IFBC NO. 20-TA003346AJ
NORTH REGIONAL WATER RECLAMATION FACILITY MASTER REUSE WET WEATHER MANAGEMENT SYSTEM
PROJECT NO. 6079480
NIGP 913-60
APRIL 29, 2020

Manatee County BCC
Procurement Division
1112 Manatee Avenue West Ste 803
Bradenton, FL 34205
purchasing@mymanatee.org

Manatee County
FLORIDA

ADVERTISEMENT

INVITATION FOR BID CONSTRUCTION, NO. 20-TA003346AJ

NORTH REGIONAL WATER RECLAMATION FACILTIY MASTER REUSE WET WEATHER MANAGEMENT SYSTEM

Manatee County, a political subdivision of the State of Florida (hereinafter referred to as County), will receive sealed bids from individuals, corporations, partnerships, and other legal entities authorized to do business in the State of Florida, to provide North Regional Water Reclamation Facility (NRWRF) Master Reuse Wet Weather Management Well System, as specified in this Invitation for Bid Construction to include electrical, and mechanical, underground and above ground piping and other peripherals for the installation of the Wet Weather Management Well System infrastructure.

DATE, TIME AND PLACE DUE:
The Due Date and Time for submission of Bids in response to this IFBC **is June 5, 2020, at 3:00 P.M. ET.** Bids must be delivered to the following location: Manatee County Administration Building, 1112 Manatee Ave. W., Suite 803, Bradenton, FL 34205 prior to the Due Date and Time.

SOLICITATION INFORMATION CONFERENCE:
No Solicitation Information Conference will be conducted for this solicitation.

DEADLINE FOR QUESTIONS AND CLARIFICATION REQUESTS:
The deadline to submit all questions, inquiries, or requests concerning interpretation, clarification or additional information pertaining to this Invitation for Bid Construction to the Manatee County Procurement Division is May 21, 2020. Questions and inquiries should be submitted via email to the Designated Procurement Contact shown below.

Important: A prohibition of lobbying is in place. Review Section A.13 carefully to avoid violation and possible sanctions.

DESIGNATED PROCUREMENT CONTACT: Abigail Jenkins, Senior Procurment Agent
(941) 749-3062, Fax (941) 749-3034
Email: abigail.jenkins@mymanatee.org
Manatee County Financial Management Department
Procurement Division

AUTHORIZED FOR RELEASE: Jacob Erickson

Digitally signed by Jacob Erickson
DN: cn=Jacob Erickson, o=Manatee County Government, ou=Procurement, email=jacob.erickson@mymanatee.org, c=US
Date: 2020.04.29 15:03:10 -04'00'

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SECTION A, INFORMATION FOR BIDDERS

To receive consideration, entities who submit a response to this Invitation for Bid (Bidders) must meet the minimum qualification requirements and comply with the following instructions. Bid responses (Bids) will be accepted from single business entities, joint ventures, partnerships or corporations.

A.01 BID DUE DATE

The Due Date and Time for submission of Bids in response to this Invitation for Bid (IFBC) **is June 5, 2020, at 3:00 P.M. ET.** Bids must be delivered to the following location: Manatee County Administration Building, 1112 Manatee Ave. W., Suite 803, Bradenton, FL 34205 **and** time stamped by a Procurement representative prior to the Due Date and Time.

Bids received after the Due Date and Time will not be considered. It will be the sole responsibility of the Bidder to deliver its Bid to the Manatee County Procurement Division for receipt on or before the Due Date and Time. If a Bid is sent by U.S. Mail, courier or other delivery services, the Bidder will be responsible for its timely delivery to the Procurement Division. Bids delayed in delivery will not be considered, will not be opened at the public opening, and arrangements will be made for their return at the Bidder's request and expense.

A.02 SOLICITATION INFORMATION CONFERENCE:

No Solicitation Information Conference will be conducted for this solicitation.

Attendance to mandatory information conferences and/or site visits are required to meet the minimum qualification requirements of the IFBC. Attendance to non-mandatory information conferences is not required, but is strongly encouraged.

A.03 PUBLIC OPENING OF BIDS

Bids will be opened immediately following the Due Date and Time at the Manatee County Administration Building, Suite 803 in the presence of County officials. Bidders or their representatives may attend the Bid opening.

Manatee County will make public at the opening the names of the business entities which submitted a Bid and the total bid price submitted. No review or analysis of the Bids will be conducted at the Bid opening.

A.04 SUBMISSION OF BIDS

The contents of the Bid sealed package must include:

- One (1) bound original clearly identifying Bidder and marked “ORIGINAL”.
- Two (2) bound copies clearly identifying Bidder and marked “COPY” with all required information and identical to the original.
- One (1) electronic format copy clearly identifying Bidder.

Electronic format copy should be submitted on a Universal Serial Bus (USB) portable flash memory drive or compact disc (CD) in MicroSoft Office® or Adobe Acrobat® portable document format (PDF) in one continuous file. Do not password protect or otherwise encrypt electronic Bid copies. Electronic copies must be searchable and contain an identical Bid to the original.

Submit the Bid package in a sealed container with the following information clearly marked on the outside of the package: IFBC No. 20-TA003279AJ, NWRF Master Reuse Wet Weather Management System, Bidder's name, and Bidder's address. Bids must be delivered to the Manatee County Procurement Division prior to the Due Date and Time at the following address:

Manatee County Procurement Division
1112 Manatee Ave. West, Ste. 803
Bradenton, FL 34205

A.05 DISTRIBUTION OF SOLICITATION DOCUMENTS

All documents issued pursuant to this IFBC are distributed electronically and available for download at no charge at www.mymanatee.org > *Bids and Proposals.* Documents may be viewed and downloaded for printing using Adobe Reader® software.

At its sole discretion, the County may utilize third-party providers to distribute proposals. Visit the third-party's website for more information regarding this service. Participation in the third-party system is not a requirement for doing business with Manatee County.

Additionally, the IFBC and all related documents are available for public inspection at the Manatee County Procurement Division, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205. Call (941) 749-3014 to schedule an appointment. Documents are available between the hours of 8:00 A.M. and 5:00 P.M., Monday through Friday, with the exception of County holidays.

As a courtesy, Manatee County notifies the Manatee County Chamber of Commerce and the Manatee County Black Chamber of Commerce of all active solicitations, who then distributes the information to its members.

A.06 EXAMINATION OF BID DOCUMENTS AND SITE(S)

It is the responsibility of each bidder before submitting a bid, to (a) examine the IFBC documents thoroughly; (b) visit the Project Site(s) to become familiar with local conditions that may affect cost, progress, performance, or furnishing of the Work; (c) consider federal, state, and local codes, laws, and regulations that may affect costs, progress, performance, or furnishing of the Work; (d) study and carefully correlate bidder's observations with the IFBC documents; and (e) notify County in writing of all conflicts, errors, or discrepancies in the IFBC documents.

Each bidder may, at bidder's own expense, make or obtain any additional examinations, investigations, explorations, tests and studies, and obtain any additional information and data which pertain to the physical conditions at or contiguous to the Project Site(s) or otherwise which may affect cost, progress, performance or furnishing of the Work and which bidder deems necessary to determine his bid for performing and furnishing the Work in accordance with the time, price and other terms and conditions of the IFBC documents. County will provide each bidder access to the site(s) to conduct such explorations and tests.

Bidder shall fill all holes, clean up and restore the Project Site(s) to its former condition upon completion of such explorations. The lands upon which the Work is to be performed, rights-of-way and easements for access thereto, and other lands designated for use by successful bidder in performing the Work are identified in the IFBC documents.

All additional lands and access thereto required for temporary construction facilities or storage of materials and equipment are to be provided by successful bidder. Easements for permanent structures or permanent changes in existing structures are to be obtained and paid for by County unless otherwise provided in the IFBC documents.

Inspection of the Project Site(s) is a requirement to be considered for award of this bid. Prior to submitting a bid, each bidder shall examine the Project Site(s) and all conditions thereon fully familiarizing themselves with the full scope of the Work. Failure to become familiar with Project Site conditions will in no way relieve the successful bidder from the necessity of furnishing any materials or performing any Work that is required to complete the Project in accordance with the Project Plans and Specifications. Bidder shall acknowledge inspection of the Project Site(s) on his/her signed, submitted Bid Form.

A.07 ADDENDA

Any interpretations, corrections or changes to this IFBC will be made by addenda. Addenda will be posted on the Procurement Division's web page of the County website at http://www.mymanatee.org/purchasing > *Bids and Proposals*. For those solicitations that are advertised on a third-party website, addenda will also be posted on the third-party's distribution system on the 'Planholders' link.

All addenda are a part of the IFBC and each Bidder will be bound by such addenda. It is the responsibility of each Bidder to read and comprehend all addenda issued. Failure of any Bidder to acknowledge an issued addendum in its Bid will not relieve the Bidder from any obligation contained therein.

A.08 BID FORMS

Bids must include the forms provided in this IFBC. If needed, additional pages may be attached to a form. Bidders must fully complete and execute all Bid Forms. Bid Forms must be executed by an authorized official of the company who has the legal authority to bind the company.

A.09 BID EXPENSES

All costs incurred by Bidder in responding to this IFBC will be the sole responsibility of the Bidder.

A.10 QUESTION AND CLARIFICATION PERIOD

Each Bidder shall examine all IFBC documents and will judge all matters relating to the adequacy and accuracy of such documents. Any questions or requests concerning interpretation, clarification or additional information pertaining to this IFBC, including the sample Agreement, shall be made in writing via email to the Manatee County Procurement Division to the Designated Procurement Contact or to purchasing@mymanatee.org. All questions received and responses given will be provided to potential bidders via an addendum to this IFBC.

Manatee County will not be responsible for oral interpretations given by other sources including County staff, representative, or others. The issuance of a written addendum by the Procurement Division is the only official method whereby interpretation, clarification or additional information will be given.

A.11 FALSE OR MISLEADING STATEMENTS

Bids which contain false or misleading statements, or which provide references which do not support an attribute or condition claimed by the Bidder, may be rejected. If, in the opinion of the County, such information was intended to mislead the County in its evaluation of the Bid, and the attribute, condition or capability is a requirement of this IFBC. Such Bidder will be disqualified from consideration for this IFBC and may be disqualified from submitting a response on future solicitation opportunities with the County.

A.12 CONFIDENTIALITY OF SECURITY RELATED RECORDS

a. Pursuant to Florida Statutes § 119.071(3), the following records (hereinafter referred to collectively as "the Confidential Security Records") are confidential and exempt from the disclosure requirements of Florida Statutes § 119.07(1):

   i. A Security System Plan or portion thereof for any property owned by or leased to County or any privately owned or leased property held by County.
   ii. Building plans, blueprints, schematic drawings, and diagrams, including draft, preliminary, and final formats, which depict the internal layout and structural elements of a building, arena, stadium, water treatment facility, or other structure owned or operated by County.
   iii. Building plans, blueprints, schematic drawings, and diagrams, including draft, preliminary, and final formats, which depict the internal layout or structural elements of an attractions and recreation facility, entertainment or resort complex, industrial complex, retail and service development, office development, or hotel or motel development in the possession of, submitted to County.

b. Successful Bidder agrees that, as provided by Florida Statute, it shall not, as a result of a public records request, or for other reason disclose the contents of, or release or provide copies of the Confidential Security Records to any other party absent the express written authorization of County's Property Management Director or to comply with a court order requiring such release or disclosure. To the extent successful Bidder receives a request for such records, it shall immediately contact the County's designated Contract administrator who shall coordinate County's response to the request.

A.13 LOBBYING

After the issuance of any IFBC, prospective bidders, bidders, or their agents, representatives or persons acting at the request of such bidder shall not contact, communicate with or discuss any matter relating to the IFBC with any officer, agent or employee of Manatee County other than the Procurement Official or the contact identified in this IFBC, pursuant to the Manatee County Code of Laws. This prohibition includes copying such persons on all written communication, including email correspondence. This requirement begins with the issuance of an IFBC and ends upon execution of the final Agreement or when the IFBC has been cancelled. Violators of this prohibition shall be subject to sanctions as provided in the Manatee County Code of Laws.

A.14 UNBALANCED BIDDING PROHIBITED

County recognizes that large and/or complex projects will often result in a variety of methods, sources, and prices. However, where in the opinion of the County such variation does not appear to be justified given bid requirements and industry and market conditions, the Bid will be presumed to be unbalanced. Examples of unbalanced Bids will include:

a. Bids showing omissions, alterations of form, additions not specified, or required conditional or unauthorized alternate bids.
b. Bids quoting prices that substantially deviate, either higher or lower, from those included in the Bids of competitive Bidders for the same line item unit costs.
c. Bids where the unit costs offered are in excess of, or below reasonable cost analysis values.

In the event County determines that a Bid is presumed unbalanced, it will request the opportunity to and reserves the right to, review all source quotes, bids, price lists, letters of intent, and other supporting documentation which the Bidder obtained and upon which the Bidder relied upon to develop its Bid. County reserves the right to deem any presumptive unbalanced Bid where the Bidder is unable to demonstrate the validity and/or necessity of the unbalanced unit costs as non-responsive.

A.15 FRONT LOADING OF BID PRICING PROHIBITED

Prices offered for performance and/or acquisition activities which occur early in the Project Schedule, such as mobilization; clearing and grubbing; or maintenance of traffic; that are substantially higher than pricing of competitive bidders within the same portion of the Project Schedule, will be presumed to be front loaded. Front loaded bids could reasonably appear to be an attempt to obtain unjustified early payments creating a risk of insufficient incentive for the bidder to complete the Work or otherwise creating an appearance of an undercapitalized bidder.

In the event County determines that a bid is presumed to be front loaded, it will request the opportunity to, and reserves the right to, review all source quotes, bids, price lists, letters of intent, and other documents which the bidder obtained and upon which the bidder relied IFBC

upon to develop the pricing or acquisition timing for these bid items. County reserves the right to reject as nonresponsive any presumptive front-loaded bids where the bidder is unable to demonstrate the validity and/or necessity of the front-loaded costs.

A.16 WITHDRAWAL OR REVISION OF BIDS

Bidders may withdraw Bids under the following circumstances:

a. If Bidder discovers a mistake(s) prior to the Due Date and Time. Bidder may withdraw its Bid by submitting a written notice to the Procurement Division. The notice must be received in the Procurement Division prior to the Due Date and Time for receiving Bids. A copy of the request shall be retained, and the unopened Bid returned to the Bidder; or

b. After the Bids are opened but before a contract is signed, Bidder alleges a material mistake of fact if:

    1. The mistake is clearly evident in the solicitation document; or
    2. Bidder submits evidence which clearly and convincingly demonstrates that a mistake was made in the Bid. Request to withdraw a Bid must be in writing and approved by the Procurement Official.

A.17 IRREVOCABLE OFFER

Any Bid may be withdrawn up until the Due Date and Time. Any Bid not so withdrawn shall, upon opening, constitute an irrevocable offer for a period of ninety (90) days to provide the goods or services set forth in this IFBC or until one or more of the Bids have been duly accepted by County, whichever occurs first.

A.18 RESERVED RIGHTS

County reserves the right to accept or reject any and/or all bids, to waive irregularities and minor technicalities, and to request resubmission. Also, County reserves the right to accept all or any part of the bid and to increase or decrease quantities to meet additional or reduced requirements of County. Any sole response received by the first submission date may or may not be rejected by County depending on available competition and current needs of County. For all items combined, the bid of the lowest, responsive, responsible bidder will be accepted, unless all bids are rejected.

The lowest, responsible bidder shall mean that Bidder who makes the lowest Bid to sell goods and/or services of a quality which meets or exceeds the quality of goods and/or services set forth in the IFBC documents or otherwise required by County.

To be responsive, a Bidder shall submit a Bid which conforms in all material respects to the requirements set forth in the IFBC.

To be a responsible bidder, the bidder shall have the capability in all respects to perform fully the bid requirements, and the tenacity, perseverance, experience, integrity, reliability, capacity, facilities, equipment, and credit which will assure good faith performance.

Also, County reserves the right to make such investigation as it deems necessary to determine the ability of any bidder to furnish the service requested. Information County deems necessary to make this determination shall be provided by the bidder. Such information may include, but shall not be limited to current financial statements, verification of availability of equipment and personnel, and past performance records.

A.19 APPLICABLE LAWS

Bidder must be authorized to transact business in the State of Florida. All applicable laws and regulations of the State of Florida and ordinances and regulations of Manatee County will apply to any resulting Agreement. Any involvement with the Manatee County Procurement Division shall be in accordance with the Manatee County Procurement Ordinance as amended.

A.20 COLLUSION

By submitting a bid in response to this IFBC, Bidder certifies that it has not divulged, discussed or compared its bid with any other bidder, and has not colluded with any other bidder or parties to this bid whatsoever. Further, Bidder, and in the case of a joint bid each party thereto, certifies as to their own organization, that in connection with this IFBC that:

a. All prices and/or cost data submitted have been arrived at independently, without consultation, communication, or agreement, for the purpose of restricting competition, as to any matter relating to such prices and/or cost data, with any other bidder or with any competitor;

b. All prices and/or cost data quoted for this bid have not been knowingly disclosed by the Bidder and will not knowingly be disclosed by the Bidder, prior to the scheduled opening, directly or indirectly to any other bidder or to any competitor;

c. No attempt has been made, or will be made, by Bidder to induce any other person or firm to submit or not to submit a bid for the purpose of restricting competition;

d. The only person or persons interested in this bid is/are named in Bidder's Bid and that no person other than those identified has any interest in the Bid or in the resulting Agreement to be entered into.

e. No person or agency has been employed or retained to solicit or secure the resulting Agreement upon an agreement or understanding or a commission, percentage, brokerage, or contingent fee except bona fide employees or established commercial agencies maintained by Bidder for purpose of doing business.

A.21 CODE OF ETHICS

With respect to this and any bid, if a Bidder violates, directly or indirectly, the ethics provisions of the Manatee County Procurement Code and/or Florida criminal or civil laws related to public procurement, including but not limited to Florida Statutes Chapter 112, Part II, Code of Ethics for Public Officers and Employees, such Bidder will be ineligible for award to perform the work described in this IFBC, and may be disqualified from submitting on any future quote or bid requests to supply goods or services to Manatee County. By submitting a bid, the Bidder represents to County that all statements made, and materials submitted are truthful, with no relevant facts withheld.

A.22 PUBLIC CONTRACTING AND ENVIRONMENTAL CRIMES

A person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime, as that term is defined in Section 287.133, Florida Statutes, may not submit a bid to provide any goods or services to a public entity; may not submit a bid with a public entity for the construction or repair of a public building or public work; may not submit bids on leases of real property to a public entity; may not be awarded or perform Work as a contractor, supplier, Subcontractor, or consultant under an agreement with any public entity; and may not transact business with any public entity in excess of the threshold amount provided in Section 287.017, Florida Statutes, for CATEGORY TWO for a period of thirty-six (36) months following the date of being placed on the convicted list.

In addition, the Manatee County Code of Laws prohibits the award of any bid to any person or entity who/which has, within the past five (5) years, been convicted of, or admitted to in court or sworn to under oath, a public entity crime or of any environmental law that, in the reasonable opinion of the Procurement Official, establishes reasonable grounds to believe the person or business entity will not conduct business in a responsible matter.

To ensure compliance with the foregoing, the Code requires all persons or entities desiring to do business with County to execute and file with the Purchasing Official an affidavit, executed under the pain and penalties of perjury, confirming that person, entity and any person(s) affiliated with the entity, does not have such a record and is therefore eligible to seek and be awarded business with County. In the case of a business entity other than a partnership or a corporation, such affidavit shall be executed by an authorized agent of the entity. In the case of a partnership, such affidavit shall be executed by the general partner(s). A Public Contracting and Environmental Crimes Certification form is attached herein for this purpose.

A.23 SCRUTINIZED COMPANIES

Florida Statutes § 287.135, as amended from time to time, may contain limitations on the part of a company to conduct business with the County. Submission of a response to this solicitation shall be subject to all procedural requirements contained within that statute including the submission of any required certification of eligibility to contract with the County. It shall be the responsibility of the company responding to this solicitation to concurrently review the current version of the statute and ensure it is compliant. To the extent a certification is required, it shall be provided on the form located at Appendix F *Vendor Certification Regarding Scrutinized Companies Lists*.

A.24 AGREEMENT

The successful Bidder will be required to execute the Agreement, a sample of which is attached hereto and made a part hereof. The County will transmit the Agreement to the successful Bidder for execution. The successful Bidder agrees to deliver the required number of duly executed copies of the Agreement, with any other required documents, to the County within ten calendar days of receipt.

A.25 LEGAL NAME

Bidders shall clearly indicate the full legal name, including any d/b/a, address, email address, and telephone number on the Bid Form. Bid Forms shall be signed above the typed or printed name and title of the signer. The signer must be an official of the organization and have the authority to bind the bidder to the submitted bid.

When bidder is a partnership, the Bid Form shall be signed in the name of the firm and by all partners required under the terms of the partnership agreement. When a corporation is a bidder, the authorized corporate officers shall sign.

Bidders who are corporations or limited partnerships shall provide a certified copy of their permit to transact business in the State of Florida, preferably along with the Bid Form, or within forty-eight (48) hours after request by County.

When submitting a bid as a joint venture, it must have filed paper documents with the Division of Profession's Construction Industry Licensing Board prior to submitting a bid.

A.26 DISCOUNTS

All discounts must be incorporated in the prices contained in the bid and not shown separately. Unless otherwise specified in this IFBC, pricing must be all inclusive, including delivery costs. The prices indicated on the Pricing Form shall be the prices used in determining award.

A.27 TAXES

Manatee County is exempt from Federal Excise and State Sales Taxes. (F.E.T. Cert. No. 59-78-0089K; Florida Sales Tax Exempt Cert. No. 85-8012622206C-6). Therefore, the Bidder is prohibited from delineating a separate line item in its bid for any sales or service taxes.

The successful Bidder will be responsible for the payment of taxes of any kind, including but not limited to sales, consumer, use, and other similar taxes payable on account of the work performed and/or materials furnished under the award in accordance with all applicable laws and regulations.

A.28 QUALITY

Unless otherwise specifically provided in the IFBC documents, all goods provided shall be new, the latest make or model, of the best quality, of the highest grade of workmanship, and of the most suitable for the purpose intended.

Unless otherwise specifically provided in the IFBC documents, reference to any equipment, material, article or patented process, by trade name, brand name, make or catalog number, shall be regarded as establishing a standard of quality and shall not be construed as limiting competition.

A.29 AUTHORIZED PRODUCT REPRESENTATION

Bidder, by virtue of submitting the name and specifications of a manufacturer's product, will be required to furnish the named manufacturer's product. Failure to do so may, in the County's sole discretion, be deemed a material breach of the resulting agreement and shall constitute grounds for County's immediate termination of the resulting agreement.

A.30 ROYALTIES AND PATENTS

The successful Bidder shall pay all royalties and license fees for equipment or processes in conjunction with the equipment and/or services being furnished. Successful Bidder shall defend all suits or claims for infringement of any patent, trademark or copyright, and shall save County harmless from loss on account thereof, including costs and attorney's fees.

A.31 AMERICANS WITH DISABILITIES ACT

Manatee County does not discriminate upon the basis of any individual's disability status. This non-discrimination policy involves every aspect of County's functions including one's access to participation, employment, or treatment in its programs or activities. Anyone requiring reasonable accommodation for an information conference or bid opening should contact the person named on the cover page of this document at least twenty-four (24) hours in advance of either activity.

A.32 EQUAL EMPLOYMENT OPPORTUNITY

In accordance with Title VI of the Civil Rights Act of 1964, Title 15, Part 8 of the Code of Federal Regulations and the Civil Rights Act of 1992, Manatee County hereby notifies all Bidders that it will affirmatively ensure minority business enterprises are afforded full opportunity to participate in response to this IFBC and will not be discriminated against on the grounds of race, color, national origin, religion, sex, age, handicap, or marital status in consideration of award.

A.33 MINORITY AND/OR DISADVANTAGED BUSINESS ENTERPRISES

The State of Florida Office of Supplier Diversity provides the certification process and maintains the database of certified MBE/DBE firms. Additional information may be obtained at https://www.dms.myflorida.com/agency_administration/office_of_supplier_diversity_osd or by calling (850) 487-0915.

A.34 DELIVERY

Unless otherwise specified, all prices shall include all delivery cost (FOB Destination).

A.35 MATHEMATICAL ERRORS

1. Bid pricing forms without imbedded mathematical formulas: In the event of multiplication/extension error(s), the unit price shall prevail. In the event of addition error(s) the extension totals will prevail. In the event the dollar amount for contract contingency is omitted, it will be added to the total price of the Bid.

2. Bid pricing forms with imbedded mathematical formulas: Interactive bid pricing forms that contain mathematical formulas may be provided to automate lengthy and complex bid forms. In the event bid pricing forms with imbedded formulas are used and a multiplication/extension error(s) is discovered in the formula, the unit price entered by the Bidder shall prevail.

3. Bidder shall assume the responsibility and accuracy of the information input in the bid pricing form and therefore shall verify that the calculations are correct before submitting its Bid.

4. Regardless of the type of bid pricing form used, all Bids shall be reviewed mathematically by the County using these standards.

A.36 SUBCONTRACTORS

The successful bidder will obtain prior written approval from the County for any subcontractor(s) and the work each will perform. A subcontractor is defined as any entity performing work within the scope of the project who is not an employee of the successful Bidder.

Bidders subcontracting any portion of the work shall include a list of subcontractors along with their bid. The list shall include: name and address of subcontractor, type of work to be performed and the percent of the contract amount to be subcontracted.

A.37 E-Verify

Prior to the employment of any person under this contract, the successful Bidder shall utilize the U.S. Department of Homeland Security's E-Verify system to verify the employment eligibility of (a) all persons employed during the contract term by the successful Bidder to perform employment duties within Florida and (b) all persons, including subcontractors, assigned by the successful Bidder to perform work pursuant to the contract with Manatee County. For more information on this process, please refer to United States Citizenship and Immigration Service site at: http://www.uscis.gov/.

Only those individuals determined eligible to work in the United States shall be employed under this contract.

By submission of a bid in response to this IFBC, the successful Bidder commits that all employees and subcontractors will undergo e-verification before placement on this contract.

The successful Bidder shall maintain sole responsibility for the actions of its employees and subcontractors. For the life of the contract, all employees and new employees brought in after contract award shall be verified under the same requirement stated above.

A.38 DISCLOSURE

Upon receipt, all inquiries and responses to inquiries related to this IFBC become "Public Records," and shall be subject to public disclosure consistent with Florida Statues, Chapter 119.

Bids become subject to disclosure thirty (30) days after the opening or if a notice of intent to award decision is made earlier than this time as provided by Florida Statutes § 119.071(1)(b). No announcement or review of the bids shall be conducted at the public opening.

Based on the above, County will receive bids at the time and date stated and will make public at the opening the names of the business entities of all that submitted a bid.

If County rejects all bids and concurrently notices its intent to reissue the solicitation, the rejected bids are exempt from public disclosure until such time as County provides notice of an intended decision concerning the reissued solicitation or until County withdraws the reissued

solicitation. A bid is not exempt for longer than twelve (12) months after the initial notice rejecting all bids.

Pursuant to Florida Statutes 119.0701, to the extent successful Bidder is performing services on behalf of the County, successful Bidder must:

a. Keep and maintain public records required by public agency to perform the service.

b. Upon request from the public agency's custodian of public records, provide the public agency with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in Florida Statutes, Chapter 119, or as otherwise provided by law.

c. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of the contract term and following completion of the contract if the successful Bidder does not transfer the records to the public agency.

d. Upon completion of the contract, transfer, at no cost, to the public agency all public records in possession of contractor or keep and maintain public records required by the public agency to perform the service. If the successful Bidder transfers all public records to the public agency upon completion of the contract, the successful Bidder shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the successful Bidder keeps and maintains public records upon completion of the contract, the successful Bidder shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the public agency, upon request from public agency's custodian of public records, in a format that is compatible with the information technology systems of the public agency.

IF THE SUCCESSFUL BIDDER HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE SUCCESSFUL BIDDER'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO ANY RESULTING CONTRACT, CONTACT COUNTY'S CUSTODIAN OF PUBLIC RECORDS AT:

Phone: (941) 742-5845
Email: debbie.scaccianoce@mymanatee.org
Mail: Manatee County BCC
Attn: Records Manager
1112 Manatee Ave W.
Bradenton, FL 34205.

A.39 LOCAL PREFERENCE

Local business is defined as a business legally authorized to engage in the sale of the goods and/or services, and which certifies within its Bid that for at least six (6) full months prior to the advertisement of this IFBC it has maintained a physical place of business in Manatee, Desoto, Hardee, Hillsborough, Pinellas or Sarasota County with at least one full-time employee at that location.

Local preference shall not apply to the following categories of agreements:

1. Purchases or agreements which are funded, in whole or in part, by a governmental or other funding entity, where the terms and conditions governing the funds prohibit the preference.
2. Any bid announcement which specifically provides that local preference, as set forth in this section, is suspended due to the unique nature of the goods or services sought, the existence of an emergency as found by either the County Commission or County Administrator, or where such suspension is, in the opinion of the County Attorney, required by law.
3. For a competitive solicitation for construction services in which fifty percent (50%) or more of the cost will be paid from state.

4. To qualify for local preference under this section, **a local business must certify to County** by completing an "**Affidavit as to Local Business Form,"** which is available for download at www.mymanatee.org/vendor. Click on "Affidavit for Local Business" to access and print the form. Complete, notarize, and mail the notarized original to the following address: Manatee County Procurement Division, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205.
5. It is the responsibility of the bidder to ensure accuracy of the Affidavit as to Local Business and notify County of any changes affecting same.

A.40 VENDOR REGISTRATION

Registering your business will provide Manatee County a sourcing opportunity to identify suppliers of needed goods and services and identify local businesses. To register as a supplier with the County go to www.mymanatee.org/vendor. For assistance with supplier registration, call the Procurement Division main number at (941) 749-3014. Office hours are Monday – Friday, 8:00 A.M. to 5:00 P.M., excluding County holidays.

A link to Vendor Registration is listed on the Procurement Division's web page at http://www.mymanatee.org/home/government/departments/financial-management/purchasing.html. Click on *"Register as a Vendor",* then "*Vendor Registration Form"*. Registration is not mandatory to submit a Bid.

A.41 ENVIRONMENTAL SUSTAINABILITY

All bidders are encouraged to use as many environmentally preferable "green" products, materials, as supplies, as possible to promote a safe and healthy environment. Environmentally preferable are products or services that have a reduced adverse effect on the environment.

Bidder shall acknowledge in its Bid if Bidder has an environmental sustainability initiative. In addition, Bidder shall submit with its Bid a brief summary of Bidder's environmental sustainability initiative. This information will be used as a determining factor in the award decision when all other factors, including local preference, are otherwise equal.

A.42 ePAYABLES

Manatee County Board of County Commissioners and the Manatee County Clerk of the Circuit Court have partnered to offer the ePayables program, which allows payments to be made to vendors via credit cards.

The Clerk of the Circuit Court will issue a unique credit card number to vendor after goods are delivered or services rendered, vendors submit invoices to the remit to address on the purchase order. When payments are authorized, an email notification is sent to the vendor. The email notification includes the invoice number(s), invoice date(s), and amount of payment. There is no cost for vendors to participate in this program; however, there may be a charge by the company that processes your credit card transactions.

If Bidder is interested in participating in this program, complete the ePayables Application attached herein and return the completed form via email to lori.bryan@manateeclerk.com.

A.43 BASIS OF AWARD

County will not make award to a Bidder who is delinquent in payment of any taxes, fees, fines, contractual debts, judgments, or any other debts due and owed to the County, or is in default on any contractual or regulatory obligation to the County. By submitting this solicitation response, Bidder attests that it is not delinquent in payment of any such debts due and owed to the County, nor is it in default on any contractual or regulatory obligation to the County. In the event the Bidder's statement is discovered to be false, bidder will be subject to suspension and/or debarment and the County may terminate any award it has with bidder.

Award shall be to the lowest, responsive, responsible bidder(s) meeting specifications which includes delivery time requirements, qualification requirements, and having the lowest total offer for requirements listed on the Bid Form for the Work as set forth in this IFBC. Bid prices shall include costs for furnishing all labor, equipment and/or materials for the completion of the Work to the County's satisfaction, in accordance with and in the manner set forth and described in the IFBC documents and within the prescribed time.

Only one (1) completion schedule for 380 calendar days shall be submitted and considered.

In evaluating Bids, County shall consider the qualifications of the Bidders; and if required, may also consider the qualifications of the subcontractors, suppliers, and other persons and organizations proposed. County may also consider the operating costs, maintenance requirements, performance data and guarantees of major items of materials and equipment proposed for incorporation in the Work.

Whenever two or more responsive, responsible bids which are equal with respect to price and all other evaluation factors are received, the bid from the local business shall be given preference in award.

Whenever two or more responsive, responsible bids which are equal with respect to price are received, and both or neither of these bids are from a local business, the award shall be determined by a chance drawing, coin toss, or similar tie-breaking method conducted by the Procurement Division and open to the public.

Bidder acknowledges that County has, or may hire, others to perform work similar to or the same as that which is within the scope of work of this IFBC. In the event that the successful Bidder cannot meet the delivery time or availability requirements of materials, the County, at its sole discretion can obtain the goods and services from other sources.

A.44 SCOPE OF WORK

The successful Bidder shall furnish and install all materials, equipment and labor which is reasonably inferable and necessary for the proper completion of the Work specified in this IFBC, whether specifically indicated in the IFBC or not.

