupied by valves or fittings.

2. PAYMENT - The unit prices as set forth in the Bid Form shall constitute full compensation for the size and type of material, for all excavation, backfilling, dewatering, furnishing, laying, jointing, all required connections between existing and new pipes, testing and disinfecting, all grassing work and complete restoration of all areas disturbed by the Contractor's operation. Pipe which has not been properly laid, bedded, jointed or backfilled shall not be included for payment. Payment for all fittings, gaskets, metallic tracer tape, concrete thrust blocks and anchors, as detailed on the Drawings and specified herein shall be included in the unit price per foot of pipe.

C. VALVE AND BOX

1. MEASUREMENT - Measurement for payment of valve and box as specified and shown on the Drawings, will be the number of units actually furnished and installed.

2. PAYMENT - Payment will be made for each box and valve of the size and type furnished and installed at the applicable unit price entered in the Bid Form. Payment will be in addition to the unit price paid for water mains.

D. **CONNECTING NEW WATER LINES TO EXISTING WATER LINES**

1. MEASUREMENT - Each connection of a new water line to an existing water line will be measured for payment as one unit and according to size.

2. PAYMENT - Payment for each connection of new water main to existing water main will be made at the unit price set forth in the Bid Form, and shall be full compensation for the item of work, complete, including location of existing water lines, all required excavation and backfilling, furnishing and installing all tees, gate valves, fittings, tapping sleeves, tapping valves, valve boxes, furnishing and placing all concrete supports, furnishing all labor, materials, tools, equipment; and all incidental and related work required.

E. **HIGHWAY AND RAILROAD CROSSINGS**

1. MEASUREMENT - The length of highway or railroad crossing to be measured for payment will be the actual length of steel casing pipe installed at each location shown, except that no measurement will be allowed for lengths that exceed the distances shown on the plans without prior written approval of the Engineer.

2. PAYMENT - Payment for jacking and boring highway or railroad crossings will be at the unit price per linear foot inserted in the Bid Form for the size of casing pipes and type of materials used regardless of depth. Unit price will constitute compensation in full for all labor, materials, equipment, dewatering, excavating, backfilling, casing pipe, inserting carrier pipe into casing, skids, bands, fittings and supplies required for each installation, and all grassing work. Carrier pipe will be included for payment under other items.

F. **PAVEMENT REPLACEMENT**

1. MEASUREMENT - Measurement for payment of pavement removed and later replaced shall be the lineal footage cut measured on the horizontal plane, along the centerline of the piping installed. Measurement shall be from edge to edge of pavement cut. Only that pavement located directly over the centerline of the piping being installed, will be considered eligible for payment unless otherwise shown on the Drawings or authorized by the Engineer. There shall be no duplication of measurement; e.g., pavement replacement measured for payment along a pipeline cannot be again measured for payment along a pipeline cannot be again measured for payment along an intersecting pipeline.

2. PAYMENT - Payment for pavement removed and later replaced, measured as defined above, shall be at the respective unit prices per linear foot set forth in the Bid Form. The respective unit prices shall be payment in full for the item including, but not limited to, all compaction required, materials as specified and shown on the Drawings, joint fabrication, all as applicable.

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL

Unless otherwise specified or shown on the drawings, materials and equipment shall be the standard product of a manufacturer and shall comply with the Contract Documents and applicable standards for such materials or equipment.

2.2 NON-TOXIC PAINTS PROPOSED FOR CONTACT WITH DRINKING WATER

Coatings and the chemicals that are contained in coatings to a surface in contact with drinking water, or are otherwise on equipment surfaces that come into contact with the water shall be certified as being in conformance with American National Standards Institute (ANSI) and NSF International (previously known as the National Sanitation Foundation) Standard 60-1988 by an entity certified by ANSI.

2.3 WATER SYSTEM COMPONENTS IN CONTACT WITH DRINKING WATER

Water system components which come into contact with drinking water shall conform with ANSI/NSF Standard 61, Drinking Water System Components.

2.4 DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall conform to the requirements of AWWA C151 unless otherwise noted on the plans. The pipe thickness shall be in accordance with the requirements of AWWA C151 Pressure Class 200 psi or higher. For above ground installations, threaded flanged pipe shall be supplied in accordance with AWWA C115. Glands for mechanical joints shall be ductile iron or cast iron. Pipe shall be as manufactured by American Ductile Iron Pipe Co., Clow or equal.

B. Fittings shall conform to the requirements of AWWA C110 or C153. Fittings shall be mechanical joint, or flanged as noted on the plans, and shall have a 250 psi minimum working pressure. Fittings shall be as manufactured by U.S. Pipe Co., American Ductile Iron Pipe Co., Clow or equal.

C. Flanged fittings shall conform to ANSI B16.1, screwed-on flanges, faced and drilled to ANSI Class 125-pound template. They shall provide 1/16-inch full face gaskets of red sheet rubber.

D. Joints shall conform to the requirements of AWWA C111.

E. Coatings and Linings of the internal surfaces of all ductile iron pipe and fittings for water mains shall be coated with a cement lining and seal coat in accordance with AWWA C104. The outside surface shall be coated with a bituminous coating approximately one mil thick.

F. All pipe shall be given a factory hydrostatic test of not less than 500 psi.

2.5 POLYVINYL CHLORIDE PIPE (PVC) AND FITTINGS

A. PVC pipe for potable water in sizes 4 inch through 12-inch shall conform to AWWA Standard C900-97, "PVC Pressure Pipe for Water", or AWWA Standard C909-02, "Molecularly Oriented Polyvinyl Chloride (PVCO) Pressure Pipe for Water". Laying lengths shall be 20 feet $\pm$ 1 inch for all sizes.

B. Pipe shall have an integral bell end or extruded coupling with gasket seal which is in compliance with the requirements of ASTM D3139, "Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals".

C. Pipe shall be **Pressure Class 235 psi (DR 18)** with cast iron outside dimensions. Each piece of pipe shall be hydrostatically tested to 600 psi. Marking shall include nominal size and O.D. Base (e.g. 6 inch C.I.), material code designation number (PVC 1120), dimension ratio number (DR 18), AWWA pressure Class 150, AWWA designation AWWA C900 or C909, as manufacturer's name and production code. All PVC pipe shall be Underwriters Laboratory (UL) and Factory Mutual approved. All water mains shall be blue in color, and the color shall be the same through the wall of the pipe (i.e., not a surface paint or coating).

D. PVC pipe in sizes under 4 inches shall be 200 psi (SDR 21) in IPS dimensions manufactured from 1120 PVC resin. Pipe shall have integral wall bells or extruded couplings with gasket seals. Pipe shall be marked with manufacturer's name, size, material code (PVC 1120), pressure rating (200 psi), DR number (DR21).

E. All taps on PVC pipe will be made through saddles or tapping sleeve and valve.

F. Fittings for pipe smaller than 4 inches in diameter shall be PVC. Fittings for pipe 4 inches and larger shall be Ductile Iron conforming with the requirements of ANSI/AWWA C153/21.53-84.

2.6 WATER SERVICE PIPING

Polyethylene potable water service tubing shall conform to AWWA Standard C901, with dimensions and tolerances that conform to the values set forth in ASTM D2666. Copper tubing size outside diameter with standard dimension ratio 9 (SDR-9). Polyethylene raw material is defined by ASTM D2581, Type II, Grade I (PB2110). Working pressure shall be 250 psi at 73.4 degrees F. Tubing shall be blue in color and imprinted with size, manufacturer's name, working pressure, NSF potable water approval, ASTM specification number, and production code.

An affidavit of compliance will be required for all PB service tubing installed. Manufacturer will sign, seal and certify that all materials delivered shall comply with the requirements of AWWA C901, this Specification, and all standards of the manufacturer.

2.7 HDPE (HIGH DENSITY POLYETHYLENE)

High Density Polyethylene (HDPE) water pressure pipes shall be PE 4710 DR 17 and shall be seamed together using the standardization of butt-fusion procedure. HDPE shall be installed via open trench and Directional bore methods. The connecting of HDPE Pipe to other material should be in accordance with Chapter 9 of PPI's Handbook* of Polyethylene Pipe, 2nd ed. and PPI TN-36, General Guidelines for Connecting 10 HDPE Potable Water Pressure Pipes to DI and PVC Piping Systems

HDPE must meet AWWA C901-08 Specification for DR 17 pipe.

SUBMITTALS: Material list naming each product to be used identified by manufacturer and type number, in accordance with Section 01340.

PRODUCT HANDLING: Handle pipe and fittings to insure delivery in a sound undamaged condition.

JOB CONDITIONS: Do not lay pipe when trenches or weather conditions are not suitable for such work.

2.8 DETECTABLE BURIED WARNING TAPE AND COPPER LOCATION WIRE

Detectable buried pipe warning tape shall be 2 inches minimum width, long lasting plastic with metalized foil core specifically designed for non-metallic pipes and shall be placed over all PVC water lines and fittings. Metalized core shall be detectable to depths of up to 6 feet by use of commercially available pipe location equipment. Tape shall be furnished in manufacturer's standard color and roll length and shall be imprinted continuously with the following words unless otherwise approved: CAUTION BURIED WATER MAIN BELOW. Detectable buried warning tape shall be equal to or better than Terra Tape "D", as manufactured by Griffolyn Company Inc., 10020 Mykawa Road, Post Office Box 33248, Texas, 77033

In addition to the installation of the detectable buried warning tape over all PVC water lines, the Contractor shall install a 14 gauge insulated copper wire directly on top of all PVC water lines and taped every ten feet for location purposes. The wire shall be continuous and all connections taped. Three feet of excess wire shall be left in all valve boxes. Each fire hydrant shall have one wrap of the wire around the barrel located at final grade and connected to the wire on the water main. No additional payment will be made for this wire and tape installation and will be included in the unit price per linear foot for PVC water pipe.

2.9 VALVES AND GATES

A. General

1. Unless otherwise indicated, valves three (3) inches and smaller shall be all brass or bronze, and valves larger

than three (3) inches shall be iron body, bronze mounted. Unless otherwise indicated, gate, globe, angle, and check valves three (3) inches and smaller shall be provided with threaded connections; those larger than three (3) inches shall be provided with connections as indicated. Connections shall conform to the herein above specified piping connections.

2. All valves shall be ample strength to withstand and operate satisfactorily under the working pressures and shall be subject to the test pressure specified herein. All valves shall be rated for a minimum cold water working pressure of 150 psi and a minimum test pressure of 300 psi, except as otherwise specified herein.

3. Tests shall be made in the shop with a hydrostatic water pressure, cost of tests to be merged in the cost of the valves, and any valves which leak or which show any defects shall be rejected.

B. Gate Valves 4" and Larger (Resilient Wedge)

1. All valves in size four inch through 12 inch shall be of the resilient wedge gate type. Valves shall be manufactured to meet all applicable requirements of AWWA Standards for Resilient Seated Gate Valves, C509 or C515. All valves of this type shall be bubble tight at 200 psi water pressure.

2. Valves shall have non-rising stems open by turning counter clockwise (left) and with two inch square operating nut with arrow cast in metal to indicate direction of opening.

3. The inside of the valve body and bonnet shall be lined with an epoxy coating. The lining shall be a two-part thermosetting epoxy resin applied by the manufacturer and equal to Endurall 3300.

4. Each valve shall have the manufacturer's name, pressure rating and year manufactured cast on the body. Prior to shipment from the factory, each valve shall be tested by hydrostatic pressure equal to twice the specified working pressure.

5. All valves shall be the mechanical joint type as manufactured by Mueller, Clow, American, Dresser or equal.

6. Each valve shall be equipped with a valve box. For this project a total of two (2) tee handle socket valve wrenches shall be furnished by the Contractor to the Owner. The cost of valve wrenches and boxes shall be included in the price of the valve.

C. Gate Valves, Under 4 inches (Bronze)

Gate valves three (3) inches in size and smaller shall be 125 lb. bronze, rising stem, double wedge disc, union or screwed bonnet type. Valves shall be of a design to permit repacking under pressure. Unless otherwise indicated valves shall be equipped with handwheels. Each valve shall be equipped with a valve box.

2.10 VALVE BOXES

All valves installed underground shall be provided with adjustable cast iron valve boxes to fit the depth of earth cover over the valve. Boxes shall be three piece adjustable screw type with a minimum inside diameter of 5". Boxes shall be furnished with case iron covers marked "Water" and so constructed as to be tight and non-rattling. Boxes shall be so designed as not to bear on the valve or pipeline or transmit any surface loads thereto.

2.11 FIRE HYDRANTS

All fire hydrants shall fully comply with AWWA C-502 and be a mechanical-joint, dry barrel-traffic type as manufactured by American AVK High Pressure, 250 PSI, Nostalgic type or approved equal. The upper and lower stem along with all

hardware shall be stainless steel. The size shall be six (6) inches in diameter by three (3) feet in length with 5-1/4 inch main valve opening, a 1-1/2 inch Pentagon operating nut and equipped with two 2-1/2 inch hoses and one 4-1/2 inch pumper connections. The hydrant shall be painted fire engine red with caps equipped with chains.

2.12 FLUSHING HYDRANTS

All flushing hydrants shall be hidden type dry barrel design with 3-ft. bury depth, shut-off valve and 2-1/2" hose nozzle as manufactured by Mueller No. A-410 or equal. Contractor shall provide and install necessary fittings to transition from water main to 2" pipe thread connection. Shut-off valve shall be provided with integral drain to allow hydrant post to drain after use to prevent freeze damage.

2.13 HOSE BIBS

Hose bibs shall be Crane No. 58 or equal of size shown on the Drawings.

2.14 CORPORATION STOPS AND CURB STOPS

All corporation stops and curb stops shall be maintained and dimensioned in accordance with AWWA Standard C800. All compression fittings shall be designed for use with copper tubing size (CTS) service lines. Stainless steel insert stiffeners will be required when polybutylene tubing is used. "Ball type or Oriseal" valves shall be used in all sizes. Either Ford (pack joint), A. Y. McDonald (T-series), or Mueller (110 series) is approved for use. No substitutes.

All corporation stops and curb stops will conform to the inlet and outlet configuration as listed below:

CORPORATION STOPS				
SIZE	3/4"	1"	1½"	2"
INLET	cc thread	cc thread	IP thread	IP thread
OUTLET	compression	compression	compression	compression

CURB STOPS				
SIZE	3/4"	1"	1½"	2"
INLET	compression	compression	compression	compression
OUTLET	female IP thread	female IP thread	female IP thread	female IP thread

2.15 SERVICE SADDLES

For 3/4 inch and 1 inch taps on PVC pipe, a service saddle with a single 2 inch wide stainless steel band or strap shall be furnished. The saddle shall be of cast or ductile iron and shall be epoxy, nylon, or PE coated (10 mils minimum). Approved styles are Ford FC101, Romac 101N and Rockwell 315, or Cascade Model CNS1. No substitutes.

For 1 1/2 inch and 2 inch taps on PVC pipe, a more stable saddle is required. Saddles for these taps shall have either two each stainless steel 2 inch straps or a single stainless strap a minimum of 3 1/4 inches wide. The saddle body shall be cast or ductile iron and shall be coated with epoxy or nylon. Approved styles are Ford FC202, Romac 202N and Rockwell 317, Cascade Model CNS2.

As an equal alternate, service saddles may be Continental "Fasttap" model #5263-31-2506-00.

2.16 REPAIR OR JOINING CLAMPS

If repair or joining clamps are required, Contractor shall notify Engineer for approval indicating make and model and intend use. Clamps shall be of non-corrosive material (i.e., stainless steel, cast iron, bronze) as manufactured by Rockwell or equal.

2.17 TAPPING SADDLES, SLEEVES AND CROSSES

A. Tapping Saddles

Tapping saddles shall be fabricated of ductile iron or steel and suitable for either wet or dry installation as manufactured by American Cast Iron Pipe Company, U.C. M. Corporation, or approved equal. The sealing gasket shall be the o-ring type suitable for the applicable service. The outlet flange shall be ANSI B16.1, 125 lb. standard.

The straps and bolts shall be a corrosion resistant alloy steel.

B. Tapping Sleeves and Crosses

Tapping sleeves and crosses shall be of mechanical joint type with outlet flange per ANSE B16.1, 125 lb. standard as manufactured by Mueller No. 615 or 715, or approved equal.

C. Cut-In Sleeves

Cut-In sleeves shall be mechanical joint type class 150 ductile iron as manufactured by Mueller.

2.18 METER BOXES

Meter boxes shall be concrete, plastic, or cast iron unless otherwise indicated on the plans or in the Bid Proposal. The inside dimensions shall be approximately 11" x 24", rectangular in shape with a hinged cast iron lid for reading the meter. The box shall be large enough to house the back flow preventor, meter, curb stop, and hand valve.

2.19 DOMESTIC WATER METER (NOT APPLICABLE)

A. General

All water meters shall be sized as indicated on the plans and shall be Schlumberger Industries model T-10, or approved equal, with programmable oil-filled encoder register (mfr. Rep.: SEMSCO, 407-831-3516). No batteries shall be required in either register or receptacle pad. A mini-pit receptacle shall be supplied for each meter and shall be installed in meter box lid by contractor, such that reading can be accomplished without removing meter box lid. Two meter reading long Advantage Wands shall be provided with Ni-Cad batteries and battery charger. All software, hardware and technical instruction/support (one year) shall be provided as required to allow the meter reading system to be set up and operated and data to be downloaded to an IBM compatible computer at no additional cost to the Owner.

Alternate Design:

The domestic meter shall be a positive displacement, 5/8 inch by ¾ inch size unless otherwise indicated on drawings. It shall meet AWWA standards for displacement type cold water meters. The water meter shall be a Rockwell SR or approved equal.

B. Meter Construction

1. Main Case

The meter shall have a bronze main case. The bronze case must be able to withstand internal pressure and external stress without distortion, cracking or breaking to cause leaking or to interfere with the proper operation of the meter. The meter shall have a strainer to prevent foreign material from entering the measuring chamber.

2. Register

The register shall be hermetically sealed and magnetically driven. The registration reading shall be U.S. gallons with a 10 gallon sweepband and shall have a capacity of 1,000,000 gallons.

3. Accuracy and Operating Range

Normal operating flow range of the meter shall be 1 to 20 gallons per minute and accuracy at the normal flow range shall be 100 ± 1.5 percent of actual flow. Low flow registration shall be 95 percent at 1/4 gallons per minute. Maximum pressure loss at 20 gallons per minute shall not exceed 11 psi. Maximum operating pressure shall be 140 psi.

C. Workmanship and Materials

The supplier and manufacturer shall warrant the register for 10 years, the meter case for the life of the meter, and the new meter accuracy for 5 years. The supplier shall replace or repair, without charge, those parts in which a defect has developed within the specified warranty period upon return of such parts.

The meter installation shall be warranted for a period of twelve (12) months.

Alternate Design:

The supplier and manufacturer shall warrant the meter including register for a period of twenty five (25) years. The supplier shall replace or repair, without charge, those parts in which a defect has developed within the specified warranty period upon return of such parts.

2.20 GLOBE SERVICE VALVES (HAND VALVE)

Globe service valves (hand valves) shall be installed inside meter box. Valves shall be 3/4" size with 3/4" iron pipe threads end configuration. Globe service valves shall be Ford G11-333 or approved equal.

2.21 ANGLE BALL METER VALVES

Angle ball meter valves shall be 5/8" size with inlet pack joint for 3/4" plastic tubing. Angle ball meter valves shall be Ford BA43-232W or approved equal.

2.22 RESIDENTIAL BACKFLOW PREVENTER

Residential backflow preventers shall be Mueller RPZ Model H-14242 or approved equal.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Safety

In the Contractor's use of streets and highway for the work to be done under these Specifications he shall conform to all City, State, and local laws and regulations. The Contractor shall provide, erect, and maintain effective barricades, danger signals, and signs on all intercepted streets or highways for protection of the work and safety of the public rights-of-ways shall be provided with lights which shall be kept burning at all times between sunset and sunrise. The Contractor shall be responsible for all damages resulting from any neglect or failure to meet these requirements. Where conditions require the presence of a watchman to fulfill the requirements stated herein, same shall be furnished without extra cost to the Owner.

B. Maintenance of Service

The Contractor shall arrange his work to cause minimum disturbance of normal pedestrian and vehicular traffic and will be held responsible for providing suitable means of access to all public and private properties during all stages of the construction. Should the construction work require repairs, changes or modifications of other utilities, it shall be the responsibility of the Contractor to provide for the maintenance of continuous water, electric, telephone, and gas as well as sewage and other utility services to all present customers of such utilities, unless approval in writing is secured from the utility company for interruption of such service. Contractor's attention is directed to section 02200 "Earthwork" for additional maintenance of service requirements.

C. Limits of Construction

In locations where the work is to be installed in streets or road right-of-way the activities of the Contractor shall be confined to these public properties. Where the use of private property is deemed necessary by the Contractor to facilitate construction work arrangement for such use with the property Owner shall be the responsibility of the Contractor. The Contractor shall save the Owner harmless from all claims by adjacent property owners for trespassing or damage due to the activities of the Contractor in the prosecution of the work.

D. Existing Utilities

The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition and extent of all such installations and structures as may be encountered and as may affect the construction operations.

All existing improvements such as pavements, conduit, poles, pipes and other structures, shall be carefully supported and fully protected from injury. The Contractor shall be responsible for damages to these existing utilities and shall, in case they are damaged, restore them to their original condition at no cost to the owner.

Contractor shall give written notice to the Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of work. This can be accomplished by making the appropriate contact with the following utility companies listed on page

2 of the plans.

3.2 PIPE INSTALLATION

A. Connections to Existing Mains

It is the Contractor's responsibility to make exploratory excavations and/or use other methods available to locate valves, fittings and piping prior to construction of any underground piping system and to adjust the new piping layout to agree with existing piping layout prior to construction and at no additional cost to the Owner. All adjustments shall be subject to approval by the Engineer prior to installation.

Prior to any connection to existing mains, all new water mains and service lines must have passed all pressure and disinfection test as required herein and written permission must be obtained from the Engineer authorizing the connection. The Engineer's authorization shall only be given after a clearance or partial clearance is issued by the Florida Department of Environmental Protection.

Contractor shall have all fittings and equipment and adequate labor on-hand so as to make as quick as possible connection to minimize interruption of water service. Engineer shall specify time of day and day of week for connection to minimize effects of interruption. Contractor shall notify Engineer and utility owner 48 hours prior to connection. Engineer may require Contractor to use restraint rods, retainer glands or other methods in place of thrust blocks to avoid time required for concrete to harden.

B. Separation

Water and sewer lines shall maintain a horizontal separation of 10 feet or a vertical separation of 18 inches. When this is not possible, concrete encasement of pipe for a distance of ten feet each side of the sewer main shall be used. In lieu of the concrete encasement, ductile iron pipe may be used. A minimum vertical separation of 6 inches shall be maintained with all other utilities.

C. Excavation, Backfill and Compaction

Excavation, backfill and compaction shall meet the requirements of Section 02200, Earthwork and as shown on the drawings. Stones found in trenches for water mains shall be removed to a depth of at least six inches below the bottom of the pipe, and continuous and uniform bedding shall be provided. Backfill material shall be tamped in layers around pipe main to a sufficient height above the pipe to provide adequate support and protect the pipe.

D. Field Layout

Only approximate location of lines are indicated on drawings. Field adjustment of location will be required. Consult Engineer for proper adjustments.

E. Depth of Cover

Where elevations are not indicated, lay water main lines with a minimum of 36 inches of cover unless shallower depths are specifically indicated on the drawings. Greater depths will be permitted where required to miss obstructions or for proper installation of valves, hydrants, or specials. Pipe shall not be deflected more than manufacturer's recommendation.

Service lines shall have a minimum cover of 18 inches.

F. Well Pointing

Water shall not be allowed in the trench at any time. An adequate supply of well points, headers or pumps, all in first class operating conditions, may be used to remove the water. The use of gravel and pumps shall also be an acceptable means of removing the water. The trench shall be excavated no more than the available pumping facilities are capable of handling. This discharge from pumps shall be routed to natural drainage channels or emptied into drains or storm sewers.

G. Ductile Iron Pipe (D.I.P.)

Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA Standard Specification C600 and the Handbook of Ductile Iron Pipe, 6th Edition.

H. Polyvinyl Chloride Pipe (PVC)

PVC pipe and fittings shall be installed in accordance with the Handbook of PVC Pipe, 2nd Edition.

I. Pipe Laying

The bottom of the trench shall not be excavated below the specified grade. If undercutting occurs, the bottom of the trench shall be brought up to the original grade with approved material, thoroughly compacted as directed by the Engineer.

After placing a length of pipe in the trench, the spigot end shall be centered in the bell, the pipe forced home, brought to correct alignment, and covered with an approved backfill material.

When pipe laying is not in progress, the open ends of pipe shall be closed by a water tight plug or other approved means. This provision shall apply during the noon hour as well as overnight. If water is in the trench, the seal shall remain in place until the trench is pumped completely dry.

The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner without damage to the pipe.

Lines shall be laid reasonably straight and any change in grade following the contour of the ground shall be made in long sweeping curves and no abrupt changes in direction or grade will be allowed except as indicated on the Drawings.

3.3 INSTALLATION OF COPPER LOCATION WIRE AND DETECTABLE WARNING TAPE

Installation of the 14 gauge insulated copper wire and the detectable buried warning tape shall be installed by the Contractor over all PVC and plastic water mains and service lines as indicated on the Drawings and specified here, except the detectable tape is not required over service lines. Following trenching and laying of the water main line, the trench shall be backfilled and compacted as specified elsewhere to a depth of 16 inches $\pm$ 2 inches measured from ground level. Tape shall then be placed into the trench with the wording side visible and centered directly above the pipe below. Installation of the tape shall be in accordance with the manufacturer's recommendations, except as otherwise specified or approved. Tape shall run continuously. Where splicing is required, tape shall be over-lapped a minimum of 12 inches.

Following placement of the tape, the trench shall be backfilled with due caution to prevent displacement or damage

to the tape.

After the tape has been installed and the trench backfilled, the Contractor shall perform a detection test using a commercially available pipe detector furnished by the Contractor. Any undetectable tape shall be replaced by the Contractor to the satisfaction of the Engineer at no additional expense to the Owner.

3.4 VALVES AND FITTINGS

All valves and fittings shall be set and joined to the pipe in the proper location as specified in the Drawings. A valve box shall be provided for every valve. This valve box shall not transmit shock or stress to the valve and shall be centered and plumb over the wrench nut of the valve, with the box cover flush with the final grade or as may be specified in the Drawings.

3.5 THRUST BLOCKS

Longitudinal thrust along pressurized pipe lines at bends, tees, reducers, and caps or plugs shall be counteracted by enough weight of concrete to counterbalance the vertical and horizontal thrust forces. Where undisturbed trench walls are not available for thrust blocking, the Contractor shall furnish and install suitable pipe harnesses or ties designed and manufactured for this purpose. Harnesses and/or ties shall be approved by the Engineer.

Thrust blocks shall be sized for 150 psi hydrostatic pressure, with dimensions as indicated on the Water Detail Sheet. Restrained joints shall be used where directed by the drawings and may be used at other locations with prior approval by the Engineer. Joints shall be protected by felt roofing paper prior to placing concrete thrust block.

Concrete for thrust blocking shall be no leaner than one part cement, 1 1/2 parts sand, and 5 1/2 parts aggregate having a compressive strength of 2000 psi. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks.

In lieu of thrust blocking, with the approval of the Engineer, pipe harnesses and/or ties or restrained push-on or restrained mechanical joints may be used.

3.6 RESTRAINED JOINTS

Sections of piping designated on the drawings as having restrained joints or those requiring restrained joints due to insufficient time to allow curing of concrete thrust blocks shall be constructed using pipe and fittings with restrained "locked-type" joints, retainer glands, or tie rods, and the joints shall be capable of holding against withdrawal for line pressures up to 150 pounds per square inch (psi). Tie rods, clamps, or other dissimilar metal shall be protected against corrosion by hand application of a 2.0 mils thick bituminous coat. Bolts, nuts, and tie rods shall be hot dipped galvanized, low alloy, high-strength steel. Tie rods, tie bolts, and hairpins shall have a minimum diameter of 3/4 inch, and 7000 pound tensile strength.

Contractor shall submit type and method of restrained joints to Engineer for approval prior to use.

3.7 SERVICE TAPS

All tapping shall follow manufacturer's recommended procedures. Taps will be located at 10:00 or 2:00 on the circumference of the pipe. Direct taps will be allowed only on ductile iron pipe. All other materials will be tapped with a saddle. Teflon tape for sealing and lubricating will be used on the threads of all corporation stops. Torque on corporation stops will not exceed manufacturer's recommendations. Allowance for any possible movement in the main will be made by making a half loop in the service piping at the tap and compacting backfill to 100 percent standard proctor under this loop.

3.8 SERVICE LATERALS

Water Service laterals shall be continuous with no joints from the water main to the water meter unless specifically allowed by the Engineer. However, in no case will joints be allowed under roadways.

Laterals may be installed by the open trench method except for paved areas. Under paved areas service laterals shall be installed by the dry-uncased boring method unless otherwise specifically indicated on the plans.

The dry-uncased boring method or "push-pull" method shall be used to eliminate the need for open cutting of streets or sidewalks. The Contractor shall use equipment specifically designed for this purpose such as the Mighty Mole or the Trojan Workhorse Pusher. The push rod shall be of the size compatible with the service lateral. The rod shall be pushed under the paved area and then the pipe attached and pulled back through. The pits for the operation shall be no closer than 3 feet to the edge of payment. In no case shall a wet boring method be allowed.

3.9 PRESSURE AND LEAKAGE TESTS OF WATER DISTRIBUTION PIPING

Contractor shall furnish all gauges, meters, pressure pumps, equipment, fittings, and labor needed to test the line. The cost of these items shall be included in price of pipe. Contractor shall notify Engineer 48 hours prior to start of test. All pipe installed shall be tested and written acceptance issued by the Engineer prior to connection of new line to existing water system. The pressure test shall include service lines to the curb stop.

The Contractor may test the system with joints exposed or backfilling complete at his option. The contractor shall obtain and pay for all water used. Care shall be used to prevent backflow of test water into potable water source. Potable water source shall be disconnected prior to pressurizing test line. Water used during test shall be taken from a container, not directly from the existing water system.

At least 24 hours prior to the start of the pressure and leakage test, pressure shall be raised to 150 psig and held to allow any "soil creep" or other stress relaxation to occur. If any pressure reduction occurs during the 24 hour "shakedown" period, reestablish the required hydrostatic test pressure, then proceed with the leakage test.

The pressure required for the field hydrostatic pressure test shall be 150 psi. The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure. Corporation cocks at least 3/4 inches in diameter, pipe risers and angle globe valves shall be provided at each pipe dead-end and high points in order to bleed air from the line. Duration of pressure test shall be at least two hours. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced. The pipe lines shall be tested in such section as may be directed by the Engineer by shutting valves or installing temporary plugs as required. The line shall be filled with water, all air removed, and the test pressure shall be maintained in the pipe for the entire test period by means of a gasoline or electric driven test pump to be furnished by the Contractor. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage.

No pipe installation will be accepted until or unless the leakage (evaluated on a pressure basis of 150 psi) is less than 2.2 gallons per 24 hours per thousand feet per inch nominal diameter. The following tabulates the allowable leakage.