The successful Bidder shall furnish all shop drawings, work drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all Work required by these Specifications.

The successful Bidder shall perform the Work complete, in place and ready for continuous service and shall include any repairs, replacements, and / or restoration required as a result of damages caused prior to acceptance by the County.

Construction of a Class I Deep Injection Well system for the disposal of excess reclaimed water during wet weather seasons, and for brine concentrate from the future Reverse Osmosis facility. Includes permitting, design, and construction of injection wells and associated monitoring wells, piping, valves, flow meters, and connection to existing Supervisory Control and Data Acquisition (SCADA) system, and all other required appurtenances.

A.45 COMPLETION OF WORK

The Work will be completed and ready for final inspection within the specified calendar days from the date the Contract Time commences to run. Total Completion time based on 380 calendar days with a milestone completion time for the first injection Well-1 receiving reclaimed waster is 160 calendar days from NTP.

A.46 LIQUIDATED DAMAGES

If the successful Bidder fails to achieve substantial completion of the Work within the contract time and as otherwise required by the Agreement (to include not only the entire Work but any portion of the Work as set forth therein), the County shall be entitled to retain or recover from the successful Bidder, as liquidated damages and not as a penalty, the sum of $724.00 per calendar day, commencing upon the first day following expiration of the contract time and continuing until the actual date of substantial completion.

Such liquidated damages are hereby agreed to be a reasonable estimate of damages the County will incur because of delayed completion of the Work. The County may deduct liquidated damages as described in this paragraph from any unpaid amounts then or thereafter due the successful bidder under this Agreement. Any liquidated damages not so deducted from any unpaid amounts due the successful bidder shall be payable to the County at the demand of the County, together with interest from the date of the demand at the maximum allowable rate.

A.47 CONTRACT CONTINGENCY WORK

Contract contingency is a monetary allowance used solely at County's discretion to handle unexpected conditions as required to satisfactorily complete the Work in accordance with the IFBC documents. A Field Directive must be issued by an authorized County representative to authorize use of contract contingency funds.

The percentage for contract contingency is listed on the Bid Form. Bidder shall enter the dollar amount for contract contingency based on the percentage of the total base bid. The total contract award will include contract contingency.

Appropriate uses of contract contingency include increases to existing bid item quantities that do not change the initial scope of Work, which may be directed by County staff; modification items not originally bid which were unforeseen yet necessary during the Work to provide a safe, complete Project and that do not change the initial scope of Work; and unanticipated conflicts and/or design changes required during construction which are necessary to provide a safe, complete Project and that do not change the initial Scope of Work.

Inappropriate uses of contract contingency include anything that changes the initial scope of Work, including the Contract Sum and Contract Time, and adding bid items not previously contemplated that change the initial scope of Work.

A.48 LICENSES AND PERMITS

The successful Bidder shall be solely responsible for obtaining all necessary license and permit fees, including, but not limited to, all license fees, permit fees, impact fees, or inspection fees, and responsible for the costs of such fees. Successful Bidder is solely responsible for ensuring all work complies with all Federal, State, local, and Manatee County ordinances, orders, codes, laws, rules, regulations, directives, and guidelines.

A.49 PROTEST

Any actual bidder, proposer, or contractor who is aggrieved in connection with the notice of intent to award of a contract with a value greater than $250,000 where such grievance is asserted to be the result of a violation of the requirements of the Manatee County Procurement Code or any applicable provision of law by the officers, agents, or employees of the County, may file a protest to the Procurement Official.

Protest must be in writing and delivered via email at purchasing@mymanatee.org or by hand delivery to the Procurement Division at 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205 by 5:00 p.m. on the fifth business day following the date of posting of the Notice of Intent to Award on the County website. There is no stay of the procurement process during a protest. The Procurement Official shall have the authority to settle and resolve a protest concerning the intended award of a contract.

For additional information regarding the County protest process, visit the Procurement Division webpage on the County website.

A.50 ACCESSIBILITY

The County is committed to making its documents and information technologies accessible to individuals with disabilities by meeting the requirements of Section 504 of the Rehabilitation Act and best practices (w3C WCAG 2). **For assistance with accessibility regarding this solicitation, contact the Manatee County Procurement Division via email at purchasing@mymanatee.org or by phone at 941-748-4501 X3014.**

Successful Bidder shall ensure all its electronic information, documents, applications, reports, and deliverables required under this Agreement are in a format that meets the requirements of Section 504 of the Rehabilitation Act and best practices (w3C WCAG 2).

Where not fully compliant with these requirements and best practices, Successful Bidder shall provide clear points of contact for each document and information technology to direct users in how to obtain alternate formats. Further, successful Bidder shall develop accommodation strategies for those non-compliant resources and implement strategies to resolve the discrepancies.

A.51 SOLICITATION SCHEDULE

The following schedule has been established for this Solicitation process. Refer to the County's website (www.mymanatee.org > Business > *Bids & Proposals*) for meeting locations and updated information pertaining to any revisions to this schedule.

Scheduled Item	Scheduled Date
No Solicitation Information Conference schedule	N/A
Question and Clarification Deadline	May 21, 2020
Final Addendum Posted	May 29, 200
Bid Response Due Date and Time	June 5, 2020, 3:00 PM, ET
Due Diligence Review Completed	June 2020
Projected Award	June 2020

NOTE: Any statements contained in the Scope of Work, Bid Summary, Construction Agreement, General Conditions of the Construction Agreement and/or Exhibits which vary from the information in Section A, Information for Bidders, shall have precedence over the Information for Bidders.

END OF SECTION A

SECTION B, BID FORMS

(To be completed and returned with Bid)

APPENDIX A, MINIMUM QUALIFICATIONS
IFBC No. 20-TA003346AJ

Bidders must submit the information and documentation requested in this Attachment that confirms Bidder meets the following minimum qualification requirement(s):

1. Must have been registered with the State of Florida, Division of Corporations to do business in Florida.

   No documentation is required. The County will verify registration.

2. Bidder, or its representative(s), has made an inspection of the construction site for work specified in this IFBC on or after the date of advertisement of this IFBC and prior to the Due Date and Time.

   Bidder must submit a statement on company letterhead and signed by an authorized official of Bidder that Bidder, or its representative(s), has made an inspection of the construction site, listing the date of the inspection, and the individuals by name, who conducted the inspection.

3. Bidder must have possessed a General Contractor License issued by the Florida Department of Business and Professional Regulation for a period of at least three (3) consecutive years since May 1, 2017. License must be current and valid through the Due Date for submission of bids for this IFBC.

   Provide a copy of Bidder's General Contractor License issued by the Florida Department of Business and Professional Regulation and documentation confirming Bidder has been licensed and/or certified for the period of May 1, 2017 through the date of submission of the Bid.

4. Bidder has provided construction services for a wet weather management well system for at least three projests at a water or waste water treament facility. Each project shall include one (1) or more of the following components; (i) construction of recharge or injection well, (ii) installation of electrical system, (iii) piping, pump system, (iv) plumbing, and instrumentation and controls.

   Provide the following information for the three (3) qualifying projects.

   a) Name of project
   b) Location (City/State)
   c) Project contact information
   d) Contact phone
   e) Contact email
   f) Service dates (Start/End)

5. The Bidder's well subcontractor has successfully completed installation of at least three (3) recharges or well infrastructure injections at a water or wastewater treatment facility. Additional subcontractors (i.e. electrical, instrument & controls, etc.) shall have successfully completed installation of infrastructure improvements of at least (3) projects consisting of electrical, instrumentation, valve manifold, and well pump installation of comparable size and scope to the project described in this IFBC.

   NOTE: The County, at its sole discretion, shall determine if the qualifying project is of similar scope and complexity as the project described in this IFBC.

   Provide the following information for the subcontractors (well contractor, electrical, I&C, etc.) and the qualifying project.

   a) Name of subcontractor
   b) Name of project
   c) Location (City/State)
   d) Project contact Information
   e) Contact phone
   f) Contact email
   h) Construction dates (Start/End)

6. Bidder's key personnel, project manager and work-site superintendent to be assigned to the County's project, have performed wet weather management well installation working in a similar capacity to the one designated for the County's project.

   Provide the names of the key personnel and provide the resumes for each that demonstrates the individual has previously served in in the role designated for the County's project. Indicate which of the above referenced projects in Items 4, they have worked on.

7. Bidder, on the day the bid is submitted, has a certified or registered Qualifying Agent, as required by Section 489.119, Florida Statutes, and that Qualifying Agent has been the same Qualifying Agent of Bidder for a period of at least three consecutive years, since May 1, 2017.

   Submit a copy of Bidder's Qualifying Agent's registration or certification along with supporting documentation confirming Qualifying Agent has been the Qualifying Agent for Bidder for three years, since May 1, 2017.

8. Bidder and Bidder's Subcontractor is not on the Florida Department of Management Services Suspended, Debarred, Convicted Vendor Lists.

   No documentation is required. The County will verify.

9. If Bidder is submitting as a joint venture must file the required documents with the Florida Department of Business and Professional Regulation as required by Florida Statute Section 489.119, prior to the Due Date and Time.

If Bidder is not a joint venture, provide a statement to that effect. If Bidder is a joint venture, provide a copy of Bidder's approved filing with the Florida Department of Business and Professional Regulation.

10. Bidder has no reported conflict of interests in relation to this IFBC.

Submit a fully completed copy of Appendix I. If applicable, on a separate page disclose the name of any officer, director or agent who is also an employee of the County. Disclose the name of any County employee who owns, directly or indirectly, any interest in the Bidder's firm or any of its branches. If no conflicts of interests are present, Bidder must submit a statement to that affect.

END OF APPENDIX A

APPENDIX B, BIDDER'S QUESTIONNAIRE

Bidder must fully complete and return this form with its Bid. Bidder warrants the truth and accuracy of all statements and answers herein contained. (Attach additional pages if necessary.)

THIS QUESTIONNAIRE MUST BE COMPLETED AND SUBMITTED WITH YOUR BID

1. Contact Information:

FEIN #: _____

License #: _____

License Issued to: _____

Date License Issued (MM/DD/YR): _____

Company Name: _____

Physical Address: _____

City: _____ State of Incorporation: _____ Zip Code: _____

Phone Number: ( ) _____ Fax Number: ( ) _____

Email address: _____

2. Bidding as: an individual __; a partnership __; a corporation __; a joint venture __

3. If a partnership, list names and addresses of partners; if a corporation, list names of officers, directors, shareholders, and state of incorporation; if joint venture, list names and address of ventures' and the same if any venture are a corporation for each such corporation, partnership, or joint venture:

_____

_____

_____

_____

4. Bidder is authorized to do business in the State of Florida: ☐ Yes ☐ No

For how many years? _____

5. Your organization has been in business (under this firm's name) as a

_____

Is this firm in bankruptcy? _____

6. Attach a list of projects where this specific type of Work was performed.

BIDDER: _____

7. Is this firm currently contemplating or in litigation? Provide summary details.

8. Have you ever been assessed liquidated damages under a contract during the past five (5) years? If so, state when, where (contact name, address and phone number) and why.

9. Have you ever failed to complete Work awarded to you? Or failed to complete projects within contract time? If so, state when, where (contact name, address, phone number) and why.

10. Have you ever been debarred or prohibited from providing a bid to a governmental entity? If yes, name the entity and describe the circumstances.

11. Will you subcontract any part of this Work? If so, describe which portion(s) and to whom.

12. If any part of work will be subcontracted, list MBE/DBE/WBE/VETERAN to be utilized. Include the estimated dollar amount of the portion of Work each will perform.

BIDDER: _____

13. What equipment do you own to accomplish this Work? (A listing may be attached)

_____

_____

_____

14. What equipment will you purchase/rent for the Work? (Specify which)

_____

_____

_____

15. If applicable to the Work for this IFBC, Drilling Supervisor Qualifications: Contractor shall provide a boring specialist who shall remain on the project site during the entirety of the directional boring operation. This includes, but is not limited to, drilling fluid preparation, seaming, boring and pulling. The boring specialist shall have a minimum of five (5) years' experience in supervising directional bores of similar nature, diameter, materials and lengths. (Reference: Specification Section 02619, Horizontal Directional Drilling).
Provide the contact information for a minimum of three (3) projects wherein the boring specialist has performed this type of work, diameter, materials and lengths.

Boring specialist's name: _____
Boring specialist's years of experience in supervising directional bores _____
Provide contact name, and contact number for projects:

_____

_____

_____

16. If applicable to the Work for this IFBC, Pipe Fusion Qualifications: All boring and fusing equipment shall be certified for operation. The Contractor responsible for thermal butt fusing pipe and fittings shall have manufacturer certification for performing such work or a minimum of five (5) years of experience performing this type of work.

Thermal butt fusing pipe and fittings contractor or subcontractor's name: _____
Attach a copy of contractor's/subcontractor's manufacturer certification to this Questionnaire
OR
Provide contractor's/subcontractor's years of experience in thermal butt fusing pipe and fittings _____
If manufacturer certification is not provided, include contact name, and contact number for projects that confirms five years of experience:

_____

_____

_____

BIDDER: _____

17. If applicable to the Work for this IFB, Pipe Bursting Qualifications: The Contractor shall be certified by the manufacturer of the pipe bursting system that they are fully trained licensed installer of the manufacturer's pipe bursting system. Contractor shall provide a letter to the County documenting

this requirement. (Reference: Specification Section 02619A, Pipe Bursting (PB) of Existing Mains).

18. List the following regarding the surety which is providing the bond(s):

Surety's Name: _____

Address: _____

_____

Name, address, phone number and email of surety's resident agent for service of process in Florida:

Agent's Name: _____

Address: _____

_____

Phone: _____

Email: _____

19. Is Bidder a local business as defined in Section A.38, Local Preference?

☐ Yes ☐ No

If yes, by signing below Bidder certifies that for at least six months prior to the advertisement date of this IFB it has maintained a physical place of business in Manatee, Desoto, Hardee, Hillsborough, Pinellas or Sarasota counties with at least one full-time employee at that location.

BIDDER: _____

BY: _____

PRINTED NAME: _____

TITLE/DATE: _____

PHYSICAL ADDRESS OF QUALIFYING LOCAL LOCATION: _____

_____

NAME OF QUALIFYING EMPLOYEE AT LOCAL LOCATION: _____

20. Confirm if Bidder has an environmental sustainability initiative as defined in Section A.41.

☐ Yes ☐ No

If yes, submit a brief summary (2-3 paragraphs) of the environmental sustainability initiative.

BIDDER: _____

APPENDIX C, ENVIRONMENTAL CRIMES CERTIFICATION

SWORN STATEMENT PURSUANT TO ARTICLE V, MANATEE COUNTY PROCUREMENT CODE

Bidder must fully complete and return this form with its Bid. This form must be signed and sworn to in the presence of a notary public or other official authorized to administer oaths.

This sworn statement is submitted to the Manatee County Board of County Commissioners by

_____

[Print individual's name and title]

for _____ [Print name of entity submitting sworn statement]

whose business address is _____

and (if applicable) its Federal Employer Identification Number (FEIN) is _____. If the entity has no FEIN, include the Social Security Number of the individual signing this sworn statement: _____.

I understand that no person or entity shall be awarded or receive an Owner's Agreement for public improvements, procurement of goods or services (including professional services) or an Owner's lease, franchise, concession or management agreement, or shall receive a grant of Owner's monies unless such person or entity has submitted a written certification to Owner that it has not:

(1) been convicted of bribery or attempting to bribe a public officer or employee of Manatee County, the State of Florida, or any other public entity, including, but not limited to the Government of the United States, any state, or any local government authority in the United States, in that officer's or employee's official capacity; or

(2) been convicted of an agreement or collusion among bidders or prospective bidders in restraint of freedom of competition, by agreement to bid a fixed price, or otherwise; or

(3) been convicted of a violation of an environmental law that, in the sole opinion of Owner's Purchasing Official, reflects negatively upon the ability of the person or entity to conduct business in a responsible manner; or

(4) made an admission of guilt of such conduct described in items (1), (2) or (3) above, which is a matter of record, but has not been prosecuted for such conduct, or has made an admission of guilt of such conduct, which is a matter of record, pursuant to formal prosecution. An admission of guilt shall be construed to include a plea of nolo contendere; or

(5) where an officer, official, agent or employee of a business entity has been convicted of or has admitted guilt to any of the crimes set forth above on behalf of such an entity and pursuant to the direction or authorization of an official thereof (including the person committing the offense, if he is an official of the business entity), the business shall be chargeable with the conduct herein above set forth. A business entity shall be chargeable with the conduct of an affiliated entity, whether wholly owned, partially owned, or one which has common ownership or a common Board of Directors. For purposes of this Form, business entities are affiliated if, directly or indirectly, one business entity controls or has the power to control another business entity, or if an individual or group of individuals controls or has the power to control both entities. Indicia of control shall include, without limitation, interlocking management or ownership, identity of interests among family members, shared organization of a business entity following the ineligibility of a business entity under this

Article, or using substantially the same management, ownership or principles as the ineligible entity.
(Continued)

Any person or entity who claims that this Article is inapplicable to him/her/it because a conviction or judgment has been reversed by a court of competent jurisdiction shall prove the same with documentation satisfactory to Owner's Purchasing Official. Upon presentation of such satisfactory proof, the person or entity shall be allowed to contract with Owner.

I UNDERSTAND THAT THE SUBMISSION OF THIS FORM TO THE CONTRACTING OFFICER FOR MANATEE COUNTY IS VALID THROUGH DECEMBER 31 OF THE CALENDAR YEAR IN WHICH IT IS FILED. I ALSO UNDERSTAND THAT ANY AGREEMENT OR BUSINESS TRANSACTION SHALL PROVIDE FOR SUSPENSION OF PAYMENTS, OR TERMINATION, OR BOTH, IF THE CONTRACTING OFFICER OR COUNTY ADMINISTRATOR DETERMINES THAT **SUCH** PERSON OR ENTITY HAS MADE FALSE CERTIFICATION.

_____
[Signature]

STATE OF _____
COUNTY OF _____

Sworn to and subscribed before me this _____ day of _____, 20_____ by _____

Who is personally known / has produced _____ as identification
[Type of identification]

My commission expires _____

_____
Notary Public Signature

_____
[Print, type or stamp Commissioned name of Notary Public]

Signatory Requirement - In the case of a business entity other than a partnership or a corporation, this affidavit shall be executed by an authorized agent of the entity. In the case of a partnership, this affidavit shall be executed by the general partner(s). In the case of a corporation, this affidavit shall be executed by the corporate president.

APPENDIX D, FLORIDA TRENCH SAFETY ACT

Bidder must fully complete and return this form with its Bid. This form must be singed in the presence of a notary public or by an officer authorized to administer oaths.

1. This Sworn Statement is submitted with **IFBC NO. 20-TA003346AJ**
2. This Sworn Statement is submitted by_____ whose business address is_____ and, if applicable, its Federal Employer Identification Number (FEIN) is_____. If the entity has no FEIN, include the Social Security Number of the individual signing this sworn statement _____.
3. Name of individual signing this Sworn Statement is: _____, Whose relationship to the above entity is: _____.
4. The Trench Safety Standards that will be in effect during the construction of this project shall include, but are not limited to: Laws of Florida, Chapters 90-96, TRENCH SAFETY ACT, and OSHA RULES AND REGULATIONS 29 CFR 1926.650 Subpart P, effective October 1, 1990.
5. The undersigned assures that the entity will comply with the applicable Trench Safety Standards and agrees to indemnify and hold harmless the County and Engineer of Record, and any of their agents or employees from any claims arising from the failure to comply with said standard.
6. The undersigned has appropriated the following costs for compliance with the applicable standards:

Trench Safety Measure (Description)	Units of MeasureUnit (LF, SY)	Quantity	Unit Cost	Extended Cost
a. _____	_____	_____	$_____	_____
b. _____	_____	_____	$_____	_____
c. _____	_____	_____	$_____	_____
d. _____	_____	_____	$_____	_____

7. The undersigned intends to comply with these standards by instituting the following procedures:
_____
_____
_____

THE UNDERSIGNED, in submitting this bid, represents that they have reviewed and considered all available geotechnical information and made such other investigations and tests as they may deem necessary to adequately design the trench safety system(s) to be utilized on this project.

_____
(Authorized signature / Title)

SWORN to and subscribed before me this _____ day of _____, 20_____.
(Impress official seal)

Notary Public, State of Florida: _____

My commission expires: _____

Angelina M. Colonneso

CLERK OF THE CIRCUIT COURT AND COMPTROLLER OF MANATEE COUNTY

1115 Manatee Avenue West, Bradenton, Florida 34205 - Phone (941) 749-1800 Fax (941) 741-4082, P.O. Box 25400, Bradenton, Florida 34206 - www.manateeclerk.com

Bidder must fully complete and return this form with its Bid.

APPENDIX E: ePAYABLES APPLICATION

Company name_____

Contact person_____

Phone number_____

Email Address_____

FINANCE USE ONLY

Open orders: YES or NO

PEID _____

CREATE DATE _____

CONFIRMED WITH

_____

Name and phone number

IFAS _____

BANK _____

INITIALS_____

Return completed form to:
Via email to: lori.bryan@manateeclerk.com
Via fax to: (941) 741-4011
Via mail:
PO Box 1000
Bradenton, Fl 34206

Revised: September 30, 2015

"Pride in Service with a Vision to the Future"
Clerk of the Circuit Court – Clerk of Board of County Commissioners – County Comptroller – Auditor and Recorder

APPENDIX F, SCRUTINIZED COMPANY CERTIFICATION

This certification is required pursuant to Florida State Statute Section 287.135.

As of July 1, 2011, a company that, at the time of bidding or submitting a proposal for a new contract or renewal of an existing contract, is on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List is ineligible for, and may not bid on, submit a proposal for, or enter into or renew a contract with an agency or local governmental entity for goods or services of $1 million or more.

Bidder must fully complete and return this form with its Bid.

Company _____ FID or EIN No. _____

Address _____

City _____ State _____ Zip _____

I, _____, as a representative of _____

certify and affirm that this company is not on the Scrutinized Companies with Activities in Sudan List or the Scrutinized Companies with Activities in the Iran Petroleum Energy Sector List.

_____	_____
Signature	Title
_____	_____
Printed Name	Date

APPENDIX G, INSURANCE STATEMENT

Bidder must fully complete and return this form with its Bid.

THE UNDERSIGNED has read and understands the insurance requirements of this IFBC applicable to any contract resulting from this solicitation and shall provide the insurances required by this Appendix within ten (10) days from the date of Notice of Intent to Award.

Bidder Name: _____ Date: _____

Signature (Authorized Official): _____

Printed Name/Title: _____

Insurance Agency: _____

Agent Name: _____ Agent Phone: _____

APPENDIX H, ACKNOWLEDGMENT OF ADDENDA

The undersigned acknowledges receipt of the following addenda:

Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:
Addendum No. _____	Date Received:

Print or type Bidder's information below:

Name of Bidder | Telephone Number

Street Address | City/State/Zip

Email Address

Print Name & Title of Authorized Officer | Signature of Authorized Official Date

APPENDIX I, AFFIDAVIT OF NO CONFLICT

COUNTY OF _____
STATE OF _____

BEFORE ME, the undersigned authority, this _____ day of _____, 20____ personally appeared, _____, a principal with full authority to bind _____ (hereinafter the "Affiant"), who being first duly sworn, deposes and says:

(a) is not currently engaged or will not become engaged in any obligations, undertakings or contracts that will require the Affiant to maintain an adversarial role against the County or that will impair or influence the advice, recommendations or quality of work provided to the County; and

(b) has provided full disclosure of all potentially conflicting contractual relationships and full disclosure of contractual relationships deemed to raise a question of conflict(s); and

(c) has provided full disclosure of prior work history and qualifications that may be deemed to raise possible question of conflict(s).

Affiant makes this affidavit for the purpose of inducing Manatee County, a political subdivision of the State of Florida, to enter into an Agreement for NRWRF Master Reuse Wet Weather Management Well System.

If applicable, on a separate page Bidder shall disclose the name of any officer, director or agent of Bidder who is also an employee of the County and the name of any County employee who owns, directly or indirectly, any interest in the Bidder's firm or any of its branches. If no conflicts of interest are present, submit a statement to that affect.

_____
Signature

_____
Print Name

SUBSCRIBED to and sworn before me this ____ day of _____, 20__.

[Notary Seal]

Notary Public

My commission expires: _____

_____
Notary Signature

_____
Print Name

Personally known OR produced identification. Type of identification produced _____ _____.

APPENDIX J, BID PRICING FORM

IFBC NO. 20-TA003346AJ
NRWRF MASTER REUSE WET WEATHER MANAGEMENT WELL SYSTEM

Total Bid Price/Offer for Bid: $_____ Complete. Based on a completion time of 380 calendar days, with a milestone completion time for the first injection Well-1 receiving reclaimed waster 160 calendar days from NTP.

We, the undersigned, hereby declare that we have carefully reviewed the IFB Documents in their entirety and with full knowledge and understanding of the Bid information and all its requirements, submit this Bid, which is complete in meeting each specification, term, and condition contained therein.

As Bidder, we understand that the IFB documents, including but not limited to, all specifications, terms, and conditions shall be made a part of any resulting Agreement between County and the successful Bidder. Failure by successful Bidder to comply with such specifications, terms and conditions shall result in Agreement default, whereupon, the defaulting successful Bidder shall be required to pay for all re-procurement costs, damages, and attorney fees as incurred by County, and agrees to forfeit its bid bond.

Authorized Signature(s):_____

Name and Title of Above Signer(s):_____

Date:_____

APPENDIX J, BID PRICING FORM

IFBC 20-TA0033346AJ
NRWRF MASTER REUSE WET WEATHER MANAGEMENT WELL SYSTEM PROJECT
REVISED BID FORM

TOTAL CONTRACT AWARD (Including 10% Contract Contingency) based on a 380 Calendar Day Completon Time

LINE NO.	DESCRIPTION	EST. QTY	U/M	UNIT PRICE	EXTENDED PRICE
1.	MOBILIZATION - DEMOBILIZATION	1	LS		$ -
2.	Temporary Erosion and Sediment Control	1	LS		$ -
3.	Gravel/Shell Roadways, New	208	SY		$ -
4.	Gravel/Shell Roadways, Restoration	69	SY		$ -
5.	Asphalt Pavement, Restoration	3,767	SY		$ -
6.	Concrete Valley Curb, Remove & Replace	74	LF		$ -
7.	Chain Link Fencing, Remove & Reset Existing	350	LF		$ -
8.	Chain Link Fencing, Furnsih & Install, Includes Gates	650	LF		$ -
9.	Finish Grade and Sodding	3,738	SY		$ -
10.	16" DI Reclaimed Water Main, buried, complete	1	LS		$ -
11.	12" DI Reclaimed Water Main, buried, complete	1	LS		$ -
12.	20" x 16" Tapping Valve & Sleeve, Furnish & Install	1	EA		$ -
13.	20" x 12" Tapping Valve & Sleeve, Furnish & Install	1	EA		$ -
14.	12" Reclaimed Water Gate Valve & Box, Furnish & Install	3	EA		$ -
15.	Reclaimed Water Line ARV Assembly, Furnish & Install	4	EA		$ -
16.	2" PVC Monitoring Well Drain Line, buried, complete	1	LS		$ -
17.	Drain Connection to Existing 6" Drain Pipe, complete	1	LS		$ -
18.	Drain Connection to Existing Sewer, complete	1	LS		$ -
19.	Guard Posts, Furnish & Install	17	EA		$ -
20.	Injection Well IW-1 Aboveground Piping and Infrastructure	1	LS		$ -
21.	Injection Well IW-1 Basket Strainer Station	1	LS		$ -
22.	Injection Well IW-1 Remote Control Vavle Manifold Station	1	LS		$ -
23.	Injection Well IW-1 Electrical	1	LS		$ -
24.	Injection Well IW-1 I&C	1	LS		$ -
25.	Injection Well IW-2 Aboveground Piping and Infrastructure	1	LS		$ -
26.	Injection Well IW-2 Remote Check Valve Station	1	LS		$ -
27.	Injection Well IW-2 Electrical	1	LS		$ -
28.	Injection Well IW-2 I&C	1	LS		$ -
29.	Dual Zone Monitor Well (DZMW-1) Aboveground Piping and Infrastructure	1	LS		$ -
30.	Dual Zone Monitor Well Sample Pump APMW-1, Furnish & Install	1	EA		$ -
31.	Dual Zone Monitor Well Sample Pump NSLMW-1, Furnish & Install	1	EA		$ -
32.	Dual Zone Monitor Well (DZMW-1) Electrical	1	LS		$ -
33.	Dual Zone Monitor Well (DZMW-1) I&C	1	LS		$ -
34.	Monitor Well APMW-2 Aboveground Piping and Infrastructure	1	LS		$ -
35.	Monitor Well Sample Pump APMW-2, Furnish & Install	1	EA		$ -
36.	Monitor Well APMW-2 Electrical	1	LS		$ -
37.	Monitor Well APMW-2 I&C	1	LS		$ -
38.	Monitor Well DMW-1 Aboveground Piping and Infrastructure	1	LS		$ -

APPENDIX J, BID PRICING FORM

IFBC 20-TA0033346AJ
NRWRF MASTER REUSE WET WEATHER MANAGEMENT WELL SYSTEM PROJECT
REVISED BID FORM

TOTAL CONTRACT AWARD (Including 10% Contract Contingency) based on a 380 Calendar Day Completon Time

LINE NO.	DESCRIPTION	EST. QTY	U/M	UNIT PRICE	EXTENDED PRICE
39.	Monitor Well Sample Pump DMW-1, Furnish & Install	1	EA		$ -
40.	Monitor Well DMW-1 Electrical	1	LS		$ -
41.	Monitor Well DMW-1 I&C	1	LS		$ -
42.	Conduit Duct Bank Construction, Concrete Encased	1	LS		$ -
43.	Electric Handholes, Complete	11	EA		$ -
44.	Dewatering Building Electrical Modifications	1	LS		$ -
45.	SCADA Modifications and Programming	1	LS		$ -
46.	Legal Description of the Wells	1	LS		$ -
SUB-TOTAL BASE BID					**$ -**
Contract Contingency (Used only with County Approval)				**10%**	**$ -**
TOTAL CONTRACT AWARD (Including 10% Contract Contingency) based on a 380 Calendar Day Completon Time					**$ -**

Authorized Signature(s):

Name and Title of Above Signer(s):

Date:

SECTION C, BID ATTACHMENTS

BID ATTACHMENT 1, INSURANCE AND BOND REQUIREMENTS

The CONTRACTOR will not commence work under the resulting Agreement until all insurance coverages indicated by an "X" herein have been obtained. The CONTRACTOR shall obtain and submit to the Procurement Division within ten (10) calendar days from the date of notice of intent to award, at its expense, the following minimum amounts of insurance (inclusive of any amounts provided by an umbrella or excess policy): Work under this Agreement cannot commence until all insurance coverages indicated herein have been obtained on a standard ACORD form (inclusive of any amounts provided by an umbrella or excess policy):

☒ **Automobile Liability Insurance Required Limits**

Coverage must be afforded under a per occurrence policy form including coverage for all owned, hired and non-owned vehicles for bodily injury and property damage of not less than:

- $1,000,000 Combined Single Limit; OR
- $ 500,000 Bodily Injury and $500,000 Property Damage
- $10,000 Personal Injury Protection (No Fault)
- $500,000 Hired, Non-Owned Liability
- $10,000 Medical Payments

This policy shall contain severability of interests' provisions.

☒ **Commercial General Liability Insurance Required Limits (per Occurrence form only; claims-made form is not acceptable)**

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County, a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $1,000,000 Single Limit Per Occurrence
- $2,000,000 Aggregate
- $1,000,000 Products/Completed Operations Aggregate
- $1,000,000 Personal and Advertising Injury Liability
- $50,000 Fire Damage Liability
- $10,000 Medical Expense, and
- $1,000,000, Third Party Property Damage
- $ Project Specific Aggregate (Required on projects valued at over $10,000,000)

This policy shall contain severability of interests' provisions.

☒ **Employer's Liability Insurance**

Coverage limits of not less than:

- $100,000 Each Accident
- $500,000 Disease Each Employee
- $500,000 Disease Policy Limit

☒ **Worker's Compensation Insurance**

☐ **US Longshoremen & Harbor Workers Act**

☐ **Jones Act Coverage**

Coverage limits of not less than:

- Statutory workers' compensation coverage shall apply for all employees in compliance with the laws and statutes of the State of Florida and the federal government.
- If any operations are to be undertaken on or about navigable waters, coverage must be included for the US Longshoremen & Harbor Workers Act and Jones Act.

Should 'leased employees' be retained for any part of the project or service, the employee leasing agency shall provide evidence of Workers' Compensation coverage and Employer's Liability coverage for all personnel on the worksite and in compliance with the above Workers' Compensation requirements. NOTE: Workers' Compensation coverage is a firm requirement. Elective exemptions are considered on a case-by-case basis and are approved in a very limited number of instances.

☐ **Aircraft Liability Insurance Required Limits**

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $ Each Occurrence Property and Bodily Injury with no less than $100,000 per passenger each occurrence or a 'smooth' limit.
- $ General Aggregate.

☐ **Un-Manned Aircraft Liability Insurance (Drone)**

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $ Each Occurrence Property and Bodily Injury; Coverage shall specifically include operation of Unmanned Aircraft Systems (UAS), including liability and property damage.
- $ General Aggregate

☐ **Installation Floater Insurance**

When the contract or agreement **does not** include construction of, or additions to, above ground building or structures, but does involve the installation of machinery or equipment, Installation Floater Insurance shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- 100% of the completed value of such addition(s), building(s), or structure(s)

☐ **Professional Liability and/or Errors and Omissions (E&O) Liability Insurances**
Coverage shall be afforded under either an occurrence policy form or a claims-made policy form. If the coverage form is on a claims-made basis, then coverage must be maintained for a minimum of three years from termination of date of the contract. Limits must not be less than:

- $ 1,000,000 Bodily Injury and Property Damage Each Occurrence
- $ 2,000,000 General Aggregate

☒ **Builder's Risk Insurance**
When the contract or agreement includes the construction of roadways and/or the addition of a permanent structure or building, including the installation of machinery and/or equipment, Builder's Risk Insurance shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- An amount equal to 100% of the completed value of the project, or the value of the equipment to be installed
- The policy shall not carry a self-insured retention/deductible greater than $10,000

Coverage shall be for all risks and include, but not be limited to, storage and transport of materials, equipment, supplies of any kind whatsoever to be used on or incidental to the project, theft coverage, and Waiver of Occupancy Clause Endorsement, where applicable.

☐ **Cyber Liability Insurance**

Coverage shall comply with Florida Statute 501.171, shall be afforded under a per occurrence policy form, policy shall be endorsed and name 'Manatee County, a political subdivision of the State of Florida' as an Additional Insured, and include limits not less than:

- $ Security Breach Liability
- $ Security Breach Expense Each Occurrence
- $ Security Breach Expense Aggregate
- $ Replacement or Restoration of Electronic Data
- $ Extortion Threats
- $ Business Income and Extra Expense
- $ Public Relations Expense

NOTE: Policy must not carry a self-insured retention/deductible greater than $25,000.

☐ **Hazardous Materials Insurance (As Noted Below)**
Hazardous materials include all materials and substances that are currently designated or defined as hazardous by the law or rules of regulation by the State of Florida or federal government.
All coverage shall be afforded under either an occurrence policy form or a claims-made policy form, and the policy shall be endorsed and name 'Manatee County, a political subdivision of the State of

Florida' as an Additional Insured. If the coverage form is on a claims-made basis, then coverage must be maintained for a minimum of three years from termination of date of the contract. Limits must not be less than:

☐ ***Pollution Liability***
Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Bodily Injury and Property Damage to include sudden and gradual release, each claim and aggregate.

☐ ***Asbestos Liability (If handling within scope of Contract)***
Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Bodily Injury and Property Damage to include sudden and gradual release, each claim and aggregate.

☐ ***Disposal***
When applicable, CONTRACTOR shall designate the disposal site and furnish a Certificate of Insurance from the disposal facility for Environmental Impairment Liability Insurance covering liability.

- Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Liability for Sudden and Accidental Occurrences, each claim and an aggregate.
- Amount equal to the value of the contract, subject to a $1,000,000 minimum, for Liability for Non-Sudden and Accidental Occurrences, each claim and an aggregate.

☐ **Hazardous Waste Transportation Insurance**
CONTRACTOR shall designate the hauler and have the hauler furnish a Certificate of Insurance for Automobile Liability insurance with Endorsement MCS-90 for liability arising out of the transportation of hazardous materials. EPA identification number shall be provided.

All coverage shall be afforded under either an occurrence policy form or a claims-made policy form and the policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured. If the coverage form is on a claims-made basis, then coverage must be maintained for a minimum of three years from termination of date of the contract. Limits must not be less than:

- Amount equal to the value of the contract, subject to a $1,000,000 minimum, per accident.

☐ **Liquor Liability Insurance**
Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- $1,000,000 Each Occurrence and Aggregate

☐ **Garage Keeper's Liability Insurance**

Coverage shall be required if the maintenance, servicing, cleaning or repairing of any County motor vehicles is inherent or implied within the provision of the contract.

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- Property and asset coverage in the full replacement value of the lot or garage.

☐ **Bailee's Customer Liability Insurance**

Coverage shall be required for damage and/or destruction when County property is temporarily under the care or custody of a person or organization, including property that is on, or in transit to and from the person or organization's premises. Perils covered should include fire, lightning, theft, burglary, robbery, explosion, collision, flood, earthquake and damage or destruction during transportation by a carrier.

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- Property and asset coverage in the full replacement value of the County asset(s) in the CONTRACTOR'S care, custody and control.

☐ **Hull and Watercraft Liability Insurance**

Coverage shall be afforded under a per occurrence policy form, policy shall be endorsed and name "Manatee County, a political subdivision of the State of Florida" as an Additional Insured, and include limits not less than:

- $ Each Occurrence
- $ General Aggregate
- $ Fire Damage Liability
- $10,000 Medical Expense, and
- $ Third Party Property Damage
- $ Project Specific Aggregate (Required on projects valued at over $10,000,000)

☐ **Other [Specify]**

BOND REQUIREMENTS

☒ **Bid Bond**

A Bid Bond in the amount of 5% of the total offer. Bid bond shall be submitted with the sealed response and shall include project name, location, and / or address and project number. In lieu of the bond, the bidder may file an alternative form of security in the amount of 5% of the total offer. in the form of a money order, a certified check, a cashier's check, or an irrevocable letter of credit issued to Manatee County. NOTE: A construction project over $200,000 requires a Bid Bond in the amount of 5% of the total bid offer.

☒ **Payment and Performance Bond**

A Payment and Performance Bond shall be submitted by Successful Bidder for 100% of the award amount and shall be presented to Manatee County within ten (10) calendar days of issuance of the notice of intent to award. NOTE: A construction project over $200,000 requires a Payment and Performance Bond.

INSURANCE REQUIREMENTS

I. THE POLICIES BELOW ARE TO CONTAIN, OR BE ENDORSED TO CONTAIN, THE FOLLOWING PROVISIONS:

1. Commercial General Liability and Automobile Liability Coverages

a. **"Manatee County, a Political Subdivision of the State of Florida," is to be named as an Additional Insured in respect to:** Liability arising out of activities performed by or on behalf of the successful Bidder, his agents, representatives, and employees; products and completed operations of the successful Bidder; or automobiles owned, leased, hired or borrowed by the successful Bidder. The coverage shall contain no special limitation(s) on the scope of protection afforded to the County, its officials, employees or volunteers.

In addition to furnishing a Certificate of Insurance, the successful Bidder shall provide the endorsement that evidences Manatee County being listed as an Additional Insured. This can be done in one of two ways: (1) an endorsement can be issued that specifically lists "Manatee County, a Political Subdivision of the State of Florida," as Additional Insured; or, (2) an endorsement can be issued that states that all Certificate Holders are Additional Insured with respect to the policy.

b. The successful Bidder's insurance coverage shall be primary insurance with respect to the County, its officials, employees and volunteers. Any insurance or self-insurance maintained by the County, its officials, employees or volunteers shall be excess of successful Bidder's insurance and shall be non-contributory.

c. The insurance policies must be on an occurrence form.

2. Workers' Compensation and Employers' Liability Coverages

The insurer shall agree to waive all rights of subrogation against the County, its officials, employees and volunteers for losses arising from work performed by the successful Bidder for the County.

II. GENERAL INSURANCE PROVISIONS APPLICABLE TO ALL POLICIES:

1. Prior to the execution of contract, or issuance of a Purchase Order, and then annually upon the anniversary date(s) of the insurance policy's renewal date(s) for as long as this contract remains in effect, successful Bidder shall furnish the County with a Certificate(s) of Insurance (using an industry accepted certificate form, signed by the Issuer, with applicable endorsements, and containing the solicitation or contract number, and title or description) evidencing the coverage set forth above and naming "Manatee County, a Political Subdivision of the State of Florida" as an Additional Insured on the applicable coverage(s) set forth above.

2. If the policy contains an aggregate limit, confirmation is needed in writing (letter, email, etc.) that the aggregate limit has not been eroded to procurement representative when supplying Certificate of Insurance.

In addition, when requested in writing from the County, successful Bidder will provide the County with a certified copy of all applicable policies. The address where such certificates and certified policies shall be sent or delivered is as follows:

Manatee County, a Political Subdivision of the State of Florida
Attn: Risk Management Division
1112 Manatee Avenue West, Suite 969
Bradenton, FL 34205

3. The project's solicitation number and title shall be listed on each certificate.

4. successful Bidder shall provide thirty (30) days written notice to the Risk Manager of any cancellation, non-renewal, termination, material change, or reduction in coverage of any insurance policies to procurement representative including solicitation number and title with all notices.

5. successful Bidder agrees that should at any time successful Bidder fail to meet or maintain the required insurance coverage(s) as set forth herein, the County may terminate this contract.

6. The successful Bidder waives all subrogation rights against Manatee County, a Political Subdivision of the State of Florida, for all losses or damages which occur during the contract and for any events occurring during the contract period, whether the suit is brought during the contract period or not.

7. The successful Bidder has sole responsibility for all insurance premiums and policy deductibles.

8. It is the successful Bidder's responsibility to ensure that his agents, representatives and subcontractors comply with the insurance requirements set forth herein. successful Bidder shall include his agents, representatives, and subcontractors working on the project or at the worksite as insured under its policies, or successful Bidder shall furnish separate certificates and endorsements for each agent, representative, and subcontractor working on the project or at the worksite. All coverages for agents, representatives, and subcontractors shall be subject to all of the requirements set forth to the procurement representative.

9. All required insurance policies must be written with a carrier having a minimum A.M. Best rating of A- FSC VII or better. In addition, the County has the right to review the successful Bidder's deductible or self-insured retention and to require that it be reduced or eliminated.

III. Successful Bidder understands and agrees that the stipulated limits of coverage listed herein in this insurance section shall not be construed as a limitation of any potential liability to the County, or to others, and the County's failure to request evidence of this insurance coverage shall not be construed as a waiver of successful Bidder's obligation to provide and maintain the insurance coverage specified.

IV. The enclosed Hold Harmless Agreement shall be signed by the successful Bidder and shall become a part of the contract.

V. Successful Bidder understands and agrees that the County does not waive its immunity and nothing herein shall be interpreted as a waiver of the County's rights, including the limitation of waiver of immunity, as set forth in Florida Statutes 768.28, or any other statutes, and the County expressly reserves these rights to the full extent allowed by law.

VI. No award shall be made until the Procurement Division has received the Certificate of Insurance and Hold Harmless Agreement in accordance with this section.

[Remainder of page intentionally left blank]

BID ATTACHMENT 2, TECHNICAL SPECIFICATIONS

CONTRACT DOCUMENTS

FOR THE CONSTRUCTION OF

NORTH REGIONAL WATER RECLAMATION FACILITY MASTER REUSE WET WEATHER MANAGEMENT WELL SYSTEM PROJECT

PREPARED FOR:

MANATEE COUNTY UTILITIES
MANATEE COUNTY, FL

VOLUME 1 OF 2
SPECIFICATIONS

For Information regarding this project contact:

NIEL POSTLETHWAIT, P.E.
4350 West Cypress Street
Suite #600
Tampa, FL 33607-4178
(813) 281-7749

CH2MHILL

CH2M HILL
Project No. 674077

APRIL 2020

BID DOCUMENTS

MANATEE COUNTY MASTER REUSE WET WEATHER MANAGEMENT WELL SYSTEM PROJECT

(NRWRF INJECTION WELL INFRASTRUCTURE)

SIGNATURE / SEAL SHEET

SECTION	TITLE
01005	GENERAL REQUIREMENTS
01010	SUMMARY OF WORK
01015	CONTROL OF WORK
01016	SAFETY REQUIREMENTS AND PROTECTION OF PROPERTY
01030	SPECIAL PROJECT PROCEDURES
01045	CUTTING AND PATCHING
01050	FIELD ENGINEERING AND SURVEYING
01090	REFERENCE STANDARDS
01150	MEASUREMENT AND PAYMENT
01152	REQUESTS FOR PAYMENT
01153	CHANGE ORDER PROCEDURE
01200	PROJECT MEETINGS
01300	SUBMITTALS
01310	CONSTRUCTION SCHEDULE AND PROJECT RESTRAINTS
01 31 13	PROJECT COORDINATION
01340	SHOP DRAWINGS, PROJECT DATA AND SAMPLES
01370	SCHEDULE OF VALUES
01380	CONSTRUCTION PHOTOGRAPHS
01410	TESTING AND TESTING LABORATORY SERVICES
01 43 33	MANUFACTURERS' FIELD SERVICES
01 45 16.13	CONTRACTOR QUALITY CONTROL
01500	CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS
01510	TEMPORARY AND PERMANENT UTILITIES
01570	TRAFFIC REGULATION
01 57 13	TEMPORARY EROSION AND SEDIMENT CONTROL
01580	PROJECT IDENTIFICATION AND SIGNS
01600	MATERIAL AND EQUIPMENT
01 61 00	COMMON PRODUCT REQUIREMENTS
01620	STORAGE AND PROTECTION
01700	CONTRACT CLOSEOUT
01710	CLEANING
01720	RECORD DOCUMENTS
01730	OPERATING AND MAINTENANCE DATA
01740	WARRANTIES AND BONDS
01 88 15	ANCHORAGE AND BRACING
01 91 14	EQUIPMENT TESTING AND FACILITY STARTUP
09 90 04	PAINTING (CONDENSED)
40 05 15	PIPING SUPPORT SYSTEMS
40 27 00	PROCESS PIPING – GENERAL
40 27 00.01	CEMENT-MORTAR-LINED DUCTILE IRON PIPE AND FITTINGS
40 27 00.08	STAINLESS STEEL PIPE AND FITTINGS – GENERAL SERVICE
40 27 00.10	POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS
40 27 01	PROCESS PIPING SPECIALTIES
40 27 02	PROCESS VALVES AND OPERATORS
40 80 01	PROCESS PIPING LEAKAGE TESTING

Tao Fu

SIGNATURE

12/16/2019

DATE

SEAL:

Expiration Date: 02/28/2021

MANATEE COUNTY MASTER REUSE WET WEATHER MANAGEMENT WELL SYSTEM PROJECT

(NRWRF INJECTION WELL INFRASTRUCTURE)

SIGNATURE / SEAL SHEET

SECTION	TITLE	SECTION	TITLE
03 30 10	STRUCTURAL CONCRETE	05 50 00	METAL FABRICATIONS
03 63 00	CONCRETE DOWELING	05 52 16	ALUMINUM RAILINGS
05 05 19	POST-INSTALLED ANCHORS		

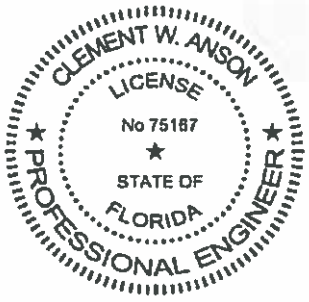
C Clement W

SIGNATURE

12/16/2019

DATE

SEAL:



Expiration Date: 02/21/2021

MANATEE COUNTY MASTER REUSE WET WEATHER MANAGEMENT WELL SYSTEM PROJECT

(NRWRF INJECTION WELL INFRASTRUCTURE)

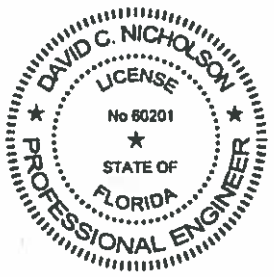
SIGNATURE / SEAL SHEET

SECTION	TITLE	SECTION	TITLE
26 05 02	BASIC ELECTRICAL REQUIREMENTS	26 20 00	LOW-VOLTAGE AC INDUCTION MOTORS
26 05 04	BASIC ELECTRICAL MATERIALS AND METHODS	26 24 16	PANELBOARDS
26 05 05	CONDUCTORS	26 27 26	WIRING DEVICES
26 05 26	GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS	26 43 00	SURGE PROTECTIVE DEVICES
26 05 33	RACEWAYS AND BOXES	26 50 00	LIGHTING
26 05 70	ELECTRICAL SYSTEMS ANALYSIS		
26 08 00	COMMISSIONING OF ELECTRICAL SYSTEMS		

SIGNATURE

12/17/2019
DATE

SEAL:



Expiration Date: 02/28/2021

MANATEE COUNTY MASTER REUSE WET WEATHER MANAGEMENT WELL SYSTEM PROJECT

(NRWRF INJECTION WELL INFRASTRUCTURE)

SIGNATURE / SEAL SHEET

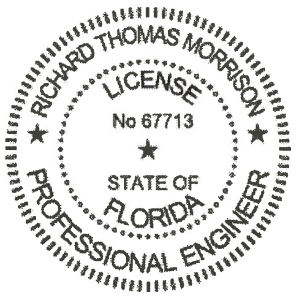
SECTION	TITLE
31 10 00	SITE CLEARING
31 23 13	SUBGRADE PREPARATION
31 23 16	EXCAVATION
31 23 19.01	DEWATERING
31 23 23	FILL AND BACKFILL
31 23 23.15	TRENCH BACKFILL

SECTION	TITLE
31 41 00	SHEETING AND SHORING
32 11 23	AGGREGATE BASE COURSES
32 12 16	ASPHALT PAVING
32 31 13	CHAIN LINK FENCES AND GATES
32 92 00	TURF AND GRASSES

SIGNATURE

12/16/19
DATE

SEAL:



Expiration Date: 12/31/2020

MANATEE COUNTY MASTER REUSE WET WEATHER MANAGEMENT WELL SYSTEM PROJECT

(NRWRF INJECTION WELL INFRASTRUCTURE)

SIGNATURE / SEAL SHEET

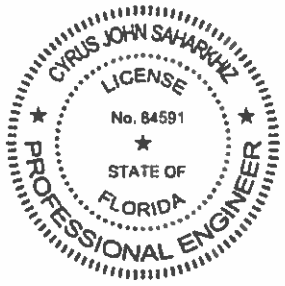
SECTION	TITLE
40 90 00	INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS
40 91 00	INSTRUMENTATION AND CONTROL COMPONENTS
40 95 80	FIBER OPTIC COMMUNICATION SYSTEM

SIGNATURE

12/13/2019

DATE

SEAL:



Expiration Date: 02/28/2021

CONTRACT DOCUMENTS

FOR

Manatee County Master Reuse Wet Weather Management Well System Project

(NRWRF Injection Well Infrastructure)

ELLENTON, FLORIDA

Project Number 6079480

April 2020

(Bid Documents)

DEPARTMENT CONTACT / UTILITIES:

County of Manatee, Florida
c/o Manatee County Procurement Division
1112 Manatee Avenue West
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813-281-7770

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This specification includes by reference the Manatee County Public Works Standards, Part I Utilities Standards Manual approved June 2015.

DRAWINGS (BOUND SEPARATELY)

END OF SECTION

INFRASTRUCTURE ENGINEERING STANDARD SPECIFICATIONS

SECTION 01005
GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE AND INTENT

A. Description: The Work to be done consists of the furnishing of all labor, materials and equipment, and the performance of all work included in this Contract.

B. Work Included:

1. The Contractor shall furnish all labor, superintendence, materials, plant, He shall perform and complete the Work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the County, and in strict accordance with the Contract Documents. The Contractor shall clean up the Work and maintain it during and after construction, until accepted, and shall do all work and pay all incidental costs. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the Work.
2. The cost of incidental work described in these General Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the Work and shall be included in the prices for the various Contract Items. No additional payment will be made.
3. The Contractor shall be solely responsible for the adequacy of his workmanship, materials and equipment.
4. The County uses e-Builder to track submittals and pay requests. Contractor shall initiate submittals and pay requests into e-Builder as directed by the County.

C. Public Utility Installations and Structures:

1. Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto.
2. The Contractor shall protect all installations and structures from damage during the work. Access across any buried public utility installation or structure shall be made only in such locations and by means approved by the County. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities damaged by the Contractor which are shown on the Drawings or have been located in the field by the utility shall be repaired by the Contractor, at his expense, as approved by the County. No separate payment shall be made for such protection or repairs to public utility installations or structures.

3. Public utility installations or structures owned or controlled by the County or other governmental body, which are required by this contract to be removed, relocated, replaced or rebuilt by the Contractor not identified in any separate bid item shall be considered as a part of the general cost of doing the Work and shall be included in the prices bid for the various contract items. No separate payment shall be made.
4. Where public utility installations or structures owned or controlled by the County or other governmental body are encountered during the course of the work, and are not indicated on the Drawings or in the Specifications, and when, in the opinion of the County, removal, relocation, replacement or rebuilding is necessary to complete the work under this Contract, such work shall be accomplished by the utility having jurisdiction, or such work may be ordered, in writing by the County, for the contractor to accomplish. If such work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such work is accomplished by the Contractor, it will be in accordance with the General and Supplemental General Conditions.
5. The Contractor shall give written notice to County and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight (48) hours in advance of breaking ground in any area or on any unit of the work. This can be accomplished by making the appropriate contact with the "Sunshine State One-Call of Florida, Inc.," Sunshine811 (sunshine811.com or Call 811) and per all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).
6. The maintenance, repair, removal, relocation or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the County.

1.02 DRAWINGS AND SPECIFICATIONS

A. Drawings: When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions, and large-scale drawings in preference to small-scale drawings.

B. Copies Furnished to Contractor: The Contractor shall furnish each of the subcontractors, manufacturers, and material men such copies of the Contract Documents as may be required for their work. Additional copies of the Drawings and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

C. Supplementary Drawings: When, in the opinion of the County, it becomes necessary to explain more fully the work to be done or to illustrate the work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared by the County and five paper prints thereof will be given to the Contractor.

D. Contractor to Check Plans and Data: The Contractor shall verify all dimensions, quantities and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications or other data received from the County, and shall notify him of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction or improper operation resulting therefrom nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the County, should such errors or omissions be discovered. All schedules are given for the convenience of the County and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quality of materials and equipment included in work to be done under the Contract.

E. Specifications: The Technical Specifications consist of three parts: General, Products and Execution. The General Section (or Scope) contains General Requirements which govern the Work. Products (or Materials and Equipment) and Execution (or Workmanship) modify and supplement these by detailed requirements for the Work and shall always govern whenever there appears to be a conflict.

F. Intent:

1. All work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described.
2. The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.
3. The inclusion of the Related Requirements (or work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor, and shall not be interpreted as a complete list of related Specification sections.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer:

1. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the County, that the manufacturer or subcontractor deal directly with the County. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.
2. Any two or more pieces or material or equipment of the same kind, type or classification, and being used for identical types of services, shall be made by the same manufacturer.

B. Delivery: The Contractor shall deliver materials in ample quantities to insure the most speedy and uninterrupted progress of the work so as to complete the work within the allotted time. The Contractor shall also coordinate deliveries in order to avoid delay in, or impediment of, the progress of the work of any related Contractor.

C. Tools and Accessories:

1. The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind or size of equipment, one complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.
2. Spare parts shall be furnished as specified.
3. Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight and principal rating data.

D. Installation of Equipment:

1. The Contractor shall have on hand sufficient proper equipment and machinery of ample capacity to facilitate the Work and to handle all emergencies normally encountered in work of this character.
2. Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Drawings, unless directed otherwise by the County during installation. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

3. The Contractor shall furnish, install and protect all necessary anchor and attachment bolts and all other appurtenances needed for the installation of the devices included in the equipment specified. Anchor bolts shall be as approved by the County and made of ample size and strength for the purpose intended. Substantial templates and working drawings for installation shall be furnished.
4. The Contractor shall furnish all materials and labor for, and shall properly bed in non-shrink grout, each piece of equipment on its supporting base that rests on masonry foundations.
5. Grout shall completely fill the space between the equipment base and the foundation. All metal surfaces coming in contact with concrete or grout shall receive a coat of coal tar epoxy equal to Koppers 300 M or provide a 1/32-inch Neoprene gasket between the metal surface and the concrete or grout.

E. Service of Manufacturer's Engineer: The Contract prices for equipment shall include the cost of furnishing (as required by equipment specifications sections) a competent and experienced engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test and place in operation the equipment in conformity with the Contract Documents. After the equipment is placed in permanent operation by the County, such engineer or superintendent shall make all adjustments and tests required by the County to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the County in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General:

1. Inspection and testing of materials will be performed by the County unless otherwise specified.
2. For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Three copies of the reports shall be submitted and authoritative certification thereof must be furnished to the County as a prerequisite for the acceptance of any material or equipment.
3. If, in the making of any test of any material or equipment, it is ascertained by the County that the material or equipment does not comply with the Contract, the Contractor will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the work and replace it with acceptable material, without cost to the County.

4. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.
5. The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the County formally takes over the operation thereof.

B. Costs:

1. All inspection and testing of materials furnished under this Contract will be performed by the County or duly authorized inspection engineers or inspections bureaus without cost to the Contractor, unless otherwise expressly specified.
2. The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor and such costs shall be deemed to be included in the Contract price.
3. Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the County for compliance. The Contractor shall reimburse the County for the expenditures incurred in making such tests on materials and equipment which are rejected for non-compliance.

C. Inspections of Materials: The Contractor shall give notice in writing to the County, at least 2 weeks in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain a request for inspection, the date of commencement and the expected date of completion of the manufacture of preparation of materials. Upon receipt of such notice, the County will arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials or he will notify the Contractor that the inspection will be made at a point other than the point of manufacture, or he will notify the Contractor that inspection will be waived. The Contractor must comply with these provisions before shipping any material. Such inspection shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

D. Certificate of Manufacture: When inspection is waived or when the County so requires, the Contractor shall furnish to him authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the work have been manufactured and tested in conformity with the Contract Documents. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

E. Shop Tests of Operating Equipment:

1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the Work until the County notifies the Contractor, in writing, that the results of such tests are acceptable.
2. The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

F. Preliminary Field Tests: As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make preliminary field tests of equipment. If the preliminary field tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, prior to the acceptance tests, make all changes, adjustments and replacements required. The furnishing Contractor shall assist in the preliminary field tests as applicable.

G. Final Field Tests:

1. Upon completion of the work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance tests as specified or required to prove compliance with the Contract Documents.
2. The Contractor shall furnish labor, fuel, energy, water and all other materials, equipment and instruments necessary for all acceptance tests, at no additional cost to the County. The Supplier shall assist in the final field tests as applicable.

H. Failure of Tests:

1. Any defects in the materials and equipment or their failure to meet the tests, guarantees or requirements of the Contract Documents shall be promptly corrected by the Contractor. The decision of the County as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to make these corrections or if the improved materials and equipment, when tested, shall again fail to meet the guarantees of specified requirements, the County, notwithstanding its partial payment for work, and materials and equipment, may reject the materials and equipment and may order the Contractor to remove them from the site at his own expense.

2. In case the County rejects any materials and equipment, then the Contractor shall replace the rejected materials and equipment within a reasonable time. If he fails to do so, the County may, after the expiration of a period of 30 calendar days after giving him notice in writing, proceed to replace such rejected materials and equipment, and the cost thereof shall be deducted from any compensation due or which may become due the Contractor under his Contract.

I. Final Inspection: During such final inspections, the Work shall be clean and free from water. In no case will the final pay application be prepared until the Contractor has complied with all requirements set forth and the County has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Document.

1.05 TEMPORARY STRUCTURES

A. Temporary Fences: If, during the course of the Work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall, at his own expense, if so ordered by the County, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The County shall be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.

1.06 SAFETY

A. Safety: The Contractor shall comply with safety requirements in accordance with Section 01016, Safety Requirements and Protection of Property.

B. First Aid: The Contractor shall keep upon the Site, at each location where work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when people are employed on the Work.

1.07 LINES AND GRADES

A. Grade: All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings, or as given by the County. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

B. Safeguarding Marks:

1. The Contractor shall safeguard all points, stakes, grade marks, monuments and bench marks made or established on the Work, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or removing without authorization such established points, stakes and marks.

2. The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the Work and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.

C. Datum Plane: All elevations indicated or specified refer to the Mean Sea Level Datum of the NGVD 1929 Datum and/or NAVD 1988 – as indicated on the Drawings.

1.08 ADJACENT STRUCTURES AND LANDSCAPING

A. Responsibility:

1. The Contractor shall also be entirely responsible and liable for all damage or injury as a result of his operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the Work. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the Work, whether or not shown on the Drawings, and the removal, relocation and reconstruction of such items called for on the Drawings or specified shall be included in the various Contract Items and no separate payments will be made therefore. Where such public and private property, structures of any kind and appurtenances thereto are not shown on the Drawings and when, in the opinion of the County, additional work is deemed necessary to avoid interference with the Work, payment therefore will be made as provided for in the General Conditions.
2. Contractor is expressly advised that the protection of buildings, structures, tunnels, tanks, pipelines, etc. and related work adjacent and in the vicinity of his operations, wherever they may be, is solely his responsibility. Conditional inspection of buildings or structures in the immediate vicinity of the project which may reasonably be expected to be affected by the Work shall be performed by and be the responsibility of the Contractor.
3. Contractor shall, before starting operations, make an examination of the interior and exterior of the adjacent structures, buildings, facilities, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the County. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be given to the County.
4. Prior to the beginning of any excavations, the Contractor shall advise the County of all buildings or structures on which he intends to perform work or which performance of the project work will affect.

B. Protection of Trees:

1. All trees and shrubs shall be adequately protected by the Contractor with boxes and otherwise and in accordance with ordinances governing the protection of trees. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age, at the proper season and at the sole expense of the Contractor.
2. Beneath trees or other surface structures, where possible, pipelines may be built in short tunnels, backfilled with excavated materials, except as otherwise specified, or the trees or structures carefully supported and protected from damage.
3. The County may order the Contractor, for the convenience of the County, to remove trees along the line or trench excavation. If so ordered, the County will obtain any permits required for removal of trees. Such tree removal ordered shall be paid for under the appropriate Contract Items.

C. Lawn Areas: Lawn areas shall be left in as good condition as before the starting of the Work. Where sod is to be removed, it shall be carefully removed, and later replaced, or the area where sod has been removed shall be restored with new sod.

D. Restoration of Fences: Any fence, or part thereof, that is damaged or removed during the course of the Work shall be replaced or repaired by the Contractor and shall be left in as good a condition as before the starting of the Work. The manner in which the fence is repaired or replaced and the materials used in such work shall be subject to the approval of the County. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate Contract Item or items, or if no specific Item is provided therefore, as part of the overhead cost of the Work, and no additional payment will be made therefore.

1.09 PROTECTION OF WORK AND PUBLIC

A. Barriers and Lights: During the prosecution of the Work, the Contractor shall put up and maintain at all times such barriers and lights as will effectually prevent accidents. The Contractor shall provide suitable barricades, red lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the work causes obstructions to the normal traffic or constitutes in any way a hazard to the public, in accordance with state and local requirements.

B. Smoke Prevention: A strict compliance with ordinances regulating the production and emission of smoke will be required. No open fires will be permitted.

C. Noise: The Contractor shall eliminate noise to as great an extent as practicable at all times. Air compressing plants shall be equipped with silencers and the exhaust of all engines or other power equipment shall be provided with mufflers. In the vicinity of hospitals and schools, special care shall be used to avoid noise or other nuisances. The Contractor shall strictly observe all local regulations and ordinances covering noise control.

D. Access to Public Services: Neither the materials excavated nor the materials or plant used in the construction of the Work shall be so placed as to prevent free access to all fire hydrants, valves or manholes.

E. Dust prevention: The Contractor shall prevent dust nuisance from his operations or from traffic by keeping the roads and/or construction areas sprinkled with water at all times.

1.10 CUTTING AND PATCHING

A. The Contractor shall do all cutting, fitting or patching of his portion of the work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the County and in accordance with the Drawings and Specifications. The Work must be done by competent workmen skilled in the trade required by the restoration.

1.11 CLEANING

A. During Construction: During construction of the Work, the Contractor shall, at all times, keep the Site of the Work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the Site if, in the opinion of the County, such material, debris, or rubbish constitutes a nuisance or is objectionable. The Contractor shall remove from the Site all of his surplus materials and temporary structures when no further need therefore develops.

B. Final Cleaning:

1. At the conclusion of the Work, all equipment, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and he shall remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.
2. The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver such materials and equipment undamaged in a bright, clean, polished and new operating condition.

1.12 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, excessive noise or dust.

B. Sound levels must meet Manatee County Ordinance No. 87-34, (which amends Ordinance 81-3, The Manatee County Noise Control Ordinance). Sound levels in excess of such ordinance are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the County for excessive noise shall not relieve the Contractor of the other portions of this specification. Contractor may be required, at their own expense, to furnish all diesel driven equipment with hospital rated noise suppression mufflers.

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

1.13 MISCELLANEOUS

A. Protection against Siltation and Bank Erosion:

1. The Contractor shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed water courses and drainage ditches.
2. The Contractor, at his own expense, shall remove any siltation deposits and correct any erosion problems as directed by the County which results from his construction operations.

B. Protection of Wetland Areas: The Contractor shall properly dispose of all surplus material, including soil, in accordance with Local, State and Federal regulations. Under no circumstances shall surplus material be disposed of in wetland areas as defined by the Florida Department of Environmental Protection or Southwest Florida Water Management District.

C. Existing Facilities: The work shall be so conducted to maintain existing facilities in operation insofar as is possible. Requirements and schedules of operations for maintaining existing facilities in service during construction shall be as described in the Special Provisions.