Allowable Leakage Per 1000 ft of Pipeline (In Gallons)								
Duration of Test	Nominal Pipe Diameter							
	2"	3"	4"	5"	6"	8"	10"	12"
1 hour	0.18	0.28	0.37	0.46	0.55	0.74	0.92	1.10
2 hour	0.37	0.55	0.74	0.92	1.10	1.47	1.84	2.20

Where any section of a main is provided with concrete reaction backing the hydrostatic pressure test shall not be made until at least five (5) days have elapsed after the concrete reaction backing was installed. If high early-strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least three (3) days have elapsed.

3.10 FLUSHING OF COMPLETED PIPELINES

Following the hydrostatic test and backfilling, each section of completed pipeline shall be as thoroughly flushed as possible. A minimum flow shall be used for flushing that will insure a velocity in the pipe of 2.5 feet per second. Water required for testing and flushing shall be furnished by the Contractor. The water shall be from a potable water source satisfactory to the Owner.

3.11 DISINFECTING POTABLE WATER PIPELINES

Following flushing, the Contractor shall disinfect all water distribution mains and service lines in accordance with AWWA Specification C601-68 and with the State of Florida Health Standards. Water shall be fed slowly into the system applying sufficient chlorine to produce a dosage in excess of 50 ppm at the farthest point in the system from the point of application. The chlorine solution then shall be retained in the line for a minimum period of 24 hours. At the end of this time if a minimum chlorine residual of 5 ppm is not obtained, the procedure shall be repeated. During the disinfection process all valves shall be operated. After disinfection, the water shall be flushed from the system at its extremities until excessive chlorine residuals are eliminated. The water shall also be flushed through the service lines. The lines shall then be refilled with potable water. Bacteriological sampling and analysis of the replacement water shall be taken by the Contractor as directed by the Engineer or County Health Department and submitted to the nearest approved bacteriological laboratory. Disinfection shall not be considered satisfactory until laboratory reports are satisfactory to the Division of Health and clearance granted by F.D.E.P. Each sample point shall have two consecutive passing tests taken no less than 24 hours apart.

For water main sections less than 200 feet in length, a minimum of 2 bacteriological sample points shall be tested, one from each end of the pipe section. For water main sections greater than 200 feet in length, a minimum of 3 bacteriological sample points shall be tested, one at each end and one near the midpoint of the section of pipe. But in no case shall less than one bacteriological sample point be tested for each 300 lineal feet of pipe.

Water required for disinfection, testing and flushing shall be furnished by the Contractor. The water shall be from a potable water source satisfactory to the Owner. All cost associated with disinfecting including the cost of the water shall be included in the unit cost of the pipe and no separate payment will be made for this item.

Contractor shall not make any connection to existing water system nor place any water line in operation until all

pressure and bacteriological test have been successfully completed and written authorization issued by the Engineer with clearance granted by F.D.E.P.

NOTE: H.T.H. should be applied at a rate of 0.7 pounds per 1000 gallons. Calcium hypochlorite tablets (H.T.H.) containing 70 percent available chlorine may be used when water mains are 12 inches and smaller and lengths up to 2,500 feet. The water main shall be disinfected with a concentration of 50 PPM chlorine. The H.T.H. tablets shall be glued with a #1 Permatex. They shall be placed one foot from the end of the top innerside of the pipe. The following table was computed with 20 feet joints of pipe.

4" pipe	use 1 H.T.H. tablet or 0.5 lb. per 1000 feet of pipe
6" pipe	use 2 H.T.H. tablets or 1.0 lb. per 1000 feet of pipe
8" pipe	use 3 H.T.H. tablets or 1.8 lb. per 1000 feet of pipe
10" pipe	use 5 H.T.H. tablets or 3 lb. per 1000 feet of pipe
12" pipe	use 7 H.T.H. tablets or 4.1 lb. per 1000 feet of pipe

Tablets shall be placed in each section of pipe, fire hydrants, and hydrant branches.

3.12 RESTORATION OF DAMAGED SURFACES, STRUCTURES AND PROPERTY

Where pavement, trees, shrubbery, fences or other property and surface structures not designated as pay items, have been damaged, removed or disturbed by the Contractor whether deliberately or not, such property and surface structures shall be replaced or repaired at the expense of the Contractor to a condition equal to that before work began within a timeframe approved by the Engineer.

END OF SECTION

**VERIFICATION OF WATERLINE
PRESSURE AND DISINFECTION TEST**

PROJECT _____ PROJECT NO. _____
PROJECT LOCATION _____
ENGINEER _____ CONTRACTOR _____

DESCRIPTION/LOCATION OF WATERLINE
SHOWN ON CONSTRUCTION PLANS SHEET(S) _____
(INCLUDE TOTAL LINEAL FEET OF EACH PIPE SIZE AND TYPE)

SKETCH (SHOW SAMPLING POINTS)

PRESSURE TEST

DATE _____ PRESSURE _____ p.s.i. DURATION _____ HOURS
ALLOWABLE LEAKAGE _____ GALLONS
ACTUAL OBSERVED LEAKAGE _____ GALLONS

DISINFECTION

DATE _____ VOLUME OF WATER IN PIPE _____ GALLONS
HTH ADDED TO WATER _____ POUNDS
CHLORINE RESIDUAL AT END OF 24 HOURS _____ PPM

BACTERIOLOGICAL TEST

DATE SAMPLES TAKEN _____ NO. OF SAMPLES _____
LABORATORY _____
RESULTS _____

As Engineer or Engineer's representative, having verified the waterline described above has passed the pressure and disinfecting test and requirements as specified in the contract documents and clearance has been
by F.D.E.P., do hereby authorize said waterline for connection to existing system and/or placement in service. However, this does not constitute final acceptance of the waterline nor acceptance of backfill or paving associated with the waterline.

SIGNATURE

TITLE

DATE

Attachments: F.D.E.P. Clearance letter
Bacteriological Test Reports

SECTION 02732

SANITARY SEWERS

PART 1 - GENERAL

1.1 SCOPE OF WORK

The work includes furnishing all labor, materials, equipment and incidentals necessary for the complete installation of all gravity sewer lines, manholes, fittings and appurtenances as shown on the drawings and as specified herein.

1.2 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The work under this contract shall be in strict accordance with the following codes and standards:

- Local, county and municipal codes;
- American Society for Testing Materials (ASTM);
- American National Standards Institute;
- Southern Building Code - Standard Plumbing Code; and
- Florida Department of Environmental Protection. (FDEP)

1.3 CONTRACTOR LICENSE

Contractor and Subcontractor shall possess valid licenses required by state and local codes. All sanitary sewer work shall be performed by a State of Florida licensed Certified General Contractor or Underground Utility Contractor. All plumbing work on private property shall be performed by a plumber licensed in the local community or county of the job site.

1.4 SHOP DRAWINGS AND SUBMITTALS

Shop drawings shall be submitted for items included under this Section and shall include the following minimum information:

- Full details of pipe, fittings, special joints, and assembly thereof, including manufacturer's name;
- Joint materials and details;
- Catalogue cuts, dimensions, full details and loading capacity of manhole frames and coverings;
- Certifications as specified herein; and
- Reinforcing steel bending and setting drawings.

At the Engineer's option, furnish sworn certificates that all tests and inspections required by the Specifications under which the materials were manufactured have been satisfied.

1.5 RELATED WORK

- Testing
- Earthwork
- Boring and jacking

1.6 BASIS OF PAYMENT

Payment for items covered in this section shall be in accordance with the Bid Proposal. When quantities are listed in the Bid Proposal, the quantities shall be determined in the following manner. However, if items are not specifically listed in the Bid Proposal, such items are considered to be included in the unit price of the item of which they are associated.

A. Gravity Sanitary Sewers:

Payment for furnishing and installing of gravity sewer will be made on a linear foot basis for each size and type of pipe as measured from center line of manhole to center line of manhole. No reduction of length will be made for the space occupied by manholes, wyes, or other appurtenances. A change of pipe material or class thickness of the same pipe material within a manhole section will be paid for on a linear foot basis from point of transition to point of transition. The depth of gravity sewer will be determined from approved cut sheets showing center line elevations at twenty-five (25) foot intervals and shall be measured from existing grade to the pipe invert. The unit prices will include all costs associated with the pipe such as pipe transitions, transportation, earthwork, gravel bedding and haunching to spring line of pipe, suitable backfill, compaction, pavement restoration, dewatering, testing (both leakage and backfill density), jointing materials, labor and tie-ins to new or existing manholes.

B. Manholes:

Manholes will be paid for on a per unit basis according to depth of cut necessary to construct the manhole. The depth of cut will be measured from the top of the manhole ring to the invert of the manhole. The unit price will include all costs for labor, materials, earthwork, testing, frame and cover, dewatering, manhole picks, etc.

C. Drop Inlets:

Drop inlets to manholes will be paid for in addition to the unit price paid per manhole, in accordance with the unit price for each drop inlet for the size of line, regardless of the depths of drop on pipe line materials. The unit price will be full compensation for extending the manhole base out to support the drop, all fittings required and concrete encasement, all as shown on the Drawings.

D. Service Laterals:

Payment for furnishing and installing of service laterals will be made on a linear foot basis as measured from center line of sewer main to the point of termination; usually the right-of-way or easement line or on a per unit basis for each individual service lateral installed. See the Bid Proposal for which method of payment is used. Payment will include all fittings, wyes, bends, cleanouts, location markers, earthwork, pavement, sidewalk, drive-way and lawn restoration, testing, tie-ins, etc.

E. Household Hookups:

Payment for furnishing and installing of household hookups will be made on a per unit basis of each house or building connection to the service lateral. Household hookup begins at the point the "service lateral" ends, usually the property line. A single hookup may require multiple connections at a single house (i.e. washing machine drain). Payment will include all pipe (regardless of length), fittings, bends, cleanouts, earthwork, pavement and lawn restoration, testing, tie-ins, etc.

F. Abandon Existing Septic Tanks:

Payment for proper abandonment of existing septic tanks will be made on a per unit basis of each septic tank abandon. Payment will include all backfill sand, pump out and proper disposal of tank

septage, lawn restoration, etc.

G. Concrete:

No specific payment will be made for concrete materials or costs in connections with their installation. Compensation for these items shall be included in the appropriate pay item with which they are associated and when identified in the bid schedule.

H. Maintenance of Flow:

No specific payment will be made for maintaining wastewater flow or required backup equipment. Compensation for these items shall be included in the appropriate pay item with which they are associated.

I. Backfill Density Test

No separate payment will be made for Backfill Density Test. Compensation for these items shall be included in the appropriate pay item with which they are associated.

J. Select Backfill (Borrow Fill)

Payment for use of select backfill material will be made in accordance with Section 02200 Earthwork.

PART 2 - MATERIALS AND EQUIPMENT

2.1 GENERAL

Unless otherwise specified or shown on the drawings, materials and equipment shall be the standard product of a manufacturer and shall comply with the Contract Documents and applicable standards for such materials or equipment.

2.2 DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall conform to ANSI A21.51. Ductile iron shall have a minimum tensile strength of 60,000 psi with a minimum yield strength of 42,000 psi. Thickness of pipe to be supplied shall be one class greater than that required under Table 50.12 AWWA C150 (ANSI 21.50) and not less than Class 51 unless specifically called out on the Drawings.

B. Pipe shall be supplied in lengths not in excess of a nominal 20 feet. Pipe shall be rubber-ring type push-on joints.

C. All ductile iron pipe fittings shall be cast iron or ductile iron. Fittings shall meet the requirements of ANSI Specifications as applicable. Rubber gasket joints shall conform to ANSI A21.11 for push-on joints.

D. Ductile iron pipe shall be coated inside with a polyethylene liner and on the outside with a bituminous coating to a dry film thickness of at least 1.0 mils in accordance with ANSI A21.51. The polyethylene liner materials shall be virgin polyethylene complying with ASTM Designation D1248 compounded with sufficient additives to resist ultraviolet rays during aboveground storage of the pipe. The polyethylene shall be fused to the interior of the pipe by heat forming a tightly bonded lining a minimum of 20 mils thick extending from the spigot end to the barrel socket. A ceramic epoxy liner may be used in lieu of the polyethylene liner with the Engineer's prior approval. Ceramic epoxy linings shall be minimum 40 mils thick amine cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. Protecto 401 Ceramic Epoxy lining is approved for use.

2.3 POLYVINYL CHLORIDE PIPE

- A. Gravity sewer lines and laterals shall be polyvinyl chloride pipe and shall conform to ASTM Designation D-3034. Pipe shall be SDR-35.
- B. Joints shall be of the bell and spigot type with rubber sealing ring in accordance with ASTM D-3212. The bell shall consist of an integral wall section with a solid cross section rubber ring factory-assembled.
- C. Fittings installed in polyvinyl chloride pipe lines shall conform to the same specifications as the pipe line in which they are installed.
- D. In addition to the requirements of ASTM specifications, the pipe shall not be out-of-round or crooked in alignment as determined by the Engineer. Any length of pipe in sizes 6-inch through 12-inch diameter whose inside diameters measured at right angles to each other vary more than 1/8-inch may be rejected.
- E. Material shall meet or exceed the requirements of ASTM Designation 1784, Type 1, Grade 1 (12454-B). All PVC materials shall be stored in accordance with the manufacturer's specifications (not in direct sunlight). PVC pipe and fittings which show signs of ultraviolet degradation will be considered substandard and unfit for use.
- F. All wyes, fittings, laterals and manhole couplings shall be manufactured by the pipe manufacturer. No saddles will be allowed for new pipe or as determined by the Engineer. Adapters shall be suitable for pipe supplied. All joints shall be rubber gasket. Asbestos cement manhole couplings will not be allowed.

2.4 PRECAST CONCRETE MANHOLES

- A. Precast concrete manhole base, barrel, and eccentric top sections shall conform to Specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C-478, except as otherwise specified below.
- B. The minimum wall thickness for the various size barrel sections shall be 5 inches.
- C. Barrel sections shall have tongue and groove joints, with "Ram-Nek" as manufactured by the K.T. Snyder Company, Houston, Texas, or approved equal; or O-ring gaskets set in preformed indentations conforming to ASTM C-443 standard specifications, or Federal specification SS-S-0210 (GSA-FSS).
- D. Concrete shall conform to ASTM C-94, Type II cement, with a compressive strength of 4,000 psi. Mortar shall be composed of one part cement to two parts sand.
- E. The date of manufacture and the name of the manufacturer or trademark shall be clearly marked on the outside of each precast section when the form is removed and on the inside after painting. Sections shall be cured by an approved method for at least 2 days prior to painting and shall not be shipped until at least 2 days after having been painted. Sections shall not be shipped until at least 7 days after removal from the forms.
- F. Top sections shall be eccentric cones, except where cover over the top of the pipe is less than 4 feet and these manholes shall have vertical walls with a flat precast concrete slab top. Precast concrete slabs over top section, where required, shall be capable of supporting the overburden plus a live load equivalent to AASHTO H-20 loading. The tops of bases shall be suitably shaped to mate with the precast barrel section.

G. The interior and mating surfaces of the manhole shall be coated with a heavy duty coal tar epoxy coating containing not less than 72.9% by volume nonvolatile solids, approved equal to (or superior to) Koppers 300-M. This coating shall consist of a primer as specified by the manufacturer and a top coat for a total minimum thickness of 16 dry mils.

H. Top of cone shall be set between 3 inches and 18 inches below bottom of manhole cover frame. It is the intent of Specifications to provide a minimum of 3 inches to accommodate future grade changes without disturbing manholes. Riser unit sections shall be used to bring the top of the cone within the required 18 inches. The remaining distance between the top of the cone and the bottom of the cover frame shall be mortared and bricked if the distance is less than 6 inches. If the distance is between 6 and 18 inches, precast leveling rings shall be used. The leveling rings shall be a minimum of 2 inches thick and have at least one continuous #3 reinforcing bar. Leveling rings shall not be used for more than 18 inches vertical adjustment.

I. Where pipes enter or exit manholes, a "Kor-N-Seal" molded neoprene boot with stainless steel internal and external bands as manufactured by the National Pollution Control Systems, Inc., Nashua, New Hampshire, or a polyurethane joint with a short transition joint as manufactured by Mooreform Corporation, Centralia, Illinois, or an approved equal (or superior) connection shall be provided.

J. Manholes with precast invert channels formed directly into a precast concrete manhole base shall be used except at junctions with existing mains, in which case, cast-in-place manhole bases shall be used. The floor outside the channel shall be smooth and sloped downward toward the channel. The unit shall be of the Moore Base Design as manufactured by Mooreform Corporation, Centralia, Illinois, Tru-Contour as manufactured by A-LOK Products, Inc. 697 Main Street, Tully Town, Pennsylvania, or an approved equal or superior unit.

K. Manholes shall include manufacturer provided steps. Manhole steps shall be aluminum or plastic, ASTM C-478, grouted in place using Embeco 167 mortar or other approved method. Steps will be placed over the downstream side of the manhole.

L. All precast sections shall be case with non-penetrating lifting inserts. Approved: A-Lok Products Corp., Tullytown, Pennsylvania 19007.

2.5 MANHOLE FRAMES AND COVERS

Manhole frames and covers shall be gray or ductile cast iron, free from cracks, holes and cold shuts, and shall conform to ASTM A48-83 Class 40 for gray iron castings or ASTM A 536, Grade 60-45-12, for ductile iron castings. Frames and covers shall conform to details shown on the drawings including lettering. Bearing surfaces shall be machined to provide even bearing surfaces or shall have a non-rocking feature. Frames and covers shall be designed to withstand an HS 20-44 loading as defined in AASHTO Specifications.

2.6 MANHOLE PICK

Contractor shall furnish Owner with two manhole picks of the type recommended by the manhole frame and cover manufacturer to allow ease of removal of cover. Contractor shall submit cut sheet of manhole pick for Engineer's approval prior to delivery. Cost of manhole picks shall be included in the price of the manhole.

2.7 NONSHRINK GROUT

Grout shall be inorganic, nonshrink, nonmetallic type grout similar to Thoroseal or equal. Grout shall be placed with a tamping stick to ensure complete filling in holes and space around pipe.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. Safety:

The Contractor use of streets and highway for the work to be done under these Specifications he shall conform to all City, State and local laws and regulations. The Contractor shall provide, erect, and maintain effective barricades, danger signals, and signs on all intercepted streets or highways for protection of the work and safety of the public. Rights-of-way shall be provided with lights which shall be kept burning at all times between sunset and sunrise. The Contractor shall be responsible for all damages resulting from any neglect or failure to meet these requirements. Where conditions require the presence of a watchman to fulfill the requirements stated herein, same shall be furnished without extra cost to the Owner.

B. Maintenance of Service - Traffic

The Contractor shall arrange his work to cause minimum disturbance of normal pedestrian and vehicular traffic and will be held responsible for providing suitable means of access to all public and private properties during all stages of the construction. A minimum of one lane of traffic shall be maintained at all times. Contractor shall keep all disturbed roads graded smooth and passable. If the road becomes impassable, the Contractor shall stabilize with dry, select backfill. The Owner may require the Contractor to work in off hours (i.e. 1:00am or Holidays) in order to minimize disturbance.

C. Maintenance of Utility Services

Should the construction work require repairs, changes or modifications of other utilities, it shall be the responsibility of the Contractor to provide for the maintenance of continuous water, electric, telephone, and gas as well as sewage and other utility services to all present customers of such utilities, unless approval in writing is secured from the utility company for interruption of such service.

Where existing septic tank service is disrupted due to construction work or is to be abandoned after connection to a new sanitary sewer system, Contractor shall provide uninterrupted service to all current septic tank users by providing pump-out of affected septic tanks if required, **at no additional cost to the Owner**. Septage pumping and disposal shall be by a licensed septage hauler.

The Owner may require the Contractor to work off hours (i.e. 1:00 a.m. or holidays) in order to minimize disruption of utility services.

D. Limits of Construction:

In locations where the work is to be installed in streets or road rights-of-way the activities of the Contractor shall be confined to these public properties. Where the use of private property is deemed necessary by the Contractor to facilitate construction work arrangement for such use with the property Owner shall be the responsibility of the Contractor. The Contractor shall save the Owner harmless from all claims by adjacent property owners from trespassing or damage due to the activities of the Contractor in the prosecution of the work.

E. Existing Utilities:

The Contract Documents contain data relative to existing public utility installations and structures

above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition and extent of all such installations and structures as may be encountered and as may affect the construction operations.

All existing improvements such as pavements, conduit, poles, pipes and other structures, shall be carefully supported and fully protected from injury. The Contractor shall be responsible for damages to these existing utilities and shall, in case they are damaged, restore them to their original condition at no cost to the owner.

Contractor shall give written notice to the Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of work. This can be accomplished by making the appropriate contact with the utility companies indicated on the plans.

F. Backfill for pipes, structures, and roadways: All trenching, backfill, earthwork, and compaction testing shall be in accordance with Section 02200 Earthwork and other applicable sections. For deep sections of PVC sanitary sewer, i.e. 10 ft. and deeper, the pipe shall be embedded with Class I (crushed rock) in accordance with ASTM D 2321. The Class I embedment shall include 6" bedding (below bottom of pipe) and shall extend to the top of the pipe. All sanitary sewer backfill under paved areas shall be select backfill as defined in Section 02200 (except for crushed rock as required in deep areas). Contractor shall include price in bid for transport of select backfill material to the site from an approved borrow pit.

3.2 MANHOLE INSTALLATION

A. Manholes shall be pre-cast with pre-cast invert channels except cast-in-place manhole bases may be used when connecting to existing mains.

B. Manholes constructed over existing sanitary sewers shall be installed in a manner such that wastewater flow is not interrupted. Care shall be taken in excavating for the manhole so that the existing line is not broken or disjointed in such a way that sewage leakage occurs. Only after the new line has been approved by Engineer shall the existing line be cut into in such a way that a smooth invert may be grouted forming the transition between the new pipe and the existing pipe that is to remain in service. The pipe to be abandoned shall be plugged with grout and bricks to form a watertight plug extending a minimum of 3 inches beyond the outside face of the manhole wall.

C. Manholes are to be constructed completely water tight except for the cover. Any water infiltration will cause the manhole to be unacceptable.

D. Manhole invert elevations shall not deviate more than 0.20 feet from design elevations; manhole top elevations no more than 0.5 inches in pavement areas and 2.0 inches elsewhere from design elevations. Center line of manhole ring & cover shall not deviate more than 18" from designed horizontal location. Top elevations shown on the plans are approximate. Manhole tops shall be 1 inch above the finished ground or flush with finished pavement.

E. Set precast concrete sections vertical and in true alignment. Install O-ring rubber gasket in the recess in the base of previously set section or prime and double seal joint surfaces with "Ram-Nek" premolded plastic joint sealer or approved equal.

F. Completely plug seal and smooth all holes in sections used for their handling and the annular space between the wall and entering pipes with nonmetallic, nonshrink grout. Finish grout smooth and flush with the adjoining interior and exterior manhole wall surfaces and make watertight.

G. Manholes located within the limits of proposed street paving are to be constructed a minimum of 1.0 feet below proposed finished street grade as shown by the Plans. After street base course is completed, the base is to be cut around the manhole and removed, the manhole cover is to be adjusted to conform to the finished street grade, and the excavated area backfilled with concrete (8:1 sand-cement mix to within 8 inches of the finished base grade and 2,800 psi concrete for the top 8 inches troweled to conform to finished base grade). Cost of adjustment is to be included in the manhole price.

H. Set manhole frames and lids to conform accurately 1.0 inch above the finished ground or flush with finish pavement as shown or as directed by the Engineer. Set frames on manholes concentric with the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flanges of the frame will be completely filled and made watertight. Place a ring of mortar around the outside of the bottom flange at least 1 inch thick and pitched.

3.3 GRAVITY SEWER LINE INSTALLATION

A. A geotechnical report (if provided) includes soils data from the area where the proposed gravity sewer lines are to be constructed for the Contractor's information and use. Contractor is solely responsible for selecting suitable equipment and methods for these anticipated site conditions.

B. Gravity sewer lines shall be laid according to the details shown on the Drawings or specified herein, and according to applicable portions of ASTM Designation D-2321, Underground Installation of Flexible Thermoplastic Sewer Pipe. Ductile iron pipe shall be installed in accordance with the requirements of Section VII of the Handbook of Ductile Iron Pipes, 4th Edition. **Gravel bedding and haunching to spring line of pipe** shall be installed for all proposed gravity sewer lines, as shown on the Drawings.

C. Sewer mains shall be laid by use of a laser beam directed along the interior of the pipe. The laser equipment shall be of the type specifically designed for such use. The sewer main shall at all points be within 0.1+ feet of the vertical design elevation and be within 0.2+ feet of the horizontal design location.

D. The trench bottom shall be graded to the proposed elevation of the pipe line and the bottom shaped to fit the lower quadrant of the pipe unless special bedding material is required. Holes shall be excavated at each bell so that pipe is uniformly supported along the entire length of the barrel only and not the bell. Pipe bedding shall be as described in Section "Earthwork".

E. The storage of pipe on the job site shall be done in accordance with pipe manufacturer's recommendations and with the approval of the Engineer. Pipe shall be protected during handling against impact shocks and free fall. Pipe laying shall not precede backfilling by more than 100 feet without approval from the Engineer.

F. Pipe bells shall be laid on the upstream end. Pipe laying shall commence at the lowest elevation, and shall terminate only at manholes, service branches or cleanouts. The interior of the pipe and the jointing seal shall be free from sand, dirt and trash before installing in the line. Extreme care must be taken to keep the bells of the pipe free from dirt and rocks so that joint may be properly assembled without overstressing the bells. The jointing of the pipe shall be done in strict accordance with the pipe manufacturer's instructions and shall be done entirely in the trench.

G. Each time the work on the sewer is halted for more than one hour, the ends of the pipe shall be sealed to prevent foreign material from gaining entrance to the pipe.

H. Concrete encasement shall be used where indicated on the drawings. In all cases where sewer mains cross water mains with minimum clear distance between top of sewer and bottom of

water main of less than 18 inches, sewer shall be ductile iron pipe or 6-inch thick concrete encased PVC ASTM D-3034 for a distance of 10 feet to either side of point of crossing. Dimensions of encasement or of cradles shall conform to those shown on the drawings. Each pipe shall be supported on brick at two points to allow minimum thickness of concrete to be placed under pipe. Concrete shall be placed carefully around and over pipe to avoid displacement or floating of pipe. Trench shall be dewatered properly before placing of concrete. Backfill shall not be placed over a concrete cradle or arch until 24 hours after pouring unless authorized by the Engineer.

I. Joint seals in polyvinyl chloride pipe and fittings shall comply with ASTM Designation D-3212. Laying instructions of the manufacturer of the pipe and joint shall be followed explicitly. Any pipe having defective joint surfaces (bell and spigot) shall be rejected.

3.4 LATERAL INSTALLATION

A. A lateral connection shall be provided for each platted lot or parcel. Location of lateral connections shall be determined by the Engineer in the field.

B. Service connections shall be extended to the property line as shown on the drawings and adequately sealed with plugs or caps prior to beginning tightness tests. Six inches of crusher-run gravel or bedding rock shall be placed in front of the plugs or caps and over the top of the last 3-feet of pipe laid.

C. The Contractor shall maintain a record of service connection locations in conjunction with the "As-Built Plans" and, upon completion of work, shall furnish a copy of record to Engineer. The record shall include (1) location of wye branch and end of sewer connection referenced to next downstream manhole of each run, (2) offset of end of service as referenced from center line of main sewer pipe, (3) depth at end of service, and (4) distance from service end to nearest lot corner (reference lot corner shall be clearly indicated on the record). End of service pipe shall be marked with a 3'-0" minimum length of #4 rebar buried underground directly over end of service and extending to one inch above ground.

D. Service connections shall be constructed perpendicular to the sewer, unless otherwise indicated on a straight line and a constant grade of not less than 2 percent (1/4 inch per foot) and not greater than 100 percent (i.e., 45 degrees from horizontal). Riser piping is not acceptable. Inverts of service connections at property lines shall be established so as to provide a minimum grade of 2 percent to the center of the lot or parcel with a minimum invert depth of 4 feet, unless otherwise indicated by the drawings.

E. No special fittings shall be used for a service connection constructed from a manhole. Service lines from manholes shall have crown elevation of service pipe matching that of effluent sewer. A shaped invert shall be provided from the wall of the manhole to shaped invert of main sewer.

F. When installing service connections on existing sewer mains not having wyes or tees, the Contractor shall install tapping tees or saddles. The opening in the sewer main shall be cut using a diamond tipped power driven cutter for clay pipe or a saw of the type recommended by the manufacturer of PVC pipe. Tapping tees or saddles shall be installed using an epoxy type jointing compound provided by the saddle manufacturer and stainless steel bands.

3.5 HOUSEHOLD HOOKUPS

A. Under no circumstance shall household/building connection be attempted until all sewer main and pumpstation tests have been accepted by the Engineer and written authorization issued by the Engineer to proceed with hookups.

B. Contractor shall connect new service lateral to existing house plumbing in a manner

acceptable to the Engineer, and in accordance with local plumbing codes. Fittings with bends greater than 45 degrees shall not be used. Cleanouts shall be installed where indicated on the drawings, but a minimum of one at the property line, one at the house connection, and one for every 90 degree change in direction of the lateral.

C. Contractor shall connect all sanitary and gray water drains from the house or building (including washing machine drains) to the new service lateral.

D. The Contractor shall ensure that all laterals within the right-of-way are deep enough to receive the private service line while maintaining a minimum slope of 1/4 inch per foot on the private service.

E. Contractor shall cooperate with property owner to minimize disturbance and restore all damaged trees, grass, structures, etc.

3.6 ABANDON EXISTING SEPTIC TANKS

A. Where house or building is connected to new sewer system by Contractor, the Contractor shall abandon the existing septic tank by locating and disconnecting it, pumping it out, breaking hole in the bottom of the septic tank to provide drainage, and filling it with clean sand. Contractor shall dispose of septic tank top by either breaking it up and using as fill for tank, or disposing of it offsite. The area shall be resodded. While being disconnected, the Contractor shall bypass the tank to the replaced private service line to the service connection at the right-of-way. Household sewage service shall not be interrupted.

B. Contractor shall work closely with property owner to minimize disturbance.

C. Septage pumping and disposal shall be by a licensed septage hauler.

3.7 TESTING

A. General:

All sanitary sewers installed under this contract shall be tested for tightness, deflection, and alignment. All service laterals from the main to the right-of-way line shall be included in the tightness test. Sanitary sewers will not be accepted by the Owner until the sewers have been tested and do in fact meet the criteria stated. All test shall be conducted by the Contractor in the presence of the Engineer. Contractor shall notify Engineer 48 hours prior to test. Contractor shall furnish all gauges, meters, pressure pumps, equipment fittings, and labor needed to test the line. The cost of these items shall be included in the installation price of pipe. Generally, the sewers will be tested from manhole to manhole. It is recommended the test be conducted on each section as soon as that section is complete in order to detect potential problems on future sections. All lines which fail to meet these tests shall be repaired and retested as necessary, until test requirements are met. The Engineer reserves the right to require the Contractor to test the first section between the manholes laid by each pipe crew under this contract.