D. Use of Chemicals: All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01010
SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS/REQUIREMENTS INCLUDED

A. The work included in this contract consists of constructing the following:

1. Reclaimed water pipeline installed by open-cut construction methods consisting of 16-inch and 12-inch ductile iron pipe including valves, joint restraint, protection of existing utilities, and restoration of gravel and pavement roadway surfaces.
2. Drain pipelines installed by open-cut construction methods consisting of 2-inch PVC pressure pipe including restoration of grassed, gravel, and pavement roadway surfaces.
3. Furnishing and installing new aboveground ductile iron and stainless-steel flanged wellhead piping for two existing injection wells. Piping and piping accessories include fittings, valves, basket strainer, pipe supports, and concrete base pad.
4. Furnishing and installing new aboveground stainless-steel wellhead piping for sampling and conveying water purged from three existing monitor wells. One well has been constructed as a dual-zone monitor well. Piping and piping accessories include fittings, valves, pipe supports, and concrete base pad.
5. Furnishing and installing four submersible type 5 hp sample pumps of stainless-steel construction.
6. Furnishing and installing of chain link fencing with gates and corner posts.
7. Furnishing and installing flow meter, pressure transducers, differential pressure transducers, and water level measurement instrumentation at each well.
8. Furnishing and installing electrical panels, control panels, motorized valve actuators, conduit, and wiring at each well site.
9. Concrete incased duct banks to include electrical power, control, and fiber optic wiring between each well and existing facilities within the plant.
10. SCADA and programming modifications to integrate the new control and instrumentation features into the plant's existing system.

B. The Contractor shall furnish all Shop Drawings, working drawings, Record Drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all work required by these Specifications and as shown on the Contract Drawings.

C. The Contractor shall perform the work complete, in place and ready for continuous service and shall include any repairs, replacements, and/or restoration required as a result of damages caused prior to acceptance by the County.

D. The Contractor shall furnish and install all materials, equipment and labor which is reasonably and properly inferable and necessary for the proper completion of the work, whether specifically indicated in the Contract Documents or not.

1.02 CONTRACTS

A. Construct all the Work under a single contract.

1.03 WORK SEQUENCE

A. All work done under this Contract shall be done with a minimum of inconvenience to the operation of the County's North Regional Water Reclamation Facility (NRWRF).

B. The methods, means, sequences and techniques used for construction of the Work is the sole responsibility of the Contractor.

C. The Contractor shall construct the work in stages to accommodate the County's use of the premises during the construction period.

1. Construction schedule developed by the Contractor shall have IW-1 receiving reclaimed water from the existing 20-inch reclaimed watermain within 160 days of the Notice to Proceed.
2. Construction schedule developed by the Contractor shall have all monitor wells able to be purged and sampled prior to IW-1 receiving reclaimed water.

D. The Contractor shall coordinate the construction schedule and operations with the County's Representative; and if overtime work is required, reimburse the County for the costs incurred as a result of the overtime work.

E. The Contractor shall not close off access to any part of the NRWRF facilities. Construction of alternative access shall be considered as part of the overall cost of the Work, and no additional payment will be made for the construction, and subsequent removal, of alternative access.

1.04 CONSTRUCTION AREAS

A. The Work of this Project is to take place within NRWRF site owned by Manatee County. The Contractor shall not conduct work or storage activities outside the areas designated by the County's representative without prior written approval.

B. The Contractor shall:

1. Limit his use of the construction areas for work and for storage, to allow for:
   a. Work by other contractors.
   b. County's use.
2. Coordinate use of work site under direction of County's Representative.
3. Assume full responsibility for the protection and safekeeping of products under this Contract stored on the Site.
4. Move any stored products under the Contractor's control that interfere with operations and use of the property by the County, or separate contractor.

1.05 COUNTY OCCUPANCY

A. It is assumed that portions of the Work will be completed prior to completion of the entire Work. If the County, at its sole discretion, desires to accept a portion of the constructed facilities after successful testing , the Contractor will be issued a dated certificate of completion and acceptance for constructed facilities being accepted. The County will assume ownership and begin operation of the described facility on that date and the three-year guaranty period shall commence on that date. The County has the option of not accepting any portion of WORK until the entire Work as a whole is completed, tested and approved by the County.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01015
CONTROL OF WORK

PART 1 GENERAL

1.01 WORK PROGRESS

A. The Contractor shall furnish personnel and equipment which will be efficient, appropriate and adequately sized to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated in the Contract. If at any time such personnel appears to the County to be inefficient, inappropriate, or insufficient for securing the quality of work required for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the personnel and equipment and the Contractor shall conform to such order. Failure of the County to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.02 PRIVATE LAND

A. The Contractor shall not enter or occupy private land outside of easements, except by permission of the affected property owner.

1.03 WORK LOCATIONS

A. Work shall be located substantially as indicated on the drawings, but the County reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons.

1.04 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the County may require special construction procedures such as limiting the length of open trench, prohibiting stacking excavated material in the street and requiring that the trench shall not remain open overnight.

B. The Contractor shall take precautions to prevent injury to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be barricaded and well lighted at all times when construction is not in progress.

1.05 DISTRIBUTION SYSTEMS AND SERVICES

A. The Contractor shall avoid interruptions to water, telephone, cable TV, sewer, gas, or other related utility services. He shall notify the County and the appropriate agency well in advance of any requirement for dewatering, isolating, or relocating a section of a utility, so that necessary arrangements may be made.

B. If it appears that utility service will be interrupted for an extended period, the County may order the Contractor to provide temporary service lines at the Contractor's expense. Inconvenience of the users shall be kept to the minimum, consistent with existing conditions. The safety and integrity of the systems are of prime importance in scheduling work.

1.06 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

A. The Contractor shall assume full responsibility for the protection of all buildings, structures and utilities, public or private, including poles, signs, services to building utilities, gas pipes, water pipes, hydrants, sewers, drains and electric and telephone cables and other similar facilities, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operation shall be repaired by the Contractor at his expense.

B. The Contractor shall bear full responsibility for obtaining locations of all underground structures and utilities (including existing water services, drain lines and sewers). Services to buildings shall be maintained and all costs or charges resulting from damage thereto shall be paid by the Contractor.

C. Protection and temporary removal and replacement of existing utilities and structures as described in this section shall be a part of the Work under the Contract and all costs in connection therewith shall be included in the unit prices established in the Bid.

D. If, in the opinion of the County, permanent relocation of a utility owned by the County is required, he may direct the Contractor, in writing, to perform the Work. Work so ordered will be paid for at the Contract unit prices, if applicable, or as extra work as classified in the General Conditions. If relocation of a privately owned utility is required, the County will notify the utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the County and utility and shall have no claim for delay due to such relocation. The Contractor shall notify public utility companies in writing at least 48 hours (excluding Saturdays, Sundays and legal holidays) before excavating near their utilities.

1.07 TEST PITS

A. Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor immediately after the utility location and the surface shall be restored in a manner equal or better than the original condition. No separate payment will be made.

1.08 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the Work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition equal or better to that existing before the damage was done, or he shall make good the damage in another manner acceptable to the County.

B. All sidewalks which are disturbed by the Contractor's operations shall be restored to their original or better condition by the use of similar or comparable materials. All curbing shall be restored in a condition equal to the original construction and in accordance with the best modern practice.

C. Along the location of this work, all fences, walks, bushes, trees, shrubbery and other physical features shall be protected and restored in a thoroughly workmanlike manner unless otherwise shown on the drawings. Fences and other features removed by the Contractor shall be replaced in the location indicated by the County as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be regraded and sodded to equal or exceed original conditions.

D. Trees close to the work which drawings do not specify to be removed, shall be boxed or otherwise protected against injury. The Contractor shall trim all branches that are liable to damage because of his operations, but in no case shall any tree be cut or removed without prior notification to the County. All injuries to bark, trunk, limbs and roots of trees shall be repaired by dressing, cutting and painting according to approved methods, using only approved tools and materials.

E. The protection, removal and replacement of existing physical features along the line of work shall be a part of the work under the Contract and all costs in connection therewith shall be included in the unit and/or lump sum prices established under the items in the Bid.

1.09 MAINTENANCE OF TRAFFIC

A. Open pits, trenches, unpaved streets, debris, or other obstructions due to construction that will prevent the normal flow of traffic during an extended construction stoppage, for any reason, shall be minimized. In the event an extended construction stoppage is found to be necessary, Contractor shall, at his own expense, provide normal traffic flow during extended construction stoppage. Extended stoppage will be defined by the County.

B. All excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary roadways, erect wheel guards or fences, or take other safety measures which are satisfactory to the County.

C. Any changes to the traffic pattern require a traffic control plan as detailed in Section 01570, Traffic Regulation of this Specification.

1.10 WATER FOR CONSTRUCTION PURPOSES

A. In locations where public water supply is available, the Contractor may purchase water for all construction purposes.

B. The Contractor shall be responsible for paying for all water tap fees incurred for the purpose of obtaining a potable water service or temporary use meter.

1.11 MAINTENANCE OF FLOW

A. The Contractor shall at his own cost, provide for the flow of sewers, drains and water courses interrupted during the progress of the Work and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the County well in advance of the interruption of any flow.

1.12 CLEANUP

A. During the course of the Work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction work and at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the work in a neat and orderly condition.

1.13 COOPERATION WITHIN THIS CONTRACT

A. All firms or person authorized to perform any work under this Contract shall cooperate with the General Contractor and his subcontractors or trades and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the County.

1.14 PROTECTION OF CONSTRUCTION AND EQUIPMENT

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

B. All structures shall be protected in a manner approved by the County. Should any of the floors, slabs, pavements or other parts of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor, at his own expense and to the satisfaction of the County. If, in the final inspection of the work, any defects, faults, or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the warranty period described in the Contract.

C. Further, the Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the County.

1.15 CONSTRUCTION WITHIN RIGHT-OF-WAY

A. Where pipe lines are installed within FDOT right-of-way, all excavation backfill and compaction for the purpose of reconstructing roadways and/or adjacent slopes contiguous thereto shall be in accordance with FDOT or Manatee County Standards and Specifications, whichever is applicable. Contractor shall satisfy the authorized representative of the FDOT with respect to proper safety procedures, construction methods, required permitting, etc., within the FDOT right-of-way.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01016
SAFETY REQUIREMENTS AND PROTECTION OF PROPERTY

PART 1 GENERAL

1.01 WORK INCLUDED

A. All Work completed by Contractor shall be accomplished in accordance with Contractor's submitted Site Health and Safety Plan and in accordance with Owner's Corporate and Site-Specific Health and Safety compliance requirements.

PART 2 PRODUCTS

2.01 GENERAL

A. Contractor agrees that each employee, while on the project site, shall wear the protective clothing and use all equipment specified in Contractor's Site Health and Safety Plan. These requirements shall apply continuously.

PART 3 EXECUTION

3.01 WORKMANSHIP

A. Contractor shall comply with its own Site Health and Safety Plan for the health and safety of persons and property in the vicinity of the Work area. All Work shall be performed in accordance with the Site Health and Safety Plan. Noncompliance by Contractor or its personnel with the Site Health and Safety Plan is grounds for a stop work order or dismissal of Contractor with payment only for the Work completed.

B. Contractor shall develop and maintain, for the duration of this contract, a safety program that will effectively implement all required safety provisions. Contractor shall appoint an employee qualified to supervise and enforce compliance with the safety program. Contractor, as a part of its safety program, shall maintain at the jobsite, safety equipment applicable to the Work, including articles necessary for administering first-aid to the injured, and shall establish a procedure for the immediate removal to a hospital or a doctor's care of any person (including Contractor's employee) who may be injured on the jobsite.

C. The duty of Engineer to conduct review of Contractor's performance is not intended to include a review or approval of the adequacy of Contractor's health and safety supervisor, the Health and Safety Program, or any safety measures taken in, on, or near the site.

D. Contractor shall be familiar with and comply with all applicable safety codes, ordinances, and statutes, and bear sole responsibility for the penalties imposed for noncompliance.

E. Contractor shall submit the name, address, and phone number of a responsible individual or individuals who will be available on a 24-hour basis to handle all emergency problems in connection with this project. Engineer and authorized government agents, and their representatives, shall at all times be provided safe access to the Work wherever it is in progress, and Contractor shall provide facilities for such access and for inspection.

F. Contractor shall do all work necessary to protect the general public from hazards including, but not limited to, open boreholes, water sumps, and trenches or excavation. Barricades, lanterns, and proper signs shall be furnished in sufficient amount to safeguard the public and the Work.

PART 4 PAYMENT

4.01 GENERAL

A. Payment for all work, materials, and equipment specified in this section will be at the unit price lump sum stated in Contractor's Unit Price Bid Schedule for Mobilization (Pay Item Nos. I-1, II-1, III-1, IV-1, V-1, VI-1 and VII-1). All other Work specified in this Section shall be considered incidental to the project cost and expenses, and shall be included as part of Contractor's Bid.

END OF SECTION

SECTION 01030
SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 PERMITS

A. Upon notice of award, the Contractor shall immediately apply for all applicable permits not previously obtained by the County to do the Work from the appropriate governmental agency or agencies. No work shall commence until all applicable permits have been obtained and copies delivered to the County. The costs for obtaining all permits shall be borne by the Contractor.

B. The Contractor shall apply for an NPDES Stormwater Construction Generic Permit. Before commencement of the work, the Contractor shall file a "Notice of Intent to Use Generic Permit for Stormwater Discharge from Large and Small Construction Activities", DEP Form 62-621.300(4)(b). Upon termination of the work, the Contractor shall file for a Notice of Termination (DEP Form 62-621.300(6)) to end permit coverage. Associated costs and permit fees shall be borne by the Contractor.

1.02 CONNECTIONS TO EXISTING SYSTEM

A. The Contractor shall perform all work necessary to locate, excavate and prepare for connections to the existing systems all as shown on the Drawings or where directed by the County. The cost for this work and for the actual connection shall be included in the price bid for the project and shall not result in any additional cost to the County. The termination point for each contract shall be as shown on the Contract Drawings.

1.03 RELOCATIONS

A. The Contractor shall be responsible for the coordination of the relocation of structures, including but not limited to light poles, power poles, signs, sign poles, fences, piping, conduits and drains that interfere with the positioning of the Work as set out on the Drawings. No relocation of the items under this Contract shall be done without approval from the County.

1.04 EXISTING UNDERGROUND PIPING, STRUCTURES AND UTILITIES

A. The attention of the Contractor is drawn to the fact that during excavation, the possibility exists of the Contractor encountering various utility lines not shown on the Drawings. The Contractor shall exercise extreme care before and during excavation to locate and flag these lines as to avoid damage to the existing lines.

B. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be endangered by the close proximity of excavation, are temporarily stayed in position while work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice.

C. The existing utility locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered. The Contractor shall be responsible for notifying the various utility companies to locate their respective utilities in advance of construction in conformance with all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

D. The existing piping and utilities that interfere with new construction shall be rerouted as shown, specified, or required. Before any piping and utilities not shown on the Drawings are disturbed, the Contractor shall notify the County and shall provide suggestions on how best to resolve the issue.

E. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities which do not interfere with complete work shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the County.

F. It is intended that wherever existing utilities such as water, sewer, gas, telephone, electrical, or other service lines must be crossed, deflection of the pipe within recommended limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated in the Drawings. However, when in the opinion of the County this procedure is not feasible, he may direct the use of fittings for utilities crossing as detailed on the Drawings. No deflections will be allowed in gravity sanitary sewer lines or in existing storm sewer lines.

1.05 SUSPENSION OF WORK DUE TO WEATHER

A. Refer to FDOT Standards and Specifications Book, Section 8.

1.06 HURRICANE PREPAREDNESS PLAN

A. Within 30 days of the date of Notice to Proceed, the Contractor shall submit to the County a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the County in case of a hurricane warning.

B. In the event of inclement weather, or whenever County shall direct, Contractor shall insure that he and his Subcontractors shall carefully protect work and materials against damage or injury from the weather. If, in the opinion of the

County, any portion of work or materials is damaged due to the failure on the part of the Contractor or Subcontractors to protect the Work, such work and materials shall be removed and replaced at the expense of the Contractor.

1.07 POWER SUPPLY

A. Electricity as may be required for construction and permanent power supply shall be secured and purchased by the Contractor.

1.08 SALVAGE

A. Any existing equipment or material, including, but not limited to, valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction under this project may be designated as salvage by the County and if so shall be protected for a reasonable time until picked up by the County. Any equipment or material not worthy of salvaging, as directed by the County, shall be disposed of by the Contractor at no additional cost.

1.09 DEWATERING

A. The Contractor shall do all groundwater pumping necessary to prevent flotation of any part of the Work during construction operations with his own equipment.

B. The Contractor shall pump out water and wastewater which may seep or leak into the excavations for the duration of the Contract and with his own equipment. He shall dispose of this water in an appropriate manner.

1.10 ADDITIONAL PROVISIONS

A. Before commencing work on any of the existing pipelines, structures or equipment, the Contractor shall notify the County, in writing, at least 10 calendar days in advance of the date he proposes to commence such work.

B. The Contractor shall provide, at his own expense, all necessary temporary facilities for access to and for protection of, all existing facilities. The County's personnel must have ready access at all times to the existing facilities. The Contractor is responsible for all damage to existing structures, equipment and facilities caused by his construction operations and must repair all such damage when and as ordered by the County.

1.11 CONSTRUCTION CONDITIONS

A. The Contractor shall strictly adhere to the specific requirements of the governmental unit(s) and/or agency(ies) having jurisdiction over the Work. Wherever there is a difference in the requirements of a jurisdictional body and these Specifications, the more stringent shall apply.

1.12 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, excessive noise or dust.

B. Sound levels must meet Manatee County Ordinance No. 87-34, (which amends Ordinance No. 81-3), The Manatee County Noise Control Ordinance). Sound levels in excess of such ordinance are sufficient cause to have the Work halted until equipment can be quieted to these levels. Work stoppage by the County for excessive noise shall not relieve the Contractor of the other portions of this specification.

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

1.13 WARRANTIES

A. All material supplied under these Specifications shall be warranted by the Contractor and the manufacturers for a period of 3 years. Warranty period shall commence on the date of County acceptance.

B. The material shall be warranted to be free from defects in workmanship, design and materials. If any part of the system should fail during the warranty period, it shall be replaced at no expense to the County. All material and installation costs shall be 100 percent borne by the Contractor.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. The Contractor shall be responsible for obtaining warranties from each of the respective suppliers or manufacturers for all the material specified under these contract specifications,

D. In the event that the manufacturer is unwilling to provide a 3-year warranty commencing at the time of County acceptance, the Contractor shall obtain from the manufacturer a 4-year warranty starting at the time of equipment delivery to the job site. This 4-year warranty shall not relieve the Contractor of the 3-year warranty starting at the time of County acceptance of the equipment.

1.14 FUEL STORAGE & FILLING

A. If the contractor is storing fuel on site, or doing his own fuel filling of portable equipment (other than hand-held equipment), he is responsible for any required response, clean-up or reporting required, at no additional cost to the county.

B. The Contractor shall prepare and submit a fuel storage/spill abatement plan prior to start of construction if required.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01045
CUTTING AND PATCHING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for all cutting, fitting and patching, including excavation and backfill, required to complete the Work or to:

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

PART 2 PRODUCTS

2.01 MATERIALS

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

PART 3 EXECUTION

3.01 INSPECTION

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

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

C. Report unsatisfactory or questionable conditions to County. Do not proceed with work until County has provided further instructions.

3.02 PREPARATION

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

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

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

3.03 PERFORMANCE

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

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

C. Fit and adjust products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

D. Restore work which has been cut or removed; install new products to provide completed work in accordance with the requirements of the Contract Documents.

E. Replace surfaces airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

F. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.

END OF SECTION

SECTION 01050
FIELD ENGINEERING AND SURVEYING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall provide and pay for field surveying service required for the Project.

B. The Contractor shall furnish and set all necessary stakes to establish the lines and grades as shown on the Contract Drawings and layout each portion of the Work of the Contract.

C. Record Drawings shall report all elevations based on NAVD88 datum and provide conversion between NGVD29 and NAVD88 datum.

1.02 QUALIFICATION OF SURVEYOR AND ENGINEER

A. All construction staking shall be conducted by or under the supervision of a Florida Registered Professional Surveyor and Mapper. The Contractor shall be responsible for the layout of all such lines and grades, which will be subject to verification by the County.

1.03 SURVEY REFERENCE POINTS

A. Existing basic horizontal and vertical control points for the Project are designated on the Contract Drawings. If control points are not designated on the Drawings, the Contractor shall include establishing suitable control points for the Work to be performed as part of the field surveying services provided.

B. Locate and protect all survey monumentation, property corners and project control points prior to starting work and preserve all permanent reference points during construction. All costs associated with the replacement of all survey monumentation, property corners and project control points shall be borne by the Contractor.

C. Make no changes or relocations without prior written notice to County.

D. Report to County when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

E. Require surveyor to replace project control points which may be lost or destroyed.

F. Establish replacements based on original survey control.

1.04 PROJECT SURVEY REQUIREMENTS

A. The Contractor shall establish temporary bench marks as needed, referenced to data established by survey control points.

B. The Contractor shall establish in the field the limits of the easements within which the pipelines and structures of the project are to be constructed.

C. The Contractor shall establish in the field a stationed survey baseline for horizontal control along pipeline routes in accordance with the reference information provided with the Contract Documents. The baseline established shall be used to reference constructed locations of the various elements of the Work that are to be shown in the project Record Drawings. The survey baseline established by the Contractor for horizontal control of the Work shall be sufficiently described in the project Record Drawings to allow the baseline to be re-established by others in the field at a future date.

1.05 RECORDS

A. The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare Record Drawings per Section 01720.

1.06 SUBMITTALS

A. A legal description of the well locations by metes and bounds and a detailed sketch of the parcel that shows the location of all injection and monitoring wells. The locations shall be measured by a Florida certified land surveyor, and shall contain the surveyor's signature, registration number, official seal, and the following statement: "I hereby certify that this survey was made under my responsible direction and supervision, and is a correct representation of the land surveyed."

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01090
REFERENCE STANDARDS

PART 1 GENERAL

1.01 REQUIREMENTS

A. Abbreviations and acronyms used in Contract Documents to identify reference standards.

B. Application: When a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes established stricter standards.

C. Publication Date: The most recent publication in effect on the date of issue of Contract Documents, except when a specific publication date is specified.

1.02 ABBREVIATIONS, NAMES AND ADDRESSES OR ORGANIZATIONS

A. Obtain copies of reference standards direct from publication source, when needed for proper performance of work, or when required for submittal by Contract Documents.

AA	Aluminum Association 818 Connecticut Avenue, N.W. Washington, DC 20006
AASHTO	American Association of State Highway and Transportation Officials 444 North Capital Street, N.W. Washington, DC 20001
ACI	American Concrete Institute Box 19150 Reford Station Detroit, MI 48219
AI	Asphalt Institute Asphalt Institute Building College Park, MD 20740
AISC	American Institute of Steel Construction 1221 Avenue of the Americas New York, NY 10020

AISI	American Iron and Steel Institute 1000 16th Street N.W. Washington, DC 20036
ANSI	American National Standards Institute 1430 Broadway New York, NY 10018
ASHRAE	American Society of Heating, Refrigerating and Air Conditioning Engineers 179l Tullie Circle, N.E. Atlanta, GA 30329
ASME	American Society of Mechanical Engineers 345 East 47th Street New York, NY 10017
ASTM	American Society for Testing and Materials 1916 Race Street Philadelphia, PA 19103
AWWA	American Water Works Association 6666 West Quincy Avenue Denver, CO 80235
AWS	American Welding Society 2501 N.W. 7th Street Miami, FL 33125
CRSI	Concrete Reinforcing Steel Institute 180 North LaSalle Street, Suite 2110 Chicago, IL 60601
FDEP	Florida Department of Environmental Protection 3900 Commonwealth Blvd. Tallahassee, FL 32399
FDOT	Florida Department of Transportation Standards Specifications for Road and Bridge Construction Maps & Publication Sales - Mail Station 12 605 Suwannee St. Tallahassee, FL 32399-0450
FS	Federal Specification General Services Administration Specifications and Consumer Information Distribution Section (WFSIS) Washington Navy Yard, Bldg. 197 Washington, DC 20407

MCPW UTIL STD	Manatee County Utility Engineering 4410-B 66th St. W. Bradenton, FL 34210
MLSFA	Metal Lath/Steel Framing Association 221 North LaSalle Street Chicago, IL 60601
MMA	Monorail Manufacturer's Association 1326 Freeport Road Pittsburgh, PA 15238
NAAMM	National Association of Architectural Metal Manufacturers 221 North LaSalle Street Chicago, IL 60601
NEMA	National Electrical Manufacturer's Assoc. 2101 L Street N.W. Washington, DC 20037
OHSA	Occupational Safety and Health Assoc. 5807 Breckenridge Pkwy., Suite A Tampa, FL 33610-4249
PCA	Portland Cement Association 5420 Old Orchard Road Skokie, IL 20076
PCI	Prestressed Concrete Institute 20 North Wacker Drive Chicago, IL 60606
SDI	Steel Door Institute 712 Lakewood Center North Cleveland, OH 44107
SMACNA	Sheet Metal and Air Conditioning Contractor's National Association 8224 Old Court House Road Vienna, VA 22180
SSPC	Steel Structures Painting Council 402 24th Street, Suite 600 Pittsburgh, PA 15213

SWFWMD	Southwest Florida Water Management District 2379 Broad Street Brooksville, FL 34604-6899
UL	Underwriter's Laboratories, Inc. 333 Pfingston Road Northbrook, IL 60062

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01150
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE

A. The scope of this section of the Contract Documents is to further define the items included in each Bid Item in the Bid Form section of the Contract Documents. Payment will be made based on the specified items included in the description in this section for each bid item.

B. All contract prices included in the Bid Form section will be full compensation for all shop drawings, working drawings, record drawings, labor, materials, tools, equipment, taxes, permit fees, expenses, and incidentals necessary to complete the construction as shown on the Drawings and/or as specified in the Contract Documents to be performed under this Contract. Actual quantities of each item bid on a unit price basis will be determined upon completion of the construction in the manner set up for each item in this section of the Specifications. Payment for all items listed in the Bid Form will constitute full compensation for all work shown and/or specified to be performed under the Contract.

C. Work not shown or called out in either the Drawings or the Specifications, but necessary in carrying out the intent of the Project or in the complete and proper execution of the Work, is required and shall be performed by the Contractor as though it were specifically delineated or described. No additional compensation will be considered for this associated and necessary Work as the cost of such work shall be considered to be included in the scope of the appropriate bid items described in this section of the Specifications.

D. Damage caused by the construction activities to existing utilities including sewers and force mains, potable and reclaimed water mains to remain, underground electrical cable, SCADA and communication cable, and all other infrastructure shall be the sole responsibility of the Contractor. No additional payment will be made for replacement or restoration of these infrastructure components in accordance with the utility owner’s requirements.

1.02 ESTIMATED QUANTITIES

A. The quantities shown are approximate and are given only as a basis of calculation upon which the award of the Contract is to be made. The County does not assume any responsibility for the final quantities, nor shall the Contractor claim misunderstanding because of such estimate of quantities. The Owner has the right to change the listed quantities as they deem necessary. Final payment will be made only for satisfactorily completed quantity of each item.

B. Field conditions may require that a greater or lesser quantity of a payment item be completed for satisfactory completion of the Work. Measurement for payment for some payment items may be found to be unnecessary. If no work is performed that qualifies for payment by a listed bid item, then the Contractor shall not be entitled to payment for work described by the bid item; and the Contractor will not be entitled to additional compensation because a bid item was not included as part of the satisfactorily completed Work.

1.03 WORK OUTSIDE AUTHORIZED LIMITS

A. No payment will be made for work constructed outside the authorized limits of work.

1.04 MEASUREMENT STANDARDS

A. Unless otherwise specified for the particular items involved, all measurements of distance shall be taken horizontally or vertically.

1.05 AREA MEASUREMENTS

A. In the measurement of items to be paid for on the basis of area of finished work, the lengths and widths to be used in the calculations shall be the final dimensions measured along the surface of the completed work within the neat lines shown or designated.

1.06 LUMP SUM ITEMS

A. Where payment for items is shown to be paid for on a lump sum basis, no separate payment will be made for any item of work required to complete the lump sum item unless the lump sum item specifically allows for partial payment. Lump sum contracts shall be complete, tested and fully operable prior to request for final payment. Contractor may be required to provide a break-down of lump sum totals.

1.07 UNIT PRICE ITEM

A. Separate payment will be made for the items of work described herein and listed on the Bid Form. Any related work not specifically listed, but required for satisfactory completion of the Work, shall be considered to be included in the scope of the appropriate listed work items.

B. No separate payment will be made for the following items and the cost of such work shall be deemed included in the applicable contract pay items of work:

1. Shop Drawings, working drawings or other contractor documentation.
2. Furnish, install, and remove project sign.

3. Maintaining red-line drawings of changes to construction plans during progress of the work.
4. Temporary utilities including water and power required for construction.
5. Contractor's field office and storage containers.
6. Building permit fee(s).
7. Site preparation, clearing, grubbing, grading and protection of existing structures, trees, and shrubbery to remain.
8. Erosion, sediment, dust, and noise control.
9. Traffic control including maintenance of traffic, maintaining safe and proper pedestrian access and travel ways, and replacement or relocation of signs.
10. Trench excavation, including necessary pavement removal and disposal; rock and/or unsuitable material removal and disposal; sheeting, shoring, and bracing as required by OSHA trench excavation safety standards; temporary barricades; and temporary trench covers.
11. Dewatering and proper disposal of surplus water.
12. Backfill and compaction, including furnishing and placing suitable fill, and all grading.
13. Protection, repair, replacement or relocation of existing utilities, damaged as a result of construction activities.
14. Replacement or restoration of grass, trees and shrubbery in non-paved areas within established pay limits.
15. Replacement or restoration of paved or unpaved roadways, grass and shrubbery plots damaged as a result of construction activities.
16. Selective demolition as shown or indicated on the Drawings, or as otherwise designated in the Contract Documents.
17. Removing and properly disposing of waste material due to construction.
18. Cleanup and restoring the job site to its original condition, which includes but is not limited to restoring the ground surface to its original grade; repair, replacement or relocation of signs, walls, and fences; and related work obviously required to complete the project in accordance with the Contract Documents.
19. Testing and placing the system into operation.
20. Any material and equipment required to be installed and utilized for testing.
21. Maintaining the existing quality of service during construction.
22. Appurtenant work as required for a complete and operable system.
23. Coordination with all Federal, State and Local agencies and utilities.
24. Any tree removal and/or tree trimming required to prepare work areas and pipe/duct banks alignments is to be included as part of the work paid for by the related bid items and meet requirements of Manatee County or any other agency having jurisdiction over such work.
25. Repair of irrigation systems damaged during construction.
26. Replacement and restoration of grass, trees, shrubbery, signs, walls, fencing, and paved or unpaved areas roadways outside of established pay limits.

27. As-built Record Drawings. Final payments shall not be requested by the Contractor or made by the County until as-built (record) drawings have been submitted an approved by the County.
28. Operation and Maintenance Manual.
29. Instructing County's designated personnel in operation, adjustment and maintenance of products, equipment and systems.

C. The Contractor's attention is again called to the fact that the quotations for the various items of work are intended to establish a total price for completing the Work in its entirety. Should the Contractor feel that the cost for any item of work has not been established by the bid items listed in the Bid Form, the Contractor shall include the cost for that work in some other applicable bid item, so that the total bid price for the Work does reflect the total price for completing the work in its entirety.

1.08 BID ITEM DESCRIPTIONS

A. Bid Item No. 1: Mobilization – Demobilization:

1. Measurement and payment for this Bid Item shall include full compensation for the required 100 percent Performance Bond, 100 Percent Payment Bond, all required insurance for the project and the Contractor's mobilization and demobilization costs as shown in the Bid Form. Mobilization includes, but is not limited to: preparation and movement of personnel, equipment, supplies and incidentals such as safety and sanitary supplies/facilities.
2. Payment for mobilization-demobilization shall not exceed 10 percent of the total Contract cost unless the Contractor can prove to the County that his actual mobilization cost exceeds 10 percent.
3. Partial payments for this Bid Item will be made in accordance with the following schedule:

Percent of Original Contract Amount:	Percent Allowable Payment of Mobilization/Demobilization Bid Item Price:
5	25
10	35
25	45
50	50
75	75
100	100

4. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the Work and demobilization.

B. Bid Item No. 2: Temporary Erosion and Sediment Control:

1. Measurement and payment for this Bid Item shall include full compensation for all Work necessary to provide effective temporary erosion and sediment control measures. Payment shall represent full compensation for all labor, materials and equipment required to install erosion and sediment and measures shown on the Contract Drawings; Construction Site NPDES permitting requirements; additional control measures that may need to be added to effectively control construction and site erosion and prevent sediment runoff from the site; maintenance of the control measures; replacement of the control measures because of material deterioration due to age or because of damage by Contractor's work activities; removal of control measures and lawful disposal of removed materials upon completion of construction activities; an all other erosion and sediment control requirements included in the Specifications.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values to be supplied by the Contractor in accordance with the Contract Documents.
3. These payments will be subject to the standard retainage provided in the Contract. Payment of the retainage will be made after completion of the Work.

C. Bid Items No. 3 and 4: Gravel/Shell Roadways:

1. Payment for all work included in these bid items will be made at the applicable Contract unit price bid per square yard of roadway as listed on the Bid Form. Payment shall represent full compensation for all labor, materials and equipment required for compacting subgrade; grading; furnishing, placing, and compacting shell or gravel material; and all incidentals necessary to complete the roadway as shown on the Contract Drawings and included in the Specifications, all ready for approval and acceptance by the County.
2. Payment for new gravel/shell roadways shall be made at the unit price per square yard listed in the Bid Form for new gravel/shell roadway. A roadway will be considered new if the location the roadway is constructed in an area that is grass or dirt with no previously applied gravel, crushed concrete, or shell material previously applied and is not regularly used as a vehicular travel way. All other roadway construction that is not asphalt surfaced shall be paid for at the unit price per square yard of restored roadway in accordance with Bid Form.

3. Payment be full compensation for construction of a gravel/shell roadway section in accordance with the applicable details on the Contract Drawings and described by the Specifications and in accordance with the requirements of Manatee County, ready for approval and acceptance by the County.
4. Measurement for payment of Gravel/Shell Roadway work shall be determined in the field by the County Representative with a representative of the Contractor present. No measurement for payment will be made for roadway surfaces constructed outside the limits agreed to in the field with the County Representative either because of the Contractor failing to conform to the limits agreed to, or for repair of roadway surfaces damaged outside the agreed limits. Such extended roadway construction or damage repair shall be by the Contractor at the Contractor's expense.

D. Bid Item No. 5: Asphalt Pavement Restoration:

1. Payment for all work included as part of this bid item will be made at the applicable Contract unit price bid per square yard of Asphalt Pavement Restoration. Payment shall represent full compensation for all labor, materials and equipment for saw cutting edges of existing roadway; removal of existing asphalt surfaces and hauling to lawful place of disposal provided by Contractor; compacting subgrade; furnishing, placing, and compacting the necessary base material; furnishing, placing, compacting, and finishing asphaltic concrete; and all incidentals necessary to complete the road restoration as shown on the Contract Drawings and included in the Specifications, all ready for approval and acceptance by the County.
2. Measurement for payment of Asphalt Pavement Restoration work shall be determined in the field by the County Representative with a representative of the Contractor present. The measurement will be delimited by saw-cut of existing pavement and limits agreed to between County Representative and Contractor prior to starting pavement work when restored roadway does not abut existing pavement. Restored pavement measured for payment will not exceed width of the existing paved surface prior to construction. Payment will include complete asphalt roadway section in accordance with applicable details on the Contract Drawings, but not less than 3 inches of asphaltic concrete surfacing, 10 inches of base, and satisfactorily prepared sub-base all in accordance with the Specifications.
3. No measurement for payment will be made for paved roadway constructed outside the limits agreed to in the field with the County Representative either because of the Contractor failing to conform to the limits agreed to, or for repair of roadway surfaces damaged outside the agreed limits. Such extended roadway construction or damage repair shall be by the Contractor at the Contractor's expense.

E. Bid Item No. 6: Concrete Curb, Remove & Replace:

1. Payment for all work included in this Bid Item will be made at the applicable Contract unit price bid per linear foot for removal and replacing of existing concrete curb as listed on the Bid Form. Measurement will be per actual number of linear feet of replacement curb installed without distinguishing between the type curb removed or installed. Payment shall represent full compensation for removal of existing curb including removal to proper place of disposal; and all labor, material, and equipment for compacting subgrade, forming, finishing, placing concrete, and finishing as specified. Replacement curb shall be complete with all incidentals necessary for a complete installation, ready for approval and acceptance by the County.

F. Bid Items 7 and 8: Chain Link Fencing:

1. Payment for all work included in these bid items will be made at the applicable Contract unit price bid per linear foot of chain link fencing as listed on the Bid Form. Payment shall represent full compensation for all labor, materials and equipment required for removal of existing fencing including proper disposal of removed materials; furnishing new materials for constructing fence in accordance with Contract Plan details, corner posts, gate assemblies; and all incidentals necessary to construct chain link fencing complete, ready for approval and acceptance by the County.
2. If temporary fencing is required to maintain plant site security, the cost to furnish satisfactory temporary fencing and removal after temporary fencing is no longer required shall be included as part of the work compensated by payment to the Contractor for these bid items. Also, the cost to connect new or replacement fence to an existing fence shall be included as part of the work compensated for by these bid items.
3. A chain link fence will be considered new if the location the fence is constructed is along an alignment where no fencing existing prior to the start of construction. All other fencing shall be paid for at the unit price for Chain Link Fencing, Remove & Replace.
4. Measurement for payment of Chain Link Fencing work shall be actual number of liner feet of fence installed. Measurement shall be made through gate openings and the cost of gates shall be compensated for as part of the unit price for Chain Link Fencing per linear foot.
5. No measurement for payment will be made for fence constructed outside the limits agreed to in the field with the County Representative prior to removal of existing fences; or for fence necessary to replace damage resulting from the Contractor’s construction methods.

G. Bid Item No. 9: Finish Grade and Sodding:

1. Payment for all work included in this bid item shall be made at the applicable Contract unit price bid per square yard for finish grading the site and installing sodding as shown on the Contract Drawings and called for by the Specifications. Payment shall represent full compensation for all labor, materials, necessary equipment, and incidentals necessary to complete the work, ready for approval and acceptance by the County.
2. The work of Finish Grade and Sodding shall include, but is not limited to, shaping the finish land surface to drain and conform to the lines and grades indicated by the plans, furnishing and placing suitable fill material, compacting, furnishing and placing topsoil, raking and rubbish removal, fertilizing area to receive sod, furnishing and placing sod, rolling sodded area, watering, and all other work necessary to achieve a uniform sodded surface, complete and acceptable to the County.
3. Measurement for payment of Finish Grade and Sodding shall be determined in the field by the County Representative with a representative of the Contractor present. Area measured for payment shall be actual area of new sod placed and producing a satisfactory stand of grass. No measurement for payment will be made for sodded surfaces constructed outside the limits agreed to in the field with the County Representative either because of the Contractor failing to conform to the limits agreed to, or for repair of graded surfaces damaged outside the agreed limits. Such extended finish grade and sodding work shall be by the Contractor at the Contractor's expense.

H. Bid Items No. 10 and 11: Reclaimed Water Main, buried, complete:

1. Payment for buried Reclaimed Water Main under these bid items shall be made at the applicable Contract lump sum price bid listed in the Bid Form . The lump sum price shall include all costs necessary for labor; equipment; survey; locating utilities that may impact construction and aligning the pipe to avoid such impacts; layout; pipe materials; joint restraining devices; excavation; dewatering; bedding; backfill and compaction; sheeting, shoring, bracing, and temporary trench covers; temporary barricades; polyethylene encasement; tracer wires and appurtenances; locator tape; flushing; testing; and all other work necessary to complete these bid items, complete and acceptable to the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.
3. Pipe installed above ground, and riser pipe pieces transitioning from a buried fitting to an above ground fitting, shall not be included in the measurement for payment of Reclaimed Water Main. Instead, Contractor shall include the cost for such piping as part of the work to be compensated for in some other appropriate bid item so that the total bid price for the work reflects full compensation for completing the Work in its entirety.

4. Contractor shall include as a cost paid for as incidental work to be performed as part of these bid items, the cost to relocate or reconstruct water or chemical pipelines other than potable water pipelines 4-inch diameter. Also, include the cost to provide temporary support of crossing utilities, to protection adjacent utilities that parallel the new water main alignment, and to keep existing utility lines in service.
5. No additional compensation will be made for excavation below the bottom of the pipe; for rock or broken concrete removal; furnishing, placing, and compacting bedding and backfill materials; or for repair of any trench settlement. Instead, the Contractor's cost for these work elements will be considered as having been included as a cost paid for as incidental work applicable to these or other bid items, and at no increase in the total bid price.

I. Bid Items No. 12, 13, and 14: Buried Valves:

1. Payment for buried valves under these bid items shall be made at the applicable Contract unit price bid per each by valve size and type listed in the Bid Form. The unit price shall include all cost for all labor; equipment; furnishing and installing the listed valve, box cover, joint connection materials including restraining devices, and concrete pad as shown on the Contract Drawings; and all incidentals necessary to provide a complete and properly operating valve installation ready for approval and acceptance by the County.
2. Above ground valves, and buried valves of size or type not listed in the Bid Form, shall not be measured for payment under one of listed bid items. Instead, Contractor shall include the cost for such valves as part of the work to be compensated for in some other appropriate bid item so that the total bid price for the work reflects full compensation for completing the Work in its entirety.

J. Bid Item No. 15: Reclaimed Water Line ARV Assembly, Furnish & Install:

1. Payment for all work included in this bid item shall be made at the applicable Contract unit price bid per each ARV assembly connected to a buried reclaimed water line, including air release valve, service saddle and corporation stop on main line, pipe and fittings to ARV, cabinet, concrete pad, and tracer wire with test box, as shown on the Contract Drawings and described in the Specifications. Payment shall represent full compensation for all labor, material, equipment, excavation, bedding, backfill, compaction, testing, and other incidentals required to provide a complete ARV assembly, properly functioning and ready for acceptance by the County.

2. ARVs shown by the Contract Drawings as a part of above ground reclaimed water piping assemblies shall not be included in the count of Reclaimed Water Line ARV Assembly to be paid with this bid item. Instead, Contractor shall include the cost for ARVs included as part of above ground piping assemblies as part of the work to be compensated for in some other appropriate bid item so that the total bid price for the work reflects full compensation for completing the Work in its entirety.
3. Contractor shall be required to furnish and install an ARV assembly on high points along the alignment of buried reclaimed water lines constructed as part of the Work of this project. If a high point is created as a result of the Contractor not following the vertical alignment shown by the plans for the water line, then the Contractor shall install an ARV assemble at no additional cost to the County and the ARV assembly shall not be included in the count of Reclaimed Water Line ARV Assembly to be paid with this bid item.
4. If no work is performed that qualifies for payment with this bid item, then the Contractor shall not be entitled to payment for work described for this bid item, and the Contractor will not be entitled to additional compensation because no payment is made for this bid item.

K. Bid Item No. 16: Monitoring Well Drain Line, buried, complete:

1. Payment for all work included in this Bid Item will be made at the applicable Contract lump sum price for PVC drain line pipe with joint connection materials including restraining devices, as shown on the Contract Drawings and listed in the Bid Form. The lump sum price shall include all costs necessary for labor; equipment; survey; locating utilities that may impact construction and aligning the pipe to avoid such impacts; layout; pipe materials; excavation; dewatering; bedding; backfill and compaction; sheeting, shoring, bracing, and temporary trench covers; temporary barricades; tracer wires and appurtenances; locator tape; flushing; testing; and all other work necessary to properly complete the drain line, ready for acceptance by the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.
3. Pipe installed above ground, and riser pipe pieces transitioning from a buried fitting to an above ground fitting, shall not be include in the measurement for payment of drain line pipe. Instead, Contractor shall include the cost for such pipe as part of the Work to be compensated for in some other appropriate bid item so that the total bid price for the work reflects full compensation for completing the Work in its entirety.

4. No additional compensation will be made for excavation below the bottom of the pipe; for rock or concrete removal; furnishing, placing, and compacting bedding and backfill materials; or for repair of any trench settlement. Instead, the Contractor's cost for these work elements will be considered as having been included as a cost paid for as incidental work applicable to this or other bid items, and at no increase in the total bid price.

L. Bid Item No. 17: Drain Tie-in to Existing 6" Drain Pipe, complete:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the work to completely connect the new single zone monitoring wells drain pipe to an existing drain pipe at the location shown on the Contract Drawings. Payment shall represent full compensation for all labor, materials, and equipment required to complete the connection, ready for approval and acceptance by the County.

M. Bid Item No. 18: Drain Connection to Existing Sewer, complete:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the work to completely connect the new dual zone monitor well drain pipe to an existing sanitary sewer pipe at the location shown on the Contract Drawings. Payment shall represent full compensation for all labor, materials, equipment, and appurtenances required to complete the connection, ready for approval and acceptance by the County.

N. Bid Item No. 19: Guard Posts, Furnish & Install:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract unit price bid per each guard post furnished and installed in accordance with the Contract Drawings, complete and accepted by the County. Payment shall represent full compensation for all labor, material, equipment, excavation, backfill, painting, and incidentals required to complete the work.
2. Each new guard post furnished and installed shall be counted for payment under this bid item, complete and acceptable to the County.
3. If no work is performed that qualifies for payment with this bid item, then the Contractor shall not be entitled to payment for work described for this bid item, and the Contractor will not be entitled to additional compensation because no payment is made for this bid item.

O. Bid Item No. 20: Injection Well IW-1 Aboveground Piping and Infrastructure:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the work to construct aboveground piping and infrastructure for Injection Well IW-1 in accordance with the Contract Drawings and the Specifications, ready for approval and acceptance by the County. Payment shall represent full compensation for all labor, materials, and equipment necessary for the work including, but not limited to, the following:
   a. Survey and layout.
   b. Site grading including excavation, backfill, and compaction.
   c. Ductile iron pipe and fittings.
   d. Stainless steel pipe and fittings.
   e. PVC pipe and fittings.
   f. Valves.
   g. Piping accessories.
   h. Pipe supports.
   i. Concrete equipment pad.
   j. Painting.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

P. Bid Item No. 21: Injection Well IW-1 Basket Strainer Station:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the work to construct the Basket Strainer Station for Injection Well IW-1 in accordance with the Contract Drawings and the Specifications, ready for approval and acceptance by the County. Payment shall represent full compensation for all labor, materials, and equipment necessary for the work including, but not limited to, the following:
   a. Survey and layout.
   b. Site grading including excavation, backfill, and compaction.
   c. Ductile iron pipe and fittings.
   d. PVC pipe and fittings.
   e. Valves.
   f. Basket strainer.
   g. Piping accessories.
   h. Pipe supports.
   i. Drainage drywell.
   j. Concrete equipment pad and steps.
   k. Painting.
   l. Aluminum handrail.

2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

Q. Bid Item No. 22: Injection Well IW-1 Control Valve Manifold Station:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the work to construct aboveground piping and infrastructure for Control Valve Manifold Station in accordance with the Contract Drawings and the Specifications, ready for approval and acceptance by the County. Payment shall represent full compensation for all labor, materials, and equipment necessary for the work including, but not limited to, the following:
   a. Survey and layout.
   b. Site grading including excavation, backfill, and compaction.
   c. Ductile iron pipe and fittings.
   d. Valves.
   e. Piping accessories.
   f. Pipe supports.
   g. Concrete equipment pad.
   h. Painting.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

R. Bid Item No. 23: Injection Well IW-1 Electrical:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the electrical work to construct the Injection Well IW-1 wellhead infrastructure, basket strainer station, and control valve manifold station all as shown on the Contract Drawings and called for by the Specifications. Work shall include, but is not limited to, labor, equipment, materials, wire, conduit, trenching, grounding, surge protection, panels, supports, switchgear, yard lights, testing, connections at the Electrical and Storage Building, and all other work necessary to construct a properly operating electrical system ready for approval and acceptance by the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.
3. Do not include the work of constructing concrete encased conduit duct banks or electric handholes as part of the work to be compensated for by this bid item. Instead, such work shall be included as part of the work measured for payment by the bid items “Conduit Duct Banks Construction, Concrete Encased” and “Electric Handholes, Complete” as appropriate.

S. Bid Item No. 24: Injection Well IW-1 I&C:

1. Payment for all Work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form to furnish and install the instrumentation for Injection Well IW-1, basket strainer station, and the control valve manifold station all as shown on the Contract drawings and called for by the Specifications. Work shall include, but is not limited to, labor, equipment, materials, flowmeter, level transducers, pressure transmitters, wire, conduit, grounding, surge protection, panels, supports, and all other work necessary to construct a properly operating electrical system ready for approval and acceptance by the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

T. Bid Item 25: Injection Well IW-2 Aboveground Piping and Infrastructure:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the work to construct aboveground piping and infrastructure for Injection Well IW-2 in accordance with the Contract Drawings and the Specifications, ready for approval and acceptance by the County. Payment shall represent full compensation for all labor, materials, and equipment necessary for the work including, but not limited to, the following:
   a. Survey and layout.
   b. Site grading including excavation, backfill, and compaction.
   c. Ductile iron pipe and fittings.
   d. Stainless steel pipe and fittings.
   e. PVC pipe and fittings.
   f. Valves.
   g. Basket strainer.
   h. Piping accessories.
   i. Pipe supports.
   j. Drainage drywell.
   k. Concrete equipment pad.
   l. Painting.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

U. Bid Item No. 26: Inject Well IW-2 Check Valve Station:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the work to construct aboveground piping and infrastructure for Check Valve Station in accordance with the Contract Drawings and the Specifications, ready for approval and acceptance by the County. Payment shall represent full compensation for all labor, materials, and equipment necessary for the work including, but not limited to, the following:
   a. Survey and layout.
   b. Site grading including excavation, backfill, and compaction.
   c. Ductile iron pipe and fittings.
   d. Check Valve.
   e. Air release valve.
   f. Piping accessories.
   g. Pipe supports.
   h. Concrete equipment pad.
   i. Painting.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

V. Bid Item No. 27: Injection Well IW-2 Electrical:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the electrical work to construct the Injection Well IW-2 wellhead infrastructure, all as shown on the Contract drawings and called for by the Specifications. Work shall include, but is not limited to, labor, equipment, materials, wire, conduit, trenching, grounding, surge protection, panels, supports, switchgear, yard lights, testing, and all other work necessary to construct a properly operating electrical system ready for approval and acceptance by the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.
3. Do not include the work of constructing concrete encased conduit duct banks or electric handholes as part of the work to be compensated for by this bid item. Instead, such work shall be included as part of the work measured for payment by the bid items “Conduit Duct Banks Construction, Concrete Encased” and “Electric Handholes, Complete” as appropriate.
4. Do not include the work to modify and connect electrical panels and motor control center in dewatering building as part of the work to be compensated for by this bid item. Instead, such work shall be paid as part of the work measured for payment by the bid item “Dewatering Building Electrical Modifications.”

W. Bid Item No. 28: Injection Well IW-2 I&C:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form to furnish and install the instrumentation for Injection Well IW-2, all as shown on the Contract Drawings and called for by the Specifications. Work shall include, but is not limited to, labor, equipment, materials, flowmeter, level transducers, pressure transmitters, wire, conduit, grounding, surge protection, panels, supports, and all other work necessary to construct a properly operating electrical system ready for approval and acceptance by the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

X. Bid Item No. 29: Dual Zone Monitor Well (DZMW-1) Aboveground Piping and Infrastructure:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the work to construct aboveground piping and infrastructure for the Dual Zone Monitor Well DZMW-1 in accordance with the Contract Drawings and the Specifications, ready for approval and acceptance by the County. Payment shall represent full compensation for all labor, materials, and equipment necessary for the work including, but not limited to, the following:
   a. Survey and layout.
   b. Site grading including excavation, backfill, and compaction.
   c. Stainless steel pipe and fittings.
   d. PVC pipe and fittings.
   e. Valves.
   f. Piping accessories.
   g. Pipe supports.
   h. Concrete equipment pad.
   i. Painting.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

Y. Bid Item 30, 31, 35, and 39: Monitor Well Sample Pumps:

1. Payment for sample pumps listed under these bid items shall be made at the applicable Contract unit price bid per each pump listed in the Bid Form for the work to furnish and install a complete sample pump system in accordance with the Contract Drawings and the Specifications, properly operating and ready for approval and acceptance by the County. Each unit price payment shall represent full compensation for all labor, materials, and equipment necessary for the work to furnish and install the listed sample pump system including, but not limited to, the following:
   a. Sample pump.
   b. Drop pipe system complete.
   c. Pump power cable complete.
   d. Pump safety cable system complete.
   e. Startup and Testing.

Z. Bid Item 32: Dual Zone Monitor Well (DZMW-1) Electrical:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the electrical work to construct the Dual Zone Monitor Well DZMW-1 wellhead infrastructure, all as shown on the Contract drawings and called for by the Specifications. Work shall include, but is not limited to, labor, equipment, materials, wire, conduit, trenching, grounding, surge protection, panels, supports, motor starters, switchgear, yard light, testing, and all other work necessary to construct a properly operating electrical system ready for approval and acceptance by the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.
3. Do not include the work of constructing concrete encased conduit duct banks or electric handholes as part of the work to be compensated for by this bid item. Instead, such work shall be included as part of the work measured for payment by the bid items “Conduit Duct Banks Construction, Concrete Encased” and “Electric Handholes, Complete” as appropriate.

AA. Bid Item No. 33: Dual Zone Monitor Well (DZMW-1) I&C:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form to furnish and install the instrumentation for the Dual Zone Monitor Well DZMW-1, all as shown on the Contract Drawings and called for by the Specifications. Work shall include, but is not limited to, labor, equipment, materials, flowmeters, level transducers, pressure gauges, wire, conduit, grounding, surge protection, panels, supports, and all other work necessary to construct

a properly operating electrical system ready for approval and acceptance by the County.

2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

BB. Bid Item No. 34: Monitor Well APMW-2 Aboveground Piping and Infrastructure:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the work to construct aboveground piping and infrastructure for the Monitor Well APMW-2 in accordance with the Contract Drawings and the Specifications, ready for approval and acceptance by the County. Payment shall represent full compensation for all labor, materials, and equipment necessary for the work including, but not limited to, the following:
   a. Survey and layout.
   b. Site grading including excavation, backfill, and compaction.
   c. Stainless steel pipe and fittings.
   d. PVC pipe and fittings.
   e. Valves.
   f. Piping accessories.
   g. Pipe supports.
   h. Concrete equipment pad.
   i. Painting.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

CC. Bid Item No. 36: Monitor Well APMW-2 Electrical:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the electrical work to construct Monitor Well APMW-2 wellhead infrastructure, all as shown on the Contract drawings and called for by the Specifications. Work shall include, but is not limited to, labor, equipment, materials, wire, conduit, trenching, grounding, surge protection, panels, supports, motor starter, switchgear, yard light, testing, and all other work necessary to construct a properly operating electrical system ready for approval and acceptance by the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.
3. Do not include the work of constructing concrete encased conduit duct banks or electric handholes as part of the work to be compensated for by this bid item. Instead, such work shall be included as part of the work measured for payment by the bid items “Conduit Duct Banks Construction, Concrete Encased” and “Electric Handholes, Complete” as appropriate.

DD. Bid Item No. 37: Monitor Well APMW-2 I&C:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form to furnish and install the instrumentation for the Monitor Well APMW-2, all as shown on the Contract Drawings and called for by the Specifications. Work shall include, but is not limited to, labor, equipment, materials, flowmeter, level transducer, pressure gauges, wire, conduit, grounding, surge protection, panels, supports, and all other work necessary to construct a properly operating electrical system ready for approval and acceptance by the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

EE. Bid Item No. 38: Monitor Well DMW-1 Aboveground Piping and Infrastructure:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the work to construct aboveground piping and infrastructure for the Monitor Well DMW-1 in accordance with the Contract Drawings and the Specifications, ready for approval and acceptance by the County. Payment shall represent full compensation for all labor, materials, and equipment necessary for the work including, but not limited to, the following:
   a. Survey and layout.
   b. Site grading including excavation, backfill, and compaction.
   c. Stainless steel pipe and fittings.
   d. PVC pipe and fittings.
   e. Valves.
   f. Piping accessories.
   g. Pipe supports.
   h. Concrete equipment pad.
   i. Painting.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

FF. Bid Item No. 40: Monitor Well DMW-1 Electrical:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for the electrical work to construct Monitor Well DMW-1 wellhead infrastructure, all as shown on the Contract Drawings and called for by the Specifications. Work shall include, but is not limited to, labor, equipment, materials, wire, conduit, trenching, grounding, surge protection, panels, supports, motor starter, switchgear, yard light, testing, and all other work necessary to

construct a properly operating electrical system ready for approval and acceptance by the County.

2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.
3. Do not include the work of constructing concrete encased conduit duct banks or electric handholes as part of the work to be compensated for by this bid item. Instead, such work shall be included as part of the work measured for payment by the bid items "Conduit Duct Banks Construction, Concrete Encased" and "Electric Handholes, Complete" as appropriate.

GG. Bid Item No. 41: Monitor Well DMW-1 I&C:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form to furnish and install the instrumentation for the Monitor Well DMW-1, all as shown on the Contract Drawings and called for by the Specifications. Work shall include, but is not limited to, labor, equipment, materials, flowmeter, level transducer, pressure gauges, wire, conduit, grounding, surge protection, panels, supports, and all other work necessary to construct a properly operating electrical system ready for approval and acceptance by the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

HH. Bid Item No. 42: Conduit Duct Banks Construction, Concrete Encased:

1. Payment for all work included in this Bid Item will be made at the applicable Contract lump sum for furnishing and installing by open cut construction methods concrete encased conduit duct banks, as shown on the Contract Drawings and called for by the Specifications. The lump sum price shall include all costs necessary for labor, equipment, material, survey, locating utilities that may impact construction and alignment of duct banks construction, layout, conduit materials, excavation, dewatering, concrete, backfill and compaction, temporary trench covers, temporary barricades, locator tape, and all other work necessary to properly construct the duct banks, complete and ready for acceptance by the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.
3. Do not include the work to furnish and install wire into conduit runs constructed as part of the work to be compensated for by this bid item. Instead, work to furnish, install, and test wire shall be included as part of the work measured for payment by the listed monitor well electrical bid items.

4. No additional compensation will be made for excavation below the bottom of a duct banks; for rock or concrete removal; furnishing, placing, and compacting bedding and backfill materials; or for repair of any trench settlement. Instead, the Contractor's cost for these work elements will be considered as having been included as a cost paid for as incidental work applicable to this or other bid items, and at no increase in the total bid price.

II. Bid Item No. 43: Electric Handholes, Complete:

1. Payment for Electric Handholes, Complete, shall be made at the applicable Contract unit price bid per each for furnishing and installing a new electric handhole. The unit price shall include all costs necessary for labor; equipment; materials; excavation; dewatering; bedding; backfill and compaction; and all other work necessary to furnish and install an electric handhole, complete and ready for approval by the County.
2. Each new electric handhole furnished and installed shall be counted for payment under this bid item, complete and acceptable to the County.

JJ. Bid Item No. 44: Dewatering Building Electrical Modifications:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price listed in the Bid Form for the work to connect to the existing electrical and I&C equipment located inside the Dewatering Building., all as shown on the Contract Drawings and called for by the Specifications. Work shall include, but is not limited to, labor, equipment, materials, wire conduit, switches, breakers, MCC modifications, panel modifications, building construction, testing, and all other work necessary to construct a properly operating electrical and I&C system ready for approval and acceptance by the County.
2. Measurement for periodic payments of this lump sum bit item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

KK. Bid Item No. 45: SCADA Modifications and Programming:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for a System Integrator to provide Process Instrumentation and Control (PIC) services including but not limited to engineering, calibrating, adjusting, testing, SCADA programming, documenting, starting up, and training for the new control and instrumentation system shown on the Contract drawings and called for by the Specifications, complete and accepted by the County.
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

LL. Bid Item No. 46: Legal description of the wells:

1. Payment for all work included in this Bid Item shall be made at the applicable Contract lump sum price bid listed in the Bid Form for a legal description of the well locations by metes and bounds and a detailed sketch of the parcel that shows the location of the wells. The locations shall be measured by a Florida certified land surveyor, and shall contain the surveyor's signature, registration number, official seal, and the following statement: "I hereby certify that this survey was made under my responsible direction and supervision, and is a correct representation of the land surveyed."
2. Measurement for periodic payments of this lump sum bid item shall be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01152
REQUEST FOR PAYMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit Applications for Payment to the Project Manager or as directed at the preconstruction meeting, in accordance with the schedule established by Conditions of the Contract and Agreement between County and Contractor.

1.02 FORMAT AND DATA REQUIRED

A. Submit payment requests in the form provided by the County with itemized data typed in accordance with the Bid Form.

B. Provide construction photographs in accordance with Contract Documents.

1.03 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. When the County requires substantiating data, Contractor shall submit suitable information with a cover letter.

B. Submit one copy of data and cover letter for each copy of application.

1.04 PREPARATION OF APPLICATION FOR FINAL PAYMENT

A. Fill in application form as specified for progress payments.

1.05 SUBMITTAL PROCEDURE

A. Submit applications for payment at the times stipulated in the Agreement.

B. Number: Three copies of each application; all signed and certified by the Contractor

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01153
CHANGE ORDER PROCEDURES

PART 1 GENERAL

1.01 DEFINITION

A. Change Order: A written order signed by the Owner, the Architect/Engineer and the Contractor authorizing a change in the Project Plans and/or Specifications and, if necessary, a corresponding adjustment in the Contract Sum and/or Contract Time, pursuant to Article V of the General Conditions of the Construction Agreement.

B. Administrative Change Adjustment: Minor change order under 10 percent of project cost or 20 percent time, does not have to be Board approved.

C. Field Directive: A written order issued by Owner which orders minor changes in the Work not involving a change in Contract Time, to be paid from the Owner's contingency funds.

D. Field Order: Minor change to contract work that does not require adjustment of contract sum or expected date of completion.

1.02 REQUIREMENTS INCLUDED

A. The Contractor shall promptly implement change order procedures:

1. Provide full written data required to evaluate changes.
2. Maintain detailed records of work done on a time-and-material/force account basis.
3. Provide full documentation to County on request.

B. The Contractor shall designate a member of the Contractor's organization who:

1. Is authorized to accept changes to the Work.
2. Is responsible for informing others in the Contractor's employ of the authorized changes into the Work.

1.03 PRELIMINARY PROCEDURES

A. Project Manager may initiate changes by submitting a Request to Contractor. Request will include:

1. Detailed description of the change, products, costs and location of the change in the Project.
2. Supplementary or revised Drawings and Specifications.

3. The projected time extension for making the change.
4. A specified period of time during which the requested price will be considered valid.
5. Such request is for information only and is not an instruction to execute the changes, nor to stop work in progress.

B. Contractor may initiate changes by submitting a written notice to the Project Manager, containing:

1. Description of the proposed changes.
2. Statement of the reason for making the changes.
3. Statement of the effect on the Contract Sum and the Contract Time.
4. Statement of the effect on the Work of separate contractors.
5. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.04 FIELD ORDER CHANGE

A. In lieu of a Change Order, the Project Manager may issue a Field Order for the Contractor to proceed with additional work within the original intent of the Project.

B. Field Order will describe changes in the Work, with attachments of backup information to define details of the change.

C. Contractor must sign and date the Field Order to indicate agreement with the terms therein.

1.05 DOCUMENTATION OF PROPOSALS AND CLAIMS

A. Support each quotation for a lump sum proposal and for each unit price which has not previously been established, with sufficient substantiating data to allow the County to evaluate the quotation.

B. On request, provide additional data to support time and cost computations:

1. Labor required.
2. Equipment required.
3. Products required.
    a. Recommended source of purchase and unit cost.
    b. Quantities required.
4. Taxes, insurance and bonds.
5. Credit for work deleted from Contract, similarly documented.
6. Overhead and profit.
7. Justification for any change in Contract Time.

C. Support each claim for additional costs and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal.

1. Name of the County's authorized agent who ordered the Work and date of the order.
2. Date and time work was performed and by whom.
3. Time record, summary of hours work and hourly rates paid.
4. Receipts and invoices for:
   a. Equipment used, listing dates and time of use.
   b. Products used, listing of quantities.
   c. Subcontracts.

1.06 PREPARATION OF CHANGE ORDERS

A. Project Manager will prepare each Change Order.

B. Change Order will describe changes in the Work, both additions and deletions, with attachments as necessary to define details of the change.

C. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.

1.07 LUMP SUM/FIXED PRICE CHANGE ORDER

A. Project Manager initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by the Contractor, or requests from the County, or both.

B. Once the form has been completed, all copies should be sent to Contractor for approval. After approval by Contractor, all copies should be sent to County for approval. The County will distribute executed copies after approval by the Board of County Commissioners.

1.08 UNIT PRICE CHANGE ORDER

A. Contents of Change Orders will be based on, either:

1. County's definition of the scope of the required changes.
2. Contractor's Proposal for a change, as approved by the County.
3. Survey of completed work.

B. The amounts of the unit prices to be:

1. Those stated in the Agreement.
2. Those mutually agreed upon between County and Contractor.

1.09 TIME AND MATERIAL / FORCE ACCOUNT CHANGE ORDER / CONSTRUCTION CHANGE AUTHORIZATION

A. Refer to Article V.5.6 of the General Conditions of the Construction Agreement.

1.10 CORRELATION WITH CONTRACTOR'S SUBMITTALS

A. Periodically revise Schedule of Values and Application for Payment forms to record each change as a separate item of work, and to record the adjusted Contract Sum.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time. Revise sub schedules to show changes for other items of work affected by the changes.

C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01200
PROJECT MEETINGS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The County shall schedule the pre-construction meeting, periodic progress meetings and special meetings, if required, throughout progress of work.

B. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The Contractor shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.02 PRE-CONSTRUCTION MEETING

A. Attendance:

1. County's Engineer.
2. County's Project Manager.
3. Contractor.
4. Resident Project Representative.
5. Related Labor Contractor's Superintendent.
6. Major Subcontractors.
7. Major Suppliers.
8. Others as appropriate.

B. Suggested Agenda:

1. Distribution and discussion of:
   a. List of major subcontractors.
   b. Projected construction schedules.
   c. Coordination of utilities.
2. Critical work sequencing.
3. Project Coordination:
   a. Designation of responsible personnel.
   b. Emergency contact persons with phone numbers.
4. Procedures and processing of:
   a. Field decisions.
   b. Submittals.
   c. Change Orders.
   d. Applications for Payment.