B. Manhole Leakage Tests:

Manholes shall be tested for leakage by Negative Air Pressure (Vacuum) Test as prescribed in **ASTM C 1244** to demonstrate the integrity of the installed materials and the construction procedures. This test method shall be used for testing concrete manhole sections utilizing mortar, mastic, or gasketed joints and is intended to demonstrate the condition of the concrete manholes prior to backfill. In accordance with the ASTM C 1244, the test head shall be placed at the top of the manhole in accordance with the manufacturer's recommendations. A vacuum of 10 in. Hg shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off. The time shall be measured for

the vacuum to drop to 9 in. Hg. The manhole shall pass if the time for the vacuum reading to drop from 10 in. Hg to 9 in. Hg meets or exceeds the values indicated in ASTM C 1244 Table 1, shown below. If the manhole fails the initial test, necessary repairs shall be made by an approved method. The manhole shall then be retested until a satisfactory test is obtained.

TABLE 1 Minimum Test Times for Various Manhole Diameters in Seconds

Depth (ft)	Diameter, in.								
	30	33	36	42	48	54	60	66	72
Time, in seconds									
8	11	12	14	17	20	23	26	29	33
10	14	15	18	21	25	29	33	36	41
12	17	18	21	25	30	35	39	43	49
14	20	21	25	30	35	41	46	51	57
16	22	24	30	34	40	46	52	58	67
18	25	27	32	38	45	52	59	65	73
20	28	30	35	42	50	53	65	72	81
22	31	33	39	46	55	64	72	79	89
24	33	36	42	51	59	64	78	87	97
26	36	39	46	55	64	75	85	94	105
28	39	42	49	59	69	81	91	101	113
30	42	45	53	63	74	87	98	108	121

C. Tightness Test (Low Pressure Air Test):

It is critical that the sewer system be constructed in a water tight fashion in order to eliminate infiltration and exfiltration. All sewer mains, laterals, and manholes shall be visually inspected. Any observed indications of infiltration shall require the Contractor to determine the source and make the necessary corrections. In addition, the sewer mains and laterals shall be subject to a low pressure air test to be performed in the following manner:

1. The Contractor shall have completed to installation of the sewer main section including the associated manholes and laterals. The laterals shall have been installed to right-of-way and a temporary air tight plug installed. In order to better locate leaks, backfill operations need to be complete only to one foot above the top of pipe. At the Contractor's option and risk additional backfill may be added prior to the test.
2. The Contractor shall clean and remove all debris, silt, earth or other material from the sewer prior to testing. The sewer shall be flushed with water by the Contractor. None of this water or debris shall be allowed to enter the existing sewer.
3. Equipment specifically designed for low pressure air testing of sewer pipe shall be used and the Contractor shall supply the Engineer with such information so as the Engineer may be reasonable assumed the equipment is property functioning and calibrated.
4. Test plugs shall be installed in the pipe at the upstream and downstream manholes.
5. In order to compensate for groundwater table, all gauge pressures listed herein shall be increased by adding 0.5 psi for each foot of groundwater depth above the invert of the pipe.
6. Air shall be added slowly to the test portion of the pipe until the internal air

pressure is raised to 4.0 psig. A stabilization time of 5 minutes will be used to allow entering air to equalize with the temperature of the pipe wall.

7. At the end of the stabilization time, the internal air pressure shall be observed, and the time required for the pressure drop from 3.5 to 3.0 psig recorded. The minimum time allowed for this 0.5 psi pressure drop for 8 inch main with laterals shall be 5 minutes for manholes spaced less than 300 feet apart and 6 minutes for manholes spaced between 300 and 400 feet apart. For pipe sizes differing from this, the standard test method provided in ASTM F 1417 shall be followed.
8. Should testing on any sections of pipe line disclose an air loss greater than that permitted, the Contractor shall repair the defective area at his own expense. Following corrections, the sewer shall be tested again.

D. Tightness Test (Infiltration):

All sewer mains shall be subject to infiltration test. The test consists of observing and measuring the groundwater infiltration into the new sewer main. The maximum allowable infiltration rate for any section of sewer main shall be 4 gallons per 1,000 lineal feet of sewer main per hour. (This allowance takes into account service laterals and is based upon the standard 50 gallons per inch of diameter per mile per day). The Contractor shall conduct the infiltration test in the presence of the Engineer prior to the acceptance of the sewer main.

E. Deflection Test (Mandrel Test):

After the completion of all backfilling operations on a section of sewer main, a deflection test shall be conducted to determine the out-of-roundness of the pipe. The maximum allowable deflection shall be 5%. The test shall consist of passing a 5% deflection mandrel through the entire length of the pipe without the mandrel becoming stuck nor requiring the use of excess force. For 8 inch pipe the mandrel shall have a minimum diameter of 7.2 inches. The mandrel may be floated through the pipe using clean water but must be attached to a string of sufficient strength to allow it to be retrieved if it becomes stuck. This test may be performed in conjunction with pipe flushing.

F. Alignment Test (Lamp Test):

After the completion of all backfilling operations on a section of sewer main an alignment test shall be conducted. After the pipe is flushed, a high beam 12 volt lamp with lamp diameter of the approximate size of the pipe diameter shall be placed at one end of the section of pipe. A hand mirror shall be used at the opposite end of the pipe to observe the light. The pipeline shall be deemed to be in poor alignment if less than three quarters of the opening at the opposite end of the pipe can be seen by the inspector. Allowable deviations from vertical grade shown on the drawings shall be no more than 3/8" below or above the true grade line. In addition, vertical sags and crowns in the pipe joints shall be no more than 1/4" across any 16 feet of pipe length. Horizontal alignment, as shown on the contract drawings, shall be within 1" of the true line and shall not vary more than 1/2" across any single joint of pipe, unless otherwise shown on the contract drawings. Any sections of pipe found to be defective, damaged or in poor alignment shall be taken up and re-laid or replaced at the Contractor's expense.

G. TV Inspection:

The Owner may elect to perform TV inspection of the sewer lines to verify proper alignment. Maximum allowable dips resulting in standing water shall not exceed the allowable deviations specified in Paragraph F above.

3.8 CLEANING

At the conclusions of the work, the Contractor shall thoroughly clean all of the pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. Debris cleaned from the lines shall be removed from the

lowest outlet. Debris or water from the lowest outlet shall not be introduced into the Owner's sewage collection system. If, after this outlet cleaning obstructions remain, they shall be removed. After the pipe is cleaned and if the groundwater level is above the pipe, or following a heavy rain, the Engineer will examine the pipe for leaks. If defective pipes or joints are discovered at this time, they shall be repaired by the Contractor.

END OF SECTION

SECTION 02733

SEWAGE FORCE MAINS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The Contractor shall supply all labor, equipment, materials and incidentals necessary to install and test all yard piping and appurtenances as shown on the Drawings and as specified herein.

B. This work shall include, but not be limited to the following: ductile iron pipe, PVC pipe, valves and fittings. All concrete thrust blocks or restrained joints required for all types of piping. Also all excavation, backfilling, sheeting, slope protection, drainage, concrete work, riprap, grading and all other work necessary to complete the construction, installation and testing of the piping work as specified in Section 02200, "EARTHWORK".

1.2 APPLICABLE CODES, STANDARDS, AND SPECIFICATIONS

The work under this contract shall be in strict accordance with the following codes and standards:

- Local, county and municipal codes
- American Society for Testing Materials (ASTM)
- American National Standards Institute; (ANSI)
- Southern Building Code - Standard Plumbing Code
- Florida Department of Environmental Protection
- All local Government rules and regulations.
- American Water Works Association (AWWA)

1.3 CONTRACTOR LICENSE

Contractor and Subcontractor shall possess valid licenses required by state and local codes. All "sewer force main" work shall be performed by a State of Florida licensed Underground Utility Contractor.

1.4 SHOP DRAWINGS AND SUBMITTALS

A. Submit shop drawings to the Engineer for review showing a complete laying plan of all pipe, including all fittings, adapters, valves and specials along with the manufacturer's drawings and specifications indicating complete details of all items. The pipe details shall include pipe class or design and back-up computations; laying schedule which specifies pipe class, class coding, joints, station limits and transition stations for the various pipe classes; and list of abbreviated terms with their full meaning. The above shall be submitted to the Engineer for approval before fabrication and shipment of these items. The locations of all pipes shall conform to the locations indicated on the Drawings. In most cases, a certain amount of flexibility in positioning of pipes will be allowed, especially where new pipes will connect to existing piping.

B. 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.

C. The Contractor shall submit a Shop Drawing for review by the Engineer, detailed information showing the type of restrained joints proposed and the calculations for determining the total restrained joint pipe length for each fitting in each pipe size. No restrained joint shall be installed unless the

Engineer has approved in writing the calculations for such joints.

1.5 RELATED WORK

- Testing
- Earthwork
- Boring and Jacking

1.6 INSPECTION

A. All pipe and fittings to be installed under this contract may be inspected at the site of manufacture for compliance with these Specifications by an independent laboratory selected by the Owner. The manufacturer's cooperation shall be required in these inspections. The cost of inspection by an independent laboratory, will be borne by the Owner.

1.7 CONNECTION TO WORK BY OTHERS OR EXISTING LINES

A. Lines installed under other Contracts, to which piping of this Contract must connect, the following work shall be performed:

1. Removing the temporary plug provided in the pipe installed under another contract.
2. Furnishing and installing piping and making proper connections.

B. Connection to existing lines, to which piping of this Contract must connect, the following work shall be performed.

1. Expose buried lines to confirm or determine end connection, pipe material and diameter.
2. Furnish and install appropriate piping and make proper connections.

1.8 BASIS OF PAYMENT

A. Payment for items covered in this section will be made on a unit price basis in accordance with the accepted Bid Schedule. Units of payment are defined as follows.

B. Force Main Piping: Payment for the furnishing and installation of piping used as force mains will be made on a linear foot basis measured through fittings and valves. The unit price per foot shall include all costs for transportation, excavation, backfilling, if necessary, dewatering, making tie-ins to branch mains, replacement of driveways, damage to utilities, testing, and all other costs not identified in a separate pay item. The furnishing and installation of all fittings complete with reaction blocking shall also be included in this unit price.

C. Valves: All valves including air-release valves shall be paid for on an individual unit price basis. The unit price shall include the valve box or manhole, small piping, fittings, and reaction blocking.

D. Highway and Railroad Crossings: Casings installed by the jack and bore method shall be paid for on a linear foot basis and the unit price shall include all costs such as boring, excavation, dewatering, etc. The carrier pipe installed in the casing shall be paid for in accordance with Paragraph 1.9.B, Force Main Piping.

E. Pavement Replacement: Pavement which is replaced shall be paid for in a linear foot basis including all costs for subbase, base, and wearing course. Such payment shall be made only where the center line of the new force is located within the existing pavement.

PART 2 - MATERIALS AND PRODUCTS

2.1 DUCTILE IRON PIPE AND FITTINGS

A. Ductile iron pipe shall conform to ANSI A21.51, unless the pipe is to be installed above ground, in which case threaded flange ductile iron pipe shall be supplied in accordance with ANSI A21.15. Ductile iron shall have a minimum tensile strength of 60,000 psi with a minimum yield strength of 42,000 psi. Thickness of pipe to be supplied shall be in accordance with the requirements of ANSI A21.51 Pressure Class 200 psi or higher.

B. Pipe shall be supplied in lengths not in excess of a nominal 20 feet. Pipe shall be either the rubbering type push-on joints, standard mechanical joint pipe or restrained joint where required. Ball joint pipe and flange joint pipe shall be used where shown on the Drawings. Mechanical and restrained joint pipe shall be furnished with sufficient quantities of accessories as required by each joint.

C. All pipe fittings shall be cast iron or ductile iron with a minimum pressure rating of 250 psi. Fittings shall meet the requirements of ANSI A21.10 or A21.53 (for compact fittings). Rubber gasket joints shall conform to ANSI A21.11 for mechanical and push-on type joints. Ball joints shall conform to ANSI A21.51, with a separately cast ductile iron bell conforming to ASTM A536, Grade 70-5-5, and a cast steel retainer ring conforming to ASTM A148, Grade 90-60. Flanged fittings shall conform to ANSI A21.10 or A21.53 (for compact fittings) and be furnished flat faced and drilled to 125 pounds template in accordance with ANSI B16.1 with full faced gaskets.

D. All pipe and fittings for wastewater force mains shall be coated inside with a polyethylene liner and on the outside with a bituminous coating to a dry film thickness of at least 1.0 mil in accordance with ANSI A21.51. The polyethylene liner material shall be virgin polyethylene complying with ASTM Designation D1248 compounded with sufficient additives to resist ultraviolet rays during aboveground storage of the pipe. The polyethylene shall be fused to the interior of the pipe by heat forming a tightly bonded lining a minimum of 20 mils thick extending from the spigot end to the barrel socket. A two-part epoxy liner may be used in lieu of the polyethylene liner with the Engineer's prior approval.

E. All pipe shall be given a factory hydrostatic test of not less than 500 pounds per square inch.

2.2 POLYVINYL CHLORIDE PIPE AND FITTINGS

A. Polyvinyl Chloride Pipe shall be pressure rated at 200 psi at 73 degrees F. Pipe shall be manufactured from approved Type I Grade I PVC conforming to ASTM D1784 and shall meet all requirements of ASTM D2241 with standard dimension ratio SDR 21. AWWA Standard C900, DR 18, PVC pressure pipe may also be used. Pipe joints shall have thickened-wall integral bells or extruded, machined couplings. All sewage force mains shall be green in color, and the color shall be the same through the wall of the pipe (i.e., not a surface paint or coating).

B. Pipe shall be joined using compression type joints similar to "Plas-Tyton", "Bell-Ring" or "Ring-Tite". Each joint shall have a pressure rating equal to or greater than the pipe with which it is used. Pipe and couplings shall be NSF approved and bear the NSF-PW marking.

C. Fittings for use with PVC pipe shall be either PVC for fittings 4" and smaller or cast iron for fittings 6" and larger and shall have joints suitable for pipe being used. PVC fittings shall meet all requirements of PVC pipe and joints. Cast iron or ductile iron fittings shall meet all requirements of paragraph 2.1.C. All fittings shall be pressure rated in excess of pipe being used.

2.3 AIR RELEASE VALVES

A. Air release valves, including valve vaults with cast iron frame and covers, shall be constructed in accordance with details and at locations shown on the Plans. Vaults shall be constructed so that top is flush or slightly above finished ground surface. Valves shall be installed at high-points in force main.

B. The valve body and cover shall be of cast iron construction, ASTM A126-B, and all internal working parts shall be of stainless steel Type 316. The venting orifice shall be of 3/8 inch in diameter and the seating material shall be of Viton. The inlet opening shall be standard 2-inch NPT screwed connection. The valve shall include a flushout feature for periodic cleaning of the internal mechanism. The overall height of the valve body shall not exceed 18 inches.

C. Air release valves shall be as manufactured by APCO, Valmatic, or equal.

2.4 CHECK VALVES

A. Swing check valves shall have cast iron body with flanged ends rated at 125 lbs. Valves shall be fitted with an external lever and spring. Bronze body ring shall be threaded into the valve port. Valve clapper shall be cast iron, bronze face, and shall swing completely clear of waterway then valve is full open. Hinge pin shall be of 18-8 stainless steel construction and shall be utilized with bronze bushings and O-ring seals. Valves shall be equipped with removable cover plate to permit entry or for complete removal of internal components without removing the valve from the line. Valve rating shall be 175 psi water working pressure, 350 psi hydrostatic test pressure. Valves shall be manufactured by Mueller, Catalogue No. A-2600-6-02, or equal.

2.5 PLUG VALVES

A. Plug valves shall be quarter-turn, non-lubricated full ported eccentric type with semi-steel bodies, resilient faced plugs, and welded nickel or epoxy coated seats. Port areas shall be at least 100 percent of the pipe flow area. All valves 4 inches and larger shall be of the bolted design. All exposed nuts, bolts, springs, and washers shall be hot dipped galvanized, except exposed hardware for submerged valves shall be of stainless steel. Valve bodies shall be semi-steel with 125 pound ANSI Standard flanged ends, except that plug valves for use with threaded cast iron or ductile iron piping shall have screwed end connections. Plug valves shall comply with AWWA C517 "Resilient-Seated Cast-Iron Eccentric Plug Valves", latest issue.

B. All valves 8 inches and larger shall be equipped with gear actuators. All gearing shall be enclosed suitable for running in oil with seals provided on all shafts to prevent entry of dirt and water into the actuator. All shaft bearings shall be furnished with permanently lubricated bronze bearing bushings. Actuator shall clearly indicate valve position and an adjustable stop shall be provided. Construction of actuator housing shall be semi-steel.

C. All plug valves shall be for bi-directional service and shall be installed so that the direction of flow through the valve is in accordance with the manufacturer's recommendations. "Seat End" shall be cast in valve body or otherwise clearly indicated. For sewer lift station applications the seat end of the valve shall be installed toward the pump. In other locations, install valve with greater pressure on seat end. In vertical lines install valve with seat end up.

D. All valves and actuators shall be as manufactured by Henry Pratt Co., Val-Matic, Homestead Industries (1500 series), DeZurick, Milliken Valve or equal.

2.6 VALVE BOXES

All buried valves shall have cast iron two or three piece valve boxes with cast iron covers. Valve boxes shall be provided with suitable heavy bonnets and to extend to such elevation at or slightly above the finished grade surface as directed by the Engineer. The barrel shall be one or two-piece, screw type, having 5-1/4 inch shaft. Covers shall have "SEWER" cast into the top for all wastewater force mains. All valves shall have actuating nuts extended to within six inches of the top of valve box cover.

2.7 DETECTABLE BURIED WARNING TAPE AND COPPER LOCATION WIRE

Detectable buried pipe warning tape shall be 2 inches minimum width, long lasting plastic with metalized foil core specifically designed for non-metallic pipes and shall be placed over all PVC lines and fittings. Metalized core shall be detectable to depths of up to 6 feet by use of commercially available pipe location equipment. Tape shall be furnished in manufacturer's standard color and roll length and shall be imprinted continuously with the following words unless otherwise approved: CAUTION BURIED SEWER MAIN BELOW. Detectable buried warning tape shall be equal to or better than Terra Tape "D", as manufactured by Griffolyn Company Inc., 10020 Mykawa Road, Post Office Box 33248, Texas, 77033.

In addition to the installation of the detectable buried warning tape over all PVC lines, the Contractor shall install a 14 gauge insulated copper wire directly on top of all PVC lines and taped every ten feet for location purposes. The wire shall be continuous and all connections taped. Three feet of excess wire shall be left in all valve boxes. No additional payment will be made for this wire and tape installation and will be included in the unit price per linear foot for PVC sewage force main pipe.

PART 3 - EXECUTION

3.1 GENERAL

A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe or coatings. Pipe or fittings shall not be dripped. All pipe or fittings shall be examined before laying, and no piece shall be installed which is found to be defective. Any damage to the pipe coatings shall be repaired as directed by the Engineer.

B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being laid or installed. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner. All pipe and fittings shall be thoroughly cleaned before laying, shall be kept clean until they are used in the work, and when installed or laid, shall conform to the lines and grades required. A 48" minimum cover shall be maintained.

C. There shall be at least a 10-foot horizontal separation between water mains and sewer force mains. Force mains crossing water mains shall be laid to provide a minimum vertical distance of 18 inches. Between the outside of the force main and the outside of the water main. This shall be the case where the water main is either above or below the force main. At crossings, one full length of water pipe shall be located so both joints will be as far from the force main as possible. Special structural support for the water main and the force main may be required.

D. Safety:

The Contractor use of streets and highway for the work to be done under these Specifications he shall conform to all City, State and local laws and regulations. The Contractor shall provide, erect, and maintain effective barricades, danger signals, and signs on all intercepted streets or highways for protection of the work and safety of the public. Rights-of-way shall be provided with lights which shall be kept burning at all times between sunset and sunrise. The Contractor shall be responsible for all damages resulting from any neglect or failure to meet these requirements. Where conditions require the presence of a watchman to fulfill the requirements stated herein, same shall be furnished without extra cost to the Owner.

E. Maintenance of Service - Traffic

The Contractor shall arrange his work to cause minimum disturbance of normal pedestrian and vehicular traffic and will be held responsible for providing suitable means of access to all public and private properties during all stages of the construction. A minimum of one lane of traffic shall be maintained at all times. Contractor shall keep all disturbed roads graded smooth and passable. If the road becomes impassable, the Contractor shall stabilize with dry, select backfill. The Owner may require the Contractor to work in off hours (i.e. 1:00am or Holidays) in order to minimize disturbance.

F. Maintenance of Utility Services

Should the construction work require repairs, changes or modifications of other utilities, it shall be the responsibility of the Contractor to provide for the maintenance of continuous water, electric, telephone, and gas as well as sewage and other utility services to all present customers of such utilities, unless approval in writing is secured from the utility company for interruption of such service.

Where existing septic tank service is disrupted due to construction work or is to be abandoned after connection to a new sanitary sewer system, Contractor shall provide uninterrupted service to all current septic tank users by providing pump-out of affected septic tanks if required, at no additional cost to the Owner. Septage pumping and disposal shall be by a licensed septage hauler.

The Owner may require the Contractor to work off hours (i.e. 1:00 a.m. or holidays) in order to minimize disruption of utility services.

G. Limits of Construction:

In locations where the work is to be installed in streets or road rights-of-way the activities of the Contractor shall be confined to these public properties. Where the use of private property is deemed necessary by the Contractor to facilitate construction work arrangement for such use with the property Owner shall be the responsibility of the Contractor. The Contractor shall save the Owner harmless from all claims by adjacent property owners from trespassing or damage due to the activities of the Contractor in the prosecution of the work.

H. Existing Utilities:

The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition and extent of all such installations and structures as may be encountered and as may affect the construction operations.

All existing improvements such as pavements, conduit, poles, pipes and other structures, shall be carefully supported and fully protected from injury. The Contractor shall be responsible for damages to these existing utilities and shall, in case they are damaged, restore them to their original condition at no cost to the owner.

Contractor shall give written notice to the Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of work. This can be accomplished by making the appropriate contact with the utility companies indicated on the plans.

I. Backfill for pipes, structures, and roadways: All trenching, backfill, earthwork, and compaction testing shall be in accordance with Section 02200 Earthwork and other applicable sections.

3.2 DUCTILE IRON PIPE

A. Ductile iron pipe and fittings shall be installed in accordance with requirements of Section VII of the Handbook of Ductile Iron Pipe, Fourth Edition. Trench excavating, backfilling and compacting shall meet the requirements of Section 02200.

B. All pipe shall be sound and clean before laying. When laying is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved in laying. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the plans, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench. Solid sleeves shall be used only where approved by the Engineer.

C. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a Tyton bell shall be beveled to conform to the manufactured spigot end. Lining shall be undamaged.

D. Jointing Ductile-Iron Pipe:

1. Push-on joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe, and the joint surfaces cleaned and lubricated. The plain end of the pipe is to be aligned with the bell of the pipe to which it is to be joined, and pushed home with a jack or by other means. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is correctly located.

2. Mechanical joints at valves, fittings, and where designed on the drawings and/or as specified, shall be in accordance with the "Notes on Method of Installation" under ANSI Specification A21.11 and the instructions of the manufacturer. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torques. Under no condition shall extension wrenches or pipe over handle or ordinary ratchet wrench be used to secure greater leverage.

3. Ball joints, where designated on the drawings and/or as specified, shall be installed in strict accordance with the manufacturer's instructions. Where ball joint assemblies occur at the face of structures

or tanks, the socket end shall be at the structure or tank and the ball end assembled to the socket.

4. Flanged joints shall be in accordance with ANSI Specifications A21.15 including its Appendix "A" and the instructions of the manufacturer. Flanged joints shall be fitted so that the contact faces bear uniformly on the gasket and then are made up with relatively uniform bolt stress.

5. All valves, fittings and other appurtenances needed upon the pipe lines shall be set and jointed as indicated on the Drawings or as required by the manufacturer.

6. Unless otherwise noted, underground piping shall be mechanical joint with restraints as needed.

7. Deflected joint pipe shown on the Drawings is shown only as an assistance in illustrating a preferred means of installation in specific locations, and is not intended to indicate all deflected joint pipe necessary to effect the installation as shown in plan and profile views. The cost of all such deflections shall be included within the bid price for furnishing and installing the pipe.

3.3 PVC PIPE

A. PVC piping shall be installed to the requirements of the manufacturer, applicable portions of paragraph 3.2 and those of Section 02200, and the Handbook of PVC Pipe, 2nd Edition.

3.4 PIPE SUPPORTS AND THRUST BLOCKS

A. Longitudinal thrust along force mains at bends, tees, reducers, and caps or plugs shall be counteracted by enough weight of concrete to counterbalance the vertical and horizontal thrust forces. Where undisturbed trench walls are not available for thrust blocking, the Contractor shall furnish and install suitable pipe harnesses or ties designed and manufactured specifically for this purpose. Harnesses and/or ties shall be approved by the Engineer.

B. Joints shall be protected by felt roofing paper prior to placing concrete thrust block.

C. Bearing area of thrust blocks shall be adequate to prevent any movement of the fitting and shall be of the size and dimensions as shown on the Drawings.

D. Concrete for thrust blocking shall be no leaner than 1 part cement, 1-1/2 parts sand, and 5-1/2 parts aggregate. Concrete shall be placed against undisturbed material, and shall not cover joints, bolts or nuts, or interfere with the removal of any joint. Wooden side forms shall be provided for thrust blocks.

E. Restrained joints shall be used on force mains larger than 12-inch diameter. In lieu of thrust blocking on lines 12-inch in diameter and smaller and with the approval of the Engineer, pipe harnesses and/or ties or restrained push-on or restrained mechanical joints may be used.

3.5 RESTRAINED JOINTS

A. Sections of piping designated on the Drawings as having restrained joints or those requiring restrained joints shall be constructed using pipe and fittings with restrained "Locked-type" joints and

the joints shall be capable of holding against withdrawal for line pressures up to 150 pounds per square inch (psi). The pipe and fittings shall be as shown for restrained push-on joints or restrained mechanical joints on Page 416 in Section VI, in the Handbook of Ductile Iron Pipe, 4th Edition, except that mechanical joint ductile iron pipe retainer glands will be permitted only with the Engineer's prior approval.

B. Restrained pipe joints that achieve restraint by incorporating cut out sections in the wall of the pipe shall have a minimum wall thickness at the point of cut out that corresponds with the minimum specified wall thickness for the rest of the pipe.

C. The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. The formula and parameters given on Page 414 of the Handbook of Ductile Iron Pipe, 4th Edition, shall be used to determine the minimum requirements.

D. Bolts and nuts for restrained joints shall be hot dipped galvanized, low alloy, high strength steel.

E. The Contractor shall also provide restrained joints in accordance with the above criteria wherever thrust blocks are not used in conjunction with below ground fittings on lines 12 inches in diameter or less.

3.6 PRESSURE AND LEAKAGE TESTS OF SEWAGE FORCE MAIN PIPING

Contractor shall furnish all gauges, meters, pressure pumps, equipment, fittings, and labor needed to test the line. The cost of these items shall be included in price of pipe. Contractor shall notify Engineer 48 hours prior to start of test. All pipe installed shall be tested and written acceptance issued by the Engineer prior to connection of new line to existing lines.

The Contractor may test the system with joints exposed or backfilling complete at his option. The contractor shall obtain and pay for all water used. Care shall be used to prevent backflow of test water into potable water source. Potable water source shall be disconnected prior to pressurizing test line. Water used during test shall be taken from a container, not directly from the existing water system.

At least 24 hours prior to the start of the pressure and leakage test, pressure shall be raised to 150 psig and held to allow any "soil creep" or other stress relaxation to occur. If any pressure reduction occurs during the 24 hour "shakedown" period, reestablish the required hydrostatic test pressure, then proceed with the leakage test.

The pressure required for the field hydrostatic pressure test shall be 150 psi. The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure. Corporation cocks at least 3/4 inches in diameter, pipe risers and angle globe valves shall be provided at each pipe dead-end and high points in order to bleed air from the line. Duration of pressure test shall be at least two hours. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced. The pipe lines shall be tested in such section as may be directed by the Engineer by shutting valves or installing temporary plugs as required. The line shall be filled with water, all air removed, and the test pressure shall be maintained in the pipe for the entire test period by means of a gasoline or electric driven test pump to be furnished by the Contractor. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage.

No pipe installation will be accepted until or unless the leakage (evaluated on a pressure basis of 150 psi) is less than 2.2 gallons per 24 hours per thousand feet per inch nominal diameter. The following tabulates the allowable leakage.

Allowable Leakage Per 1000 ft of Pipeline (In Gallons)

<u>Duration of Test</u>	<u>Nominal Pipe Diameter (Inches)</u>							
	<u>2</u>	<u>3</u>	<u>4</u>	<u>6</u>	<u>8</u>	<u>10</u>	<u>12</u>	<u>14</u>
1 hour	0.18	0.28	0.37	0.55	0.74	0.92	1.10	1.29
2 hours	0.37	0.55	0.74	1.10	1.47	1.84	2.20	2.57

Where any section of a main is provided with concrete reaction backing the hydrostatic pressure test shall not be made until at least five (5) days have elapsed after the concrete reaction backing was installed. If high early-strength cement is used in the concrete reaction backing, the hydrostatic pressure test shall not be made until at least three (3) days have elapsed. For other pipe sizes, the leakage shall not exceed that determined by the following formula:

$$L = \frac{SD\sqrt{P}}{133,200}$$

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 during the leakage test, in pounds per square inch (gauge)

3.7 FLUSHING OF COMPLETED PIPELINES

Following the hydrostatic test and backfilling, each section of completed pipeline shall be as thoroughly flushed as possible. A minimum flow shall be used for flushing that will ensure a velocity in the pipe of 2.5 feet per second. Water required for testing and flushing shall be furnished by the Contractor. The water shall be from a potable water source satisfactory to the Owner.

END OF SECTION

SECTION 02734

SEWAGE LIFT STATION WITH SUBMERSIBLE PUMPS

PART 1 - GENERAL

1.1 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required to install, place in operation, and field test submersible wastewater pumps as hereinafter specified. The station shall be complete with pumps, motors, piping, valves, electrical work (including motor controls), structures, connections and appurtenances, tested and ready for service.
- B. These specifications are intended to give a general description of what is required, but do not cover all details which will vary in accordance with the requirements of the equipment as offered. It is, however, intended to cover the furnishing, the shop testing, the delivery and complete installation and field testing, of all materials, equipment and appurtenances for the complete pumping units as herein specified, whether specifically mentioned in these specifications or not.

1.2 SITE CONDITIONS

Prior to submitting his bid, the Contractor shall satisfy himself as to the character and amount of different soil material, groundwater and the subsurface conditions to be encountered in the work to be performed. Information and data, when furnished, are for the Contractor's general information. However, it is expressly understood that any interpretation or conclusion drawn therefrom is totally the responsibility of the Contractor.

1.3 SUBMITTALS

Shop Drawings - Contractor shall submit shop drawings and product data for equipment furnished under this section in accordance with the GENERAL CONDITIONS.

If approval is requested for an alternate pump model the following data shall be submitted (electronic pdf) to the Engineer at least 10 days prior to receipt of bids:

- 1) Certified Dimensional Print
- 2) Pump Performance Curve
- 3) Pictorial and Schematic Wiring Prints
- 4) Parts Listed and Instructional Prints
- 5) Pump Components and Warranty.

1.4 OPERATING AND MAINTENANCE DATA

A. Contractor shall compile data and related information appropriate for owner's maintenance and operation of products furnished under contract and furnish an Operation and Maintenance Manual in accordance with this section.

B. Manual preparation shall be done by trained and experienced personnel familiar with the requirements of this section. The Manual should be an 8 1/2 X 11 bound volume with neatly typed text and should include all manufacturers data. Drawings and schematics should be bound to the manual and folded to 8 1/2 X 11 inches.