5. Procedures for maintaining Record Documents.
6. Use of Premises:
    a. Office, work and storage areas.
    b. County's requirements.
7. Temporary utilities.
8. Housekeeping procedures.
9. Liquidated damages.
10. Equal Opportunity Requirements.
11. Laboratory testing.
12. Project/Job meetings: Progress meeting, other special topics as needed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01300
SUBMITTALS

PART 1 GENERAL

1.01 SCHEDULES

A. General:

1. The Contractor shall:
   a. Submit estimated progress schedule and preliminary schedule of submittals to Engineer prior to any drilling activities at the site.
   b. Revise and resubmit as specified, and identify all changes made from previous schedule submittal.

B. Progress Schedule:

1. Submit preliminary progress schedule within 20 days of award.
2. Show complete sequence of construction by activity, identifying work of separate parts and pay items as outlined in the Bid Schedule, and other logically grouped activities.
3. Indicate submittal dates and product manufacture and delivery dates.
4. Update progress schedule monthly and submit with payment application. Payment application will not be reviewed without such schedule.
5. Claims for Adjustment of Contract Times: Where Engineer has not yet rendered formal decision on Contractor's claim for adjustment of Contract Times, and parties are unable to agree as to amount of adjustment to be reflected in progress schedule, Contractor shall reflect that amount of time adjustment in progress schedule as Engineer may accept as appropriate for the interim. It is understood and agreed that such interim acceptance by Engineer will not be binding and will be made only for purpose of continuing to schedule Work, until such time as formal decision as to an adjustment, if any, of the Contract Times acceptable to Engineer has been rendered. Contractor shall revise progress schedule prepared thereafter in accordance with Engineer's formal decision.

C. Schedule of Submittals, Preliminary Schedule of Submittals: Indicate submittals required by Specification section number with brief description, starting and completion dates for respective submittal preparation, and submittal review by Engineer.

1.02 SHOP DRAWINGS

A. General:

1. Shop Drawings, as defined herein, consist of all Drawings, diagrams, illustrations, schedules, and other data which are specifically prepared by Contractor to illustrate some portion of the work; and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams, and other information prepared by a manufacturer and submitted by Contractor to illustrate material or equipment for distinct portions of the work. All submissions will be legible and in English (certified translation to English is acceptable).
2. Submittal of incomplete or unchecked Shop Drawings will not be acceptable. Shop Drawing submittals which do not clearly show Contractor's review stamp or specific written indication of Contractor review will be returned to Contractor for resubmission.
3. Submittal of Shop Drawings not required under these Contract Documents and not shown on the schedule of submittals will be returned to Contractor unreviewed and unstamped by Engineer.

B. Procedures - Contractor shall:

1. Submit to Engineer for review and approval in accordance with the accepted schedule of submittals, three copies, including one reproducible copy, of Shop Drawings.
2. Combine submittals specified in each Specification section into a single package. Partial packages will not be reviewed until all submittals required for the section have been received.
3. Transmit each submittal on Engineer accepted form.
4. Sequentially number the transmittal forms; re-submittals to have original number with an alphabetic suffix.
5. Identify project, Contractor, Specification section number, pertinent drawing sheet and detail number(s), products, units and assemblies, and the system or equipment identification or tag number as shown.
6. Apply Contractor's stamp, signed or initialed certifying that review, verification of products required, field dimensions, adjacent construction work, and coordination of information, is in accordance with requirements of the Contract Documents.
7. Transmit submittals in accordance with finalized schedule of submittals, and deliver as follows:

Submittals to Owner:

Manatee County Public Works, 1022 26th Avenue East
Bradenton, FL 34208, Attn: Antony Russo, P.E.

Submittals to Engineer:

CH2M HILL Engineers Inc., 4350 West Cypress St. Suite 600, Tampa, Florida, 33607, Attn: Niel Postlethwait, P.E.

8. Provide space for Engineer's review stamp.
9. Revise and resubmit submittals as required; identify all changes made since previous submittal.

C. Submittals will be acted upon by Engineer and transmitted to Contractor not later than 10 working days after receipt by Engineer.

D. When Shop Drawings have been reviewed by Engineer, two copies will be returned to Contractor appropriately annotated. If major changes or corrections are necessary, Shop Drawing may be rejected and two sets will be returned to Contractor with such changes or corrections indicated. Correct and resubmit the Shop Drawings in the same manner and quantity as specified for the original submittal. One digital copy will be provided to the Owner.

E. Material and Equipment Colors: Engineer will provide a schedule of selected colors within 30 days after approval of submittals and after receiving samples of the manufacturers' standard AWWA pipe colors for those items requiring Owner's selection.

1.03 SAMPLES AND TEST SPECIMENS

A. Where required in the Specifications, and as determined necessary by Engineer, submit test specimens or samples of materials, appliances, and fittings to be used or offered for use in connection with the work. Include information as to their sources and prepay cartage charges and submit such quantities and sizes for proper examination and tests to establish the quality or equality thereof, as applicable.

B. The Contractor shall submit samples and test specimens in ample time to enable Engineer to make tests or examinations necessary, without delay to the work.

C. The Contractor shall submit additional samples as required by Engineer to ensure equality with the original approved sample and/or for determination of Specification compliance.

D. Tests required by the Specifications to be performed by an independent laboratory shall be made by a laboratory licensed or certified in accordance with State statutes.

E. Samples and laboratory services shall be at the expense of Owner unless otherwise included in the unit prices bid for the associated work.

F. Approved sample items (centralizers, hardware, etc.) may be incorporated into the work upon approval and when no longer needed by Engineer for reference.

1.04 QUALITY CONTROL SUBMITTALS

A. Manufacturers' Certification of Proper Installation: Where manufacturer's certification is required in the Specifications, the manufacturer shall provide certification stating the following:

1. The product or system has been installed in accordance with the manufacturer's recommendations.
2. The product or system has been inspected by a manufacturer's authorized representative.
3. The product or system has been serviced with the proper lubricants.
4. Applicable safety equipment has been properly installed.
5. Proper electrical and mechanical connections have been made.
6. Proper adjustments have been made and the product or system is ready for functional testing, plant startup, and operation.

B. Certification of Compliance:

1. Where specified, Contractor shall furnish certification of compliance for products specified to a recognized standard or code prior to the use of such products in the work. Certifications shall be signed by the manufacturer of the product; state that the components involved comply in all respects with the requirements of the Specifications. Furnish certification of compliance with each lot delivered to the job site and clearly identify the lot so certified.
2. Products used on the basis of a certification of compliance may be sampled and tested at any time. The fact that a product is used on the basis of a certification of compliance shall not relieve Contractor of responsibility for incorporating products in the work which conforms to requirements of the Contract Documents. Products not conforming to such requirements will be subject to rejection whether in-place or not.
3. Engineer reserves the right to refuse permission for use of products on the basis of a certification of compliance.

C. Functional Test Certification: Where a certification of functional testing is specified for certain equipment, Contractor (as applicable to the equipment furnished) shall state in writing that:

1. Necessary test pump equipment has been successfully tested.
2. Necessary equipment systems have been checked for proper installation, started, and successfully tested to indicate they are operational.
3. Adjustments and calibrations have been made.
4. The systems and subsystems are capable of performing their intended functions.

5. The facilities are ready for performance testing, or for startup and intended operation, as applicable.
6. Where several manufacturers have furnished equipment in a system, obtain each manufacturer's review and acknowledgment of its respective equipment as part of a functional test for the overall system.

D. Performance Test Reports: Contractor shall prepare and submit performance test reports where specified for equipment and systems.

1.05 OPERATION AND MAINTENANCE (O & M) MANUALS

A. No O&M manuals are anticipated for this portion of the Project.

1.06 CONTRACT CLOSE-OUT SUBMITTALS

A. Record Drawings: Each month, or as otherwise agreed, submit to Engineer a current listing and description of each change incorporated into the work since the preceding submittal. Engineer will prepare a set of record drawings for project which will include changes made in materials, locations, and dimensions of the work.

1.07 CONSTRUCTION PHOTOGRAPHS

A. The Contractor shall photograph the preconstruction and post-construction site for its records.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01310
CONSTRUCTION SCHEDULE AND PROJECT RESTRAINTS

PART 1 GENERAL

1.01 GENERAL

A. Construction under this contract must be coordinated with the County and accomplished in a logical order to maintain utilization and flow through existing facilities and public properties and rights-of-way and to allow construction to be completed within the time allowed by Contract Documents and in the manner set forth in the Contract.

1.02 CONSTRUCTION SCHEDULING GENERAL PROVISIONS

A. No work shall be done between 7:00 p.m. and 7:00 a.m. (unless alternate schedule is approved) nor on weekends or legal holidays without written permission of the County. However, emergency work may be done without prior permission.

B. Night work may be established by the Contractor as regular procedure with the written permission of the County. Such permission, however, may be revoked at any time by the County if the Contractor fails to maintain adequate equipment and supervision for the proper execution and control of the work at night.

C. Due to potential health hazards and requirements of the State of Florida and the U.S. Environmental Protection Agency, existing facilities must be maintained in operation.

D. The Contractor shall be fully responsible for providing all temporary piping, plumbing, electrical hook-ups, lighting, temporary structure, or other materials, equipment and systems required to maintain the existing facility's operations. All details of temporary piping and temporary construction are not necessarily shown on the Drawings or covered in the Specifications. However, this does not relieve the Contractor of the responsibility to insure that construction will not interrupt proper facility operations.

E. The Contractor shall designate an authorized representative of his firm who shall be responsible for development and maintenance of the schedule and of progress and payment reports. This representative of the Contractor shall have direct project control and complete authority to act on behalf of the Contractor in fulfilling the commitments of the Contractor's schedule.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The Contractor shall submit a critical path schedule as described herein.

B. The planning, scheduling, management and execution of the work is the sole responsibility of the Contractor. The progress schedule requirement is established to allow County to review Contractor's planning, scheduling, management and execution of the work; to assist County in evaluating work progress and make progress payments and to allow other contractors to cooperate and coordinate their activities with those of the Contractor.

2.02 FORM OF SCHEDULES

A. Prepare schedules using the latest version of Microsoft Project, or other County approved software, in the form of a horizontal bar chart diagram. The diagram shall be time-scaled and sequenced by work areas. Horizontal time scale shall identify the first work day of each week.

B. Activities shall be at least as detailed as the Schedule of Values. Activity durations shall be in whole working days. In addition, man-days shall be shown for each activity or tabulated in an accompanying report.

C. Diagrams shall be neat and legible and submitted on sheets at least 11 inches by 17 inches suitable for reproduction. Scale and spacing shall allow space for notations and future revisions.

2.03 CONTENT OF SCHEDULES

A. Each monthly schedule shall be based on data as of the last day of the current pay period.

B. Description for each activity shall be brief, but convey the scope of work described.

C. Activities shall identify all items of work that must be accomplished to achieve substantial completion, such as items pertaining to Contractor's installation and testing activities; items pertaining to the approval of regulatory agencies; contractor's time required for submittals, fabrication and deliveries; the time required by County to review all submittals as set forth in the Contract Documents; items of work required of County to support pre-operational, startup and final testing; time required for the relocation of utilities. Activities shall also identify interface milestones with the work of other contractors performing work under separate contracts with County.

D. Schedules shall show the complete sequence of construction by activities. Dates for beginning and completion of each activity shall be indicated as well as projected percentage of completion for each activity as of the first day of each month.

E. Submittal schedule for Shop Drawing review, product data, and samples shall show the date of Contractor submittal and the date approved submittals will be required by the County, consistent with the time frames established in the Specifications.

F. For Contract change orders granting time extensions, the impact on the Contract date(s) shall equal the calendar-day total time extension specified for the applicable work in the Contract change orders.

G. For actual delays, add activities prior to each delayed activity on the appropriate critical path(s). Data on the added activities of this type shall portray all steps leading to the delay and shall further include the following: separate activity identification, activity description indicating cause of the delay, activity duration consistent with whichever set of dates below applies, the actual start and finish dates of the delay or, if the delay is not finished, the actual start date and estimated completion date.

H. For potential delays, add an activity prior to each potentially delayed activity on the appropriate critical path(s). Data for added activities of this type shall include alternatives available to mitigate the delay including acceleration alternatives and further show the following: separate activity identification, activity description indicating cause of the potential delay and activity duration equal to zero work days.

2.04 SUPPORTING NARRATIVE

A. Status and scheduling reports identified below shall contain a narrative to document the project status, to explain the basis of Contractor's determination of durations, describe the Contract conditions and restraints incorporated into the schedule and provide an analysis pertaining to potential problems and practical steps to mitigate them.

B. The narrative shall specifically include:

1. Actual completion dates for activities completed during the monthly report period and actual start dates for activities commenced during the monthly report period.
2. Anticipated start dates for activities scheduled to commence during the following monthly report period.
3. Changes in the duration of any activity and minor logic changes.

4. The progress along the critical path in terms of days ahead or behind the Contract date.
5. If the Monthly Status Report indicates an avoidable delay to the Contract completion date or interim completion dates as specified in the Agreement, Contractor shall identify the problem, cause and the activities affected and provide an explanation of the proposed corrective action to meet the milestone dates involved or to mitigate further delays.
6. If the delay is thought to be unavoidable, the Contractor shall identify the problem, cause, duration, specific activities affected and restraints of each activity.
7. The narrative shall also discuss all change order activities whether included or not in the revised/current schedule of legal status. Newly introduced change order work activities and the CPM path(s) that they affect, must be specifically identified. All change order work activities added to the schedule shall conform with the sequencing and Contract Time requirements of the applicable Change Order.
8. Original Contract date(s) shall not be changed except by Contract change order. A revision need not be submitted when the foregoing situations arise unless required by County. Review of a report containing added activities will not be construed to be concurrence with the duration or restraints for such added activities; instead the corresponding data as ultimately incorporated into the applicable Contract change order shall govern.
9. Should County require additional data, this information shall be supplied by Contractor within 10 calendar days.

2.05 SUBMITTALS

A. Contractor shall submit estimated and preliminary progress schedules (as identified in the Terms and Conditions of the Contract and the General Conditions), monthly status reports, a startup schedule and an as-built schedule report all as specified herein.

B. All schedules, including estimated and preliminary schedules, shall be in conformance with the Contract Documents.

C. The finalized progress schedule discussed in the Contract Documents shall be the first monthly status report and as such shall be in conformance with all applicable specifications contained herein.

D. Monthly Status Report submittals shall include a time-scaled (days after notice to proceed) diagram showing all contract activities and supporting narrative. The initial detailed schedule shall use the notice to proceed as the start date. The finalized schedule, if concurred with by County, shall be the Work plan to be used by the contractor for planning, scheduling, managing and executing the Work.

E. The schedule diagram shall be formatted as above. The diagram shall include (1) all detailed activities included in the preliminary and estimated schedule submittals, (2) calendar days prior to substantial completion, (3) summary activities for the remaining days. The critical path activities shall be identified, including critical paths for interim dates, if possible.

F. The Contractor shall submit progress schedules with each application for payment.

2.06 MONTHLY STATUS REPORTS

A. Contractor shall submit detailed schedule status reports on a monthly basis with the Application for Payment. The first such status report shall be submitted with the first Application for Payment and include data as of the last day of the pay period. The Monthly Report shall include a "marked-up" copy of the latest detailed schedule of legal status and a supporting narrative including updated information as described above. The Monthly Report will be reviewed by County and Contractor at a monthly schedule meeting and Contractor will address County's comments on the subsequent monthly report. Monthly status reports shall be the basis for evaluating Contractor's progress.

B. The "marked-up" diagram shall show, for the latest detailed schedule of legal status, percentages of completion for all activities, actual start and finish dates and remaining durations, as appropriate. Activities not previously included in the latest detailed schedule of legal status shall be added, except that contractual dates will not be changed except by change order. Review of a marked-up diagram by County will not be construed to constitute concurrence with the time frames, duration, or sequencing for such added activities; instead the corresponding data as ultimately incorporated into an appropriate change order shall govern.

2.07 STARTUP SCHEDULE

A. At least 60 calendar days prior to the date of substantial completion, Contractor shall submit a time-scaled (days after notice to proceed) diagram detailing the work to take place in the period between 60 days prior to substantial completion, together with a supporting narrative. County shall have 10 calendar days after receipt of the submittal to respond. Upon receipt of County's comments, Contractor shall make the necessary revisions and submit the revised schedule within 10 calendar days. The resubmittal, if concurred with by County, shall be the Work Plan to be used by Contractor for planning, managing, scheduling and executing the remaining work leading to substantial completion.

B. The time-scaled diagram shall use the latest schedule of legal status for those activities completed ahead of the last 60 calendar days prior to substantial completion and detailed activities for the remaining 60-day period within the time frames outlined in the latest schedule of legal status.

C. Contractor will be required to continue the requirement for monthly reports, as outlined above. In preparing this report, Contractor must assure that the schedule is consistent with the progress noted in the startup schedule.

2.08 REVISIONS

A. All revised schedule submittals shall be made in the same form and detail as the initial submittal and shall be accompanied by an explanation of the reasons for such revisions, all of which shall be subject to review and concurrence by County. The revision shall incorporate all previously made changes to reflect current as-built conditions. Minor changes to the approved submittal may be approved at monthly meetings; a minor change is not considered a revision in the context of this paragraph.

B. A revised schedule submittal shall be submitted for review when required by County.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 31 13
PROJECT COORDINATION

PART 1 GENERAL

1.01 SUBMITTALS

A. Sequence of Construction: Within 4 weeks from notice to proceed.

1.02 CONSTRUCTION SAFETY PROGRAM

A. The Contractor shall develop and maintain for the duration of this Contract, a safety program that will effectively incorporate and implement all required safety provisions. The safety program shall be consistent with all Project Site safety requirements. The Contractor shall appoint an employee who is qualified and authorized to supervise and enforce compliance with the safety program.

B. The duty of the Engineer to conduct construction review of the Contractor's performance is not intended to include a review or approval of the adequacy of the Contractor's safety supervisor, the safety program, or any safety measures taken in, on, or near the construction site.

1.03 SAFETY EQUIPMENT

A. The Contractor, as part of his safety program, shall maintain at his office or other well-known place at the jobsite, safety equipment applicable to the work as prescribed by the governing safety authorities, all articles necessary for giving first-aid to the injured, and shall establish the procedure for the immediate removal to a hospital or a doctor's care of any person who may be injured on the jobsite.

B. The Contractor shall do all work necessary to protect the general public from hazards, including, but not limited to, surface irregularities or unramped grade changes in pedestrian sidewalk or walkway, and trenches or excavations in roadway. Barricades, lanterns, and proper signs shall be furnished in sufficient amount to safeguard the plant staff, public, and the work.

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

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

1.04 ACCIDENT REPORTS

A. If death or serious injuries or serious damages are caused, the accident shall be reported immediately by telephone or messenger to the Engineer and Owner. In addition, the Contractor must promptly report in writing to the Engineer all accidents whatsoever arising out of, or in connection with, the performance of the work whether on, or adjacent to, the Site, giving full details and statements of witnesses.

B. If a claim is made by anyone against the Contractor or any Subcontractor on account of any accident, the Contractor shall promptly report the facts in writing to the Engineer, giving full details of the claim.

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

A. Authorized government officials shall at all times have safe access to the work, and the Contractor shall provide proper facilities for such access and inspection.

1.06 UTILITY NOTIFICATION AND COORDINATION

A. Coordinate the Work with various utilities within Project limits. Notify applicable utilities prior to commencing Work, if damage occurs, or if conflicts or emergencies arise during the Work. Contact Owner to obtain contact person for each utility.

1.07 FACILITY OPERATIONS

A. Continuous operation of Owner's facilities is of critical importance. Schedule and conduct activities to enable existing facilities to operate continuously, unless otherwise specified.

B. Construction and startup of IW-1 well and monitoring wells shall be completed prior to IW-2.

C. Perform Work continuously during critical connections and changeovers, and as required to prevent interruption of Owner's operations.

D. When necessary, plan, design, and provide various temporary services, utilities, connections, temporary piping and heating, access, and similar items to maintain continuous operations of Owner's facility.

E. Do not close lines, open or close valves, or take other action which would affect the operation of existing systems, except as specifically required by the Contract Documents and after authorization by Owner and Engineer. Such authorization will be considered within 48 hours after receipt of Contractor's written request.

F. Process or Facility Shutdown:

1. Provide 14 days advance written request for approval of need to shut down a process or facility to Owner and Engineer.
2. Power outages will be considered upon 48 hours written request to Owner and Engineer. Describe the reason, anticipated length of time, and areas affected by the outage. Provide temporary provisions for continuous power supply to critical facility components.

G. Do not proceed with Work affecting a facility's operation without obtaining Owner's and Engineer's advance approval of the need for and duration of such Work.

H. Relocation of Existing Facilities:

1. During construction, it is expected that minor relocations of Work will be necessary.
2. Provide complete relocation of existing structures and Underground Facilities, including piping, utilities, equipment, structures, electrical conduit wiring, electrical duct bank, and other necessary items.
3. Use only new materials for relocated facility. Match materials of existing facility, unless otherwise shown or specified.
4. Perform relocations to minimize downtime of existing facilities.
5. Install new portions of existing facilities in their relocated position prior to removal of existing facilities, unless otherwise accepted by Engineer.

1.08 ADJACENT FACILITIES AND PROPERTIES

A. Examination:

1. After Effective Date of the Agreement and before Work at Site is started, Contractor, Engineer, and affected property owners and utility owners shall make a thorough examination of pre-existing conditions including existing buildings, structures, and other improvements in vicinity of Work, as applicable, which could be damaged by construction operations.
2. Periodic reexamination shall be jointly performed to include, but not limited to, cracks in structures, settlement, leakage, and similar conditions.

B. Documentation:

1. Record and submit documentation of observations made on examination inspections in accordance with Section 01720, Project Record Documents.
2. Such documentation shall be used as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Contractor's operations, and is for the protection of adjacent property owners, Contractor, and Owner.

1.09 REFERENCE POINTS AND SURVEYS

A. Location and elevation of bench marks are shown on Drawings.

B. Contractor's Responsibilities:

1. Provide additional survey and layout required to layout the Work.
2. Notify Engineer at least 3 working days in advance of time when grade and line to be provided by Owner will be needed.
3. Check and establish exact location of existing facilities prior to construction of new facilities and any connections thereto.
4. In event of discrepancy in data or staking provided by Owner, request clarification before proceeding with Work.
5. Maintain complete accurate log of survey work as it progresses as a Record Document.
6. On request of Engineer, submit documentation.
7. Provide competent employee(s), tools, stakes, and other equipment and materials as Engineer may require to check layout, survey, and measurement work performed by others.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CUTTING, FITTING, AND PATCHING

A. Cut, fit, adjust, or patch Work and work of others, including excavation and backfill as required, to make Work complete.

B. Obtain prior written authorization of Engineer before commencing Work to cut or otherwise alter:

1. Structural or reinforcing steel, structural column or beam, elevated slab, trusses, or other structural member.
2. Weather-resistant or moisture-resistant elements.
3. Efficiency, maintenance, or safety of element.
4. Work of others.

C. Refinish surfaces to provide an even finish.

1. Refinish continuous surfaces to nearest intersection.
2. Refinish entire assemblies.
3. Finish restored surfaces to such planes, shapes, and textures that no transition between existing work and the Work is evident in finished surfaces.

D. Restore existing work, Underground Facilities, and surfaces that are to remain in completed Work including concrete-embedded piping, conduit, and other utilities as specified and as shown on Drawings.

E. Make restorations with new materials and appropriate methods as specified for new Work of similar nature; if not specified, use recommended practice of manufacturer or appropriate trade association.

F. Fit Work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces and fill voids.

G. Remove specimens of installed Work for testing when requested by Engineer.

END OF SECTION

SECTION 01340
SHOP DRAWINGS, PROJECT DATA AND SAMPLES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the County for review and approval: working drawings, Shop Drawings, test reports and data on materials and equipment (hereinafter in this section called data), and material samples (hereinafter in this section called samples) as are required for the proper control of work, including, but not limited to those working drawings, Shop Drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.

B. The Contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the County. This log should include the following items:

1. Submittal description and number assigned.
2. Date submitted.
3. Date returned to Contractor.
4. Status of submittal (No exceptions taken, returned for confirmation or resubmittal, rejected).
5. Date of resubmittal and return (as applicable).
6. Date material released (for fabrication).
7. Projected date of fabrication.
8. Projected date of delivery to site.
9. Projected date and required lead time so that product installation does not delay contact.
10. Status of O&M manuals submitted.

1.02 CONTRACTOR’S RESPONSIBILITY

A. It is the duty of the Contractor to check all Drawings, data and samples prepared by or for him before submitting them to the County for review. Each and every copy of the Drawings and data shall bear Contractor's stamp showing that they have been so checked. Shop Drawings submitted to the County without the Contractor's stamp will be returned to the Contractor for conformance with this requirement. Shop Drawings shall indicate any deviations in the submittal from requirements of the Contract Documents.

B. Determine and verify:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with Specifications and indicate all variances from the Specifications.

C. The Contractor shall furnish the County a schedule of Shop Drawing submittals fixing the respective dates for the submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall indicate those that are critical to the progress schedule.

D. The Contractor shall not begin any of the work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the County, with No Exceptions Taken or Approved as Noted.

E. The Contractor shall submit to the County all Drawings and schedules sufficiently in advance of construction requirements to provide no less than 21 calendar days for checking and appropriate action from the time the County receives them.

F. All material and product submittals, other than samples, may be transmitted electronically as a pdf file. All returns to the contractor will be as a pdf file only unless specifically requested otherwise.

G. The Contractor shall be responsible for and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of work prior to the completion of the review by County of the necessary Shop Drawings.

1.03 COUNTY'S REVIEW OF SHOP DRAWINGS AND WORKING DRAWINGS

A. The County's review of drawings, data, and samples submitted by the Contractor shall cover only general conformity to the Specifications, external connections and dimensions which affect the installation.

B. The review of drawings and schedules shall be general and shall not be construed:

1. As permitting any departure from the Contract requirements.
2. As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials.
3. As approving departures from details furnished by the County, except as otherwise provided herein.

C. If the Drawings or schedules as submitted describe variations and show a departure from the Contract requirements which the County finds to be in the interest of the County and to be so minor as not to involve a change in Contract Price or time for performance, the County may return the reviewed drawings without noting any exception.

D. When reviewed by the County, each of the Shop and Working Drawings shall be identified as having received such review being so stamped and dated. Shop Drawings stamped "REJECTED" and with required corrections shown shall be returned to the Contractor for correction and resubmittal.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals, the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by the County on previous submissions. The Contractor shall make any corrections required by the County.

F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the County.

G. The County shall review a submittal/resubmittal a maximum of three times after which cost of review shall be borne by the Contractor. The cost of engineering shall be equal to the County's actual payroll cost.

H. When the Shop Drawings and Working Drawings have been completed to the satisfaction of the County, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the County.

I. No partial submittals shall be reviewed. Incomplete submittals shall be returned to the Contractor and shall be considered not approved until resubmitted.

1.04 SHOP DRAWINGS

A. When used in the Contract Documents, the term "Shop Drawings" shall be considered to mean Contractor's plans for material and equipment which become an integral part of the Project. These drawings shall be complete and detailed. Shop Drawings shall consist of fabrication, drawings, setting drawings, schedule drawings, manufacturer's scale drawings and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature and performance and test data, shall be considered only as supportive to required Shop Drawings as defined above.

B. Drawings and schedules shall be checked and coordinated with the work of all trades involved, before they are submitted for review by the County and shall bear the Contractor's stamp of approval and original signature as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval and original signature shall be returned to the Contractor for resubmission.

C. Each Shop Drawing shall have a blank area 3-1/2 inches by 3-1/2 inches, located adjacent to the title block. The title block shall display the following:

1. Number and title of the Drawing.
2. Date of Drawing or revision.
3. Name of project.
4. Name of contractor and subcontractor submitting drawing.
5. Clear identification of contents and location of the Work.
6. Specification title and number.

D. If Drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal. If acceptable, proper adjustment in the contract shall be implemented where appropriate. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility of executing the work in accordance with the Contract, even though such Drawings have been reviewed.

E. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material. Materials and equipment lists shall give, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.

F. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.

G. All manufacturers or equipment suppliers who proposed to furnish equipment or products shall submit an installation list to the County along with the required Shop Drawings. The installation list shall include at least five installations where identical equipment has been installed and have been in operation for a period of at least 1 year.

H. Only the County will utilize the color "red" in marking Shop Drawing submittals.

1.05 WORKING DRAWINGS

A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's fabrication and erection drawings for structures such as roof trusses, steelwork, precast concrete elements, bulkheads, support of open cut excavation, support of utilities, groundwater control systems, forming and false work; underpinning; and for such other work as may be required for construction of the project.

B. Copies of working drawings as noted above, shall be submitted to the County where required by the Contract Documents or requested by the County and shall be submitted at least 30 days (unless otherwise specified by the County) in advance of their being required for work.

C. Working drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the County, which review will be for general conformance and will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the Contractor; the County and Engineer shall not have responsibility therefor.

1.06 SAMPLES

A. The Contractor shall furnish, for the review of the County, samples required by the Contract Documents or requested by the County. Samples shall be delivered to the County as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until reviewed by the County.

B. Samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.
2. Full range of color, texture and pattern.
3. A minimum of two samples of each item shall be submitted.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01370
SCHEDULE OF VALUES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the County a Schedule of Values allocated to the various portions of the Work, within 10 days after date of Notice to Proceed.

B. Upon request of the County, the Contractor shall support the values with data which will substantiate their correctness.

C. The Schedule of Values shall be used only as the basis for the Contractor's Applications for Payment.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Schedule of Values will be considered for approval by County upon Contractor's request. Identify schedule with:

1. Title of Project and location.
2. Project number.
3. Name and address of Contractor.
4. Contract designation.
5. Date of submission.

B. Schedule of Values shall list the installed value of the component parts of the Work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Follow the table of contents for the Contract Document as the format for listing component items for structures:

1. Identify each line item with the number and title of the respective major section of the Specification.
2. For each line item, list sub values of major products or operations under item.

D. Follow the bid sheets included in this Contract Documents as the format for listing component items for pipe lines.

E. The sum of all values listed in the schedule shall equal the total Contract sum.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01380
CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall employ a competent photographer to take construction record photographs or perform video, recording including furnishing all labor, materials, equipment and incidentals necessary to obtain photographs and/or video recordings of all construction areas.

B. Preconstruction record information shall consist of video recordings on digital video disks (DVD).

C. Construction progress information shall consist of photographs and digital photographs on a recordable compact disc (CD-R).

1.02 QUALIFICATIONS

A. All photography shall be done by a competent camera operator who is fully experienced and qualified with the specified equipment.

B. For the video recording, the audio portion should be done by a person qualified and knowledgeable in the specifics of the Contract, who shall speak with clarity and diction so as to be easily understood.

1.03 PROJECT PHOTOGRAPHS

A. Provide one print of each photograph with each pay application.

B. Provide one recordable compact disc with digital photographs with each pay application.

C. Negatives:

1. All negatives shall remain the property of photographer.
2. The Contractor shall require that photographer maintain negatives or protected digital files for a period of two years from date of substantial completion of the Project.
3. Photographer shall agree to furnish additional prints to County at commercial rates applicable at time of purchase. Photographer shall also agree to participate as required in any litigation requiring the photographer as an expert witness.

D. The Contractor shall pay all costs associated with the required photography and prints. Any parties requiring additional photography or prints shall pay the photographer directly.

E. All project photographs shall be a single weight, color image. All finishes shall be smooth surface and glossy and all prints shall be 8 inches by 10 inches.

F. Each print shall have clearly marked on the back, the name of the Project, the orientation of view, the date and time of exposure, name and address of the photographer and the photographers numbered identification of exposure.

G. All project photographs shall be taken from locations to adequately illustrate conditions prior to construction, or conditions of construction and state of progress. The Contractor shall consult with the County at each period of photography for instructions concerning views required.

1.04 VIDEO RECORDINGS

A. Video, recording shall be done along all routes that are scheduled for construction. Video, recording shall include full, recording of both sides of all streets and the entire width of easements plus 10 feet on each side on which construction is to be performed. All video recording shall be in full color.

B. A complete view, in sufficient detail with audio description of the exact location shall be provided.

C. The engineering plans shall be used as a reference for stationing in the audio portion of the recordings for easy location identification.

D. Two complete sets of video recordings shall be delivered to the County on digital video disks (DVD) for the permanent and exclusive use of the County prior to the start of any construction on the project.

E. All video recordings shall contain the name of the project, the date and time of the video, recording, the name and address of the photographer and any other identifying information required.

F. Construction shall not start until preconstruction video recordings are completed, submitted and accepted by the County. In addition, no progress payments shall be made until the preconstruction video recordings are accepted by the County.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01410
TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. County shall employ and pay for the services of an independent testing laboratory to perform testing specifically indicated on the Contract Documents or called out in the Specifications. County may elect to have materials and equipment tested for conformity with the Contract Documents at any time.

1. Contractor shall cooperate fully with the laboratory to facilitate the execution of its required services.
2. Employment of the laboratory shall in no way relieve the Contractor's obligations to perform the Work of the Contract.

1.02 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of the Work.
3. Perform any duties of the Contractor.

1.03 CONTRACTOR’S RESPONSIBILITIES

A. Cooperate with laboratory personnel; provide access to Work and/or to Manufacturer's operations.

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes which require control by the testing laboratory.

D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. The County may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor and no extra charge to the County shall be allowed on account of such testing and certification.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at the project site or at the source of the product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed due to insufficient notice, Contractor shall reimburse County for laboratory personnel and travel expenses incurred due to Contractor's negligence.

G. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience and as approved by the County.