1.5 EQUIPMENT INSTALLATION CERTIFICATE

The manufacturer shall provide a written report, through the Contractor and endorsed in writing by the Contractor, certifying that the equipment has been properly installed and checked and is ready for placement into routine permanent service.

1.6 MANUFACTURER'S STARTUP SERVICES

The Contractor shall furnish services of manufacturer's technical representative to inspect the completed installation, correct or supervise correction of any defects or malfunctions, and instruct operating personnel in proper operating and maintenance procedures.

1.7 BASIS OF PAYMENT

A. Measurements

Each sewage pumping station constructed will be measured as one item. Each bid item shall include furnishing and installing the pumping station indicated in the Bid Form (Proposal), consisting of pumps and motors, wetwell and piping connections; piping, valves and fittings; concrete work; electrical connections, apparatus and wiring; site work, including clearing, dewatering, excavation, backfill and compaction, fill and grading, grassing, and fencing, if drawn and specified; and all related and incidental items of work, labor, materials, and equipment required to complete the pumping station as specified within the limits shown on the Drawings.

B. PAYMENT

Payment will be made for each pumping station at the applicable lump sum price entered in the Bid Form (Proposal), which price will be full compensation for all work required to complete the station and place it into service.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. The pumping units required under this section shall be complete including pumps and motors designed in accordance with Standards of the Hydraulic Institute. All parts shall be so designed and proportioned as to have liberal strength, stability, and stiffness and to be especially adapted for the work to be done. Ample room shall be provided for inspection, repairs, and adjustments.

B. Stainless steel nameplates giving the name of the manufacturer, the rated capacity, head, speed, and all other pertinent data shall be attached to each pump and motor.

2.2 PUMPS

A. Description

The Contractor shall furnish and install two pumps for each sewer lift station conforming to the requirements listed in the following table and as described in these Specifications and Plans. The Flygt pump model listed in the following table constitutes the basis-of-design and such pricing shall be included in Section 0410, Bid Form, as the sewer lift station Base Bid.

B. Pre-Approved Deductive Alternates

Alternate pumps will be considered, provided pump curves and other documentation listed in paragraph 1.3 are submitted to the Engineer at least 10 days prior to the bid due date, and provided the recommended model meets the performance requirements described in these Specifications. Contractor is responsible to identify any deviations from these Specification requirements and to provide a technical basis for any proposed deviations. Alternate pumps will only be allowed by issuance of an Addendum and shall be included in Section 0410, Bid Form, as a Deductive Alternate.

Lift Station Name	Shutoff Head	Design Conditions	Secondary Point	Flygt Pump Model	Impeller	Motor
MERE Shelter	80 ft.	150 gpm @ 55 ft. TDH, including 23 ft. static head	900 gpm @ 20 ft. TDH	4" NP3127.070 HT	Adaptive 488	10 hp, 1765 RPM, 208V, 3-phase

B. PUMP DESIGN

The pumps shall be capable of handling raw, unscreened sewage. The discharge connection elbow shall be permanently installed in the wet well along with the discharge piping. The pumps shall be automatically connected to the discharge connection elbow when lowered into place, and shall be easily removed for inspection or service. There shall be no need for personnel to enter pump well. Sealing of the pumping unit to the discharge connection elbow shall be accomplished by the simple linear downward force of the pump. A sliding guide bracket shall be an integral part of the pump unit. The entire weight of the pump unit shall be guided by no less than two guide bars and pressed tightly against the discharge connection elbow with metal-to-metal contact by gravity only. Sealing of the discharge interface by means of a diaphragm, O-ring, or other devices will not be acceptable. No portion of the pump shall bear directly on the floor of the wet well.

The pump, with its appurtenances and cable, shall be capable of continuous submergence underwater, without loss of water-tight integrity to a depth of 65 ft. Totally submersible design, with all electrical parts housed in cast-iron, water-tight enclosure. Motor cooling system shall be by induction of pumping liquid as cooling source or Engineer approved. The internals to the cooling system shall be non-clogging by virtue of their dimensions. The pump must be able to operate dry without damage while pumping under load. Thrust and radial bearings shall be of the ball type. The motor shafting shall be stainless steel and designed for extremely difficult sewage pumping service.

Sealing of the pumping unit to the discharge connection shall be accomplished by a simple linear downward motion of the pump with the entire weight of the pumping unit guided by no less than two (2) guide bars to and pressing tightly against the discharge connection; no portion of the pump shall bear directly on the floor of the sump and no rotary motion of the pump shall be required for sealing. Sealing at the discharge connection by means of a diaphragm, O-ring, or similar method of sealing will not be accepted as an equal to a metal contact of the pump discharge and mating discharge connection specified.

The pump shall be capable of operating in a continuous condition in a liquid with a temperature up to 104°F even when the motor is not submerged.

The motor shall be capable of no less than 30 evenly spaced starts per hour and be able to operate throughout the entire pump performance curve from shut-off through run-out.

C. PUMP CONSTRUCTION

The impeller shall be of Hard-Iron, ASTM A-532, 25% Chrome Cast Iron, dynamically balanced, semi-open, multi-vane, back swept, screw-shaped, non-clog design. The impeller leading edges shall be mechanically self-cleaned automatically upon each rotation as they pass across a spiral groove located on the volute suction. The screw-shaped hard-iron impeller shall be hardened to Rc 60 and shall be capable of handling solids, fibrous materials, heavy sludge and other matter normally found in wastewater. The screw shape of the impeller inlet shall provide an inducing effect for the handling of up to 6% sludge and rag-laden wastewater. The impeller to volute clearance shall be readily adjustable by the means of a single trim screw. The impeller shall be mounted on the motor shaft. Couplings or gear boxes shall not be accepted.

The pump volute shall be a single piece gray cast iron, ASTM A-48, Class 35B, non-concentric design with smooth passages of sufficient size to pass any solids that may enter the impeller. Minimum inlet and discharge size shall be as specified. The volute shall have a replaceable insert ring containing at least one sharp-edged groove. The spiral groove shall provide trash release pathways and sharp edge(s) across which each impeller vane leading edge shall cross during rotation so to remain unobstructed. The volute insert ring shall be cast of Hard-Iron, ASTM A-523, 25% Chrome Cast Iron and provide effective sealing between the multi-vane semi-open impeller and the volute housing.

The materials of construction shall be as follows:

- 1) Pump housing: ASTM A-48, Class 35B
- 2) Impeller and insert ring: A 532 ALLOY III A (25% Chrome)
- 3) Stator housing: ASTM A-48, Class 35B
- 4) Shaft: ASTM A479 S43100-T
- 5) Shaft seal: Pump side: - Corrosion resistant Tungsten carbide WCCR
- 6) Shaft seal Motor side: - Carbon-Aluminum oxide (AL203)

A sliding guide bracket shall be an integral part of the pumping unit and the pump casing shall have a machined connecting flange to connect with the cast iron discharge connection, which shall be bolted to the floor of the sump and so designed as to receive the pump connecting flange without the need of any bolts or nuts.

The pump shaft shall rotate on two bearings. Motor bearings shall be permanently grease lubricated and have a nominal L10 bearing life of 50,000 hours. The upper bearing shall be a single deep groove ball bearing. The lower bearing shall be a two row angular contact bearing to compensate for axial thrust and radial forces. Single row lower bearings are not acceptable.

The shaft seal shall be a positively driven dual, tandem mechanical shaft seal system consisting of two seals, each having an independent spring system. The seal shall be in a separate lubricant chamber lubricated and cooled by environmental friendly medical white oil. The lubricant chamber shall be designed to prevent over-filling and shall provide capacity for lubricant expansion. It shall have one drain and one inspection plug that are accessible from the exterior of the motor unit. The seal system shall not rely upon the pumped media for lubrication. The seals shall require neither maintenance nor adjustment and shall be capable of operating in either clockwise or counter clockwise direction of rotation without damage or loss of seal function. The rotating inner seal ring shall have small back-swept grooves laser inscribed upon its face to act as a micro pump as it rotates, returning any fluid that should enter the dry motor chamber back into the lubricant chamber. Shaft seals without positively driven tandem mechanical seal or conventional double mechanical seals that are either carried out with a common single or double spring are not accepted. Any leakage passing the sealing shall not pass the bearings. Before it reaches the bearings the liquid shall create an alarm via the floating leakage sensor.

The pump shall be fitted with a rigid explosion proof lifting bail of suitable strength to lift up to two times the weight of the pump. The lifting bail shall provide a large open loop so that the bail can be hooked from the surface, precluding the need for personnel to enter the dry well. The bail shall be designed so that standard, commercially available shackles and fittings can be used to attach lifting chains or wire rope lifting assemblies.

The pump shall be Explosion approved according FM CLASS 1. DIV 1 "C" & "D"

The stator windings shall be insulated with moisture resistant NEMA Class H rated for 356°F.

All submersible pump motors shall be manufactured for use in NEC Class I, Division I, Group D environments.

The pump motor shall be induction type with a squirrel cage rotor, shell type design, housed in an air filled, watertight chamber. It shall be permanently submersible according standard IEC 60034 and protection class IP 68.

The motor shall be equipped with at least 30 feet of screened cable suitable for submersible pump applications. The power cable shall be sized according to NEC and ICEA. The outer jacket of the cable shall be oil resistant chlorinated polyethylene rubber. The cable shall be capable of continuous submergence underwater without loss of watertight integrity to a depth of 65 feet.

The motor and the pump shall be produced by the same manufacturer.

The motor shall be protected by the following sensors:

- a. 3 bi-metal Thermal switches for thermal monitoring of the stator.
- b. 1 float switch/sensor in leakage chamber to monitor leakage in the leakage chamber.
- c. 1 float switch/sensor in the terminal connection housing to monitor any leakage thru the cables and the cable entries.

Pump supplier to furnish manufacturer recommended pump motor protection modules coordinated with furnished pump motors to provide protection of the motors for high temperature and leakage. Pump protection modules to be supplied to the control panel supplier for installation into the control panel.

D. EQUIPMENT FOR WET WELL INSTALLATION

- a. For each pump the contractor shall supply and install a discharge connection made of cast iron ASTM A-48, Class 35B.
- b. The outlet flange of the discharge connection shall be 4" drilled according ANSI B16.1-89; tab.5.
- c. The pump(s) shall be automatically and firmly connected to the discharge connection, guided by no less than two parallel guide bars extending from the top of the station to the wet well mounted discharge connection. The material of the guide bars shall Stainless steel AISI 316.
- d. The length of the guide bars shall be as indicated in the Drawings and they shall be fastened at the top of the station with a guide bar holder made of Stainless steel AISI 316.
- e. For each pump the Contractor shall supply and install a cable holder made with 6 hooks of Stainless steel AISI 316.

E. PUMP TEST

Each completed and assembled pump/motor unit shall undergo the following factory tests at the manufacturer's plant prior to shipment. The Manufacturer shall provide on demand a copy of his

quality control plan for these tests and an ISO 9001 factory certificate:

- 1) Prior to submergence the pump shall be run dry and checked for correct rotation.
- 2) Minimum 3-point hydraulic performance test; minimum 30-minute run time.
- 3) No-Leak seal integrity test.
- 4) Electrical integrity test.

F. PUMP WARRANTY

The pumps shall be provided with 60 months (5 years) warranty against defects in materials and or workmanship. The warranty shall cover the entire pump, not individual components. Upon warranty occurrence, the manufacturer's authorized service center shall remove the pump, repair, reinstall and provide start up on the repaired pump. A detailed failure analysis shall be submitted to the Owner for their records summarizing corrective action taken. The manufacturer shall submit the published warranty with the submittal drawings.

2.3 SUBMERSIBLE PUMP GUIDE BAR ASSEMBLY

Each pumping unit shall be equipped with a guide bar assembly as recommended by the pump manufacturer. All material used to fabricate the upper guide holder and cable holder shall be aluminum or stainless steel. All bolts, anchors, and other fasteners shall be 316 stainless steel.

2.4 ACCESS FRAMES AND COVERS

The lift station shall be equipped with aluminum access frames and covers rated for 300 lb./sq. ft. loading, complete with hinged and flush mounted locking mechanism and hinged fall protection grating (safety orange) as indicated on Drawings. All hardware shall be 316 stainless steel. Doors should open to 90 degrees and lock in that position by a stainless steel positive locking arm and release handle. Doors shall have a stainless steel lifting handle and stainless steel snap-lock, with removable key handle and plug. Access frames and covers shall be manufactured by Halliday Products Inc., U.S. foundry, or by an approved equal.

2.5 PORTABLE HOIST (THIS SECTION NOT APPLICABLE)

A. Only one portable hoist is required for the project; however, base sockets shall be provided on all submersible pump stations.

B. There shall be provided one portable hoist manufactured using 304 stainless steel tubing capable of supporting 1500 pounds. The hoist shall have adjustable reach of 42" and shall have a maximum operating height of 72". Hoist shall be designed and manufactured for use with socket inserts to be installed at each station. Hoists shall be provided with lubricated pulley, winch and static loop for double line operation. Winch shall be mounted 42" above base level for ease of operator operation.

C. Hoist shall be fitted with a 1200 pound minimum capacity single line winch. Winch shall be provided with self activating brake to hold load securely in place if handle is released. Winch shall be fitted with heavy duty hardened steel drive gears, needle bearings and cover over gears and brake. Winch shall be provided with 60' of minimum 4000# capacity stainless steel cable, safety hook and pulley block for double line operation.

D. Base sockets shall be constructed of 304 stainless steel. Sockets shall be designed for easy installation of hoists and to allow full rotation of hoist with minimum operator effort. Hoist shall fit in socket with minimum play. Covers shall be provided with sockets to prevent escape of wetwell gases when not in use. Sockets shall be cast in place with wet well lid by precast company.

PART 3 - EXECUTION

3.1 INSPECTION AND TESTING

- A. Upon completion of installation, the Contractor, in the presence of the Engineer and a qualified manufacturer's representative, shall perform a preliminary test on the system to insure the functioning of all component parts to the satisfaction of the Engineer.
- B. Approval of the preliminary test by the Engineer shall not constitute final acceptance of the equipment furnished.
- C. After the system is in full operation, a full operating test shall be performed in the presence of the Engineer and a qualified manufacturer's representative. The Contractor shall furnish all labor, materials and equipment required for such test and shall correct any deficiencies noted, by repairing or replacing the defective component, and retesting as required until the equipment meets the satisfaction of the Engineer. A minimum of one complete 8-hour day shall be furnished to satisfy the full load operating test requirements.
- D. Operating personnel shall be trained in operation and maintenance of equipment at startup. Instruction shall be given in operation, service, adjustments, and routine maintenance. Recommended spare lists and maintenance schedules shall be provided.

PART 4 - WETWELL

- A. Precast concrete manhole barrel shall conform to specifications for Precast Reinforced Concrete Manhole Sections, ASTM Designation C-478, except as otherwise specified below.
- B. The minimum wall thickness for the various size barrel sections shall be 5 inches or as shown on the Drawings. Lifting holes for handling shall be non-penetrating.
- C. Barrel sections shall have tongue and groove joints, with "Ram-Nek" as manufactured by the K.T. Snyder Company, Houston, Texas, or approved equal; or O-ring gaskets set in preformed indentations conforming to ASTM C-443 standard specifications, or Federal Specification SS-S-0210 (GSA-FSS).
- D. Concrete shall conform to ASTM C-94, Type II cement, with a compressive strength of 4,000 psi. Mortar shall be composed of one part cement to two parts sand.
- E. The date of manufacture and the name of the manufacturer or trademark shall be clearly marked on the outside of each precast section when the form is removed and on the inside after painting. Sections shall be cured by an approved method for at least 2 days prior to painting and shall not be shipped until at least 2 days after having been painted. Sections shall not be shipped until at least 7 days after removal from the forms.
- F. Precast concrete slabs over top section shall be capable of supporting the overburden plus a live load equivalent to AASHTO H-20 loading. The tops of bases shall be suitably shaped to mate with the precast barrel section.
- G. The interior of the wetwell shall be protected with a HDPE liner (see Section 02566).

H. The exterior and mating surfaces of the wetwell shall be coated with a heavy duty coal tar epoxy coating containing not less than 72.9% by volume nonvolatile solids, approved equal to (or superior to) Koppers 300-M. This coating shall consist of a primer as specified by the manufacturer and a top coat for a total minimum thickness of 16 dry mils.

I. Where pipes enter or exit wetwell, a "Kor-N-Seal" molded neoprene boot with stainless steel internal and external bands as manufactured by the National Pollution Control Systems, Inc., Nashua, New Hampshire, or a polyurethane joint with a short transition joint as manufactured by Mooreform Corporation, Centralia, Illinois, or an approved equal (or superior) connection shall be provided.

J. Where pipes or conduits enter or exit top section, the annular space shall be grouted water and gas tight. Grout shall be Thoroseal or equal.

END OF SECTION

SECTION 02735

PAINTING

Part 1 - General

1.1 SCOPE OF WORK

- A. The work under this section includes furnishing all paint, materials, labor and supervision, and equipment to complete the painting and protective coatings as shown on the drawings and specified herein.
- B. Surface preparation, paint and coatings materials, and their application shall be as recommended by the coating manufacturer and approved by the Engineer. The Contractor shall take all health and safety precautions necessary to prevent accidents during the storage, handling, application and drying of any of the coatings herein described.
- C. Paints and coatings used to finish the surfaces of structures or vessels which come into contact with potable water shall meet the applicable requirements of the County Health Department and the State Department of Environmental Protection or other regulatory agencies having jurisdiction.

1.2 ABBREVIATIONS

ANSI	American National Standards Institute
AWWA	American Water Works Association
MDFT	Minimum Dry Film Thickness
MDFTPC	Minimum Dry Film Thickness Per Coat
mil	Thousandths of an inch
NACE	National Association of Corrosion Engineers
NSF	National Sanitation Foundation
OSHA	Occupational Safety and Health Administration
PSDS	Paint System Data Sheet
SFPG	Square Feet Per Gallon
SFPGPC	Square Feet Per Gallon Per Coat
SP	Surface Preparation
SSPC	Steel Structures Painting Council

1.3 SUBMITTALS

- A. Submittals shall be made in accordance with "2.3 SUBSTITUTIONS" herein.
- B. Furnish product data sheets for each coating system used hereon, including Technical Data Sheets, and colors available (where applicable) for each product used in the coating system, except for products applied by equipment manufacturers.
- C. All painting and coating products for use in potable water service shall have received prior approval from the Florida Department of Environmental Protection. Provide the Engineer with a letter of acceptance from FDEP for each product selected by the Contractor for use in potable water.

1.4 QUALITY ASSURANCE

- A. Applicator's experience: Minimum 5 year's practical experience in application of specified products on projects of similar size and scope. Contractor shall supply Engineer with reference project information, including phone numbers.

1.5 MATERIAL DELIVERY, HANDLING, AND STORAGE

- A. Deliver materials to project site in undamaged, unopened containers that plainly show, at time of use; designated name, date of manufacture, batch number, shelf-life, color, and manufacturer. Store materials in a properly identified, protected area that is heated or cooled to maintain a temperature range recommended by the coating manufacturer.

1.6 ENVIRONMENTAL REQUIREMENTS

- A. Coatings shall only be applied during good painting weather. Air and surface temperatures shall be within limits described by the manufacturer for the coating being applied and surface temperatures shall be at least 5°F above the dew point of ambient air. Work areas shall be reasonably free of airborne dust, and smoke at time of application and during cure or drying.
† Cold weather painting - Follow manufacturer's product data sheets for application temperature limits and accelerated curing charts. Contact manufacturer for any deviations from published guidelines.
- B. Abrasive blasting shall only be performed when relative humidity is less than 85% and when surface temperature is at least 5°F above the dew point of ambient air.

1.7 WARRANTY

- A. The CONTRACTOR and coating manufacturer shall jointly and severally warrant to the OWNER and guarantee the work under this section against defective workmanship and material for a period of one year commencing on the date of final acceptance of this work.

PART 2 MATERIALS

- 2.1 Materials specified herein, and approved for use on this project, are manufactured by Thnemec Company, Inc., Kansas City, MO. Heat-resistant coatings listed are manufactured by Dampney Company, Inc., Everett, MA. Technical information may be obtained from the following:

Robert Crumbaugh
SteelCon Coating Systems, Inc.
2100 3rd Avenue South
Irondale, Alabama 35210
205-951-2086

- 2.2 Materials specified are those which have been evaluated for the specific service. Products are listed to establish a *standard of quality*. Requests for substitution must be approved in writing ten (10) days prior to date of bid. Substitute systems must have required documentation. The burden of proof of the merit of the proposed substitute is upon the proposer. The decision of the Engineer regarding approval or disapproval of the proposed substitution shall be final.

2.3 SUBSTITUTIONS

- A. Requests for substitution shall contain the following technical product information.
- Full name and number of each product
 - Complete descriptive literature
 - Directions for use
 - Generic Vehicle Type
 - Material Safety Data Sheets (MSDS)
 - Certification that all products are formulated free of lead and chromates
 - Percent (%) Solids by Volume
 - Recommended Dry Film Thickness per coat
 - Independent certified test reports showing results to equal the performance criteria of the products specified.
- B. Materials supplied by other manufacturers may be considered for substitution if the following prevailing conditions exist:
1. Performance criteria of the specified materials are exceeded by the submitted alternate materials as listed in paragraph 2.1 and detailed on the technical data sheets of each specified product.
 2. No products shall be considered that would decrease film thicknesses or offer a change in generic type of coating specified.
 3. The submittal must compare the performance criteria of the specified material with that of submitted material and be documented in a side by side manner for the Engineer and Owner to review.
 4. Substitute materials must be for complete systems and not individual products combined with the specified materials. Performance criteria for all products within a system must meet or exceed the specified materials.
 5. Only one (1) alternate submittal will be received for this specification and must be accompanied by a detailed statement of the sum to be added or deducted from the base.
- C. Materials supplied by other manufacturers must include the following performance data as certified by a qualified testing laboratory:
1. ASTM B117 - Method of Salt Spray (Fog) Testing
 2. ASTM D149 - Method of Dielectric Breakdown Voltage and Dielectric Strength Electrical Insulating Materials of Commercial Power Frequencies.
 3. ASTM D3359- Method for Measuring Adhesion by Test Tape.
 4. ASTM D3363- Method for Film Hardness by Pencil Test.
 5. ASTM D4060- Method for Abrasion Resistance of Organic Coatings by the Taber Abrader.
 6. ASTM D4541- Method for Pull-Off Strength of Coats Using Portable Adhesion Testers.
 7. ASTM 4585 - Practice Testing the Water Resistance of Coatings Using Controlled Condensation.
 8. ASTM G53 - Practice for Operating Light and Water Exposure of Non-metallic Materials.
 9. AWWA D102-03 Standard for Painting Steel Water Storage Tanks.

PART 3 EXECUTION

3.1 General

- A. Surface Preparation Inspection:
 - 1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and the printed instructions and recommendations of the manufacturer whose product is to be applied.
 - 2. Provide Engineer minimum 14 day's advance notice prior to start of surface preparation work or coating application.
 - 3. Perform work only in presence of Engineer, unless Engineer grants prior approval to perform work in Engineer's absence.
- B. For coatings subject to immersion, obtain full cure for completed system. Consult coatings manufacturer's written instructions for these requirements. Do not immerse coating for any purpose until completion of curing cycle.
- C. The intention of these Specifications is for all new and existing, unfinished, interior and exterior wood, masonry, stucco, metal and submerged metal surfaces to be painted, whether specifically mentioned or not, except as modified herein. Concealed structural steel surfaces shall receive prime coat only unless modified herein. Exterior concrete surfaces will not be painted unless specifically modified herein. Nonmetallic materials and electrical conduit will not be painted except as required for architectural painting or color coding.

3.2 PROTECTION OF MATERIALS NOT TO BE PAINTED

- A. Remove, mask, or otherwise protect hardware, lighting fixtures, switch plates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates, and other surfaces not intended to be painted. Provide protection to prevent coating materials from falling on or marring adjacent surfaces. Protect working parts of mechanical and electrical equipment from damage. Mask openings in motors to prevent paint and other materials from entering.

3.3 APPLICATION SAFETY

- A. Perform painting work in accordance with recommendations of the following:
 - 1. Coating manufacturer's printed instructions.
 - 2. NACE guidelines, contained in the publication, "Manual for Painter Safety."
 - 3. Federal, State, and Local agencies having jurisdiction.
- B. The Contractor will be solely and completely responsible for conditions of the jobsite, including safety of all persons (including facility employees) and property during performance of the work. The Contractor will comply with all safety training requirements promulgated or required for this project.

3.4 PAINT MIXING AND THINNING

- A. Multiple-Component Coatings:
 - 1. Prepare using all the contents of the container for each component as packaged and directed by paint manufacturer. No partial batches will be permitted.
 - 2. Thinning, when permitted, will be done in strict accordance with the latest manufacturer's printed data sheet.

3. Do not use multiple-component coatings after they have been mixed beyond their pot life.
- B. Keep paint materials sealed when not in use.
- C. When multiple coats of material are applied within a given system, alternate color (job tint) coats to provide a visual reference that the required number of coats have been applied.

3.5 FIELD ABRASIVE BLASTING

- A. Perform abrasive blasting for items and equipment where specified and as required to restore damaged surfaces previously shop or field blasted and primed. Materials, equipment, and procedures shall be in accordance with recommendations of the Steel Structures Painting Council (SSPC) or the National Association of Corrosion Engineers (NACE).

3.6 PREPARATION OF SURFACES

- A. Metal Surface Preparation:

1. General:

- a. Conform to current Steel Structures Painting Council (SSPC) Specifications as follows:

- 1) Solvent Clean: SSPC-SP1
 - 2) Hand Tool Clean: SSPC-SP2
 - 3) Power Tool Clean: SSPC-SP3
 - 4) White Metal Blast Clean: SSPC-SP5 or NACE No.1
 - 5) Commercial Blast Clean: SSPC-SP6 or NACE No.3
 - 6) Brush-Off Blast Clean: SSPC-SP7 or NACE No.4
 - 7) Near-White Blast Clean: SSPC-SP10 or NACE No.2
 - 8) Power Tool Clean to Bare Metal: SSPC-SP11

- b. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet or vacu-blast methods may be required. Follow coating manufacturer's recommendations for wet blast additives and first coat application.

- c. Hand tool clean areas that cannot be cleaned by power tool cleaning.

2. Blast Cleaning Requirements

- a. Comply with applicable federal, state, and local air pollution and environmental control regulations for blast cleaning and disposition of spent aggregate and debris.
 - b. Alternatives to standard abrasive blast cleaning methods shall be subject to Engineer review.

- B. Plastic Surface Preparation: Hand sand with medium grit sandpaper to provide tooth for the coating system. Large areas may be power sanded or brush-off blasted, provided sufficient controls are in place to roughen the surface without removing excess material.

- C. Masonry and Stucco Surface Preparation:

1. Complete and cure masonry and stucco construction at least 28 days before starting surface preparation work.
 2. Remove oil, grease, dirt, salts, curing agents, other chemicals, loose materials, or foreign matter by solvent, detergent washing, or other suitable cleaning methods.

3. Clean masonry and stucco surfaces of mortar and grout spillage and other surface deposits using one of the following:
 - a. Nonmetallic fiber brushing with a solution of muriatic acid (1 part muriatic acid/3 parts water), followed by rinsing with clean water.
 - b. Brush-off blasting per SSPC-SP7 or NACE No.4.
 - c. Water blasting.
 4. Leave surfaces clean and, unless otherwise required for proper adhesion, dry prior to painting.
- D. Wood Surface Preparation: Repair damaged wood surfaces in a workman-like manner acceptable to the Engineer prior to start of painting. Fill all voids and seal all knotholes to insure that pitch does not bleed through. All surfaces shall be clean and dry prior to painting. Should any bleeding occur, Contractor shall repair with additional surface preparation and coat(s) of paint.

3.7 APPLICATION OF COATINGS

A. General:

1. Inspection: Schedule inspection with Engineer in advance for prepared surfaces and all coats prior to restarting coating applications.
2. Apply coatings in accordance with manufacturer's printed data sheets. Allow sufficient time between coats to insure complete curing of previously applied coatings.
3. Paint units or structures to be bolted together prior to their assembly.

B. Shop Primed or Factory Finished Surfaces:

1. After welding, prepare and prime holdback areas as required for specified paint system. Apply primer according to manufacturer's instructions.
2. Hand or power sand areas of chipped, peeled, or abraded coatings, feathering the edges. Apply the specified spot primer to coat the area.
3. For two-component coatings, consult the coatings manufacturer for specific procedures relating to the manufacturer's products.
4. Prior to application of finish coats, clean shop primed surfaces free of dirt, oil, and grease per SSPC-SP1 and apply a mist coat of specified primer at 1.0 mils MDFT.

C. Manufacturer Applied Paint Systems:

1. Repair abraded areas on factory finished items in accordance with the equipment manufacturer's directions.
2. Carefully blend repaired areas into original finish.

D. Film Thickness

1. Coverage is listed as either total minimum dry film thickness in mils (MDFT) or the spreading rate in square feet per gallon (SFPG). Per coat determinations are listed as MDFTPC and SFPGPC.

2. Number of coats: Minimum required irrespective of coating thickness. Additional coats may be required to achieve minimum required coating thickness, depending on method of application, differences in atmospheric conditions, and individual manufacturer's products.
3. Maximum film build per coat shall not exceed coating manufacturer's printed recommendations.
4. Give particular attention to edges, angles, flanges, and other similar areas where insufficient film thicknesses are likely to be present, and ensure proper film thickness in these areas.
5. Dry Film Thickness Testing:
 - a. Check each coat for correct film thickness. Do not take DFT measurements until coatings have cured a minimum of 8 hours.
 - b. After repaired and recoated areas have cured sufficiently, final tests will be conducted by the Engineer, measuring coating thickness, as specified in mils, with a magnetic type dry film thickness gauge as specified per SSPC-PA2.
 - c. Test finish coats, (except zinc primers, galvanized, and elastomeric coatings in excess of 25.0 mils MDFT), for holidays and discontinuities using a low voltage, wet sponge holiday detector (Tinker & Razor M-1 or equal) per manufacturer's instructions.
 - d. Testing of finish coats in excess of 25.0 mils MDFT, where required, shall be done using a high voltage holiday detector (Tinker & Razor Model AP or equal) per manufacturer's instructions.

E. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with recommendations of coating manufacturer.
2. Repair fusion bonded coatings as recommended by original applicator. Applicator shall provide liquid repair kits for this purpose as recommended by coating manufacturer.
3. Apply finish coats, including touch-up and damage-repair coats, in a manner which will present a uniform texture and color-matched appearance.

F. Unsatisfactory Application:

1. If an item has improper finish color or insufficient film thickness, clean and recoat the surface with specified paint material to obtain specified color and coverage. Obtain specific preparation information from coating manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather the edges. Follow with primer and finish coat in accordance with the specifications. Depending on extent of repair, finish sanding and additional topcoats may be required.
3. Evidence of runs, drips, sags, dry-spray, lap marks, blisters, or other imperfections shall be cause for rejection.
4. Repair defects in coating system per written recommendations of coating manufacturer.
5. Leave all staging up until the Engineer has inspected the surface or coating.
6. Replace staging removed prior to approval of the Engineer.

3.8 CLEANUP AND REMOVAL OF WASTE

- A. Place cloths and waste that might constitute a fire hazard in closed metal containers or destroy at the end of each day.
- B. Upon completion of work, remove all staging and scaffolding from site.
- C. Completely remove paint drips, overspray, or stains from adjacent surfaces and floors to leave the entire job clean.
- D. Remove and dispose of, in a manner legal in the State of Florida, all rubbish and empty containers, including spent solvents and paint materials, abrasive blasting debris, etc., leaving the premises in an acceptable aesthetic condition.

PART 4 PROTECTIVE COATING SCHEDULE

A. STEEL

System 1 Immersion, Potable or Non-Potable Water:*

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast (SSPC-SP10)	Aromatic / Mio-Zinc Urethane Tnemec 1 Omnithane	1 Coat, 2.5 – 3.5 MDFT
	Polyamidoamine Epoxy Tnemec N140 Pota-Pox Plus	1 Coat, 5.0-7.0 MDFT
	Polyamidoamine Epoxy Tnemec N140 Pota-Pox Plus	1 Coat, 5.0-7.0 MDFT

System 2 Immersion - Domestic Sewage:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (-SP10)	Aromatic / Mio-Zinc Urethane Tnemec 1 Omnithane	1 Coat, 2.5 – 3.5 MDFT
	Hydrophobic Aromatic MCU Tnemec 446-1223 Omnithane	1 Coat, 7.0 – 9.0 MDFT
	Hydrophobic Aromatic MCU Tnemec 446-1222 Omnithane	1 Coat, 7.0 – 9.0 MDFT

System 3 Exterior, Non-immersion - Mildly Corrosive Atmosphere:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (-SP6)	Aromatic / Mio-Zinc Urethane Tnemec 1 Omnithane	1 Coat, 2.5 – 3.5 MDFT
	Polyamidoamine Epoxy Tnemec Series N69	1 Coat, 3.0-5.0 MDFT
	Aliphatic Acrylic Polyurethane Tnemec Series 1074/1075*	1 Coat, 2.0-4.0 MDFT

* Series 1074 is a Gloss Finish; Series 1075 is a Semi-Gloss Finish

System 4 Interior, Non-immersion:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (-SP6)	Aromatic / Mio-Zinc Urethane Tnemec 1 Omnithane	1 Coat, 2.5 – 3.5 MDFT
	Polyamidoamine Epoxy Tnemec Series N69	1 Coat, 2.0 - 3.0 MDFT
	Waterborne Aliphatic Urethane Tnemec Series 297	1 Coat, 2.0 – 3.0 MDFT

System 5 Immersion, Non-Potable Water- High Levels of Hydrogen Sulfide:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast (-SP5)	Vinyl Ester Tnemec Series 120-5002 (Beige)	1 Coat, 12.0-18.0 MDFT
	Vinyl Ester Tnemec Series 120-5001 (Gray)	1 Coat, 12.0-18.0 MDFT

System 6 Miscellaneous Castings, Including Manhole Rings & Covers:

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (-SP6)	Polyamide Epoxy-Coal Tar Tnemec Series 46H-413	1 Coat, 14.0-16.0 MDFT

System 7 Metal Anchorage for Buried Piping:

Surface Prep.	Paint Material	Min. Coats, Cover
Clean & Dry or Power Tool (-SP3)	Coal Tar Tnemec Series 46-465	1 Coat, 8.0-12.0 MDFT

System 8 Factory Primed Steel Surfaces:

Surface Prep.	Paint Material	Min. Coats, Cover
Clean & Dry	Aromatic / Mio-Zinc Urethane Tnemec 1 Omnithane	1 Coat, 2.5-3.5 MDFT
	See topcoat atmospheric exposure for finish schedule	

System 9 High Heat Resistant - 500°F Max: Dampney/Thurmalox Coatings

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (-SP10)	Silicone Copolymer (VOC Compliant) Thurmalox 260C Air Dry Series **	1 Coat, 2.0-2.5 MDFT
	Silicone Copolymer (VOC Compliant) Thurmalox 260C Air Dry Series **	1 Coat, 2.0-2.5 MDFT

****Note:** Custom and standard colors are available.

System 10 All Immersion Areas at Domestic Sewage Plant Headworks

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (-SP10)	Aromatic / Mio-Zinc Urethane Tnemec 1 Omnithane. Stripe coat weld seams with Series 446 Omnithane.	1 Coat, 2.5 – 3.5 MDFT
	Hydrophobic Aromatic MCU Tnemec 446-1223 Omnithane	1 Coat, 7.0 – 9.0 MDFT
	Hydrophobic Aromatic MCU Tnemec 446-1222 Omnithane	1 Coat, 7.0 – 9.0 MDFT

B. MILL COATED STEEL PIPE

System 11 Exterior Pipe (Non-immersion):

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive Blast (-SP6)	Polyamidoamine Epoxy Tnemec Series N140	1 Coat, 3.0-5.0 MDFT
	Polyamidoamine Epoxy Tnemec N69	1 Coat, 3.0 – 5.0 MDFT
	Aliphatic Acrylic Polyurethane Tnemec Series 1074/1075 *	1 Coat, 2.0-4.0 MDFT

* Series 1074 is a Gloss Finish; Series 1075 a Semi-Gloss Finish

System 12 Immersion, Potable or Non-Potable Water:*

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (-SP10)	Polyamidoamine Epoxy Tnemec Series N140-1211*	1 Coat, 3.0-5.0 MDFT
	Polyamidoamine Epoxy Tnemec Series N140*	1 Coat, 5.0-7.0 MDFT

System 13 High Heat Resistant - 500°F Max: Dampney/Thurmalox Coatings

Surface Prep.	Paint Material	Min. Coats, Cover
Abrasive or Centrifugal Wheel Blast (-SP10)	Silicone Copolymer (VOC Compliant) Thurmalox 260C Air Dry Series **	1 Coat, 2.0-2.5 MDFT
	Silicone Copolymer (VOC Compliant) Thurmalox 260C Air Dry Series **	1 Coat, 2.0-2.5 MDFT

****Note:** Standard and custom colors are available.

C. GALVANIZED STEEL- PIPE & MISCELLANEOUS FABRICATIONS

System 14 Interior Mild to Moderate Exposure:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP1) Followed by Mechanical Cleaning (-SP7)	Polyamidoamine Epoxy Tnemec Series N69	1 Coat, 3.0-5.0 MDFTPC
	Waterborne Aliphatic Urethane Tnemec Series 297	1 Coat, 2.0 – 3.0 MDFT

System 15 Exterior Mild to Moderate Atmosphere (Non-immersion):

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP1) Followed by Mechanical Cleaning (-SP7)	Polyamidoamine Epoxy Tnemec Series N69	2 Coats, 3.0-5.0 MDFTPC
	Aliphatic Acrylic Polyurethane Tnemec Series 1074/1075 *	1 Coat, 2.0-4.0 MDFT

Series 1074 is a Gloss Finish : Series 1075 is a Semi-Gloss Finish

System 16 Immersion, Potable or Non-Potable Water:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP1) Followed by Mechanical Cleaning (-SP7)	Polyamidoamine Epoxy Tnemec Series N140 *	1 Coat, 3.0-5.0 MDFT
	Polyamidoamine Epoxy Tnemec Series N140 *	1 Coat, 5.0-7.0 MDFT

System 17 Galvanized Metal Repair:

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (-SP1) Followed by Mechanical Cleaning (-SP3 or Preferably -SP7)	Aromatic Urethane, Zinc-Rich Tnemec Series 90-97	1 Coat, 2.5-3.5 MDFT

D. CHAIN LINK FENCES

System 18 Exterior:

Surface Prep.	Paint Material	Min. Coats, Cover
Clean & Dry	Linseed Oil Cementitious Tnemec Series 80	1 Coat, 2.5-4.0 MDFT

E. CONCRETE, DENSE MASONRY

System 19 Immersion - Domestic Sewage:

Surface Prep.	Paint Material	Min. Coats, Cover
Brush Blast to Roughen Substrate and to Open Bug holes	Epoxy Modified Mortar Tnemec 218 Mortar Clad ---Fill flush all bug holes & voids as necessary	As necessary
	Hydrophobic Aromatic MCU Tnemec 446-1223 Omnithane	1 Coat, 7.0 – 9.0 MDFT
	Hydrophobic Aromatic MCU Tnemec 446-1222 Omnithane	1 Coat, 7.0 – 9.0 MDFT

System 20 Immersion- 100% Epoxy Lining - Domestic Sewage:
(For known Aggressive Environments eg. Hydrogen Sulfide.)

Surface Prep.	Paint Material	Min. Coats, Cover
Brush Blast to Roughen Substrate and to Open Bug holes	Epoxy Modified Mortar Tnemec 218 Mortar Clad	As required to fill bug hole, voids and spalled concrete
	Modified Polyamine Epoxy Tnemec 201 Epoxoprime	1 Coat, 6.0 – 8.0 MDFT
	Modified Polyamine Epoxy Tnemec 435 Tneme-Glaze	1 Coat, 30 – 40 MDFT

System 21 Immersion- Potable or Non-Potable Water:

Surface Prep.	Paint Material	Min. Coats, Cover
Brush Blast to Roughen Substrate and to Open Bug holes	Epoxy Modified Mortar Tnemec 218 Mortar Clad	As required to fill bug hole, voids and spalled concrete
	Polyamide Epoxy Tnemec 22 Pota-Pox 100 *	1Coat, 30 – 40 MDFTPC

System 22 Chemical Resistant Coating (Vinyl Ester System):

Surface Prep.	Paint Material	Min. Coats, Cover
Brush Blast to Roughen Substrate and to Open Bug holes	Vinyl Ester Tnemec Series 120-5002 (Beige)	1 Coat, 12.0-18.0 MDFT
	Vinyl Ester Patch Bug holes with Tnemec Series 120-5003	As Needed
	Vinyl Ester Tnemec Series 120-5001 (Gray)	1 Coat, 12.0-18.0 MDFT

System 23 Chemical-Resistant Interior Wall, Heavy Duty-CMU:

Surface Prep.	Paint Material	Min. Coats, Cover
Brush Blast to Roughen Substrate and to Open Bug holes	Waterborne Cementitious Acrylic Tnemec Series 130. Spray / Squeegee	1 Coat, 85-115 SFPG
	Polyamidoamine Epoxy Tnemec Series N69	1 Coat, 4.0-6.0 MDFT
	Waterborne Aliphatic Urethane Tnemec 297 Enviro-Glaze	1 Coat, 2.0 – 3.0 MDFT

System 24 Exterior- Non-immersion:

Surface Prep.	Paint Material	Min. Coats, Cover
Dry & Clean	Waterborne Acrylate Tnemec 156 Enviro-Crete	1 Coat, 6.0-8.0 MDFT
	Waterborne Acrylate Tnemec 156 Enviro-Crete	1 Coat, 6.0-8.0 MDFT

* Series 156 is a Flat, Smooth Finish; Series 157 is a Flat, Sand Textured Finish

System 25 Alum Containment:

Surface Prep.	Paint Material	Min. Coats, Cover
Brush Blast to Roughen Substrate and to Open Bug Holes	Modified Polyamine Tnemec 201 Epoxoprime	1 Coat, 6.0 – 8.0 MDFT
	Modified Polyamine Epoxy Tnemec 280 Tneme-Glaze	1 Coat, 8.0-12.0 MDFT
	Modified Polyamine Epoxy Tnemec 280 Tneme-Glaze	1 Coat, 8.0-12.0 MDFT

F. POROUS MASONRY (CMU)

System 26 Exterior:

Surface Prep.	Paint Material	Min. Coats, Cover
Clean & Dry	Waterborne Acrylate Tnemec 156 Enviro-Crete	2 Coats, 8.0-10.0 MDFTPC

* Series 156 is a flat, Smooth Finish; Series 157 is a Flat, Sand Textured Finish

System 27 Interior:

Surface Prep.	Paint Material	Min. Coats, Cover
Clean & Dry	Waterborne Cementitious Acrylic Tnemec Series 130. Spray / Squeegee	1 Coat, 60 - 80 SFPG
	Polyamidoamine Epoxy Tnemec Series N69	1 Coat, 4.0 – 6.0 MDFT
	Waterborne Aliphatic Urethane Tnemec 297 Enviro-Glaze	1 Coat, 2.0 – 3.0 MDFT

G. CONCRETE FLOORS

System 28 Decorative- Lab Areas, Shower & Bathroom Areas:

Surface Prep.	Paint Material	Min. Coats, Cover
Blastrac or Brush Blast	Polyamine Epoxy Tnemec Series 201	1 Coat, 6.0-8.0 MDFT
	Ceramic Filled Polyamine Epoxy Tnemec Series 222	2 Applications at 1/16" inch each (Double seed)
	Polyamine Epoxy Tnemec Series 284	1 Coat, 8.0-10.0 MDFT
	Polyester Polyurethane Tnemec 295 Clear CRU	1 Coat, 2.0 – 3.0 MDFT

System 29 Pipe gallery & Mechanical rooms:

Surface Prep.	Paint Material	Min. Coats, Cover
Acid Etch or Brush-Off Blast	Polyamide Epoxy Tnemec 205 Terra-Tread FC	1 Coat, 3.0-5.0 MDFT
	Polyamide Epoxy Tnemec 205 Terra-Tread FC Broadcast non-skid silica aggregate wet film.	1 Coat, 3.0-5.0 MDFT
	Polyester Polyurethane Tnemec 291 CRU	1 Coat, 2.0 – 3.0 MDFT

System 30 Clear Epoxy Concrete Floor Coating, Skid-Resistant:

Surface Prep.	Paint Material	Min. Coats, Cover
Acid Etch or Brush-Off Blast	Polyamine Epoxy Tnemec Series 222 Broadcast non-skid silica aggregate into 1st coat.	1 Coat, 6.0-8.0 MDFT
	Polyester Polyurethane Tnemec 295 Clear CRU Add S211-0213 Glass Beads for non-skid surface	1 Coat, 2.0 – 3.0 MDFT

H. CONCRETE STRUCTURES:

System 31 Below Grade Water Proofing:

Surface Prep.	Paint Material	Min. Coats, Cover
Brush Blast to Roughen Substrate and to Open Bug holes and create profile for coating adhesion	Crystalline Waterproofing XYPEX Drypac	As required for crack repair
	Crystalline Waterproofing XYPEX Concentrate	1 Coat, 1/8" thickness
	Crystalline Waterproofing XYPEX Modified	1 Coat, 1/8" thickness

I. CONCRETE - SPECIAL APPLICATIONS

NOTE: Consult with coatings specialist before selecting these systems.

System 32 Interior, Exposed to High Levels of Hydrogen Sulfide & Sulfuric Acid Condensate: (Typically used in above grade applications.)

Surface Prep.	Paint Material	Min. Coats, Cover
Brush Blast to Roughen Substrate and to Open Bug holes	Fill & Patch Tnemec 218 MortarClad – Fill all voids and bug holes	AS Necessary
	100% Solids Epoxy Mortar Tnemec Series 434	125 mils DFT
	100% Solids Epoxy Tnemec 435 Perma-Glaze	1 Coat, 15.0-20.0 MDFT

System 33 Fluoride Room, Floor & Walls:

Surface Prep.	Paint Material	Min. Coats, Cover
Brush Blast to Roughen Substrate and to Open Bug holes	Vinyl Ester Tnemec Series 120-5002 (Beige)	1 Coat, 12.0 to 18.0 MDFT
	Vinyl Ester Tnemec Series 120-5003 Patch Bug holes as necessary	As Needed
	Vinyl Ester Tnemec Series 120-5002 (Gray)	1 Coat, 12.0 to 18.0 MDFT

**System 34 Chemical Storage, Containment Areas For Extremely Aggressive Environments:
(Floor, Trench, Tank Pad & Color Coding Bands on Walls)**

Surface Prep.	Paint Material	Min. Coats, Cover
Brush Blast to Roughen Substrate and to Open Bug holes	Vinyl Ester Tnemec Series 120-5003--- Patch Bug holes as necessary	As Needed
	Polyamine Epoxy Tnemec Series 201	1 Coat, 6.0-8.0 MDFT
	Polyamine Epoxy Tnemec Series 270	1 Coat, 25.0-40.0 MDFT
	Polyamine Novolac Epoxy Tnemec Series 282*	1 Coat, 6.0-8.0 MDFT

*Series 282 is available in a variety of colors.

J. PLASTER & WALLBOARD (GYPSUM BOARD)

System 35 Interior:

Surface Prep.	Paint Material	Min. Coats, Cover
Dry & Clean	Vinyl Acrylic Tnemec Series 51-792	1 Coat, 1.0-2.0 MDFT
	Waterborne Acrylic Epoxy Tnemec Series 113/114 *	1 Coat, 4.0-6.0 MDFT

* Series 113 is a Satin Finish; Series 114 is a Gloss Finish

K. WOOD

System 36 Interior or Exterior:

Surface Prep.	Paint Material	Min. Coats, Cover
Dry & Clean	Alkyd Tnemec 36 Undercoater	1 Coat, 2.0-3.5 MDFT
	Alkyd Tnemec 23 Enduratone	2 Coats, 2.0-3.0 MDFTPC

L. INSULATED PIPE

System 37 Interior:

Surface Prep.	Paint Material	Min. Coats, Cover
Clean & Dry	Acrylic Emulsion Tnemec Series 29 *	2 Coats, 2.0-3.0 MDFTPC

* Series 28 is a Gloss Finish; Series 29 is a Semi-Gloss Finish

M. PVC PIPE

System 38 Interior and Exterior Fiberglass, PVC:

Surface Prep.	Paint Material	Min. Coats, Cover
Roughen by Sanding or Brush Blasting	Polyamidoamine Epoxy Tnemec Series N69	1 Coat, 3.0-5.0 MDFT
	Aliphatic Acrylic Polyurethane Tnemec Series 1074/1075 *	1 Coat, 2.0-4.0 MDFT

* Series 1074 is a Semi-Gloss Finish; Series 1075 is a Gloss Finish

N. DUCTILE & CAST IRON

System 39 Interior and Exterior- (O.D. of pipe):

Surface Prep.	Paint Material	Min. Coats, Cover
Solvent Clean (SP1) Followed by Mechanical Cleaning (SP2 or SP3 or Preferably SP7)	Polyamidoamine Epoxy Tnemec Series N140-1211	1 Coat, 5.0-7.0 MDFT
	Polyamidoamine Epoxy Tnemec Series N69	1 Coat, 3.0 – 5.0 MDFT
	Aliphatic Urethane Tnemec 1074 Endura-Shield	1 Coat, 2.0 – 3.0 MDFT

PART 5 COLOR CODE FOR PROCESSING EQUIPMENT

- A. Prior to beginning of work verify colors for new equipment with Engineer/Owner.
 B. COLOR SYSTEMS – OSHA

<i>Application</i>	<i>Generic Color</i>	<i>Color Identification</i>
Water		
	clover	110GN
Raw Water		
Settled or Clarified	aqua	10GN Aqua Sky
Finished or Potable Water	dark blue	11SF True Blue/Safety Blue
Waste Water		
Sewage Plant Effluent	clay**	21BR Earthenware
Backwash Waste	light brown	68BR Twine
Sludge	dark brown	84BR Weathered Bark
Sewer (Sanitary or Other)	dark gray	34GR Deep Space
Chemical		
Alum or Primary Coagulant	orange	04SF Tangerine/Safety Orange
Ammonia	white	11WH White
Carbon Slurry	black	35GR Black
Caustic	yellow with green band	02SF Lemon/Safety Yellow with 09SF Spearmint/Safety Green band
Chlorine (Gas & Solution)	yellow	02SF Lemon/Safety Yellow
Fluoride	light blue with red band	25BL Fountainbleu with 06SF Candy Apple/Safety red band
Lime Slurry	light green	18GN Shady Lane
Ozone	yellow with orange band	02SF Lemon/Safety Yellow with 04SF Tangerine/Safety Orange band
Phosphate Compounds	light green with red band	18GN Shady Lane with 06SF Candy Apple/Safety Red band
Polymers or Coagulant Aids	orange with green band	04SF Tangerine/Safety Orange with 09SF Spearmint/ Safety Green band
Potassium Permanganate	violet	14SF Purple Rain/Safety Purple
Soda Ash	light green with orange band	18GN Shady Lane with 04SF Tangerine/Safety Orange band
Sulfuric Acid	yellow with red band	02SF Lemon/Safety Yellow with 06SF Candy Apple/Safety Red band
Sulfur Dioxide	light green with yellow band	18GN Shady Lane with 02SF Lemon/Safety Yellow band
Other		
Compressed Air	dark green	91GN Balsam
Gas	red	28RD Monterey Tile
Other Lines	light gray	32GR Light Gray
Hoists/Trolleys	yellow**	02SF Lemon/Safety Yellow

* These colors are in accordance with the *Recommended Standards for Water Works*.

END OF SECTION

SECTION 02736 – SEWAGE CONTROL PANELS

PART 1 – GENERAL

1.1 SUMMARY

- A. This section describes the industrial control panels that are to be provided under this contract in order to provide the Owner with a fully operational system as described herein. This section is to be used as an extension of other sections and divisions within this specification in addition to the Project Plans.
- B. The Control Panel supplier shall be responsible for providing the following:
 - 1. Duplex Pump Control Panel with requirements per Project Plans
 - 2. Remote Telemetry Unit (RTU) that shall house the Pump Controller and Cellular Communication Equipment
- C. The Control Panel supplier shall provide, test, and start up all control panels and control system components related to the furnished equipment.
- D. Industrial Control Panels shall be supplied by SCADA Integrator. The SCADA Integrator shall ensure that Control Panels are designed, fabricated, and tested in compliance with Project documentation.

1.2 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
- B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
- C. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices 2017.
- D. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
- E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- F. NFPA 70e – Electrical Safety in the Workplace
- G. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

- H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
- I. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.
- J. UL 698A - Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations

1.3 DEFINITIONS

- A. Industrial Control Panel – An assembly of two or more power circuit components, control circuit components, or any combination of power and control circuit components

1.4 RELATED SECTIONS

- A. Division 26 (if furnished)
- B. Division 40 (if furnished)
- C. Refer to Project Plans for any additional requirements

1.5 SCOPE

- A. The Control Panel supplier is responsible for providing Pump Control Panels and Remote Telemetry Units as detailed in this document.
- B. The Control Panel supplier is required to provide, test, and start up all control panels and control system components related to the furnished equipment.

1.6 SUBMITTALS

- A. Provide the following for each control panel:
 - 1. Project specific, custom shop drawings
 - a. Bill of Material and Fabrication notes (List of all components that are required to deliver a complete control panel. Any notes generic or specific that are required for the fabrication of the panel. All notes and tables required by UL508A and UL698A must be included)
 - b. Power Distribution Schematic
 - c. Controls Schematic
 - d. Equipment Layout (Clearly show all components)
 - e. Recommended Spare Parts
 - f. Field Interconnect Wiring Diagrams
 - g. Network Diagrams
 - h. Component Data Sheets

2. Heat Load Calculations showing amount of ventilation or heating required per ambient temperature requirements listed below.
3. Load calculations showing the sizing of all power supplies provided (with spare capacity as specified). Power supplies should have a capacity 20% larger than required by load calculations.
4. Load calculations showing the anticipated run time of all Uninterruptable Power Supplies or Back-up Power systems provided (with spare capacity as specified).

B. Testing Related

1. Factory Acceptance Test
 - a. Test Procedure
 - b. Completed Test Forms – printed and signed
2. Site Acceptance Test
 - a. Test Procedure
 - b. Completed Test Forms – printed and signed

C. Operation and Maintenance Manual (To be included with Project USB Drive described below)

1. Table of Contents
2. System Controls Description
3. As-Built Drawings and Schematics
4. Equipment Data Sheets
5. Equipment Manuals
6. List of Required or Routine Maintenance

D. Project USB Drive (2 Copies Required)

1. Operation and Maintenance Manual
2. AutoCAD Drawing Files
3. Programming and Configuration Files as required based off equipment provided; included but not limited to Pump Controller and Cellular Communication Device

1.7 SPARE PARTS

A. Spare Parts shall be furnished for each control panel provided:

1. 10% fuses, no less than two (2) of each type provided

B. Spare Parts shall be furnished for Project as follows:

1. One (1) SEL-2411P Pump Controller as detailed in Pump Controller section
2. One (1) SEL-3061 Cellular Communication Device as detailed in Cellular Communication Device section
3. One (1) complete set of cellular communication device accessories (antennas, cabling, surge protection, etc.) that match what is provided for each site

1.8 QUALITY ASSURANCE

- A. The control panel equipment should be of the most current and proven design. The components provided by the Control Panel supplier are to be compatible with the functions required to form a complete and working system.
- B. Control panels shall be manufactured by a UL508A / UL698A certified control panel shop and each control panel shall have a UL508A serialized label upon completion of fabrication.
- C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least 5 years of documented experience.
- D. Fabricator Qualifications: Company specializing in fabricating products specified in this section with at least 5 years of documented experience.

1.9 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store control panel in accordance with manufacturer's instructions.
- B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- C. Handle carefully in accordance with manufacturer's instructions to avoid damage to control panel components, enclosure, and finish.

1.10 WARRANTY

- A. The Contractor shall provide a manufacturer's warranty covering the full replacement of all equipment specified within this section. All equipment supplied under this section shall be warrantied for a period of one (1) year by the Control Panel supplier starting from the substantial completion date of the contract.

PART 2 – PRODUCTS

2.1 GENERAL REQUIREMENTS FOR CONTROL PANELS

- A. All control panels shall be constructed in a UL508A / UL698A approved production facility and shall bear all applicable UL labels for panel construction.
- B. The completed panel shall be factory tested prior to shipment. Field installation by the Contractor shall consist only of setting the panel in place and making necessary pneumatic and/or electrical connections.

- C. All control panels shall be designed to operate at the service voltage as indicated in the project plans.
- D. The control panel(s) shall have a Short Circuit Current Rating not less than the calculated short circuit current amps at the bus of the control panel. The available short-circuit current at the industrial control panel and the date the short-circuit current calculation was performed shall be documented and made available to those authorized to inspect the installation.

2.2 CONTROL PANEL ENCLOSURES

- A. The control panel shall be designed and sized in accordance with the requirements of the Contract Plans and as specified herein. The control panel enclosure shall be manufactured by Hoffman, or an Engineer approved equal.
- B. Control Panel enclosures shall be NEMA Type 4X, 304 stainless steel and equipped with the following:
 - 1. All associated hardware constructed of 304 stainless steel.
 - 2. Doors equipped with heavy gauge, continuous, stainless-steel hinges.
 - 3. Doors that have a 3-point latching mechanism and padlocking stainless steel handles. Latch rods are required to have rollers for ease of door closing.
 - 4. All control panel seams continuously welded and ground smooth.
 - 5. Exterior control panel doors are to be removable by pulling the stainless-steel hinge pin.
 - 6. The Control Panel shall be sized to accommodate the equipment required plus 25% spare space.
- C. Hardware and Fasteners
 - 1. All associated hardware used for construction and assembly of control panel shall be 304 stainless steel.
 - 2. All mounting screws shall be drilled and tapped. Self-tapping screws are not allowed.
- D. Data Pockets
 - 1. Data pockets provided on interior of panel doors. The Control Panel supplier shall provide schematics in pocket for the associated control panel.
 - 2. Drawings placed in data pockets shall be printed in 11x17 format, double sided, and laminated.
- E. Dead Front
 - 1. The Pump Control Panel and RTU shall be provided with an aluminum dead front panel for the mounting of associated pilot devices, displays, and operator controls.
 - 2. Dead front is to have rolled edges and free of scratches, sharp edges, and burs.
 - 3. Dead Front is to be 1/8" in thickness.

2.3 AIR GAP

- A. Pump Control Panel shall be furnished with an air gap between conduits from wet well to control panel. This is to provide separation from corrosive gases that are present in the wet well.
- B. Air gap is to have a minimum height of 18" and is to be provided with a cage or screens to prevent intrusion of pests while still providing the ability to remove the cage or screens for service.

2.4 GENERATOR RECEPTACLE

- A. Pump Control Panel shall be provided with a generator receptacle mounted to the side as indicated on Project Plans. It should be mounted in a way to provide easy access for connection.
- B. The receptacle shall be Appleton ADR1034RS.

2.5 COOLING REQUIREMENTS

- A. Control Panels shall be provided with all necessary cooling/heating equipment required to maintain temperature and humidity within the operating requirements of all components located within the control panel. At the time of submittals, the Control Panel supplier is required submit calculations indicating that cooling/heating requirements have been met.
- B. Forced air ventilation should be utilized, if possible. When forced air ventilation is not possible, NEMA 4X air conditioners and sun shields shall be supplied as required to keep the equipment mounted inside the control panels operating within the manufacturers operating temperature requirements.
 - 1. The air conditioner unit shall not exchange the air inside the control panel with the air outside the control panel.
 - 2. The unit shall be conformally coated to provide environmental protection.

2.6 WIRING

- A. Power: #14 AWG Minimum, THHN.
- B. Control: #16 AWG Minimum, TFFN/MTW.
- C. Signal: #18 AWG Minimum, Stranded-Twisted Pair
- D. Communication: Cat5e

E. Wire Color Code shall be as follows:

1. All ungrounded AC conductors operating at the supply voltage shall be "Black"
2. All ungrounded AC control conductors operating at voltage less than supply shall be "Red"
3. All ungrounded DC control conductors 24VDC or greater shall be "Orange"
4. All ungrounded DC control conductors less than 24VDC shall be "Purple"
5. All ungrounded AC control conductors or wires that remain energized when the main disconnect is in the "OFF" position shall be "Yellow"
6. All grounded AC current carrying conductors shall be "White"
7. All grounded 24VDC or greater current carrying conductors shall be "Brown"
8. All grounded less than 24VDC current carrying conductors shall be "Gray"
9. All grounded AC current carrying conductors that remain energized when the main disconnect is in the "OFF" position shall be "White with a Yellow stripe"
10. All ground conductors shall be "Green"

F. Marking

1. Mark phase conductors per service voltage at each termination point.
2. All control circuit wiring shall be clearly marked on each end with shrink tube type or self-laminating vinyl permanent wire markers consistent with numbering shown on wiring diagrams.

G. A wire color code legend shall be mounted inside the control panel door.

H. All wires entering and leaving panels shall be terminated at barrier type terminal strips with no splices.

I. Devices mounted on the enclosure door or interior dead front panel shall be run in spiral wrap to avoid pinch points when opening and closing the enclosure door(s) or interior panels.

2.7 TERMINATIONS

A. All terminals shall be numbered and clearly labeled per wiring diagram.

B. No terminal strip may be located closer than 6" from the field side of the control panel or 3" if mounted at an angle to allow for adequate wire bending radius of field terminations.

C. The Pump Control Panel and RTU shall be provided with a dedicated terminal block for the termination of interconnect wires.

2.8 SURGE PROTECTION

- A. Incoming power to Pump Control Panel is to be protected by a Type 2 surge protection device that is rated for the voltage being supplied. Protection is to be provided for all modes with a minimum rating of 20kA per phase. The device is to be manufactured by Surge Suppression, Inc.
- B. Power and I/O signals shall be protected at the control panel with panel mounted surge protection that is Plug in Style & DIN rail mounted to allow for easy replacement. Interposing relays are also an acceptable form of protection. Power and I/O signals are to be protected with a minimum rating of 10kA per mode.
- C. Surge protection for radio and telemetry equipment and shall be manufactured by Surge Suppression, Inc., Polyphaser, or Engineer approved equal.