H. If the test results indicate the material or equipment complies with the Contract Documents, the County shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the contractor shall pay for the laboratory costs directly to the testing firm or the total of such costs shall be deducted from any payments due the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 43 33
MANUFACTURERS' FIELD SERVICES

PART 1 GENERAL

1.01 DEFINITIONS

A. Person-Day: One person for 8 hours within regular Contractor working hours.

1.02 SUBMITTALS

A. Informational Submittals:

1. Training Schedule: Submit, in accordance with requirements of this Specification, not less than 2 days prior to start of equipment installation and revise as necessary for acceptance.
2. Lesson Plan: Submit, in accordance with requirements of this Specification, proposed lesson plan not less than 21 days prior to scheduled training and revise as necessary for acceptance.

1.03 QUALIFICATION OF MANUFACTURER'S REPRESENTATIVE

A. Authorized representative of the manufacturer, factory trained, and experienced in the technical applications, installation, operation, and maintenance of respective equipment, subsystem, or system, with full authority by the equipment manufacturer to issue the certifications required of the manufacturer. Additional qualifications may be specified in the individual specification section.

B. Representative subject to acceptance by Engineer. No substitute representatives will be allowed unless prior written approval by such has been given.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

A. Furnish manufacturers' services, when required by an individual specification section, to meet the requirements of this section.

B. Where time is necessary in excess of that stated in the Specifications for manufacturers' services, or when a minimum time is not specified, time required to perform specified services shall be considered incidental.

C. Schedule manufacturer' services to avoid conflict with other onsite testing or other manufacturers' onsite services.

D. Determine, before scheduling services, that conditions necessary to allow successful testing have been met.

E. Only those days of service approved by Engineer will be credited to fulfill specified minimum services.

F. When specified in individual specification sections, manufacturer's onsite services shall include:

1. Assistance during product (system, subsystem, or component) installation to include observation, guidance, instruction of Contractor's assembly, erection, installation or application procedures.
2. Inspection, checking, and adjustment as required for product (system, subsystem, or component) to function as warranted by manufacturer and necessary to furnish Manufacturer's Certificate of Proper Installation.
3. Providing, on a daily basis, copies of manufacturers' representatives field notes and data to Engineer.
4. Revisiting the Site as required to correct problems and until installation and operation are acceptable to Engineer.
5. Resolution of assembly or installation problems attributable to or associated with respective manufacturer's products and systems.
6. Assistance during functional and performance testing, and facility startup and evaluation.
7. Training of Owner's personnel in the operation and maintenance of respective product as required.

3.02 MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

A. When so specified, a Manufacturer's Certificate of Proper Installation form, a copy of which is attached to this section, shall be completed and signed by equipment manufacturer's representative.

B. Such form shall certify signing party is a duly authorized representative of manufacturer, is empowered by manufacturer to inspect, approve, and operate their equipment and is authorized to make recommendations required to ensure equipment is complete and operational.

3.03 TRAINING

A. General:

1. Furnish manufacturers' representatives for detailed classroom and hands-on training to Owner's personnel on operation and maintenance of specified product (system, subsystem, component) and as may be required in applicable Specifications.

2. Furnish trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with Owner, and familiar with operation and maintenance manual information specified in Section 01730, Operating and Maintenance Data.
3. Manufacturer's representative shall be familiar with facility operation and maintenance requirements as well as with specified equipment.
4. Furnish complete training materials, to include operating and maintenance data, to be retained by each trainee.

B. Training Schedule:

1. List specified equipment and systems that require training services and show:
   a. Respective manufacturer.
   b. Estimated dates for installation completion.
   c. Estimated training dates.
2. Allow for multiple sessions when several shifts are involved.
3. Adjust schedule to ensure training of appropriate personnel as deemed necessary by Owner, and to allow full participation by manufacturers' representatives. Adjust schedule for interruptions in operability of equipment.
4. Coordinate with Section 01370, Schedule of Values and Section 01 91 14, Equipment Testing and Facility Startup.

C. Lesson Plan: When manufacturer or vendor training of Owner personnel is specified, prepare a lesson plan for each required course containing the following minimum information:

1. Title and objectives.
2. Recommended attendees (such as, managers, engineers, operators, maintenance).
3. Course description, outline of course content, and estimated class duration.
4. Format (such as, lecture, self-study, demonstration, hands-on).
5. Instruction materials and equipment requirements.
6. Resumes of instructors providing training.

D. Prestartup Training:

1. Coordinate training sessions with Owner's operating personnel and manufacturers' representatives and with submission of operating and maintenance manuals in accordance with Section 01730, Operating and Maintenance Data.
2. Complete at least 14 days prior to beginning of facility startup.

E. Post-startup Training: If required in Specifications, furnish and coordinate training of Owner's operating personnel by respective manufacturer's representatives.

3.04 SUPPLEMENTS

A. The supplement listed below, following "End of Section," is part of this specification.

1. Manufacturer's Certificate of Proper Installation.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF PROPER INSTALLATION

OWNER _____ EQPT SERIAL NO: _____

EQPT TAG NO: _____ EQPT/SYSTEM: _____

PROJECT NO: _____ SPEC. SECTION: _____

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

☐ Installed in accordance with Manufacturer's recommendations.

☐ Inspected, checked, and adjusted.

☐ Serviced with proper initial lubricants.

☐ Electrical and mechanical connections meet quality and safety standards.

☐ All applicable safety equipment has been properly installed.

☐ Functional tests.

☐ System has been performance tested, and meets or exceeds specified performance requirements. (When complete system of one manufacturer)

Note: Attach any performance test documentation from manufacturer.

Comments: _____

_____

_____

_____

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate their equipment and (iii) authorized to make recommendations required to ensure equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: _____, 20___

Manufacturer:_____

By Manufacturer's Authorized Representative: _____

(Authorized Signature)

SECTION 01 45 16.13
CONTRACTOR QUALITY CONTROL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D3740, Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.
   b. E329, Use in the Evaluation of Testing and Inspection Agencies as Used in Construction.

1.02 DEFINITIONS

A. Contractor Quality Control (CQC): The means by which Contractor ensures that the construction, to include that performed by subcontractors and suppliers, complies with the requirements of the Contract.

1.03 SUBMITTALS

A. Informational Submittals:

1. CQC Plan: Submit, not later than 30 days after receipt of Notice to Proceed.
2. CQC Report: Submit, weekly, an original and one copy in report form.

1.04 OWNER'S QUALITY ASSURANCE

A. All Work is subject to Owner's quality assurance inspection and testing at all locations and at all reasonable times before acceptance to ensure strict compliance with the terms of the Contract Documents.

B. Owner's quality assurance inspections and tests are for the sole benefit of Owner and do not:

1. Relieve Contractor of responsibility for providing adequate quality control measures.
2. Relieve Contractor of responsibility for damage to or loss of the material before acceptance.
3. Constitute or imply acceptance.
4. Affect the continuing rights of Owner after acceptance of the completed Work.

C. The presence or absence of a quality assurance inspector does not relieve Contractor from any Contract requirement.

D. Promptly furnish all facilities, labor, and material reasonably needed for performing such safe and convenient inspections and tests as may be required by Engineer.

E. Owner may charge Contractor for any additional cost of inspection or test when Work is not ready at the time specified by Contractor for inspection or test, or when prior rejection makes re-inspection or retest necessary. Quality assurance inspections and tests will be performed in a manner that will not unnecessarily delay the Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Maintain an adequate inspection system and perform such inspections as will ensure that the Work conforms to the Contract Documents.

B. Maintain complete inspection records and make them available at all times to Owner and Engineer.

C. The quality control system shall consist of plans, procedures, and organization necessary to produce an end product that complies with the Contract Documents. The system shall cover all construction and demolition operations, both onsite and offsite, including Work by subcontractors, fabricators, suppliers and purchasing agents, and shall be keyed to the proposed construction sequence.

3.02 COORDINATION MEETING

A. After the Preconstruction Conference, but before start of construction, and prior to acceptance of the CQC Plan, schedule a meeting with Engineer and Owner to discuss the quality control system.

B. Develop a mutual understanding of the system details, including the forms for recording the CQC operations, control activities, testing, administration of the system for both onsite and offsite Work, and the interrelationship of Contractor's management and control with the Owner's Quality Assurance.

C. There may be occasions when subsequent conferences may be called by either party to reconfirm mutual understandings and/or address deficiencies in the CQC system or procedures that may require corrective action by Contractor.

3.03 QUALITY CONTROL ORGANIZATION

A. CQC System Manager:

1. Designate an individual within Contractor's organization who will be responsible for overall management of CQC and have the authority to act in CQC matters for the Contractor.
2. CQC System Manager may perform other duties on the Project.
3. CQC System Manager shall be an experienced construction person, with a minimum of 3 years construction experience on similar type Work.
4. CQC System Manager shall report to the Contractor's project manager or someone higher in the organization. Project manager in this context shall mean the individual with responsibility for the overall quality and production management of the Project.
5. CQC System Manager shall be onsite during construction; periods of absence may not exceed 2 weeks at any one time.
6. Identify an alternate for CQC System Manager to serve with full authority during the System Manager's absence. The requirements for the alternate will be the same as for designated CQC System Manager.

B. CQC Staff:

1. Designate a CQC staff, available at the Site at all times during progress, with complete authority to take any action necessary to ensure compliance with the Contract. CQC staff members shall be subject to acceptance by Engineer.
2. CQC staff shall take direction from CQC System Manager in matters pertaining to QC.
3. CQC staff must be of sufficient size to ensure adequate QC coverage of Work phases, work shifts, and work crews involved in the construction. These personnel may perform other duties, but must be fully qualified by experience and technical training to perform their assigned QC responsibilities and must be allowed sufficient time to carry out these responsibilities.
4. The actual strength of the CQC staff may vary during any specific Work period to cover the needs of the Project. Add additional staff when necessary for a proper CQC organization.

C. Organizational Changes: Obtain Engineer's acceptance before replacing any member of the CQC staff. Requests for changes shall include name, qualifications, duties, and responsibilities of the proposed replacement.

3.04 QUALITY CONTROL PHASING

A. CQC shall include at least three phases of control to be conducted by CQC System Manager for all definable features of Work, as follows:

1. Preparatory Phase:
   a. Notify Owner at least 48 hours in advance of beginning any of the required action of the preparatory phase.
   b. This phase shall include a meeting conducted by the CQC System Manager and attended by the superintendent, other CQC personnel (as applicable), and the foreman responsible for the definable feature. The CQC System Manager shall instruct applicable CQC staff as to the acceptable level of workmanship required in order to meet Contract requirements.
   c. Document the results of the preparatory phase meeting by separate minutes prepared by the CQC System Manager and attached to the QC report.
   d. Perform prior to beginning Work on each definable feature of Work:
      1) Review applicable Contract Specifications.
      2) Review applicable Contract Drawings.
      3) Verify that all materials and/or equipment have been tested, submitted, and approved.
      4) Verify that provisions have been made to provide required control inspection and testing.
      5) Examine the Work area to verify that all required preliminary Work has been completed and is in compliance with the Contract.
      6) Perform a physical examination of required materials, equipment, and sample Work to verify that they are on hand, conform to approved Shop Drawing or submitted data, and are properly stored.
      7) Review the appropriate activity hazard analysis to verify safety requirements are met.
      8) Review procedures for constructing the Work, including repetitive deficiencies.
      9) Document construction tolerances and workmanship standards for that phase of the Work.
      10) Check to verify that the plan for the Work to be performed, if so required, has been accepted by Engineer.
2. Initial Phase:
   a. Accomplish at the beginning of a definable feature of Work:
      1) Notify Owner at least 48 hours in advance of beginning the initial phase.

2) Perform prior to beginning Work on each definable feature of Work:
   a) Review minutes of the preparatory meeting.
   b) Check preliminary Work to verify compliance with Contract requirements.
   c) Verify required control inspection and testing.
   d) Establish level of workmanship and verify that it meets minimum acceptable workmanship standards. Comparison with sample panels is appropriate.
   e) Resolve all differences.
   f) Check safety to include compliance with and upgrading of the safety plan and activity hazard analysis. Review the activity analysis with each worker.
3) Separate minutes of this phase shall be prepared by the CQC System Manager and attached to the QC report. Exact location of initial phase shall be indicated for future reference and comparison with follow-up phases.
4) The initial phase should be repeated for each new crew to work onsite, or any time acceptable specified quality standards are not being met.

3. Follow-up Phase:
   a. Perform daily checks to verify continuing compliance with Contract requirements, including control testing, until completion of the particular feature of Work.
   b. Daily checks shall be made a matter of record in the CQC documentation and shall document specific results of inspections for all features of Work for the day or shift.
   c. Conduct final follow-up checks and correct all deficiencies prior to the start of additional features of Work that will be affected by the deficient Work. Constructing upon or concealing nonconforming Work will not be allowed.
4. Additional Preparatory and Initial Phases: Additional preparatory and initial phases may be conducted on the same definable features of Work as determined by Owner if the quality of ongoing Work is unacceptable; or if there are changes in the applicable QC staff or in the onsite production supervision or work crew; or if work on a definable feature is resumed after a substantial period of inactivity, or if other problems develop.

3.05 CONTRACTOR QUALITY CONTROL PLAN

A. General:

1. Plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used.
2. An interim plan for the first 30 days of operation will be considered.

3. Construction will be permitted to begin only after acceptance of the CQC Plan or acceptance of an interim plan applicable to the particular feature of Work to be started.
4. Work outside of the features of Work included in an accepted interim plan will not be permitted to begin until acceptance of a CQC Plan or another interim plan containing the additional features of Work to be started.

B. Content:

1. Plan shall cover the intended CQC organization for the entire Contract and shall include the following, as a minimum:
   a. Organization: Description of the quality control organization, including a chart showing lines of authority and acknowledgment that the CQC staff will implement the three-phase control system (see Paragraph QC Phasing) for all aspects of the Work specified.
   b. CQC Staff: The name, qualifications (in resume format), duties, responsibilities, and authorities of each person assigned a QC function.
   c. Letters of Authority: A copy of a letter to the CQC System Manager signed by an authorized official of the firm, describing the responsibilities and delegating sufficient authorities to adequately perform the functions of the CQC System Manager, including authority to stop Work which is not in compliance with the Contract. The CQC System Manager shall issue letters of direction to all other various quality control representatives outlining duties, authorities and responsibilities. Copies of these letters will also be furnished to Owner.
   d. Submittals: Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, offsite fabricators, suppliers and purchasing agents.
   e. Testing: Control, verification and acceptance testing procedures for each specific test to include the test name, frequency, specification paragraph containing the test requirements, the personnel and laboratory responsible for each type of test, and an estimate of the number of tests required.
   f. Procedures for tracking preparatory, initial, and follow-up control phases and control, verification, and acceptance tests, including documentation.
   g. Procedures for tracking deficiencies from identification through acceptable corrective action. These procedures will establish verification that identified deficiencies have been corrected.
   h. Reporting procedures, including proposed reporting formats; include a copy of the CQC report form.

C. Acceptance of Plans: Acceptance of the Contractor's basic and addendum CQC plans is required prior to the start of construction. Acceptance is conditional and will be predicated on satisfactory performance during the construction. Owner reserves the right to require Contractor to make changes in the CQC plan and operations including removal of personnel, as necessary, to obtain the quality specified.

D. Notification of Changes: After acceptance of the CQC plan, Contractor shall notify Engineer, in writing, a minimum of 7 calendar days prior to any proposed change. Proposed changes are subject to acceptance by Engineer.

3.06 CONTRACTOR QUALITY CONTROL REPORT

A. As a minimum, prepare a CQC report for every 7 calendar days. Account for all days throughout the life of the Contract. Reports shall be signed and dated by CQC System Manager. Include copies of test reports and copies of reports prepared by QC staff.

B. Maintain current records of quality control operations, activities, and tests performed, including the Work of subcontractors and suppliers.

C. Records shall be on an acceptable form and shall be a complete description of inspections, the results of inspections, daily activities, tests, and other items, including but not limited to the following:

1. Contractor/subcontractor and their areas of responsibility.
2. Operating plant/equipment with hours worked, idle, or down for repair.
3. Work performed today, giving location, description, and by whom. When a network schedule is used, identify each phase of Work performed each day by activity number.
4. Test and/or control activities performed with results and references to specifications/plan requirements. The control phase should be identified (Preparatory, Initial, Follow-up). List deficiencies noted along with corrective action.
5. Material received with statement as to its acceptability and storage.
6. Identify submittals reviewed, with Contract reference, by whom, and action taken.
7. Offsite surveillance activities, including actions taken.
8. Job safety evaluations stating what was checked, results, and instructions or corrective actions.
9. List instructions given/received and conflicts in Drawings and/or Specifications.
10. Contractor's verification statement.
11. Indicate a description of trades working on the Project; the number of personnel working; weather conditions encountered; and any delays encountered.

12. These records shall cover both conforming and deficient features and shall include a statement that equipment and materials incorporated in file work and workmanship comply with the Contract.

3.07 SUBMITTAL QUALITY CONTROL

A. Submittals shall be as specified in Section 01300, Submittal. The CQC organization shall be responsible for certifying that all submittals are in compliance with the Contract requirements. Owner will furnish copies of test report forms upon request by Contractor. Contractor may use other forms as approved.

3.08 TESTING QUALITY CONTROL

A. Testing Procedure:

1. Perform tests specified or required to verify that control measures are adequate to provide a product which conforms to Contract requirements. Procure services of a licensed testing laboratory. Perform the following activities and record the following data:
    a. Verify testing procedures comply with contract requirements.
    b. Verify facilities and testing equipment are available and comply with testing standards.
    c. Check test instrument calibration data against certified standards.
    d. Verify recording forms and test identification control number system, including all of the test documentation requirements, have been prepared.
    e. Documentation:
        1) Record results of all tests taken, both passing and failing, on the CQC report for the date taken.
        2) Include specification paragraph reference, location where tests were taken, and the sequential control number identifying the test.
        3) Actual test reports may be submitted later, if approved by Engineer, with a reference to the test number and date taken.
        4) Provide directly to Engineer an information copy of tests performed by an offsite or commercial test facility. Test results shall be signed by an engineer registered in the state where the tests are performed.
        5) Failure to submit timely test reports, as stated, may result in nonpayment for related Work performed and disapproval of the test facility for this Contract.

B. Testing Laboratories: Laboratory facilities, including personnel and equipment, utilized for testing soils, concrete, asphalt and steel shall meet criteria detailed in ASTM D3740 and ASTM E329, and be accredited by the American Association of Laboratory Accreditation (AALA), National Institute of Standards and Technology (NIST), National Voluntary Laboratory Accreditation Program (NVLAP), the American Association of State Highway and Transportation Officials (AASHTO), or other approved national accreditation authority. Personnel performing concrete testing shall be certified by the American Concrete Institute (ACI).

3.09 COMPLETION INSPECTION

A. CQC System Manager shall conduct an inspection of the Work at the completion of all Work or any milestone established by a completion time stated in the Contract.

B. Punchlist:

1. CQC System Manager shall develop a punchlist of items which do not conform to the Contract requirements.
2. Include punchlist in the CQC report, indicating the estimated date by which the deficiencies will be corrected.
3. CQC System Manager or staff shall make a second inspection to ascertain that all deficiencies have been corrected and so notify the Owner.
4. These inspections and any deficiency corrections required will be accomplished within the time stated for completion of the entire Work or any particular increment thereof if the Project is divided into increments by separate completion dates.

END OF SECTION

SECTION 01500
CONSTRUCTION FACILITIES AND TEMPORARY CONTROLS

PART 1 GENERAL

1.01 WORK INCLUDED

A. Temporary utilities required during construction.

B. Temporary construction facilities, including field offices.

C. Requirements for security and protection of facilities and property.

D. Requirements for traffic regulation and access to the work.

E. Temporary controls for protection of environment.

1.02 SUBMITTALS

A. Safety and Protection Submittals: Copies of permits or approvals for construction activities from governing safety authorities.

1.03 MOBILIZATION

The Contractor shall:

A. Use only the area designated for Contractor's temporary facilities. Arrange for additional area if needed for construction operations, as acceptable to Owner, and Engineer.

B. Notify Engineer of obstructions not shown or not readily apparent by visual inspection of the staging area. If such obstructions adversely affect Contractor's operations, proper adjustment to Contract will be considered. Do not remove obstructions without Owner's prior consent.

1.04 TEMPORARY UTILITIES

A. Costs After Substantial Completion: Upon acceptance of the work or a portion of the work defined and certified as substantially complete by Engineer, and Owner commences full-time successful operation of the facility or portion thereof, the Owner will bear the cost for utilities used for Owner's operation. Contractor shall continue to pay for utilities used for their operation until final acceptance of the Work, except as provided herein.

B. Electric Power:

1. Electric power will not be available for the construction trailer. Electrical needs will be incurred and paid for by the Contractor. Contractor shall determine the type and amount available and make arrangements for obtaining temporary electric service at the site.
2. Temporary electric power shall meet construction safety requirements of OSHA, State, and other governing agencies.

C. Water:

1. Water used by Contractor from Owner must be accounted for. Supply totalizing flow meter for Contractor use. Contractor will be responsible for conveyance of water from Owner supply to construction site.
2. Contractor shall not use fire hydrants for water supply unless the appropriate County supplied meter and backflow prevention is used.

D. Sewage:

1. Provide and maintain in sanitary condition at all times chemical toilets for Contractor's employees and subcontractors' employees that comply with regulations of local and State health departments. They shall be of watertight construction so that no contamination of the area can result from their use. Contractor shall make arrangements for frequent emptying of toilets with local sewage treatment authority. Upon completion of the work, remove toilets and restore area to original condition.
2. Use of Owner's existing sanitary facilities by construction personnel will not be allowed.

E. Field Offices:

1. In addition to Contractor's field office, Contractor shall furnish and maintain a separate temporary field office for Engineer at a designated location. The field office shall be an office trailer, as approved, and shall be not less than 300 square feet of floor space with an enclosed office room at one end. The office shall be situated in a location acceptable to Engineer. The office shall be watertight and weather-proof, with screened windows and a solid door with a lock and four keys. The office shall be provided with electrical services for the duration of the contract. The office shall have any necessary equipment adequate to maintain a temperature of 72 degrees F under all conditions. The office shall be equipped with a plumbing system with drains including a separate room with lavatory, water closet, sink, wall cabinet, mirror, hand soap, and paper towels. A portable outside toilet is not acceptable. All utilities shall be provided and maintained by Contractor. No wastewater hookups to existing plant operations will be allowed. Trailer waste disposal tanks shall be pumped out by Contractor on a regular basis throughout the project duration as required to maintain clean and sanitary conditions.

2. Contractor shall supply a water cooler or refrigerator with bottled water and maintain an adequate supply throughout construction.
3. The floor of the office shall be covered with linoleum or tile and shall be furnished with:
    a. Two 30-inch by 60-inch desks with drawers and two office chairs.
    b. Folding table(s) and chairs to seat ten people.
    c. One four-drawer legal size file cabinet with lock and keys.
    d. One 7-foot by 12-inch by 3-foot steel utility shelving unit assembled.
    e. One bookshelf.
    f. One 3-foot by 4-foot bulletin board, mounted.
    g. One 3-foot by 4-foot dry erase board, mounted.
    h. One first-aid kit.
    i. Two fire extinguishers, non-toxic, dry chemical, meeting UL for Class A, B and C fires.
    j. Two waste baskets.
    k. One plain paper copier with scanning capabilities and with enlargement and reduction capabilities and automatic feeder, as approved by Engineer. Contractor shall furnish and maintain all copier supplies during the contract.
    l. A high speed wireless internet connection for Engineer's use for the duration of the Project.

1.05 REMOVAL OF TEMPORARY FACILITIES

A. Contractor shall remove temporary facilities after substantial completion, as directed by Engineer and prior to Final Completion inspection, and return area used by temporary facilities to same or better condition than originally provided.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 TEMPORARY CONSTRUCTION

A. Access Roads and Parking:

1. Temporary construction access roads will be made available to Contractor as necessary to execute the work. Maintain in good condition throughout the Project and leave the area in a condition satisfactory to the Owner.
2. Contractor shall use area designated within Contractor's temporary facilities and as agreed upon by Engineer and Owner, for parking of Contractor's employee vehicles. No personal vehicles will be allowed in the construction area or plant site outside of the designated construction and parking areas. Subcontractor vehicles required to be on site will be escorted to the site by Owner or Engineer.

B. Storage Yards and Buildings:

1. The Contractor shall:
   a. Construct temporary storage yards for the storage of products that are not subject to damage by weather conditions. Materials such as pipe and reinforcing and structural steel shall be stored on pallets or racks, off the ground, and in a manner to allow ready access for inspection and inventory. Temporary gravel surfacing of storage yards must be approved by Engineer.
   b. Store combustible materials (paints, solvents, fuels, etc.) in a well-ventilated building remote from other buildings.

C. Fencing and Barricades:

1. Security Fence: Use of security fences by Contractor is permissible. Do not modify existing fencing at location without prior authorization and approval by Owner.
2. Barricades: Contractor shall provide barricades as necessary to prevent unauthorized entry to construction areas, both inside and outside of fenced area. Also provide barricades to protect existing facilities and adjacent properties from potential damage. Locate barriers to enable access by facility operators and property owners.

3.02 SAFETY AND PROTECTION

A. Examination of Existing Facilities:

1. After the Contract is awarded and before the commencement of work, Contractor shall make a thorough examination of all existing buildings, structures, and other improvements in the vicinity of the work, as applicable, which might be damaged by construction operations.
2. Periodic examinations of existing buildings, structures, and other improvements in the vicinity of the work shall be made jointly by authorized representatives of Contractor, Engineer, and Owner. The scope of examination will include cracks in structures, settlement, leakage, and similar conditions.
3. Records in triplicate of all observations shall be prepared by the authorized representative of Owner and of Contractor. Photographs, as requested by Owner, shall be made by the Contractor. One signed copy of every document and photograph will be kept on file in the office of Engineer.
4. These records and photographs are intended for use as indisputable evidence in ascertaining whether and to what extent damage occurred as a result of Contractor’s operations, and are for protection of adjacent property owners, Contractor, and Owner.

B. Safety Requirements:

1. Contractor shall do whatever work is necessary for safety and be solely and completely responsible for conditions of the job site, including safety of all persons (including employees) and property during the Contract period. This requirement shall apply continuously and not be limited to normal working hours.
2. Safety provisions shall conform to Federal and State Departments of Labor Occupational Safety and Health Act (OSHA), and other applicable federal, state, county, and local laws, ordinances, codes, requirements set forth herein, and regulations that may be specified in other parts of these Contract Documents. Where these are in conflict, the more stringent requirement shall be followed. Contractor shall become thoroughly familiar with governing safety provisions and shall comply with the obligations set forth therein.
3. Contractor shall develop and maintain for the duration of the Contract a safety program that will effectively incorporate and implement required safety provisions. Contractor shall appoint a qualified employee who is authorized to supervise and enforce safety program compliance.
4. Engineer's duty to conduct construction review of Contractor's performance is not intended to include a review or approval of the adequacy of Contractor's safety supervisor, safety program, or safety measures taken on or near the construction site.
5. As part of safety program, Contractor shall maintain at its office or other well-known place at the jobsite safety equipment applicable to the work as prescribed by the governing safety authorities and articles necessary for administering first-aid. Establish procedures for the immediate removal to a hospital or a doctor's care of persons who may be injured on the job site.
6. Contractor shall comply with Owner's safety rules while on Owner's property.
7. If death or serious injuries or damages occur, the accident shall be reported immediately by telephone or messenger to Engineer. In addition, Contractor shall promptly report in writing all accidents whatsoever arising out of, or in connection with, the performance of the work whether on or adjacent to the site, giving full details and statements of witnesses.
8. If claim is made by anyone against Contractor or any subcontractor on account of accident, Contractor shall promptly report the facts in writing, giving full details of the claim.

C. Traffic Safety and Access: Contractor shall comply with rules and regulations of the city, state, and county authorities regarding closing or restricting the use of public streets or highways. No public or private road shall be closed, except by written permission of the proper authority. Ensure the least possible obstruction to traffic, both onsite and offsite, and normal commercial pursuits. Traffic control procedures and devices used on all local, county, and state rights-of-way shall meet the requirements of the applicable current laws and regulations for traffic control.

D. Fire Prevention: Contractor shall perform all work in a firesafe manner. Furnish and maintain on the site adequate firefighting equipment capable of extinguishing incipient fires. Comply with applicable federal, local, and state fire prevention regulations. Where these regulations do not apply, follow applicable parts of the National Fire Prevention Standard for Safeguarding Building Construction Operations (NFPA No. 241).

E. Use of Explosives: No blasting or use of explosives will be allowed on the job site.

F. Protection of Work and Property:

1. General: Contractor shall employ such means and methods necessary to adequately protect public property and property of the Owner against damage. In the event of damage to such property, immediately restore the property to a condition equal to its original condition and to the satisfaction of Engineer and property owner, and bear all costs thereof.
2. Finished Construction:
   a. Contractor shall assume the responsibility for protection of finished construction and shall repair and restore any and all damage to finished work to its original or better condition, until the project has been deemed complete by Owner.
   b. At such time temporary facilities and utilities are no longer required for the work, Contractor shall notify Engineer of intent and schedule for their removal. Remove temporary facilities and utilities from the site as Contractor's property and leave the site in such condition as specified, as shown on the Drawings or as directed by Owner.
   c. In unfinished areas, Contractor shall leave the site evenly graded, sodded, or planted as necessary, in a condition that will restore original drainage, and with an appearance equal to or better than original.

3.03 ENVIRONMENTAL CONTROLS

A. General:

1. Contractor in executing the work shall maintain affected areas within and outside project boundaries free from environmental pollution that would be in violation of federal, state, or local regulations.
2. Do not impair operation of existing sewer systems. Prevent construction material, pavement, concrete, earth, volatile and corrosive wastes, and other debris from entering sewers, pump stations, or other water or wastewater treatment facility structures. Maintain original site drainage wherever possible.

B. Waste Pollution Control:

1. The Contractor shall:
   a. Comply with laws, rules, and regulations of the State of Florida and agencies of the United States Government prohibiting the pollution of lakes, wetlands, streams, or river waters from the dumping of refuse, rubbish, or debris.
   b. Comply with the procedures and guidance outlined by the U.S. Environmental Protection Agency, the Florida Department of Environmental Protection, Manatee County, and the Southwest Florida Water Management District for erosion, and sediment control and control of turbidity in all discharges and obtain any necessary permits required for compliance.

C. Waste Material Disposal:

1. Excavated material, drilling additives, and other waste material must be disposed of by Contractor in accordance with the State of Florida and Manatee County Regulations in licensed landfills or at other sites for which approval is obtained. Contractor shall submit the proposed haul route(s) for each site intended to be used and shall bear all costs associated with the disposal of the waste. Provide watertight conveyance for liquids, semi-liquids, or saturated solids that tend to bleed during transport. A manifest must be obtained by Owner prior to removal to disposal site. Disposal costs for hazardous waste materials are the responsibility of Contractor.
2. Contractor shall maintain areas covered by the contract and affected public properties free from accumulations of waste, debris, and rubbish caused by construction operations. Remove excavated materials from the site in a manner approved by Engineer.

D. Air Pollution Control: Contractor shall minimize air pollution likely to occur from construction operations by wetting down bare soils during windy conditions, requiring proper combustion emission control devices on construction vehicles and equipment, and by shutdown of motorized equipment not in use. Trash burning will not be permitted on the construction site.

E. Noise Control: Contractor shall minimize noise by executing work using appropriate construction methods and equipment. If necessary, provide acoustical barriers so noise emanating from tools or equipment will not exceed legal noise levels.

END OF SECTION

SECTION 01510
TEMPORARY AND PERMANENT UTILITIES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for furnishing all requisite temporary utilities, i.e., power, water, sanitation, etc., and temporary facilities, including field offices. The Contractor shall obtain and pay for all permits required as well as pay for all temporary usages. The Contractor shall remove all temporary facilities upon completion of work.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with National Electric Code.

B. Comply with federal, state and local codes and regulations and with utility company requirements.

C. Comply with County Health Department regulations.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

A. Materials for temporary utilities may be "used". Materials for electrical utilities shall be adequate in capacity for the required usage, shall not create unsafe conditions and shall not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

A. Arrange with the applicable utility company for temporary power supply. Provide service required for temporary power and lighting and pay all costs for permits, service and for power used.

B. Temporary electric power shall meet construction safety requirements of OSHA, State, and other governing agencies.

2.03 TEMPORARY WATER

A. The Contractor shall arrange with Manatee County Utilities Customer Service office to provide water for construction purposes, i.e., meter, pay all costs for installation, maintenance and removal, and service charges for water used.

B. The Contractor shall protect piping and fitting against freezing.

2.04 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide sanitary facilities in compliance with all laws and regulations. They shall be of watertight construction so that no contamination of the area can result from their use. Contractor shall make arrangements for frequent emptying of toilets with local sewage treatment authority. Upon completion of the work, remove toilets and restore area to original condition.

B. The Contractor shall service, clean and maintain facilities and enclosures.

2.05 TEMPORARY FACILITIES: FIELD OFFICES

A. Contractor shall furnish and maintain a temporary field office for Contractor's use. The field office shall be an office trailer, as approved, and shall be situated in a location acceptable to the Owner. The office shall be watertight and weather proof, with screened windows and a solid door.

B. The field office shall be provided with electrical services for the duration of the contract.

C. The office shall be furnished with a high-speed wireless internet connection for the duration of the Project.

D. All utilities shall be provided and maintained by Contractor.

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall maintain and operate systems to assure continuous service.