2.9 WIRE DUCT

- A. All control panel interior mounting panels shall be provided with nonmetallic slotted ducts.
- B. All nonmetallic slotted ducts shall have spare space equal to 40% of the depth of the duct.
- C. Wire duct shall not be placed closer than 2" to the nearest terminal edge or component to all adequate space to wire the terminals.
- D. The wire duct shall be gray in color and manufactured by Panduit, or Engineer approved equal.

2.10 PANEL MOUNTED DEVICES

- A. Circuit Breakers
 - 1. The Pump Control Panel is to be provided with an interlocked Normal/Emergency circuit breaker assembly. The Normal/Emergency circuit breaker assembly shall be provided with Manufacturer's standard mechanical interlocking assembly with lock provisions.
 - 2. The RTU shall be provided with a main circuit breaker.
 - 3. All circuit breakers shall be of the same AIC rating as the upstream panel or device to which it is connected.
 - 4. Control circuit breakers shall be DIN rail mounted.
 - 5. Circuit breakers shall be manufactured by Square D or Engineer Approved Equal.
- B. Power Distribution Blocks
 - 1. Power distribution blocks shall be block style distribution manufactured by Square D, Marathon, or Engineer Approved Equal.
 - 2. All distribution blocks shall be provided with associated safety covers to provide protection from accidental contact. The safety cover shall have a test prod hole for testing purposes.

C. Fuses

1. Branch rated fuses and fuse holders shall be from the same manufacturer and shall be Cooper Bussmann, Mersen, or Littelfuse. Unless otherwise noted, the fuse rating and type shall be determined based on the equipment, which the fuse is protecting, manufacturer's recommendation for overcurrent protection.
2. Control fuse holders and fuse plugs (used for I/O signals) shall have LED blown fuse indication and shall be manufactured by Phoenix Contact or Engineer Approved Equal.
3. Control fuses used for branch protection and I/O signals shall be of 1/4" x 1-1/4" type.

D. Control Power Transformers

1. Control power transformers shall be provided as required for each Pump Control based on site service voltage as indicated in Project Plans.
2. All control power transformers shall be sized to provide 25% spare capacity.
3. All control power transformers shall be provided with protective covers to guard against accidental contact.
4. Control power transformers shall be manufactured by Square D and provided with both primary and secondary over-current protection devices per the NEC.

E. Enclosure Lighting

1. The Pump Control Panel and RTU shall have adequate lighting and shall utilize an LED panel light with an integral switch.
2. Control panel LED light shall be manufactured by Hoffman, Finder, or Engineer Approved Equal.

F. Enclosure Door Switches

1. Door switches (Intrusion Switches) shall be provided for remote indication that the enclosure has been opened.
2. Door switches are required for the Pump Control Panel and the RTU.
3. Enclosure door switches shall be manufactured by Eaton, Hoffman, or Engineer Approved Equal.

G. DC Power Supplies

1. DC Power Supplies are required as necessary for the design of the system and shall be UL Listed.
2. Power supplies shall be industrial type, AC to DC switching, output voltage as required with 120VAC input and sized for 1.5 times the application requirements.
3. Output of power supply shall be protected by secondary overcurrent protection device.
4. Power Supplies shall be manufactured by Phoenix Contact or Engineer Approved Equal.

H. Uninterruptible Power Supplies (UPS)

1. UPS shall be provided for the RTU Control Panel to provide 24VDC battery backup to the pump controller and communication equipment in the event of a power fail.
2. UPS shall have DC input and DC output and shall be DIN rail mounted.
3. UPS shall be sized 1.5 times the application requirements and should have 4-Hr minimum run time.
4. UPS shall include dry contacts for the following alarm points:
 - a. Loss of input power
 - b. Battery Failure
5. UPS shall be manufactured by Phoenix Contact or Engineer Approved Equal.

I. Operator - Pilot Lights

1. Pilot lights are to be heavy duty LED, push to test type, oil tight, industrial type with LED lamps, and shall be rated Type 4X.
2. Legend plates shall be factory engraved as required and shall have a black legend plate with white writing.
3. Pilot lights shall be required for each starter located inside the Pump Control Panel and lenses shall be colored as follows:
 - a. White (Power Indication) ex. Control Power OK
 - b. Green (Running) ex. Pump Running
 - c. Amber (Warning) ex. Motor Over Temperature
 - d. Red (Alarm) ex. High Level
4. Indication lights shall be manufactured by Square D and be 9001K 30mm type or Engineer Approved Equal.

J. Operator - Push Buttons

1. Pushbuttons shall be heavy duty, non-illuminated, oil tight, industrial type, and rated Type 4X.
2. Pushbuttons shall have momentary contacts rated at 600V, 10A continuous service
3. Legend plates shall be factory engraved as required and shall have a black legend plate with white writing.
4. Push buttons shall have flush faces unless otherwise specified and shall be the color black.
5. Pushbuttons shall be manufactured by Square D and be 9001K 30mm type or Engineer Approved Equal.

K. Operator - Selector Switches

1. Selector Switches shall be heavy duty, oil tight, industrial type, and rated Type 4X.
2. Selector switches with contacts rated at 600V, 10A continuous service.
3. Selector Switches shall be maintained type unless otherwise specified.
4. Auxiliary contacts shall be provided as required for functionality of system.
5. Legend plates shall be factory engraved as required and shall have a black legend plate with white writing.
6. Selector Switches for Hand-Off-Auto (HOA) control are required for each motor starter or RVSS contained within the Pump Control Panel.
7. Selector Switches shall be manufactured by Square D and be 9001K 30mm type or Engineer Approved Equal.

L. Elapsed Time Meters (ETM)

1. ETM shall be provided on the dead front for each pump.
2. ETM shall be 120VAC or 24VDC, shall display 7 digits, size shall be 3" maximum, and color shall be black.
3. ETM shall be manufactured by Redington or Engineer approved equal.

M. Alarm Light

1. An Alarm Light shall be provided with each Pump Control Panel and shall be a red strobe.
2. Alarm Light shall be rated for the control voltage of the Pump Control Panel
3. Alarm Light shall be mounted so that it maintains environmental ratings of control panel and is not to be mounted through the top of the enclosure.
4. Alarm Light shall be manufactured by Federal Signal or Engineer Approved Equal.

N. Motor Starters

1. All motor starters shall be NEMA rated (no IEC devices will be accepted).
2. Motor Starters shall be provided for sites where pumps are less than 5HP (horsepower).
3. All motor starters shall be provided with overload heaters sized per the needs of the application.
4. The Pump Control Panel shall use an auxiliary contact from the overload heater to provide status indication of an overload condition on the interior dead front.
5. Motor starter shall have a dead front mounted reset button.
6. Motor starter shall be provided with two (2) NO/NC auxiliary contacts.

O. Reduced Voltage Soft Starters (RVSS)

1. All RVSS units shall be manufactured by Square D and shall be ATS480 Series or Engineer Approved Equal.
2. RVSS units shall be provided for sites where pumps are 5HP or greater.
3. RVSS Unit shall have the ability to monitor and report on a motor running and a motor fault condition.
4. A shorting contactor is to be provided with the RVSS.
5. Pump Control Panel shall have RVSS keypads remote mounted on the dead front for easy access to RVSS control and monitoring without exposure to three phase electrical components.

P. Intrinsically Safe Barriers

1. Intrinsically safe barriers shall be UL listed and shall be manufactured by Phoenix Contact, Eaton MTL, or Engineer Approved Equal.
2. Intrinsically safe barriers shall be provided where required for Level Switch terminations and shall be shown and fabricated per UL698A requirements.

Q. Motor/Pump Protection

1. Pump Motor Thermal and Seal Fail Protection shall be chosen based on pumps that are in place at each remote site.

R. Ethernet Connection

1. Bulkhead style RJ45 connection shall be provided on the interior dead front of the RTU to allow for communication connectivity without having to open the dead front.

S. Pump Controllers

1. Pump Controller designed for wastewater applications shall be utilized for lift station wet well level control
2. The pump controller shall have the ability to provide run control to pumps by analyzing system floats, system faults, etc.
3. The pump controller shall have the capability to remotely start/stop pumps and provide other remote functionality through the Owner SCADA system.
4. The pump controller shall have the ability to communicate to Owner SCADA system using DNP3 protocol.
5. DNP3 mapping to be used by Owner SCADA system shall be submitted prior to programming completion for approval to ensure mapping is logical and all monitoring and control is included.
6. Pump Controller shall monitor the following digital signals from the site Pump Control Panel:
 - a. Low Float
 - b. Stop Float
 - c. Lead Float
 - d. Lag Float
 - e. Lag 2 Float (if applicable, if not leave as spare)
 - f. High Float
 - g. Intrusion Detection
 - h. UPS Alarm
 - i. Pump 1 in Auto
 - j. Pump 1 in Hand
 - k. Pump 2 in Auto
 - l. Pump 2 in Hand
 - m. Pump 3 in Auto (if applicable, if not leave as spare)
 - n. Pump 3 in Hand (if applicable, if not leave as spare)
 - o. Pump 1 Running
 - p. Pump 2 Running
 - q. Pump 3 Running (if applicable, if not leave as spare)
 - r. Pump 1 Fault
 - s. Pump 2 Fault
 - t. Pump 3 Fault (if applicable, if not leave as spare)
 - u. External Phase Monitor Alarm
 - v. Generator Running
 - w. Generator Fault
7. The Pump Controller shall output the following digital signals to the Pump Control Panel:
 - a. Pump 1 Call to Run

- b. Pump 2 Call to Run
 - c. Pump 3 Call to Run (if applicable, if not leave as spare)
 - d. Alarm Light
 - e. SEL-2411P Enabled
 - 8. The Pump Controller shall monitor the following Power inputs from the Pump Control Panel:
 - a. Phase A,B,C, and N
 - b. Current A,B,C, and N
 - 9. Pump Controllers shall be Schweitzer Engineering Laboratories, SEL-2411P, 2411P2BDBBB743B063120 having the following configuration:
 - a. Supply voltage shall be 24VDC
 - b. Digital Input voltage shall be 24VDC
 - c. Slot A shall be 24VDC
 - d. Slot C shall be 24VDC
 - e. Slot D shall be 24VDC
 - f. Slot E shall be 3ACI/3AVI (300VAC Max, 5A Phase)
 - g. Slot Z shall be 8DI (24VDC/VAC)
 - h. Unit shall be conformally coated
 - 10. Pump Controller is to be mounted through the dead front of the RTU for operator accessibility while still protecting from the three phase power inputs.
- T. Network Switch
- 1. Network switch is to be provided for the RTU and shall be utilized to connect Pump Controller, Cellular Communication Device, and RJ45 bulkhead
 - 2. Network switch shall be 5-Port, unmanaged, and DIN rail mounted
 - 3. The network switch manufacturer shall be Phoenix Contact or Engineer Approved Equal.

U. Relays

1. Interposing
 - a. Interposing relays shall be miniature industrial relays with mechanical and LED indication and test button.
 - b. The coil voltage shall be 24VDC or 120VAC and shall have DPDT contacts rated for 250V, 5A minimum.
 - c. Interposing relays shall be Finder 46 Series or approved equal.
2. General Purpose
 - a. General purpose relays shall be pluggable industrial style with mechanical and LED indication and test button.
 - b. The coil voltage shall be 24VDC or 120VAC and shall have 3PDT contacts rated for 250V, 7A minimum.
 - c. General purpose relays shall be Finder 55 series or Engineer Approved Equal.
3. Alternator
 - a. Alternator (Alternation) relay shall have coil voltage 120VAC or 24VDC with contacts rated 120VAC, 10A.
 - b. Alternator relay shall be Time Mark 2611 or Engineer Approved Equal.
4. Phase Monitor
 - a. A Phase Monitor shall be provided for Pump Control Panels.
 - b. Voltage shall be determined per site based on Project Plans.
 - c. Contacts shall be SPDT rated for 240V, 10A.
 - d. Phase Monitor shall be Time Mark 257 Series or Engineer approved equal.
5. Intrinsically Safe
 - a. Intrinsically safe relays shall be 2 or 4 channels with coil voltage 120VAC and contacts rated 120VAC/24VDC, 5A.
 - b. To be provided where required for Level Switch terminations and shall be shown and fabricated per UL698A requirements.
 - c. Intrinsically safe relays shall be Phoenix Contact, Eaton MTL, or Engineer Approved Equal.

V. Terminal Blocks

1. Terminal Blocks shall be:
 - a. Feed-thru, screw type connection
 - b. DIN rail mounted
 - c. Rated for the voltage and current of the proposed application per UL/NEC standards
 - d. Terminal blocks shall be a minimum of 6mm in width
 - e. Labelled using permanent, machined, terminal markers that are suitable for the terminal blocks specified
2. All field wiring shall land on DIN rail mounted terminal blocks near the bottom of the control panel prior to distribution throughout the control panel.
3. Terminal block layout shall group together like devices and signals
4. Feed Thru Terminal Blocks
 - a. Phoenix Contact UT 4 series
5. Field Digital Signal Terminal Blocks (As required)
 - a. Terminal Block – Phoenix Contact UT 4 3214362
6. Field Analog Signal Terminal Blocks (As required)
 - a. Terminal Block – Phoenix Contact 3214365
 - b. Fuse Plug – Phoenix Contact P-FU 5x20 3036806

W. GFCI Convenience Receptacle

1. Pump Control Panel and RTU shall have convenience receptacles installed.
2. GFCI convenience receptacle shall be UL labeled, industrial grade and either DIN rail mounted or if an interior dead front is installed, the receptacle shall be made available on the interior dead front.
3. Receptacle shall be rated for 120VAC, 15A
4. Receptacle shall clearly indicate the maximum current available
5. Receptacle shall be manufactured by Legrand, Phoenix Contact, Hubbell, or Engineer approved equal.

X. Grounding Bar

1. Provide a grounding bar inside control panel for terminating all ground wires.
2. Ground bar shall be manufactured by Square D and shall be sized based on the needs of the control panel.

Y. Nameplates

1. Nameplates shall be provided for all individual panels and panel mounted devices.
2. Nameplates shall be phenolic, engraved, and they shall be black with white lettering on the panel exterior and white with black lettering on the inside of the control panel.
3. Nameplates shall be attached to the control panel with stainless steel screws or heavy duty reinforced acrylic transfer tape.
4. Text size shall be at a minimum 0.15" and shall use a font such as Tahoma or Arial for ease of readability.
5. Nameplates shall be visible when devices are wired

Z. Cellular Communication Device

1. Communication shall be made available from the remote site to the Owner SCADA system via a cellular gateway which will be installed in the RTU.
2. Owner maintains an AT&T First Net APN and it is the responsibility of the Control Panel Supplier to coordinate with the Owner and obtain the required SIM card to install in cellular modem and to ensure all components are in place for remote site to communicate to Owner's SCADA system.
3. The cellular device shall be Schweitzer Engineering Laboratories, SEL-3061, 3061#M47Q.
4. Site communication requires additional components below:
 - a. (2) Omni Directional Antennas (field installed)
 - b. (2) LMR400 Cables, N-Male to N-Male, 20Ft(field installed)
 - c. (2) Surge Protectors by Polyphaser (field installed)
 - d. (2) RG8X Cables, N-Male to SMA-Male, 3Ft
 - e. Antenna Mounting Bracket and stainless-steel hardware (field installed)

AA.Float Switches

1. A total of (5) float switches shall be provided for each site as notated below:
 - a. Low
 - b. Stop
 - c. Lead
 - d. Lag
 - e. High
2. Float switches shall be stainless steel Teflon coated and provided with NO contacts. Cable lengths of floats shall be provided as required per site.
3. Float switches shall be Conery SSF Float type.

PART 3 – EXECUTION

3.1 PREPARATION

- A. All control panels shall be factory tested and certified prior to releasing for shipment. The testing shall consist of but not be limited to the following:
 - 1. Point to point testing of all wiring prior to application of power.
 - 2. The intended supply voltage shall be applied to the control panel and all components shall be tested for proper operation and calibration.
 - 3. The Pump Controller logic and Communication Device configuration shall be loaded, and each shall be tested for functionality.
 - 4. Each set of control panels shall be tested against a local copy of the SCADA application to verify DNP3 mapping between the Pump Controller and SCADA application to ensure all monitoring, control, and indication is available.
 - 5. Cellular communication shall be tested with Owner's SCADA system to ensure proper communication set up between the cellular gateway and the SCADA system. Obtaining SIM cards for each cellular gateway shall be coordinated through the Owner's IT personnel who manages the APN.
 - 6. All components shall be checked to confirm that each device has been installed per the plans and specifications as well as the Manufacturer's recommendations.
 - 7. The enclosure shall be inspected for defects and shall be repaired or replaced if necessary.
 - 8. All labeling and identification tags shall be verified, clean, and visible.

3.2 CONTRACTOR'S RESPONSIBILITY

- A. The Contractor shall be responsible for coordinating the installation of all equipment in the proposed locations with all other trades performing work on the project that may be affected.
- B. The Contractor shall receive final approval on all panel, enclosure, and equipment layouts from the Engineer prior to fabrication or installation.

3.3 QUALITY ASSURANCE

- A. Control panel documentation shall contain the results of the tests listed as well as any rework items and subsequent repairs that were required prior to shipment. In addition, Control Panel supplier must certify this document prior to the release for shipment.
- B. Prior to shipment one copy of the applicable documentation shall be placed in the drawing pocket of each enclosure, an electronic copy filed on manufacturer's server, and a copy sent to the Engineer.

3.4 INSTALLATION

- A. All equipment and devices shall be installed in the locations shown on the drawings, in accordance with the manufacturer's recommendations, and in compliance with the requirements of these specifications.
- B. Provide enclosure mounting supports as required for wall-mounting. All support for Control Panels in outdoor locations shall be stainless steel.
- C. Control Panels in outdoor locations shall have all cable and pipe openings sealed watertight. Cable and piping shall enter the enclosure as shown on the drawings or specified herein.

3.5 START UP AND TESTING

- A. Verify control panel being installed matches the approved shop drawings.
- B. Perform point to point verification once all field wiring is completed prior to applying voltage to system.
- C. Prepare and start equipment and systems in accordance with manufacturer instruction and recommendation.
- D. Test operation of the Pump Control Panel and RTU for control and functionality.
- E. Test the operation of the communication equipment to ensure proper operation with Owner SCADA System.
- F. All start up and testing shall be done with the Owner and Engineer present.
- G. Complete Site Acceptance Testing documentation and send electronic version of signed copy to Engineer.

3.6 TRAINING

- A. Training shall be provided to Owner personnel on full operation of Pump Control Panel and RTU. Two (2) training sessions should be held to accommodate different shifts and training shall be a minimum of two (2) hours each session.

3.7 FINAL INSPECTION

- A. Include all changes and/or alterations in the control panels prior to final inspection and acceptance by the owner.
- B. Any changes and/or alterations in the Control Panels shall be reflected/updated in all Control Panel Schematics prior to acceptance by the Owner. This includes all electronic copies delivered to the Owner.

END OF SECTION

SECTION 02737 – PROCESS INSTRUMENTATION AND CONTROLS

PART 1 – GENERAL

1.1 SUMMARY

- A. Process Instrumentation and Controls is to be completed by a Control Systems Integrator. The Integrator is responsible for implementing the proposed equipment into a fully operational control system.
- B. Integrator is responsible for the coordination, supply, and testing of the following:
 - 1. Section 02736 – Control Panels
- C. All controls should be constructed in accordance with the following standards:
 - 1. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.
 - 2. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.
 - 3. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices 2017.
 - 4. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).
 - 5. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
 - 6. NFPA 70e – Electrical Safety in the Workplace
 - 7. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.
 - 8. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.
 - 9. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.
 - 10. UL 698A - Standard for Industrial Control Panels Relating to Hazardous (Classified) Locations

1.2 QUALIFICATIONS

- A. SCADA Integrator shall have experience in water and wastewater control systems and shall have experience and confidence using the products described in Project Specifications and Plans.
- B. Licensed to perform professional engineering services in the state where the project is located.
- C. A valid Engineering Business Registry.
- D. Must be able to provide proof of business insurance and be able to meet Insurance requirements as outlined in project documentation.
- E. The Integrator shall meet the following requirements:
 - 1. Personnel shall be able to provide programming and configuration of Pump Controller, Communication Device, and SCADA System to produce a product that is able to be repeatedly used throughout the Owner's system and can be troubleshooted as needed.
 - 2. Integrator shall not introduce proprietary logic or means of programming that would inhibit the Owner in any way in the future.
 - 3. References to prior projects shall be provided to demonstrate competence of Project Scope upon request by the Engineer.
 - 4. Integrator shall maintain their own UL508A Control Panel shop.
 - 5. Geographic location of a fully staffed office of Engineers, Project Managers, and Service Personnel shall be located within a 200-mile radius of project site.

1.3 SCOPE

- A. Provide a complete remote site solution for the site detailed in contract documents that shall be integrated into Owner's existing SCADA System. The existing SCADA System is VTScada by Trihedral.
- B. Provide control panels as detailed in Section 16190 and contract documents.
- C. Each remote site shall utilize the equipment described in Section 16190 and shall communicate with the Owner's SCADA system over Cellular communication.
- D. Cellular communication efforts such as obtaining SIM cards and IP addresses shall be coordinated with the Owner's IT personnel to ensure successful implementation.

- E. Install and configure communication equipment as described in contract documents.
- F. It is the responsibility of the SCADA Integrator to develop and provide configuration files for the SEL-3061 and the SEL-2411P that can be replicated throughout all remote sites.
- G. Remote sites shall utilize similar solutions, when possible, to minimize customization between them. This will reduce the number of configurations in the field and allow Owner to better manage configuration files.
- H. Contractor shall install all wiring, piping, conduit, and necessary mounting hardware to provide the Owner with a complete system.
- I. A custom SEL-2411P tag type shall be made in VTScada to implement new remote sites in a consistent manner. Tagging should be descriptive and similar tags should be grouped together to provide logical flow of processes.
- J. A custom SEL-2411P graphical template shall be made in VTScada to implement new remote sites in a consistent manner. Graphic template shall match the design and feel of existing graphics in the application.
- K. Perform Factory Acceptance Testing of Pump Control Panel and RTU with proposed SEL-2411P and SEL-3061 VTScada tag templates and graphics to ensure proper functionality of complete system.
- L. Evaluate Owner's SCADA System to determine if existing VTScada licensing is suitable for Project. If existing licensing requires any modification, modification must be described in detail to show what upgrade path is suitable for Owner's system.
- M. Provide Training to Owner's personnel on SCADA System additions so they are familiar with navigation, monitoring, and control of system.
- N. Prepare Operation and Maintenance Manual describing VTScada graphical template and tag template showing address mapping for SEL-2411P and SEL-3061.

1.4 RELATED SECTIONS

- A. Section 16190 – Control Panels
- B. Division 26 (if provided)
- C. Refer to Project Plans for any additional requirements.

1.5 WARRANTY

- A. The Integrator shall provide a manufacturer's warranty covering the work completed. All equipment supplied and all VTScada work that is completed (graphic creation, tag creation, alarming, etc.) shall be warranted for a period of one (1) year by the Integrator from the substantial completion date of contract.

1.6 QUALITY CONTROL

- A. The Integrator shall implement equipment and software techniques that are of the most proven design.
- B. All components used shall be UL listed.
- C. Integration of equipment and updated graphics into the SCADA system shall be done after submittal approval from Owner and Engineer.
- D. Factory Acceptance Test
 - 1. Integrator shall develop a Factory Acceptance Test procedure prior to installation of hardware and software. The Factory Acceptance Test shall demonstrate the components of the system and confirm that communication, mapping, and graphics created are functional and work with the Pump Control Panel and RTU.
 - 2. The Factory Acceptance Test should include all monitoring and control functions that will be available for operations once the system is in place.
- E. Site Acceptance Test
 - 1. Integrator shall develop a Site Acceptance Test procedure prior to beginning work on site. The Site Acceptance Test shall demonstrate how the Integrator intends to check out equipment and verify it against the SCADA System.
 - 2. The Site Acceptance Test should include all monitoring and control functions that will be available to operations once the system is in place.

1.7 SUBMITTALS

- A. SCADA Integrator shall provide shop drawings and product data that will be used in the final control system for review. The fabrication or installation of components shall not take place prior to the approval of submittals.

B. Shop Drawings and Product Data

1. Shop Drawings for the SCADA Integration shall include, at a minimum, the following:
 - a. Controls Schematic
 - b. Equipment Layout (Clearly show all components)
 - c. Component Data Sheets
 - d. Software Data Sheets
 - e. Recommended Spare Parts
 - f. Control Loop Diagrams
 - g. Network Installation Drawings and Network Schematics related to the Control Panel
 - h. Control Network Diagram depicting the new remote sites as they fit into the current SCADA System Network
 - i. Screenshots of proposed graphic template for the SCADA System
 - j. Document describing DNP3 Data Mapping that will be utilized in the SEL-2411P and the VTScada Tag Template.

C. Testing Related

1. Factory Acceptance Test
 - a. Test Procedure
 - b. Completed Test Forms – printed and signed
2. Site Acceptance Test
 - a. Test Procedure
 - b. Completed Test Forms – printed and signed

D. Operation and Maintenance Manual (To be included with Project USB Drive described below)

1. Table of Contents
2. System Controls Description
3. Drawings and Schematics
4. Graphic Display Screenshots
5. Data Mapping with SCADA Tag Template
6. List of any Routine or Required Maintenance

E. Project USB Drive (2 Copies Required)

1. Operation and Maintenance Manual
2. AutoCAD Drawing Files
3. Programming and Configuration Files as required based off equipment provided; included but not limited to PLC, Pump Controller, Radio, and HMI

1.8 MEETINGS

- A. Under the coordination of the Contractor, the Integrator shall meet with Owner Personnel to review the following prior to SCADA Integration:
 - 1. SCADA Graphics
 - 2. Data that will be available to the SCADA System based off requirements in Section 16190.
 - 3. Functional Control Description of Pump Control Panel and RTU at each site.
 - 4. Initial Alarm Configuration for each alarm point, delay and priority specifically.
 - 5. Reports and Historical Data that will need to be made available for Operator use.

PART 2 – EXECUTION

2.1 CONTROL STRATEGY

- A. Summary
 - 1. Primary control of the Lift Station will be through the Pump Controller with an Alternation Relay for back up control in the event of a Pump Controller failure. Control via the Pump Controller or the Alternation relay will take place as long as the pump Hand-Off-Auto switches are in the Auto position.
- B. Float Control
 - 1. Pump Controller
 - a. Under normal operating conditions, the Pump Controller will evaluate the Float inputs from the Pump Control Panel to control the pumps in a lead, lag alternation.
 - b. Pump run commands are issued from the Pump Controller to the motor starter/RVSS through hard wired connection from the RTU to the Pump Control Panel.
 - c. To prevent the Pump Controller and Alternation Relay from both attempting to issue run commands to the pumps, the alternation relay shall be interlocked with the pump controller so as long as the pump controller is enabled only it will be able to issue run commands. If the pump controller fails, the alternation relay will be powered to issue run commands.
 - 2. Alternation Relay
 - a. In the event of a Pump Controller failure, the Alternation Relay will evaluate the Off, Lead, and Lag floats to issue run commands to the pumps in a lead, lag alternation.

3. Manual Mode

- a. The Lift Station can also be controlled by placing the pump Hand-Off-Auto switch in the Hand position. The pump will run until it is taken out of the Hand position.
- b. If an RVSS is supplied depending on site pump HP size, the RVSS is to have the capability to run the pump in a local mode via the keypad.

2.2 TRAINING

- A. Integrator shall provide training to Owner's personnel following the completion of the Site Acceptance Test. Two (2) training sessions should be offered to accommodate different shifts and training shall be a minimum of two (2) hours each session.
- B. Training will cover operation of equipment via the SCADA System and monitoring and control that is available.
- C. Training shall include written procedure for remote access to SEL-2411P and SEL-3061 from SCADA server for authorized personnel.

2.3 HISTORICAL DATA AND REPORTING

- A. Data from the SEL-2411P and SEL-3061 shall be made available for trending and reporting as required by the Owner.
- B. Logging for Analog data points shall be enabled by default.
- C. Logging for Digital data points shall be enabled according to Owner needs but should have the ability to be enabled or disabled as needed.

2.4 SCADA INTEGRATION

- A. SCADA Integrator shall be responsible for integrating remote sites into the existing SCADA system to provide the Owner with a fully functional control system per the Specifications and Plans of the project.
- B. The SCADA Integrator shall work directly for the Contractor of the project.
- C. SCADA Integrator shall work with the Contractor to schedule on-site visits to perform any necessary field work and visits should be scheduled one week in advance.

D. Supply and Provide Integration services for the following hardware and software at each site as follows:

1. Provide Pump Control Panel and RTU
2. Provide communication equipment required for RTU functionality as described in Section 16190.
3. Oversee Termination of Interconnects between Pump Control Panel and RTU
4. Perform Field Work as required to install Antenna equipment for SEL-3061
5. Perform site check out for control panels and SCADA System functionality.
6. Installation of applicable software to the Owner's SCADA server so remote communication to SEL-2411P and SEL-3061 can take place.
7. Provide Owner personnel with SEL-2411P programming cable, C662, for local connection via front port on the SEL-2411P.
8. Configuration of cellular communication device and pump controller.
9. Provide training and Project USB drives as specified.

END OF SECTION 02737

SECTION 02930

SODDING, SEEDING AND MULCHING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. Furnish all labor, materials, equipment and incidentals required to prepare lawn bed and install sodding, seeding and mulching as shown on contract drawings and as specified.

B. Areas to receive sodded grass shall be:

1. Two foot wide strip along edge of all asphaltic concrete paving constructed as a part of this contract. This includes roadways and parking areas.
2. Five foot wide strip around the perimeter of all concrete structures constructed or reconstructed as a part of this contract. This includes drainage structures, slabs, and pump stations. However, sod is not required around manholes nor fences.
3. All areas indicated on the drawings. and per references on SWPPP, Sht.C8.
4. All areas in lawns disturbed by Contractor.
5. One foot wide strip along edge of all sidewalks constructed or reconstructed as a part of this contract.

C. Areas to receive seed and mulch shall be:

1. All areas disturbed by Contractor that are not required to be sodded.
2. All areas indicated on the drawings, and per references on SWPPP, Sht.C8.

1.2 SUBMITTALS

Contractor shall submit to the Engineer a signed statement of total weight for each type of seed and fertilizer actually installed on the project with copies of purchase receipts.

PART 2 - MATERIALS

2.1 MULCH

The mulch used shall be normally dry mulch and shall consist of pangola, coastal bermuda or bahia grass hay.

2.2 SEED

Grass seed shall be a mixture of 20 parts of Bermuda seed, 40 parts of Argentine Bahia seed, and 40 parts of brown top millet, except that during the winter months, Rye grass seed or other approved

winter cover crop seed shall replace the millet. The three types of seed used shall be thoroughly dry-mixed immediately before sowing. Seed which has become wet or moldy shall not be used.

The Bermuda seed shall be hulled seed. The Argentine Bahia seed shall be scarified seed, having a minimum active germination of 40 percent and a total germination of 85 percent. All seed shall meet the requirements of the State Department of Agriculture and Consumer Services and all applicable State laws, and shall be approved by the Engineer before being sown.

2.3 FERTILIZER

Commercial fertilizer shall comply with the State fertilizer laws.

The numeral designations for fertilizer indicate the minimum percentage (respectively) of (1) total nitrogen, (2) available phosphoric acid, and (3) water-soluble potash, contained in the fertilizer.

The chemical designation shall be 12-8-8. Either dry or liquid fertilizer may be used.

2.4 SOD

Sod shall be of the same type as the surrounding areas to be restored or as otherwise indicated on the Drawings or directed by the Engineer. Sod shall meet the applicable requirements of Section 981, Grassing and Sodding Materials of the "Florida Department of Transportation Standard Specification for Road and Bridge Construction", (1986).

2.5 WATER

The Water used in the grassing operations shall be free of excess and harmful chemicals, acids, alkalies, or any substance which may be harmful to plant growth or obnoxious to traffic. Saltwater shall not be used.

PART 3 - EXECUTION

3.1 LAWN BED PREPARATION

Areas to be seeded shall be cleared of all rough grass, weeds, and debris, and the ground brought to an even grade as approved. The soil shall then be thoroughly tilled to a minimum 8-inch depth. 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, free of water-retaining depressions, the soil friable and of uniformly firm texture.

3.2 SEEDING AND MULCHING

Fertilizing, seeding or mulching operations will not be permitted when wind velocities exceed 15 miles per hour. Seed shall be planted or sown only when the soil is moist and in proper condition to induce growth.

Apply the lawn seed with a drop type spreader at the rate of eight (8) pounds per one thousand (1,000) square feet.

Apply half the seed in one direction and the remainder at right angles to the first seeding.

After applying the seed, rake the seed into the seed bed and roll with a lawn roller.

Seeded areas shall be uniformly mulched in a continuous blanket immediately following seeding

and compacting operations, using at least 1 1/2 tons of hay or straw per acre. Hay with noxious seeds or plants will not be acceptable. Rotted, brittle, molded hay will not be accepted. It is intended that mulch shall allow some sunlight to penetrate and air to circulate, at the same time shading the ground, reducing erosion and conserving soil moisture. Thickness of covering shall be adequate to hold soil but sufficiently loose and open to favor development of grass. Immediately following spreading of mulch, material shall be anchored to soil by means of a seed drill, dish harrow set to cut only slightly, or other suitable equipment which will secure mulch firmly and prevent loss or bunching by wind or rain, or may be anchored with string lines placed at sufficient intervals. On slopes where machinery cannot be used mulch may be retained in place by hand spading, string lines, or non-metallic open weave fabric. Unless rain is imminent, mulched areas shall be watered immediately after placing. Upon completion, surface or mulched areas shall be free from clods of earth, bumps, or waterholding pockets and to required grades.

3.3 SODDING

Sodding shall be incorporated into the project at the earliest practical time in the life of the contract. No sod which has been cut for more than 72 hours shall be used unless specifically authorized by the Engineer after his careful inspection thereof. Any sod which is not planted within 24 hours after cutting shall be stacked in an approved manner and maintained properly moistened.

Sodding shall not be performed when weather and soil conditions are, in the Engineer's opinion, unsuitable for proper results.

The sod shall be placed on the prepared surface, with edges in close contact, and shall be firmly and smoothly embedded by light tamping with appropriate tools.

Where sodding is used in drainage ditches, the setting of the pieces shall be staggered such as to avoid a continuous seam along the line of flow. Along the edges of such staggered areas the offsets of individual strips shall not exceed six inches. In order to prevent erosion caused by vertical edges at the outer limits, the outer pieces of sod shall be tamped so as to produce a featheredge effect.

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.

Any pieces of sod which, after placing, show an appearance of extreme dryness shall be removed from the work.

3.4 MAINTENANCE

Maintenance shall begin immediately following the last operation of grassing and continue until final acceptance. Maintenance shall include watering, mowing, replanting, and all other work necessary to produce a uniform stand of grass.

Sufficient watering shall be done by the Contractor to maintain adequate moisture for optimum development of the lawn areas. Grassed areas shall receive no less than 1.5 inches of water per week.

Grassing will be considered for final acceptance when the permanent grass is healthy and growing on 95 percent of the area with no bare areas wider than twelve (12) inches.

END OF SECTION

SECTION 316342 – VIBRO REPLACEMENT

PART 1 - GENERAL

1.1 INTRODUCTION

- A. Description: Vibro Replacement is a stone column installation method in which a Vibrator (down-hole vibratory probe) compacts aggregate into a column and densifies the surrounding soils to increase bearing capacity and reduce settlement of a planned structure. Vibro Replacement (VR) can also serve to increase shear resistance, particularly when a load is placed above them.
- B. Suitable Soil Types: Fine-grained, mixed and layered soils. These soils generally do not densify easily when subjected to vibration alone. The VR technique was developed specifically for these soils, effectively extending the range of soil types that can be improved with the deep vibratory process.

For soils and groundwater conditions in which the predrilled hole remains open and stable, the aggregate can be placed into the open hole and compacted in lifts. In unstable conditions, the hole stability must be maintained either with water (wet method) or a bottom feed Vibrator (down-hole vibrator method).

- C. Applications: Most structures including warehouses, multi-level condominiums, commercial retail or office space, wind turbine towers, road and railway embankments, tanks, retaining structures, parking structures, and for liquefaction mitigation.

1.2 INTENT

The intent of the VR specified herein is to provide soil improvement and reinforcement within the limits indicated on the project drawings to achieve the performance criteria in section 1.8 of these specifications.

1.3 STANDARDS AND REFERENCES

- A. The most recent version of the following testing methods may be employed:
 - 1. Standard Penetration Testing (SPT) ASTM D1586, in appropriate soils.
 - 2. Cone Penetrometer Testing (CPT) ASTM D5778, in appropriate soils.
- B. Reference documents as provided to VR Contractor shall include:
 - 1. This specification.
 - 2. Project drawings:
 - a. Engineer's foundation plans, drawing no.'s S-2.1, S-2.2, and S-2.3.
 - b. Engineer's existing underground utilities plan in the work area.
 - c. Existing Topo and site grading plan.
 - 3. Project geotechnical report.
 - 4. Contract documents.

1.4 DEFINITIONS

- A. Field Quality Control Representative (FQCR): The Owner's representative (geotechnical consultant or testing agency) given specific inspection tasks identified in this specification. The FQCR shall work for the Owner and Contractor and be paid by the Contractor.
- B. Wet, Top Feed Method (Replacement + Displacement): With this method, jetting water is used to remove soft material, stabilize the vibrator hole, and ensure that the stone backfill reaches the tip of the vibrator. This is the most commonly used and most cost-effective of the deep vibratory methods. Wet spoil is generated with this method, and must be carefully managed when working on confined sites or in environmentally sensitive areas. The stone backfill is densified in 2 to 3 foot lifts.
- C. Dry, Bottom Feed Method (Displacement): This method employs the same type vibrator as the top feed method, but with the addition of a hopper and supply tube to feed the stone backfill directly to the tip of the vibrator. Bottom feed Vibro Replacement is a generally dry operation with little spoil, extending the range of sites that can be treated. Treatment to depths greater than 80 feet is possible and is not inhibited by the presence of groundwater. The stone backfill is densified in 2 to 3 foot lifts.
- D. Predrilling: This procedure consists of drilling a planned VR location prior to placing the vibrator to loosen or remove the soil to facilitate vibrator penetration.

1.5 SCOPE OF WORK

- A. The work shall consist of installation, monitoring and testing of the VRs within the limits indicated on the geotechnical report and drawing no.'s S-0.1, S-0.2, S-0.3, S-2.1, S-2.2, and S-2.3 to meet the performance criteria presented in Section 1.8 of these specifications.
- B. In connection with the VR program, as shown on the drawings, the VR Contractor shall provide all labor, materials, and equipment to accomplish the following items of work:
 - 1. Predrilling of holes as necessary and stockpiling of all spoil.
 - 2. Construction of the VRs to the lines and grades on the construction drawing.
 - 3. All quality control inspections.
- C. It shall be the VR Contractor's responsibility to determine and implement the systems and criteria to ensure that the specified performance is achieved.

1.6 SUBMITTALS

- A. The following shall be submitted to the Owner's representative by the VR Contractor *with the bid documents*:
 - 1. A list of at least five previously completed projects of similar scope and purpose for approval by the Owner's representative. The list shall include a description of the project, relative size, and reference person with phone number.
- B. The following shall be submitted to the Owner's representative by the VR Contractor three weeks *prior to the start of the work*:

1. Resumes of the management, supervisory, and key personnel, for approval by the Owner's representative.
 2. A ground improvement design that demonstrates specified tolerances are achieved, as the design is the VR Contractor's responsibility.
 3. A ground improvement QC plan, as detailed in section 3.3 of these specifications, as the QC is the VR contractor's responsibility.
 4. Work procedures and control criteria.
 5. A shop drawing for review, indicating the spacing, location, and depth of the VRs to achieve the criteria outlined in this specification.
 6. A schedule of work tasks and time for completion.
- C. The following shall be submitted to the Owner's representative by the VR Contractor *during the work*:
1. Accurate daily records that include VR number, start/finish time of the VR, depth of treatment, ammeter readings and backfill quantities.
 2. Any change in the predetermined VR program necessitated by a change in the subsurface conditions.
- D. The following shall be submitted to the Owner's representative by the VR Contractor *after the work*:
1. A report documenting the results of the tests. This report will certify that the bearing pressure has been achieved within settlement tolerances.
 2. As-built drawing depicting any significant changes to the shop drawing.

1.7 QUALIFIED CONTRACTORS

- A. The VR Contractor shall be pre-qualified before bidding on this work. Keller North America is a pre-qualified contractor.

1.8 PERFORMANCE CRITERIA

1. Construct appropriate VRs with granular backfill material beneath all column foundations and load-bearing wall foundations (or specified areas) to provide the following criteria upon successful completion of each:
 - a. An allowable soil bearing capacity of 4000 pounds per square foot (psf) with a maximum total settlement of 1-inch and differential settlement of 0.5-inch over 30 feet.
2. VRs should be constructed to a depth sufficient to satisfy the criteria above, as confirmed by the testing specified in section 3.4.

1.9 QUALITY ASSURANCE

- A. The VR program shall be performed by a specialist VR Contractor with at least five continuous years of documented experience in VRs.
- B. The VR Contractor shall provide experienced management, supervisory and key personnel as required to implement the VR program, as follows:
 - 1. The Project Manager shall have at least three years of continuous experience in VRs, with at least the last two years in the full-time employment of the VR Contractor.
 - 2. The superintendent shall have at least two years of experience in VR.
 - 3. As detailed in Section 1.6 of these specifications, the VR Contractor shall provide:
 - a. Evidence of previous VR project experience.
 - b. Evidence of management, supervisory and key personnel experience.
- C. The Owner's representative will ensure that procedures and documentation conform to these specifications.

PART 2 - EQUIPMENT AND MATERIALS

2.1 EQUIPMENT

- A. Vibrator
 - 1. A Vibrator is a down hole vibratory probe producing horizontal vibrations from an energy source located near the tip of the probe. The VR Contractor shall use an electric Vibrator capable of providing at least 80 HP of rated energy and a centrifugal force of 15 tons. An appropriate metering device should be provided at such a location that inspection of amperage increase may be verified during the operation of the equipment. The metering device may be an ammeter directly indicating the performance of the Vibrator. The vibrator shall be a minimum of 16 inches in diameter. Complete equipment specifications should be submitted to the Engineer prior to commencement of the fieldwork.

2.2 BACKFILL MATERIAL

- A. Unless otherwise stated, stone shall be used for Vibro Replacement. The backfill stone should consist of relatively hard, angular to subangular durable rock fragments, with the size of particles in the range of $\frac{1}{8}$ inch to 1- $\frac{1}{2}$ inches. The material to be used should be approved by the Engineer. A gradation meeting the No. 57 (ASTM C33) criteria is acceptable. The VR Contractor shall produce evidence that the material to be used meets or exceeds the design requirements.

PART 3 - EXECUTION

3.1 SITE INSPECTION and LAYOUT OF WORK

- A. If an adjacent building is within 15 ft of the VR work area, a relevant building examination shall be performed prior to initiating work. The building must also be monitored during any work within 15 ft of the structure.
- B. After the stripping, utility relocation and initial rough grading of the treatment area, the General Contractor shall accurately lay out center of foundations for the VR Contractor to locate vibro points, as shown on the shop drawing furnished by the VR contractor and provide and maintain access.

3.2 VIBRO REPLACEMENT STONE COLUMN INSTALLATION

- A. If the Wet, Top Feed method of construction is to be used:
 - 1. Vibrator: The first 12-inch lift of stone is placed. The Vibrator will then be lowered to the design depth and stone will be added as necessary.
 - 2. The Vibrator will be repeatedly raised and lowered such that on each repenetration, the tip of the Vibrator advances to within 2 feet of the previous penetration depth, or refusal (whichever comes first). The Vibrator will not be raised more than 4 feet at any time unless the stone stops flowing to the bottom of the vibrator.
- B. If the Dry, Bottom Feed method of construction is used
 - 1. Vibrator: The Vibrator will then be lowered to the design depth and stone delivered through the tremie system as necessary.
 - 2. The Vibrator will be repeatedly raised and lowered such that on each repenetration, the tip advances to within 2 feet of the previous penetration depth, or refusal (whichever comes first). The Vibrator will not be raised more than 4 feet at any time unless the stone stops flowing to the bottom of the vibrator.
- C. If the Dry, Top Feed method of construction is used, preaugering will be performed with an auger diameter equal to 75-100% of the finished column diameter:
 - 1. Vibrator: The Vibrator will then be lowered to the design depth. The stone may be added to the hole either before or after insertion of the vibrator as long as the vibrator is able to penetrate to within 1 foot on the designed bottom of the VR.
 - 2. The Vibrator will be repeatedly raised and lowered such that on each repenetration, the tip advances to within 2 feet of the previous penetration depth, or refusal (whichever comes first). The Vibrator will not be raised more than 4 feet at any time unless the stone stops flowing to the bottom of the vibrator.

3.3 FIELD QUALITY CONTROL

- A. Inspections: Engage a FQCR to perform the following inspections.
 - 1. All VR operations shall be performed under the inspection of the FQCR.

2. Monitoring and logging of VR operations shall be done by the FQCR.
3. The FQCR will provide site inspection to ensure performance of the VR work. This inspection may include the following: observance of the VR Contractor's procedures, recording of backfill quantities, and recording of compaction time.
4. A gradation test report of the backfill material should be submitted to the Engineer to establish the suitability.
5. The FQCR shall ensure that the contractor subsequently excavating the foundation locations thoroughly compacts the footing base prior to the construction of the footing.
6. The FQCR will perform elevation monitoring of existing structures or utilities during performance of any VR within 15 feet of such structure or utility. If any settlement is observed, the contractor will be directed to discontinue work within 15 feet of the affected structure/utility until the engineer determines an alternate procedure to avoid additional settlement.

B. Special Inspections: Owner will engage a qualified special inspector to perform the following special inspections and review/oversight:

1. The Special Inspector shall periodically observe the installation and testing of the VR to verify compliance with the approved VR design and shop drawings.
2. The Special Inspector shall report any discrepancies to the Installer and General Contractor immediately.
3. The Special Inspector shall receive all installation and monitoring logs from the FQCR, gradation test reports of backfill material, and compaction test reports to verify compliance with the approved VR design and shop drawings.
4. Prepare and submit inspection reports.

3.4 TESTING

A. Penetrometer Testing, SPT or CPT (if appropriate for soil conditions and specified)

All testing to determine specification compliance will be provided by the VR engineer and VR Contractor, paid by the VR Contractor, and will consist of Penetration Testing and on-site observation during the Vibro Replacement.

1. SPT/CPT testing shall be performed at locations and points which are equidistant and farthest from two, three, or four probes, whichever is applicable, with a multiple probe pattern under a column or wall footing.
2. The work should consider an averaging of SPT/CPT values for the test hole, and also the location of the test hole within the treated area. The required criteria for the production of this work should relate to parameters used in the stone column design (e.g. to limit settlement to 1-inch and to provide a bearing capacity of 4000 psf, etc.) as determined by the SPT/CPT work.

3. The VR Engineer will provide site inspection to ensure proper performance of the Vibro Replacement work. This inspection may include the following: observance of the VR Contractor's procedures, recording of backfill quantities, and recording of ammeter information.

3.5 RESTRICTIONS

- A. VR construction is typically performed under the site permit. The General Contractor shall be responsible for obtaining any state and local permits (if required) and conforming to all state and local regulations.
- B. The Owner will be responsible for the precise delineation of all above and below ground utilities and obstructions.
- C. The VR Contractor, General Contractor, VR Engineer, Owner, and Architect/Engineer shall discuss and coordinate the following prior to design and installation when applicable:
 1. Environmental restrictions.
 2. Work boundaries.
 3. Hours for construction.

3.6 FOOTING SUBGRADE PREPARATION (by others)

- A. The footing base shall be free of all water and compacted prior to placement of any reinforcement. Compaction can be by any heavy tamping type compaction equipment designed for compaction in small spaces. Reinforcement and concrete placement shall be placed in a timely manner so that no degradation of the bearing surface occurs.

PART 4 - PAYMENT

4.1 METHOD OF PAYMENT

- A. Mobilization and demobilization shall be separate lump sum items.
- B. Design and construction of the VRs shall be a separate lump sum item.
- C. Testing: Testing shall be priced as a lump sum or unit price based on the methods specified.
- D. Inspections: Inspections shall be priced as a lump sum or unit price based on the inspections specified.

END OF SECTION 316342

**Subsurface Exploration and
Geotechnical Engineering Evaluation
for Marianna MERE Gym,
3625 Caverns Road,
Marianna, Florida**



Ardaman & Associates, Inc.

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Ardaman & Associates, Inc.

Geotechnical, Environmental and
Materials Consultants

May 29, 2025

Ardaman File No. 113-25-40-1145

David Melvin Engineers
2451 Barrington Circle, Suite 101
Tallahassee, Florida 32308
Email: kimholloway@melgineng.com

Attention: Ms. Kimberly M. Holloway, P.E.

Subject: Subsurface Exploration and Geotechnical Engineering Evaluation for Marianna
MERE Gym, 3625 Caverns Road, Marianna, Florida

Reference: Report of " Subsurface Exploration and Preliminary Geotechnical Engineering
Evaluation for Marianna MERE Gym, 3625 Caverns Road, Marianna, Florida",
Ardaman's File No. 113-25-40-1145, dated May 21, 2025

Dear Ms. Holloway:

As requested and authorized, we have completed a subsurface exploration and geotechnical engineering evaluation for the subject project. The purposes of performing this exploration were to evaluate the general subsurface conditions within the building area and to provide recommendations for site preparation and foundation support. This report documents our findings and presents our engineering recommendations.

SITE LOCATION AND SITE DESCRIPTION

The site for the proposed gymnasium is located near 3625 Caverns Road, Marianna, Florida (Section 24, Township 05 North, Range 10 West). The site is located near the Florida Caverns State Park. The site location is shown on Figure 1. The site is currently undeveloped and gently slopes towards the north, from around elevation +118 feet on the south side of the site to about +115 feet on the north side.

PROPOSED CONSTRUCTION AND GRADING

It is our understanding that the proposed development includes dual court recreation facility that consists of a 27,000 square foot gymnasium, which will be a PEMB with 12-inch CMU walls with two lower structures located north and south of the gymnasium, which will be constructed with 8-inch CMU load bearing walls and bar joists and metal roof deck. The gymnasium will also be used as a hurricane shelter.

3175 West Tharpe Street, Tallahassee, Florida 32303 Phone: (850) 576-6131

Florida: Bartow, Cocoa, Fort Myers, Miami, Orlando, Port St. Lucie, Sarasota, Tallahassee, Tampa, West Palm Beach

Louisiana: Baton Rouge, New Orleans, Shreveport

Texas: Houston

Based on your email, we understand that preliminary column loads at the gymnasium is estimated at 96 kips and the continuous wall loads are preliminarily estimated at 8 kips per linear foot. Floor loads are assumed to be less than 100 pounds per square foot.

Grading plans are not complete at this time. Therefore, we have assumed that approximately 1 to 2 feet of cut/fill will be required to raise the building area to the final elevation(s). If actual building loads or fill height exceed our assumptions, then the recommendations in this report may not be valid.

REVIEW OF SOIL SURVEY MAPS

Based on information obtained online from the Web Soil Survey as operated by the U.S. Department of Agriculture Natural Resources Conservation Services, the site is located in an area mapped as the "Orangeburg loamy sand, 2 to 5 percent slopes" soil series.

The "Orangeburg loamy sand, 2 to 5 percent slopes" soil series consists of loamy and clayey marine deposits. The internal drainage of the "Orangeburg loamy sand, 2 to 5 percent slopes" is well drained and the soil permeability is moderately high to high. According to the Soil Survey, the seasonal high water table is typically more than 80 inches below the natural ground surface.

FIELD EXPLORATION PROGRAM

SPT Borings

The field exploration program included performing four (4) Standard Penetration Test (SPT) borings advanced to 60 feet below the existing ground surface generally using the methodology outlined in ASTM D-1586. A summary of this field procedure is included in the Appendix A.

The borings were sampled at 18-inch intervals to 10 feet deep and at 5-foot intervals thereafter. Soil samples recovered during performance of the borings were visually classified in the field and representative portions of the samples were transported to our laboratory in sealed sample jars.

The groundwater level at each of the boring locations was measured during drilling. The borings were backfilled with cement grout upon completion.

Test Locations

The approximate locations of the borings are schematically illustrated on a site plan shown on Figure 1. These locations were determined in the field by Global Positioning System (GPS) utilizing hand-held GPS equipment and coordinates obtained from Google Earth Pro. Boring locations should be considered accurate only to the degree implied by the method of locating used.

LABORATORY PROGRAM

Representative soil samples obtained during our field sampling operation were packaged and transferred to our laboratory for further visual examination and classification. The soil samples were classified using visual-manual procedures in general accordance with the Unified Soil Classification System (ASTM D-2488). The resulting soil descriptions are shown on the soil boring profiles presented on Figure 2.

In addition, we conducted natural moisture content tests (ASTM D2216), percent fines analyses (ASTM D1140), and Atterberg limits tests (ASTM D4318) on selected soil samples obtained from the borings. The results of these tests are presented adjacent to the sample depth on the boring profiles on Figure 2.

GENERAL SUBSURFACE CONDITIONS

General Soil Profile

The results of the field exploration and laboratory programs are graphically summarized on the soil boring profiles presented on Figure 2. The stratification of the boring profiles represents our interpretation of the field boring logs and the results of laboratory examinations of the recovered samples. The stratification lines represent the approximate boundary between soil types. The actual transitions may be more gradual than implied.

The results of the borings indicate the following general soil profile:

Depth Below Ground Surface (feet)		Description
From	To	
0	8	Slightly clayey, silty medium to fine sand (SM-SC)
8	40	Clayey to very clayey medium to fine sand (SC) to sandy lean clay & slightly sandy fat clay (SC-CL to CH)
40	60	Weathered limestone with layers of limesilt

The above soil profile is outlined in general terms only. Please refer to Figure 2 for soil profile details.

We note that borings B-2 and B-4 encountered very loose/soft subsurface conditions indicated SPT "blow-counts" less than 4. These zones are shaded "red" on the profiles for ease of identification. All borings experienced loss of drill fluid circulation, which is generally an indication of voids or porous limestone. Each of the borings encountered "hard" limestone (i.e. SPT blow-counts greater than 30) prior to termination.

Groundwater Level

The groundwater level was measured in the boreholes during drilling. As shown on Figure 2, groundwater was encountered at about 41 to 42 feet below existing grade on the dates indicated. Fluctuations in groundwater levels should be anticipated throughout the year primarily due to seasonal variations in rainfall and other factors that may vary from the time the borings were conducted.

NORMAL SEASONAL HIGH GROUNDWATER LEVEL

The groundwater level is affected by a number of factors. The amount of rainfall and the drainage characteristics of the soils, the land surface elevation, relief points such as drainage ditches, lakes, rivers, swamp areas, etc., and distance to relief points are some of the more important factors influencing the groundwater level.

The normal seasonal high groundwater level each year is the level in the August-September period at the end of the rainy season during a year of normal (average) rainfall. The water table elevations associated with a higher than normal rainfall and in the extreme case, flood, would be higher to much higher than the normal seasonal high groundwater level, and could occur at times outside of the August-September period. The normal high water levels would more approximate the normal seasonal high groundwater levels.

Based on our interpretation of the site conditions using our boring logs, we estimate the normal seasonal high groundwater level at the boring locations to be approximately 10 feet above the groundwater levels measured at the time of our exploration.

ENGINEERING EVALUATION AND RECOMMENDATIONS

General

Based on the subsurface conditions encountered at the site and the provided structural loads, we provided foundation alternatives to support the proposed gymnasium, either on deep soil improvement, such as stone columns/vibro-replacement, or a deep foundation, such as an auger cast pile, in the referenced preliminary report. Following the transmittal and review of the referenced preliminary report, we understand that the design team has selected deep soil improvement (i.e. "stone columns/vibro-replacement") as the preferred alternative to provide foundation support.

We note that there is risk of sinkhole development on this site considering the karstic nature of the area and the nearby Florida Caverns. This risk of sinkhole development is not necessarily greater for the proposed gymnasium site than in the surrounding sites in this area. Although our borings encountered some very loose/soft zones as well as some drill fluid losses, our borings did not encounter direct evidence of a subsurface void.

We provide the following earthwork recommendations/subgrade preparation for slab-on-grade support. Implementation of these earthwork recommendations may not be required beneath the column and wall footings that will be supported by stone columns/vibro-replacement, depending on the specialty designers specifications.

These earthwork recommendations are made as a guide for the design engineer and/or architect, parts of which should be incorporated into the project's specifications.

Stripping and Grubbing/Root-Raking

The "footprints" of the proposed buildings and other hardscape areas, plus a minimum margin of five feet, should be stripped of all surface vegetation, stumps, debris, organic topsoil or other deleterious materials, as encountered. Buried utilities and other underground structures should be removed or plugged to eliminate conduits into which surrounding soils could erode.

After stripping, the site should be grubbed/root-raked such that roots with a diameter greater than ½ inch, stumps, or small roots in a dense state, are completely removed. The actual depth(s) of stripping and grubbing/root-raking must be determined by visual observation and judgment during the earthwork operation. Grubbing/root-raking should continue until determined to be adequate by Ardaman's representative who is monitoring the root-raking.

All existing foundations, slabs, asphalt, and any other underground structures should be removed from the proposed construction area. If pipes or any collapsible or leak prone utilities are not removed or completely filled (with grout or concrete), they might serve as conduits for subsurface erosion resulting in excessive settlements. Over-excavated areas resulting from the removal of underground structures and unsuitable materials should be backfilled in accordance with the fill soils section of this report.

Proof-rolling

We recommend proof-rolling the cleared surface to locate any unforeseen soft areas or unsuitable surface or near-surface soils, to increase the density of the upper soils, and to prepare the existing surface for the addition of the fill soils (as required). Proof-rolling of the building areas should consist of multiple passes of a compactor capable of achieving the density requirements described in the next paragraph. Each pass should overlap the preceding pass by 30 percent to achieve complete coverage. If deemed necessary, in areas that continue to "yield", remove all deleterious material and replace with clean, compacted sand backfill. The proof-rolling should occur after cutting and before filling. Proof-rolling should be monitored in the field by an Ardaman representative.

A density equivalent to or greater than 95 percent of the modified Proctor (ASTM D-1557) maximum dry density value for a depth of 2 feet in the building areas must be achieved beneath

the stripped and grubbed ground surface. Additional passes and/or over-excavation and re-compaction may be required if these minimum density requirements are not achieved. The soil moisture should be adjusted as necessary during compaction.

We also recommend medium to heavy vibratory compaction in the proposed building footprint. This recommendation is provided as a measure to improve the very loose to loose sands generally encountered within the top 10 feet below existing grade, and therefore equipment used should be appropriately sized to affect improvement at this depth. However, we caution that the effects of vibrations on facilities, both on and off-site, may induce settlement. Therefore, the contractor should take appropriate measures to protect existing facilities. We recommend vibration monitoring near existing facilities during vibratory compaction to document the intensity of vibrations.

Care should be exercised to avoid damaging any neighboring structures or other facilities while the compaction operation is underway. Compaction should cease if deemed detrimental to adjacent structures or utilities, and Ardaman & Associates should be notified immediately. Heavy vibratory compaction should not be used where it could affect existing structures.

Suitable Fill Material and Compaction of Fill Soils

All fill materials should be free of organic materials, such as roots and vegetation. We recommend using fill with less than 12 percent by dry weight of material passing the U.S. Standard No. 200 sieve size. Soils with more than 12 percent passing the No. 200 sieve can be used in some applications, but will be more difficult to compact due to their inherent nature to retain soil moisture. We do not recommend using fill soils with percent passing the No. 200 sieve in excess of 35 percent, or with a liquid limit in excess of 40 and plastic index in excess of 10. Portions of Stratum 1 soils may meet criteria for use of recommended fill and generally appears suitable for re-use on-site with the caveat that most of Stratum 1 soils are likely to retain excess moisture and have longer "dry-out" times.

All structural fill should be placed in level lifts not to exceed 12 inches in uncompacted thickness. Each lift should be compacted to at least 95 percent of the modified Proctor (ASTM D-1557) maximum dry density value. The filling and compaction operations should continue in lifts until the desired elevation(s) is achieved. If hand-held compaction equipment is used, the lift thickness should be reduced to no more than 6 inches.

Floor Slab Moisture Reducer and Slab Compaction Requirements

Prior to concrete placement, soil compaction beneath floor slabs should be verified for a depth of 2 feet and meet the 95 percent criteria (modified Proctor, ASTM D-1557). The slab subbase material should be soils in accordance with our "Suitable Fill Material and Compaction of Fill Soils" Section of this report. Based on the existing soil conditions, and assuming the above outlined

proof-rolling and compaction criteria are implemented an allowable subgrade modulus of 125 pci may be used in the slab design.

Precautions should be taken during the slab construction to reduce moisture entry from the underlying subgrade soils. Moisture entry can be reduced by installing a membrane between the subgrade soils and floor slab. Care should be exercised when placing the reinforcing steel (or mesh) and slab concrete such that the membrane is not punctured. We note that the membrane alone does not prevent moisture from occurring beneath or on top of the slab.

If interior columns are isolated from the floor slab, an expansion joint should be provided around the columns and sealed with a water-proof sealant. We note that differential settlement should be anticipated between a slab on grade and foundation supported on either deep soil improvement or deep foundation.

Soil Improvement for Foundation Support

Stone column/vibro-replacement are a form of soil improvement. The stone columns are typically constructed by densely compacting successive lifts of aggregate into a pre-augered hole to reinforce the soils. The vertical impact energy increases the lateral stress between the aggregate and surrounding soils, which results in increased allowable bearing pressures, often in the range of 4 to 8 ksf. Stone column/aggregate piers are provided as an alternative to deep foundation support. The use of stone column/aggregate piers would increase the soil modulus (i.e. stiffness) of the fill and native soils, which would result in a relatively uniform settlement across the structure.

Since stone columns/vibro-replacement are design/build and proprietary, additional evaluations and recommendations for bearing capacities must be provided to you by the selected contractor, signed and sealed by a Florida Licensed Professional Engineer. Based on email correspondence, we understand that an allowable bearing capacity of 4 ksf is appropriate for foundations supported on stone columns/vibro-replacement improved soil conditions to about 16 feet depth. We note that the allowable bearing capacity is ultimately determined by the provided by the specialty contractor and is dependent on the designed depth of improvement.

Vibration is a disadvantage of stone column/vibro-replacement. Not only do vibrations increase the risk of sinkhole development but sufficient spatial separation from existing structures should be maintained to avoid potential damage. The selected specialty contractor will be able to provide additional information on the distance from existing structures required.

QUALITY ASSURANCE

We recommend establishing a comprehensive quality assurance program to verify that all site preparation and foundation construction is conducted in accordance with the appropriate plans and specifications. Materials testing and inspection services should be provided by Ardaman & Associates.

As a minimum, an on-site engineering technician should monitor all stripping and grubbing to verify that deleterious materials have been removed and should observe the proof-rolling operation to verify that the appropriate number of passes are applied to the subgrade. In-situ density tests should be conducted during earthwork activities and below all structural areas including footings and floor slabs to verify that the required densities have been achieved. In-situ density values should be compared to laboratory Proctor moisture-density results for each of the different natural and fill soils encountered.

Finally, we recommend inspecting and testing the construction materials for the foundations and other structural components.

IN-PLACE DENSITY TESTING FREQUENCY

Earthwork testing is typically performed on an on-call basis when the contractor has completed a portion of the work. The test result from a specific location is only representative of a larger area if the contractor has used consistent means and methods and the soils are practically uniform throughout. The frequency of testing can be increased and full-time construction inspection can be provided to account for variations. We recommend that the following minimum testing frequencies be utilized.

In proposed building areas, a minimum frequency of one in-place density test for each 2,500 square feet of area should be used. In-place density testing should be performed at this minimum frequency for a depth of 2 feet below natural ground and for every 1-foot lift of fill placed in the structural area.

Representative samples of the various natural ground and fill soils should be obtained and transported to our laboratory for Proctor compaction tests. These tests will determine the maximum dry density and optimum moisture content for the materials tested and will be used in conjunction with the results of the in-place density tests to determine the degree of compaction achieved.

CLOSURE

The analyses and recommendations submitted herein are based on the data obtained from the soil borings presented on Figure 2 and the assumed loading conditions. This report does not reflect any variations which may occur adjacent to or between the borings. The nature and extent of the variations between the borings may not become evident until during construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations presented in this report after performing on-site observations during the construction period and noting the characteristics of the variations.

In the event any changes occur in the design, nature, or location of the proposed facility, we should review the applicability of conclusions and recommendations in this report.

Because of Ardaman & Associates' familiarity with this site and the proposed development gained through performing the subsurface soil exploration and geotechnical engineering evaluation as presented in this report, Ardaman & Associates is best suited to provide monitoring and testing services during earthwork, and to provide continued evaluation and guidance during construction should variations in the soil conditions be encountered.

This study is based on a relatively shallow exploration and is not intended to be an evaluation for sinkhole potential. This study does not include an evaluation of the environmental (ecological or hazardous/toxic material related) condition of the site and subsurface.

This report has been prepared for the exclusive use of David H. Melvin in accordance with generally accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

We are pleased to be of assistance to you on this phase of the project. When we may be of further service to you or should you have any questions, please contact us.

Very truly yours,
ARDAMAN & ASSOCIATES, INC.
Florida Registry 5950

Jeremy
M Clark

Digitally signed
by Jeremy M
Clark
Date: 2025.05.29
11:58:00 -04'00'

Aayush R. Tiwary, P.E.
Project Engineer
Florida License 101118

Jeremy M. Clark, P.E.
Senior Engineer
Florida License 77660

ART/JMC

This item has been digitally signed and sealed by Jeremy M. Clark, P.E. on the date adjacent to the seal.

Printed copies of this document are not considered signed and sealed and the signature must be verified on any electronic copies.

APPENDIX A

Standard Penetration Test Procedures

STANDARD PENETRATION TEST

The standard penetration test is a widely accepted test method of *in situ* testing of soils (ASTM D 1586), and Ardaman & Associates generally follows this test method. A 2-foot long, 2-inch O.D. split-barrel sampler attached to the end of a string of drilling rods is driven 18 or 24 inches into the ground by successive blows of a 140-pound hammer freely dropping 30 inches. The number of blows needed for each 6 inches of penetration is recorded. The sum of the blows required for penetration of the second and third 6-inch increments of penetration constitutes the test result or N-value. After the test, the sampler is extracted from the ground and opened to allow visual examination and classification of the retained soil sample. The N-value has been empirically correlated with various soil properties.

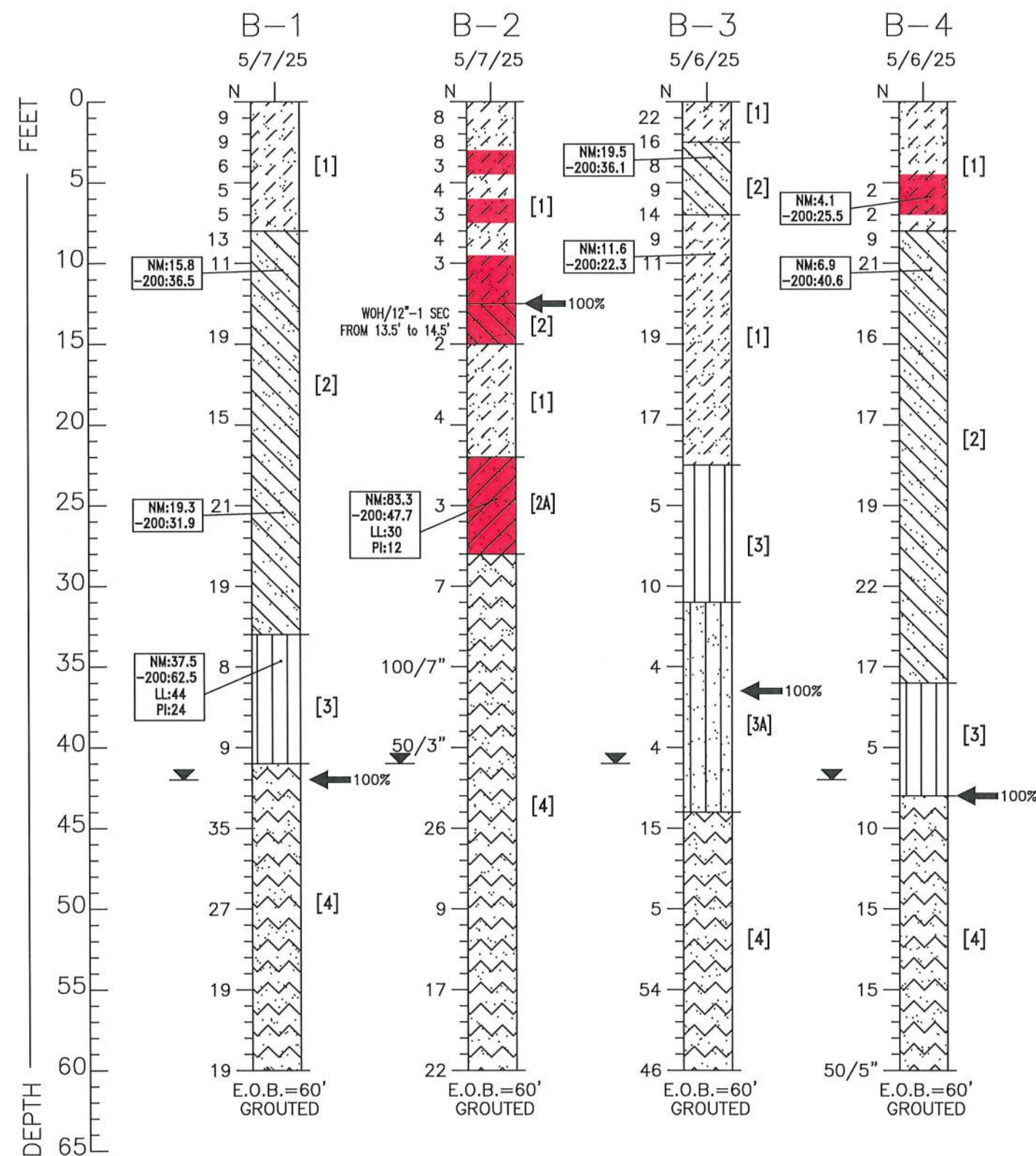
The tests are usually performed at 5-foot intervals. The test holes are advanced to the test elevations by rotary drilling with a cutting bit, using circulating fluid to remove the cuttings and hold the fine grains in suspension. The circulating fluid, which is a bentonitic drilling mud, is also used to keep the hole open below the water table by maintaining an excess hydrostatic pressure inside the hole. In some soil deposits, particularly highly pervious ones, flush-coupled casing must be driven to just above the testing depth to keep the hole open and/or prevent the loss of circulating fluid.

Representative split-spoon samples from the soils are brought to our laboratory in air-tight jars for further evaluation and testing, if necessary.

TEST BORING LOCATION PLANS (Image Source: Google Earth Pro)



SOIL BORING PROFILES



SOIL LEGEND

- [1] BROWN TO ORANGISH BROWN SLIGHTLY CLAYEY, SILTY MEDIUM TO FINE SAND (SM-SC; A-2-4)
- [2] BROWN TO ORANGISH BROWN CLAYEY TO VERY CLAYEY MEDIUM TO FINE SAND (SC; A-2-6 TO A-6)
- [2A] ORANGISH BROWN VERY CLAYEY FINE SAND TO SANDY LEAN CLAY (SC-CL; A-6)
- [3] BROWN, TAN & GRAY MOTTLED WITH BLACK SLIGHTLY SANDY LEAN TO FAT CLAY (CL TO CH; A-7)
- [3A] BROWN, TAN & GRAY SLIGHTLY SANDY LEAN TO FAT CLAY WITH LAYER OF TAN LIMESILT & WEATHERED LIMESTONE (CL TO CH; A-7)
- [4] TAN WEATHERED LIMESTONE WITH LAYERS OF LIMESILT

LEGEND

- B STANDARD PENETRATION TEST (SPT) BORING LOCATION
- EOB END OF BORING
- VERY LOOSE TO VERY SOFT ZONES (N<4)
- N STANDARD PENETRATION RESISTANCE IN BLOWS PER FOOT (ASTM D-1586)
- GROUNDWATER DEPTH ESTIMATED ON DATE DRILLED
- 50/3" 50 BLOWS FOR 3 INCHES PENETRATION INTO SOIL
- WOH SAMPLER ADVANCED BY WEIGHT OF HAMMER AND RODS ONLY
- COMPLETE LOSS OF DRILLING FLUID CIRCULATION
- NM NATURAL MOISTURE CONTENT IN PERCENT (ASTM D-2216)
- 200 PERCENT PASSING NO. 200 SIEVE SIZE (PERCENT FINES)(ASTM D-1140)
- LL LIQUID LIMIT (ASTM D-4318)
- PI PLASTICITY INDEX (ASTM D-4318)
- SP-SM,SM,SC UNIFIED SOIL CLASSIFICATION SYSTEM
- A-3,A-2-4 AASHTO SOIL CLASSIFICATION SYSTEM
- DRILLERS: SMH, DK
- DRILL RIG: CME 55; AUTO-HAMMER

WHILE THE BORINGS ARE REPRESENTATIVE OF SUBSURFACE CONDITIONS AT THEIR RESPECTIVE LOCATIONS AND FOR THEIR RESPECTIVE VERTICAL REACHES, LOCAL VARIATIONS CHARACTERISTIC OF THE SUBSURFACE MATERIALS OF THE REGION ARE ANTICIPATED AND MAY BE ENCOUNTERED. THE BORING LOGS AND RELATED INFORMATION ARE BASED ON THE DRILLER'S LOGS AND VISUAL EXAMINATION OF SELECTED SAMPLES IN THE LABORATORY. THE DELINEATION BETWEEN SOIL TYPES SHOWN ON THE LOGS IS APPROXIMATE AND THE DESCRIPTION REPRESENTS OUR INTERPRETATION OF SUBSURFACE CONDITIONS AT THE DESIGNATED BORING LOCATIONS ON THE PARTICULAR DATE DRILLED.

GROUNDWATER ELEVATIONS SHOWN ON THE BORING LOGS REPRESENT GROUNDWATER SURFACES ENCOUNTERED ON THE DATES SHOWN. FLUCTUATIONS IN WATER TABLE LEVELS SHOULD BE ANTICIPATED THROUGHOUT THE YEAR. ABSENCE OF WATER SURFACE DATA ON CERTAIN BORINGS IMPLIES THAT NO GROUNDWATER DATA IS AVAILABLE, BUT DOES NOT NECESSARILY MEAN THAT GROUNDWATER WILL NOT BE ENCOUNTERED AT THESE LOCATIONS OR WITHIN THE VERTICAL REACHES OF THESE BORINGS IN THE FUTURE.

ENGINEERING CLASSIFICATION

I COHESIONLESS SOILS		
DESCRIPTION	BLOW COUNT "N"	
VERY LOOSE	0 TO 4	
LOOSE	4 TO 10	
MEDIUM DENSE	10 TO 30	
DENSE	30 TO 50	
VERY DENSE	>50	

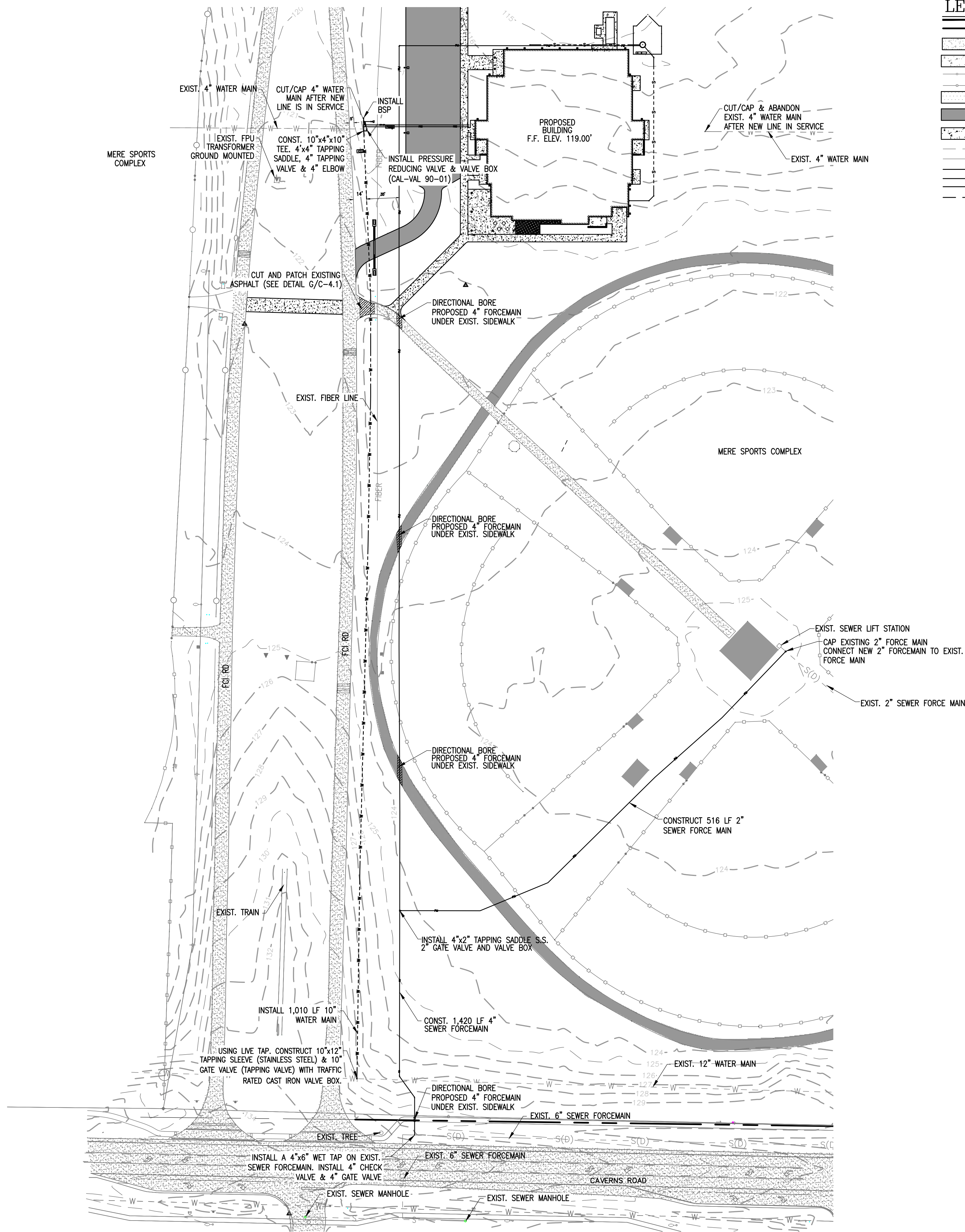
II COHESIVE SOILS		
DESCRIPTION	UNCONFINED COMPRESSIVE STRENGTH, QU, TSF	BLOW COUNT "N"
VERY SOFT	<1/4	0 TO 2
SOFT	1/4 TO 1/2	2 TO 4
MEDIUM STIFF	1/2 TO 1	4 TO 8
STIFF	1 TO 2	8 TO 15
VERY STIFF	2 TO 4	15 TO 30
HARD	>4	>30



Ardaman & Associates, Inc.
3175 W. Thorpe Street
Tallahassee, Florida 32303
(850) 576-6131

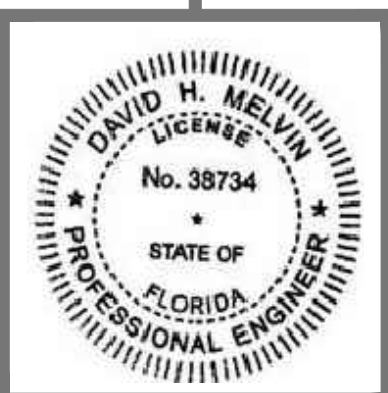
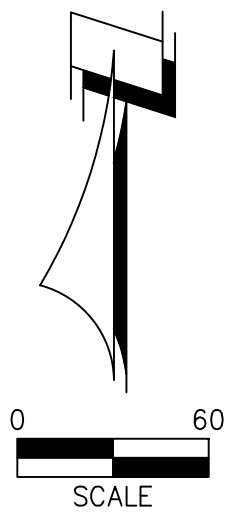
SHEET TITLE:
SUBSURFACE SOIL EXPLORATION
MARIANNA MERE GYM,
MARIANNA, JACKSON COUNTY, FLORIDA

DRAWN BY: ART	CHECKED BY: JMC	DATE: 5/16/25
FILE NO: 113-25-40-1145	APPROVED BY: J.M.CLARK, P.E.	FIGURE 2



LEGEND

	BOUNDARY
	EXISTING ASPHALT PAVEMENT
	EXISTING CONCRETE
	EXISTING CHAINLINK FENCE
	EXISTING FIELD FENCE
	EXISTING ASPHALT MILLINGS
	PROPOSED ASPHALT PAVEMENT
	PROPOSED CONCRETE
	EXISTING CONTOURS
	EXISTING WATER MAIN
	PROPOSED WATER SERVICE
	PROPOSED SEWER FORCE MAIN
	PROPOSED FIRE LINE
	PROPOSED GRAVITY SEWER SERVICE



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OVERALL UTILITY PLAN

SHEET TITLE:

CITY OF MARIANNA EMERGENCY SHELTER & MULTI-PURPOSE FACILITY
FOR
THE CITY OF MARIANNA
AT
MARIANNA EDUCATION REC. EXPO. (M.E.R.E.)
MARIANNA, FLORIDA

JOB NUMBER: M-2024-18
DATE: SEPT. 4, 2025
DRAWN BY: M.M.F.
CHECKED BY: B.H.M.

SHEET No.

C-4

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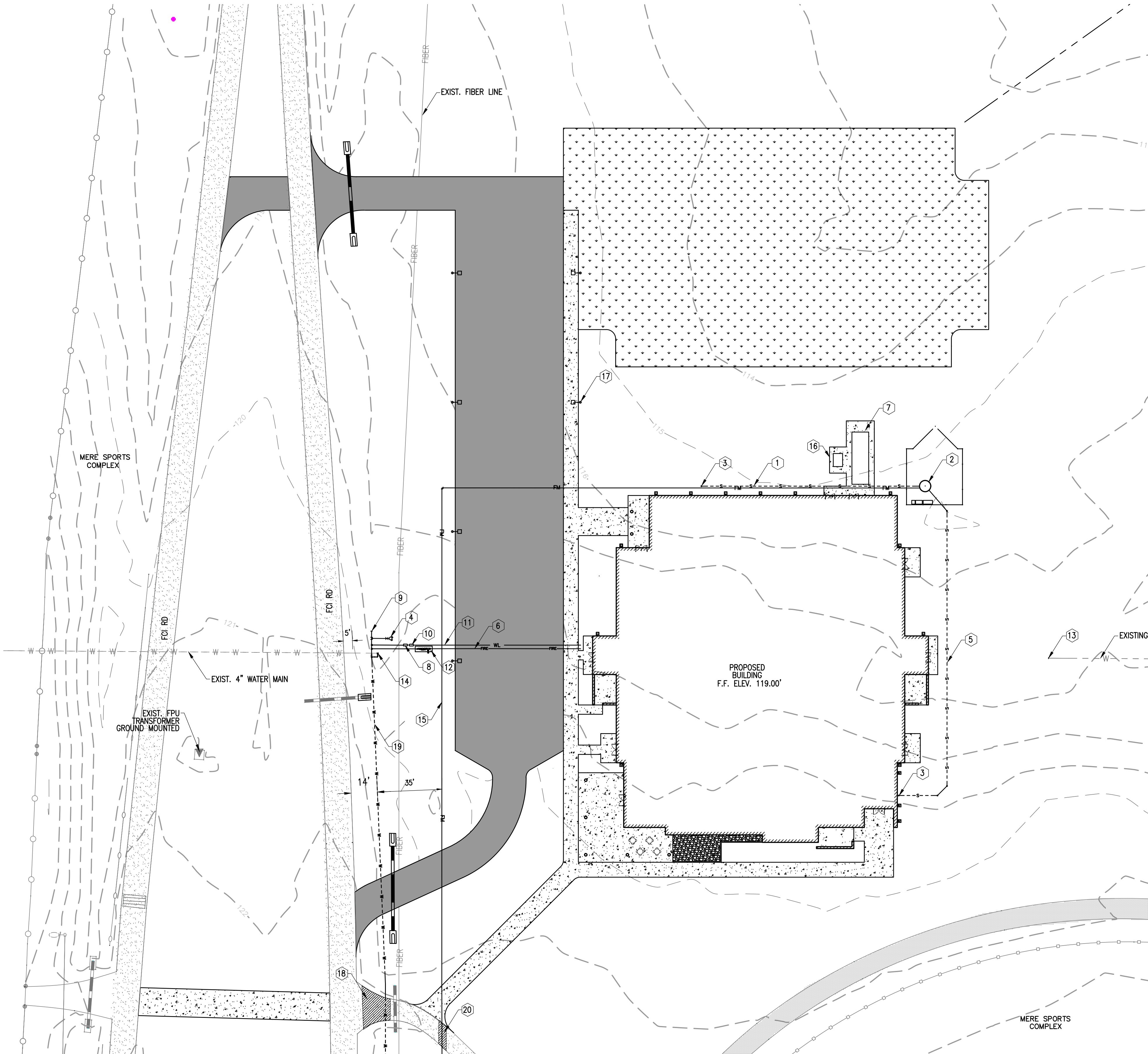


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ADDENDUM #1

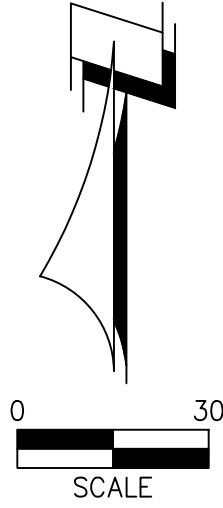
OVERALL UTILITY PLAN

1" = 60'



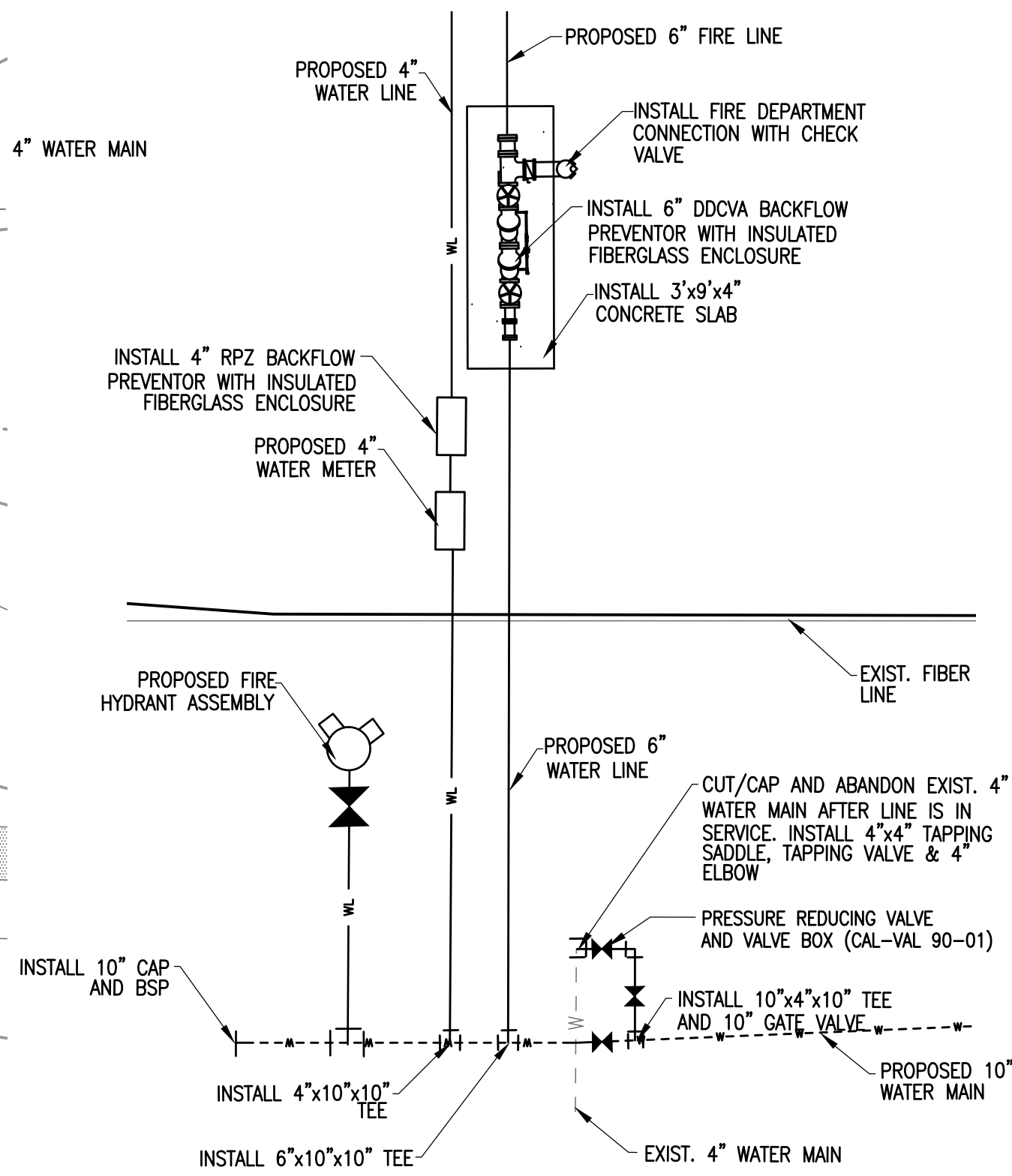
LEGEND

	BOUNDARY
	EXISTING ASPHALT PAVEMENT
	EXISTING CONCRETE
	EXISTING CHAINLINK FENCE
	EXISTING FIELD FENCE
	EXISTING ASPHALT MILLINGS
	PROPOSED ASPHALT PAVEMENT
	PROPOSED CONCRETE
	EXISTING CONTOURS
	EXISTING WATER MAIN
	PROPOSED WATER SERVICE
	PROPOSED SEWER FORCE MAIN
	PROPOSED FIRE LINE
	PROPOSED GRAVITY SEWER SERVICE



UTILITY NOTES

1. INSTALL 116 LF 6" SEWER LATERAL @ 5.17% SLOPE (1% MIN. SLOPE)
2. CONSTRUCT 6" DUPLEX SEWER LIFTSTATION W/(2) 10 HP PUMPS (CONNECTED TO GENERATOR)
TOP EL. 119.00'
INV. EL. (6" SEWER PIPE) 109.00'
BOT. EL. 103.00'
3. INSTALL 4" SEWER CLEAN-OUT (SEE DETAIL F/C-4.1)
INV. ELEV. 115.00'
4. CONSTRUCT FIRE HYDRANT ASSEMBLY
5. INSTALL 190 LF 6" SEWER LATERAL @ 3.15% SLOPE (1% MIN. SLOPE)
6. INSTALL 6" FIRE LINE (SEE PLUMBING PLAN FOR DETAILS)
7. PROPOSED NATURAL GAS GENERATOR (SEE ELECTRICAL PLAN FOR DETAILS)
8. INSTALL 4" WATER METER
9. INSTALL 10" WATER MAIN AND TERMINATE 10" WATER LINE WITH CAP & INSTALL BSP
10. INSTALL 4" RPZ BACKFLOW PREVENTOR WITH INSULATED FIBERGLASS ENCLOSURE
11. INSTALL 4" POTABLE WATER SERVICE
12. INSTALL 6" DDCA BACKFLOW PREVENTOR ON A 3'x9'x4" THICK CONCRETE SLAB WITH INSULATED FIBERGLASS ENCLOSURE.
13. CUT, CAP AND ABANDON EXISTING 4" WATER MAIN
14. CUT/CAP AND ABANDON EXISTING 4" WATER MAIN WHEN NEW LINE IS PLACED INTO SERVICE
INSTALL 10"x4"x10" TEE, 4"x4" TAPPING SADDLE, 4" TAPPING VALVE, 4" ELBOW AND PRESSURE REDUCING VALVE AND VALVE BOX (CAL-VAL 90-01)
CONST. 1,420 LF 4" SEWER FORCEMAIN
15. PROPOSED TRANSFORMER (SEE ELECTRICAL FOR DETAILS)
16. PROPOSED SITE LIGHTING (SEE DETAIL E/C-6)
17. PROPOSED 4" WATER LINE
18. CUT AND PATCH EXISTING ASPHALT (SEE DETAIL G/C-4.1)
19. CONST. 1,010 LF 10" WATER MAIN (DR 18 C900)
20. DIRECTIONAL DRILL 4" SEWER FORCE MAIN UNDERNEATH EXIST. ASPHALT ROAD



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UTILITY PLAN

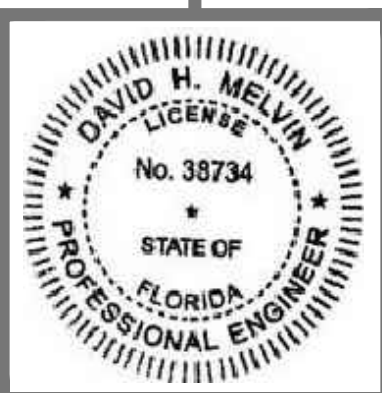
1" = 30'

METER/BACKFLOW DETAIL

A
C4.1

1" = 5'-0"

ADDENDUM #1



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