B. The Contractor shall modify and extend systems as work progress requires.

3.02 REMOVAL

A. The Contractor shall completely remove temporary facilities, materials and equipment when their use is no longer required.

B. The Contractor shall clean and repair damage caused by temporary installations or use of temporary facilities. Contractor shall return area used by temporary facilities to same or better condition than originally provided.

END OF SECTION

SECTION 01570
TRAFFIC REGULATION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for providing safe and expeditious movement of traffic through construction zones. A construction zone is defined as the immediate areas of actual construction and all abutting areas which are used by the Contractor and which interfere with the driving or walking public.

B. The Contractor shall remove temporary equipment and facilities when no longer required, restore grounds to original or to specified conditions.

1.02 TRAFFIC CONTROL

A. The necessary traffic control shall include, but not be limited to, such items as proper construction warning signs, signals, lighting devices, markings, barricades, channelization and hand signaling devices. The Contractor shall be responsible for installation and maintenance of all devices and detour routes and signage for the duration of the construction period. The Contractor shall utilize the appropriate traffic plan from the FDOT Maintenance of Traffic Standards, Series 600 of the FDOT Roadway and Traffic Design Standards, Latest Edition.

B. Should there be the necessity to close any portion of a roadway carrying vehicles or pedestrians the Contractor shall submit a traffic control plan (TCP) at least 5 days before a partial or full day closure, and at least 8 days before a multi-day closure. TCP shall be submitted, along with a copy of their accreditation, by a certified IMSA or ATSA Traffic Control Specialist.

1. At no time will more than one lane of a roadway be closed to vehicles and pedestrians without an approved road closure from the County Transportation Department. With any such closings, adequate provision shall be made for the safe expeditious movement of each.
2. All traffic control signs must be in place and inspected at least 1 day in advance of the closure. Multi-day closures notification signs shall be in place at least 3 days in advance of the closure. All signs must be covered when no in effect, and checked twice a day by the Worksite Traffic Supervisor when they are in effect.

C. The Contractor shall be responsible for removal, relocation, or replacement of any traffic control device in the construction area which exists as part of the normal preconstruction traffic control scheme. Any such actions shall be performed by the Contractor under the supervision and in accordance with the instructions of the applicable highway department unless otherwise specified.

D. The Contractor will consult with the County immediately on any vehicular or pedestrian safety or efficiency problem incurred as a result of construction of the Project.

E. The Contractor shall provide ready access to businesses and homes in the project area during construction. The Contractor shall be responsible for coordinating this work with affected homeowners.

F. When conditions require the temporary installation of signs, pavement markings and traffic barriers for the protection or workers and traffic, the entire array of such devices shall be depicted on working drawings for each separate stage of work. These drawings shall be submitted to the County for review and approval prior to commencement of work on the Site.

G. Precast concrete traffic barriers shall be placed adjacent to trenches and other excavations deeper than 6 inches below the adjacent pavement surface.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 57 13
TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.01 SUMMARY

A. This section covers Work necessary for stabilization of soil to prevent erosion during construction and land disturbing activities, to implement structural and nonstructural Best Management Practices (BMP) to control soil erosion by wind or water and keep eroded sediments and other construction-generated pollutants from moving off project sites.

B. The Contractor is responsible for providing and maintaining an effective erosion and sediment control system. Requirements described in the Specifications and shown on the Drawings shall be considered the minimum to be provided for all project construction sites and conditions. The Contractor shall provide additional measures as necessary to provide an effective erosion and sediment control system. This specification covers all project activities, including material sources, disposal sites, and offsite mitigation areas unless specific project activities are excluded elsewhere in this specification or in other Contract Documents controlling the Work.

C. National Pollutant Discharge Elimination System: Comply with Federal, state, and local laws, rules and regulations, and the National Pollutant Discharge Elimination System (NPDES) Construction Stormwater Discharge Permit or Permits applicable to the project. A copy of the Project's General Construction Permit, if applicable to the Project, is available from Owner. NPDES General Construction permits are required on projects that involve disturbance of 1 acre or more with potential to discharge stormwater to surface waters.

D. Other Regulations: A local government erosion and sediment control permit may apply and some local agency requirements may be more stringent than this specification. Adequate erosion and sediment control is essential for complying with the federal Endangered Species Act where construction runoff enters waters inhabited by protected species.

E. The Contractor is responsible for paying any fines assessed by regulatory agencies or jurisdiction for failure to meet effective erosion and sediment control system.

1.02 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, Section 104: Prevention, Control, and Abatement of Erosion and Water Pollution, Latest Edition.

2. ASTM International (ASTM):
   a. D638, Standard Test Method for Tensile Properties of Plastics.
   b. D3776/D3776M, Standard Test Methods for Mass Per Unit Area (Weight) of Fabric.
   c. D4355, Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus.
   d. D4632/D4632M, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles.
3. Federal Emergency Management Agency (FEMA).
4. National Weather Service:
   a. Precipitation-Frequency of the United States by State/Territory, 2012.
   b. Precipitation Frequency Data Server, 2012.
5. U.S. Department of Agriculture, Natural Resources Conservation Service: *Urban Hydrology for Small Watersheds*; 1986. Technical Release No. 55.
6. U.S. Environmental Protection Agency:
   a. Guidelines for Erosion and Sedimentation Control Planning.
   b. Developing Your Stormwater Pollution Prevention Plan: A Guide for Construction Sites, 2007. EPA-833-R-06-004.
   c. National Menu of BMPs, 2012.
   d. Implementation, Processes, Procedures, and Methods to Control Pollution Resulting from all Construction Activity.

   Erosion and Sediment Control Surface Mining in Eastern United States.

1.03 SYSTEM DESCRIPTION

A. Erosion, Sediment and Flood Control:

1. Provide, maintain, and operate temporary facilities to control erosion and sediment releases, and to protect the Work and existing facilities from flooding during construction period.
2. Soil erosion stabilization and sedimentation control consists of the following elements: Construction of temporary erosion control facilities such as silt fences.

B. Activities shall conform to the Florida Stormwater, Erosion and Sedimentation Control Inspector's Manual, latest version, and Drawings. In the event of a conflict, the more stringent requirement shall apply.

C. Personnel Training: Prior to commencement of construction, applicable personnel must have an understanding of the NPDES Construction Stormwater Discharge Permit's requirements and their specific responsibilities under the permit. At a minimum, personnel must be trained to understand the following as it relates to the scope of their job duties:

1. Procedures for complying with the pollution prevention requirements.
2. Procedures for conducting inspections, recording findings, and taking corrective action.

D. Install work limit fence along the Site shown on the Drawings or as instructed by Engineer. Space posts and attach fence fabric to posts as shown on the Drawings. Do not fasten fence to trees. Throughout the life of the Project, preserve and protect delineated area, acting immediately to repair or restore any fencing damaged or removed.

E. To the degree possible, coordinate this temporary Work with permanent drainage and erosion control work the Contract requires.

F. Engineer may require additional temporary control measures if it appears pollution or erosion may result from weather, nature of materials, or progress on the Work.

G. Pollution Control: Use BMPs to prevent or minimize stormwater exposure to pollutants from spills; vehicle and equipment fueling, maintenance, and storage; other cleaning and maintenance activities; and waste handling activities. These pollutants include fuel, hydraulic fluid, and other oils from vehicles and machinery, as well as debris, leftover paints, solvents, and glues from construction operations. Implement the following BMPs when applicable:

1. Written spill prevention and response procedures.
2. Employee training on spill prevention and proper disposal procedures.
3. Spill kits in all vehicles.
4. Regular maintenance schedule for vehicles and machinery.
5. Material delivery and storage controls.
6. Training and signage.
7. Covered storage areas for waste and supplies.

H. If Engineer orders the Work suspended, continue to control erosion, pollution, and runoff during the shutdown.

I. Nothing in this section shall relieve Contractor from complying with other Contract requirements.

1.04 QUALITY ASSURANCE

A. Water pollution control shall comply with procedures outlined in U.S. Environmental Protection Agency manuals entitled, “Guidelines for Erosion and Sedimentation Control Planning” and “Implementation, Processes, Procedures, and Methods to Control Pollution Resulting from all Construction Activity”.

PART 2 PRODUCTS

2.01 HIGH VISIBILITY FENCING: WORK LIMIT FENCE

A. High Visibility Fence: UV stabilized, orange, high-density polyethylene or polypropylene mesh.

B. Height: 4 feet minimum.

C. Support Posts: Wood or steel with sufficient strength and durability to support the fence through the life of the Project.

2.02 INLET PROTECTION AND DRAIN PIPE ENTRANCE

A. Geotextile as specified for Silt Fence.

2.03 SILT (SEDIMENT) FENCE

A. Geotextile:

1. In accordance with requirements of Table No. 1:
2. Manufacturers and Products:
   a. Mirafi; 100x.
   b. Geotext; 915sc.

Table No. 1

Physical Property	Required Value	Test Method
Weight, oz/sq yd, min.	4	ASTM D3776/D3776M
Equivalent Opening Size, max.	50-70	U.S. Standard Sieve
Grab Tensile Strength, lb, min.	160	ASTM D4632
Ultraviolet Radiation Resistance, % Strength Retention	70	ASTM D4355

B. Support Posts: As recommended by manufacturer of geotextile.

C. Fasteners: Heavy-duty wire staples at least 1-inch long, tie wires, or hog rings, as recommended by manufacturer of geotextile.

2.04 STABILIZED CONSTRUCTION ENTRANCE

A. Construct a pad from stone 3 inches to 6 inches in size, placed at least 8 inches deep and not less than 50 feet long.

B. Provide aggregate free of extraneous materials that may cause or contribute to track out.

C. Place separation geotextile under the rock to prevent fine sediment from pumping up into the rock pad. See Article Silt Fence for required geotextile properties.

2.05 STREET CLEANING

A. Use self-propelled pickup street sweeper(s). Mechanical broom sweepers are not allowed where environmental concerns exist about storm water pollution or air quality.

PART 3 EXECUTION

3.01 PREPARATION

A. Contractor shall be responsible for phasing Work in areas allocated for their exclusive use during Project, including proposed stockpile areas and installation of temporary erosion control devices, ditches, or other facilities.

B. Areas designated for Contractor's use during Project may be temporarily developed to provide working, staging, and administrative areas. Preparation of these areas shall be in accordance with other requirements contained within Specifications and completed in a manner to control sediment transport away from area.

C. High Visibility Fencing: Install high visibility fencing in accordance with the Drawings.

D. Inlet Protection and Drain Pipe Entrance: Install inlet protection below or above, or as a prefabricated cover at each inlet grate, as shown on the Drawings. Install inlet protection devices prior to beginning clearing, grubbing or earthwork activities. Geotextile fabric used in prefabricated inlet protection devices must meet or exceed the requirements for Moderate Survivability and minimum filtration properties. When depth of accumulated sediment and debris reaches approximately one-half the height of an internal device or one-third the height of external device (or less when so specified by the manufacturers) or as designated by Engineer, remove deposits and stabilize onsite.

1. Below Inlet Grate:
    a. Prefabricated units specifically designed for inlet protection.
    b. Must remain securely attached to drainage structure when fully loaded with sediment and debris or at the maximum level of sediment and debris specified by manufacturer.
2. Above Inlet Grate:
    a. Devices may be silt fence, sandbags, or prefabricated units specifically designed for inlet protection.
    b. Must remain securely in place around drainage structure under all conditions.

3. Inlet Grate Cover:
    a. Prefabricated units specifically designed for inlet protection and:
        1) Be a sewn geotextile fabric unit fitted to individual grate and completely enclosing grate.
        2) Have built-in lifting devices to allow manual access of stormwater system.
        3) Use an orange monofilament geotextile fabric.

E. Silt (Sediment) Fence Installation:

1. Install prior to starting earth disturbing activities.
2. Construct in accordance with manufacturer's instructions and The Florida Stormwater, Erosion, and Sedimentation Control Inspector's Manual.
3. Install geotextile in one piece, or continuously sewn to make one piece, for full length and height of fence, including portion of geotextile buried in one toe trench. Take precaution not to puncture geotextile during installation.
4. Install bottom edge of sheet in toe trench and backfill in a way that securely anchors geotextile in trench.
5. Securely fasten geotextile to each support post in a way that will not result in tearing of geotextile when fence is subjected to service loads.
6. When joints are necessary, splice geotextile together only at support post, with a minimum 6-inch overlap, and securely fasten both ends to support post.
7. Geotextile shall not extend more than 34 inches above ground surface.
8. Securely fasten to upslope side of each support post using ties. Do not staple geotextile to existing trees.
9. Remove after upslope area has been permanently stabilized.

F. Soil Stockpiles:

1. Protect from erosion with silt fence.
2. Sediment transport and erosion from working stockpiles shall be controlled and restricted from moving beyond immediate stockpile area by construction of temporary toe-of-slope ditches and accompanying silt fences, as necessary. Keep these temporary facilities in operational condition by regular cleaning, regrading, and maintenance.

G. Stabilized Construction Entrance: Construct temporary stabilized construction entrance in accordance with the Drawings, prior to beginning any clearing, grubbing, earthwork, or excavation. When stabilized entrance no longer prevents track out of sediment or debris, either rehabilitate existing entrance to original condition or construct a new entrance.

H. Street Cleaning: Use self-propelled pickup street sweepers whenever required by Engineer to prevent transport of sediment and other debris off Project Site. Provide street sweepers designed and operated to meet air quality standards. Street washing with water will require approval by Engineer. Intentional washing of sediment into storm sewers or drainage ways must not occur. Vacuuming or dry sweeping and material pickup must be used to cleanup released sediments.

3.02 FIELD QUALITY CONTROL

A. Conduct inspections jointly with Engineer every 2 weeks to evaluate conformance to requirements of Specifications.

B. Replace or repair failed or overloaded silt fences, check dams, or other temporary erosion control devices within 2 days after Site inspections.

3.03 MAINTENANCE

A. Construction activities must avoid or minimize excavation and creation of bare ground during wet weather.

B. Promptly repair or replace silt fence that becomes entangled.

C. Silt Traps:

1. Clean silt traps of collected sediment after every storm or as determined from biweekly inspections.
2. Perform cleaning in a manner that will not direct sediment into storm drain piping system.
3. Take removed sediment to area selected by Engineer where it can be cleaned of sticks and debris, then allowed to dry.
4. Dispose of final sediment onsite as designated by Engineer.
5. Dispose of debris offsite.

D. Regrade unpaved earth drainage ditches as needed to maintain original grade and remove sediment buildup. If ditch becomes difficult to maintain, install additional erosion control devices such as check dams, temporary paving, or silt fences as directed by Engineer.

E. Inspect, repair, and replace as necessary erosion control measures during the time period from start of construction to completion of construction.

F. The intentional washing of sediment into storm sewers or drainage ways must not occur. Vacuuming or dry sweeping and material pickup must be used to cleanup released sediments.

G. Inspect BMPs in accordance with the schedule in the NPDES Construction Stormwater Discharge Permit(s) or as directed by Engineer.

H. Complete an inspection report within 24 hours of an inspection. Each inspection report shall be signed and identify corrective actions. Document that corrective actions are performed within 7 days of identification. Keep a copy of all inspection reports at the Site or at an easily accessible location.

I. Initiate repair or replacement of damaged erosion and sediment control BMPs immediately, and work completed by end of next work day. Significant replacement or repair must be completed within 7 days, unless infeasible.

J. Within 24 hours, remediate any significant sediment that has left construction site. Investigate cause of the sediment release and implement steps to prevent a recurrence of discharge within same 24 hours. Perform in-stream cleanup of sediment according to applicable regulations.

K. At end of each work day, stabilize or cover soil stockpiles or implement other BMPs to prevent discharges to surface waters or conveyance systems leading to surface waters.

L. Temporarily stabilize soils at end of shift before holidays and weekends, if needed. Ensure soils are stable during rain events at all times of year.

M. Initiate stabilization by no later than end of next work day after construction work in an area has stopped permanently or temporarily.

N. Provide permanent erosion control measures on all exposed areas. Do not remove temporary sediment control practices until permanent vegetation or other cover of exposed areas is established. However, do remove all temporary erosion control measures as exposed areas become stabilized, unless doing so conflicts with local requirements. Properly dispose of construction materials and waste, including sediment retained by temporary BMPs.

3.04 REMOVAL AND CLEANING

A. When an erosion control BMP is no longer required, remove BMP and all associated hardware from the Project limits. When materials are biodegradable, Engineer may approve leaving temporary BMP in place.

B. Permanently stabilize all bare and disturbed soil after removal of erosion and sediment control BMPs. Dress sediment deposits remaining after BMPs have been removed to conform to existing grade. Prepare and sod graded area.

END OF SECTION

SECTION 01580
PROJECT IDENTIFICATION AND SIGNS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall furnish, install and maintain County project identification signs.

B. The Contractor shall remove signs on completion of construction.

C. The Contractor shall allow no other signs to be displayed except for traffic control and safety.

1.02 PROJECT IDENTIFICATION SIGN (COUNTY)

A. Two painted signs, of not less than 32 square feet (3 square meters) area, with painted graphic content to include:

1. Title of Project.
2. Name of County.
3. Names and titles of authorities as directed by County.
4. Prime Contractor.

B. Graphic design, style of lettering and colors: As approved by the County.

C. Erect on the Site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the County.

1.03 INFORMATIONAL SIGNS

A. Painted signs with painted lettering, or standard products.

1. Size of signs and lettering: as required by regulatory agencies, or as appropriate to usage.
2. Colors: as required by regulatory agencies, otherwise of uniform colors throughout project.

B. Erect at appropriate locations to provide required information.

1.04 QUALITY ASSURANCE

A. Sign Painter: Professional experience in type of work required.

B. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction period.

1.05 PUBLIC NOTIFICATION

A. Door Hangers: The Contractor shall generate and distribute door hangers to all residents who will be impacted by project construction.

1. Residents impacted include anyone who resides inside, or within 500 feet of project limits of construction.
2. The Contractor shall have additional door hangers available in the field to distribute to local residents or the public should they indicate they were not notified of the project.

B. Door Hangers shall be distributed prior to start of construction of the project. Hangers shall be affixed to doors of residents via elastic bands or tape.

EXAMPLE:

PLEASE PARDON THE INCONVENIENCE WHILE THE ROADWAY IS BEING RECONSTRUCTED IN YOUR NEIGHBORHOOD

This project consists of utility improvements and the reconstruction of ??? Boulevard from U.S. ??? to ??? Street West. The project is expected to begin in August, 200X and be completed in July 200X.

Location Map

WE HOPE TO KEEP ANY INCONVENIENCE TO A MINIMUM. HOWEVER, IF YOU HAVE ANY PROBLEMS, PLEASE CONTACT THE FOLLOWING:

A. Contractor — Project Manager
Contractor Address — PM Address
Contractor Phone (Site Phone) — PM Phone No. & Ext.

B. Project Inspector
Inspector Phone Number

AFTER HOURS EMERGENCY NUMBER – (941) 747-HELP
THANK YOU FOR YOUR UNDERSTANDING AND PATIENCE
MANATEE COUNTY GOVERNMENT –
PROJECT MANAGEMENT DEPT.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: May be new or used, wood or metal, in sound condition structurally adequate to work and suitable for specified finish.

B. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints.

1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.

C. Rough Hardware: Galvanized.

D. Paint: Exterior quality, as specified in the Contract Documents.

PART 3 EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

A. Paint exposed surface or supports, framing and surface material; one coat of primer and one coat of exterior paint.

B. Paint graphics in styles, size and colors selected.

3.02 MAINTENANCE

A. The Contractor shall maintain signs and supports in a neat, clean condition; repair damages to structures, framing or sign.

3.03 REMOVAL

A. The Contractor shall remove signs, framing, supports and foundations at completion of project.

END OF SECTION

SECTION 01600
MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Material and equipment incorporated into the Work:

1. Conform to applicable specifications and standards.
2. Comply with size, make, type and quality specified, or as specifically approved in writing by the County.
3. Manufactured and Fabricated Products:
   a. Design, fabricate and assemble in accordance with the best engineering and shop practices.
   b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.
   c. Two or more items of the same kind shall be identical and manufactured by the same manufacturer.
   d. Products shall be suitable for service conditions.
   e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
4. Do not use material or equipment for any purpose other than that for which it is specified.
5. All material and equipment incorporated into the project shall be new.

1.02 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to County. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with County prior to proceeding. Do not proceed with work without clear instructions.

1.03 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the Site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.04 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Contractor’s Options:

1. For products specified only by reference standard, select any product meeting that standard.
2. For products specified by naming one or more products or manufacturers and "or equal," Contractor must submit a request for substitutions of any product or manufacturer not specifically named in a timely manner so as not to adversely affect the construction schedule.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 61 00
COMMON PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 DEFINITIONS

A. Products:

1. New items for incorporation in the Work, whether purchased by Contractor or Owner for the Project, or taken from previously purchased stock, and may also include existing materials or components required for reuse.
2. Includes the terms material, equipment, machinery, components, subsystem, system, hardware, software, and terms of similar intent and is not intended to change meaning of such other terms used in Contract Documents, as those terms are self-explanatory and have well recognized meanings in construction industry.
3. Items identified by manufacturer's product name, including make or model designation, indicated in manufacturer's published product literature, that is current as of the date of the Contract Documents.

1.02 PREPARATION FOR SHIPMENT

A. When practical, factory assemble products. Mark or tag separate parts and assemblies to facilitate field assembly. Cover machined and unpainted parts that may be damaged by the elements with strippable protective coating.

B. Package products to facilitate handling and protect from damage during shipping, handling, and storage. Mark or tag outside of each package or crate to indicate its purchase order number, bill of lading number, contents by name, name of Project and Contractor, equipment number, and approximate weight. Include complete packing list and bill of materials with each shipment.

C. Extra Materials, Special Tools, Test Equipment, and Expendables:

1. Furnish as required by individual Specifications.
2. Schedule:
   a. Ensure that shipment and delivery occurs concurrent with shipment of associated equipment.
   b. Transfer to Owner shall occur immediately subsequent to Contractor's acceptance of equipment from Supplier.
3. Packaging and Shipment:
   a. Package and ship extra materials and special tools to avoid damage during long term storage in original cartons insofar as possible, or in appropriately sized, hinged-cover, wood, plastic, or metal box.

b. Prominently displayed on each package, the following:
   1) Manufacturer's part nomenclature and number, consistent with Operation and Maintenance Manual identification system.
   2) Applicable equipment description.
   3) Quantity of parts in package.
   4) Equipment manufacturer.

4. Deliver materials to Site.
5. Owner upon arrival for transfer of materials.
6. Replace extra materials and special tools found to be damaged or otherwise inoperable at time of transfer to Owner.

D. Factory Test Results: Reviewed and accepted by Engineer before product shipment as required in individual Specification sections.

1.03 DELIVERY AND INSPECTION

A. Deliver products in accordance with accepted current Progress Schedule and coordinate to avoid conflict with the Work and conditions at Site. Deliver anchor bolts and templates sufficiently early to permit setting prior to placement of structural concrete.

B. Deliver products in undamaged condition, in manufacturer's original container or packaging, with identifying labels intact and legible. Include on label, date of manufacture and shelf life, where applicable.

C. Unload products in accordance with manufacturer's instructions for unloading or as specified. Record receipt of products at Site. Promptly inspect for completeness and evidence of damage during shipment.

D. Remove damaged products from Site and expedite delivery of identical new undamaged products, and remedy incomplete or lost products to provide that specified, so as not to delay progress of the Work.

1.04 HANDLING, STORAGE, AND PROTECTION

A. Handle and store products in accordance with manufacturer's written instructions and in a manner to prevent damage. Store in approved storage yards or sheds provided in accordance with Section 01510, Temporary and Permanent Utilities. Provide manufacturer's recommended maintenance during storage, installation, and until products are accepted for use by Owner.

B. Manufacturer's instructions for material requiring special handling, storage, or protection shall be provided prior to delivery of material.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to ensure that products are maintained under specified conditions, and free from damage or deterioration. Keep running account of products in storage to facilitate inspection and to estimate progress payments for products delivered, but not installed in the Work.

D. Store electrical, instrumentation, and control products, and equipment with bearings in weather-tight structures maintained above 60 degrees F. Protect electrical, instrumentation, and control products, and insulate against moisture, water, and dust damage. Connect and operate continuously space heaters furnished in electrical equipment.

E. Store fabricated products above ground on blocking or skids, and prevent soiling or staining. Store loose granular materials in well-drained area on solid surface to prevent mixing with foreign matter. Cover products that are subject to deterioration with impervious sheet coverings; provide adequate ventilation to avoid condensation.

F. Store finished products that are ready for installation in dry and well-ventilated areas. Do not subject to extreme changes in temperature or humidity.

G. After installation, provide coverings to protect products from damage due to traffic and construction operations. Remove coverings when no longer needed.

H. Hazardous Materials: Prevent contamination of personnel, storage area, and Site. Meet requirements of product specification, codes, and manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide manufacturer's standard materials suitable for service conditions, unless otherwise specified in the individual Specifications.

B. Where product specifications include a named manufacturer, with or without model number, and also include performance requirements, named manufacturer's products must meet the performance specifications.

C. Like items of products furnished and installed in the Work shall be end products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation and maintenance, spare parts and replacement, manufacturer's services, and implement same or similar process instrumentation and control functions in same or similar manner.

D. Equipment, Components, Systems, and Subsystems: Design and manufacture with due regard for health and safety of operation, maintenance, and accessibility, durability of parts, and shall comply with applicable OSHA, state, and local health and safety regulations.

E. Regulatory Requirement: Coating materials shall meet federal, state, and local requirements limiting the emission of volatile organic compounds and for worker exposure.

F. Safety Guards: Provide for all belt or chain drives, fan blades, couplings, or other moving or rotary parts. Cover rotating part on all sides. Design for easy installation and removal. Use 16-gauge or heavier; galvanized steel, aluminum coated steel, or galvanized or aluminum coated 1/2-inch mesh expanded steel. Provide galvanized steel accessories and supports, including bolts. For outdoors application, prevent entrance of rain and dripping water.

G. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

H. Equipment Finish:

1. Provide manufacturer’s standard finish and color, except where specific color is indicated.
2. If manufacturer has no standard color, provide equipment with purple finish as approved by Owner.

I. Special Tools and Accessories: Furnish to Owner, upon acceptance of equipment, all accessories required to place each item of equipment in full operation. These accessory items include, but are not limited to, adequate oil and grease (as required for first lubrication of equipment after field testing), light bulbs, fuses, hydrant wrenches, valve keys, handwheels, chain operators, special tools, and other spare parts as required for maintenance.

J. Lubricant: Provide initial lubricant recommended by equipment manufacturer in sufficient quantity to fill lubricant reservoirs and to replace consumption during testing, startup, and operation until final acceptance by Owner.

2.02 FABRICATION AND MANUFACTURE

A. General:

1. Manufacture parts to U.S.A. standard sizes and gauges.
2. Two or more items of the same type shall be identical, by the same manufacturer, and interchangeable.
3. Design structural members for anticipated shock and vibratory loads.
4. Use 1/4-inch minimum thickness for steel that will be submerged, wholly or partially, during normal operation.
5. Modify standard products as necessary to meet performance Specifications.

B. Lubrication System:

1. Require no more than weekly attention during continuous operation.
2. Convenient and accessible; oil drains with bronze or stainless steel valves and fill-plugs easily accessible from the normal operating area or platform. Locate drains to allow convenient collection of oil during oil changes without removing equipment from its installed position.
3. Provide constant-level oilers or oil level indicators for oil lubrication systems.
4. For grease type bearings, which are not easily accessible, provide and install stainless steel tubing; protect and extend tubing to convenient location with suitable grease fitting.

2.03 SOURCE QUALITY CONTROL

A. Where Specifications call for factory testing to be witnessed by Engineer, notify Engineer not less than 14 days prior to scheduled test date, unless otherwise specified.

B. Calibration Instruments: Bear the seal of a reputable laboratory certifying instrument has been calibrated within the previous 12 months to a standard endorsed by the National Institute of Standards and Technology (NIST).

C. Factory Tests: Perform in accordance with accepted test procedures and document successful completion.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect materials and equipment for signs of pitting, rust decay, or other deleterious effects of storage. Do not install material or equipment showing such effects. Remove damaged material or equipment from the Site and expedite delivery of identical new material or equipment. Delays to the Work resulting from material or equipment damage that necessitates procurement of new products will be considered delays within Contractor’s control.

3.02 MANUFACTURER'S CERTIFICATE OF COMPLIANCE

A. When so specified, a Manufacturer's Certificate of Compliance, a copy of which is attached to this section, shall be completed in full, signed by entity supplying the product, material, or service, and submitted prior to shipment of product or material or execution of the services.

B. Engineer may permit use of certain materials or assemblies prior to sampling and testing if accompanied by accepted certification of compliance.

C. Such form shall certify proposed product, material, or service complies with that specified. Attach supporting reference data, affidavits, and certifications as appropriate.

D. May reflect recent or previous test results on material or product, if acceptable to Engineer.

3.03 INSTALLATION

A. Equipment Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned.

B. No shimming between machined surfaces is allowed.

C. Install the Work in accordance with NECA Standard of Installation, unless otherwise specified.

D. Repaint painted surfaces that are damaged prior to equipment acceptance.

E. Do not cut or notch any structural member or building surface without specific approval of Engineer.

F. Handle, install, connect, clean, condition, and adjust products in accordance with manufacturer's instructions, and as may be specified. Retain a copy of manufacturers' instruction at Site, available for review at all times.

3.04 FIELD FINISHING

A. In accordance with Section 09 90 04, Painting, and individual Specification sections.

3.05 ADJUSTMENT AND CLEANING

A. Perform required adjustments, tests, operation checks, and other startup activities.

3.06 LUBRICANTS

A. Fill lubricant reservoirs and replace consumption during testing, startup, and operation prior to acceptance of equipment by Owner.

3.07 SUPPLEMENTS

A. The supplement listed below, following “End of Section”, is part of this specification.

1. Form: Manufacturer’s Certificate of Compliance.

END OF SECTION

MANUFACTURER'S CERTIFICATE OF COMPLIANCE

OWNER: _____

PROJECT NAME: _____

PROJECT NO: _____

PRODUCT, MATERIAL, OR SERVICE SUBMITTED: _____

Comments: _____

_____

_____

_____

_____

_____

I hereby certify that the above-referenced product, material, or service called for by the Contract for the named Project will be furnished in accordance with all applicable requirements. I further certify that the product, material, or service are of the quality specified and conform in all respects with the Contract requirements, and are in the quantity shown.

Date of Execution: _____, 20___

Manufacturer: _____

Manufacturer's Authorized Representative *(print)*: _____

_____

(Authorized Signature)

SECTION 01620
STORAGE AND PROTECTION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall provide secure storage and protection for products to be incorporated into the Work and maintenance and protection for products after installation and until completion of Work.

1.02 STORAGE

A. Store products immediately on delivery and protect until installed in the Work, in accord with manufacturer's instructions, with seals and labels intact and legible.

B. Exterior Storage:

1. Provide substantial platform, blocking or skids to support fabricated products above ground to prevent soiling or staining.
   a. Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
   b. Prevent mixing of refuse or chemically injurious materials or liquids.

C. Arrange storage in manner to provide easy access for inspection.

1.03 MAINTENANCE OF STORAGE

A. Maintain periodic system of inspection of stored products on scheduled basis to assure that:

1. State of storage facilities is adequate to provide required conditions.
2. Required environmental conditions are maintained on continuing basis.
3. Surfaces of products exposed to elements are not adversely affected. Any weathering of products, coatings and finishes is not acceptable under requirements of these Contract Documents.

B. Mechanical and electrical equipment which requires servicing during long term storage shall have complete manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.

1. Equipment shall not be shipped until approved by the County. The intent of this requirement is to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the County.

2. All equipment having moving parts such as gears, electric motors, etc. and/or instruments shall be stored in a temperature and humidity controlled building approved by the County until such time as the equipment is to be installed.
3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.
4. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
5. Lubricants shall be changed upon completion of installation and as frequently as required, thereafter during the period between installation and acceptance.
6. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.04 PROTECTION AFTER INSTALLATION

A. Provide protection of installed products to prevent damage from subsequent operations. Remove when no longer needed, prior to completion of work.

B. Control traffic to prevent damage to equipment and surfaces.

C. Provide coverings to protect finished surfaces from damage.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the Work.

1.02 SUBSTANTIAL COMPLETION

A. The Contractor shall submit the following items when the Contractor considers the Work to be substantially complete:

1. A written notice that the Work, or designated portion thereof, is substantially complete.
2. A list of items to be completed or corrected.

B. Within a reasonable time after receipt of such notice, the County shall make an inspection to determine the status of completion.

C. Project record documents and operations and maintenance manuals must be submitted before the project shall be considered substantially complete.

D. If the County determines that the Work is not substantially complete:

1. The County shall notify the Contractor in writing, stating the reasons.
2. The Contractor shall remedy the deficiencies in the Work and send a second written notice of substantial completion to the County.
3. The County shall reinspect the Work.

E. When the County finds that the Work is substantially complete:

1. The Engineer shall prepare and deliver to the County a tentative Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a tentative list of the items to be completed or corrected before final payment.
2. The Engineer shall consider any objections made by the County as provided in Conditions of the Contract. When the Engineer considers the Work substantially complete, he will execute and deliver to the County a definite Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a revised tentative list of items to be completed or corrected.

1.03 FINAL INSPECTION

A. When the Contractor considered the Work to be complete, he shall submit written certification stating that:

1. The Contract Documents have been reviewed.
2. The work has been inspected for compliance with Contract Documents.
3. The work has been completed in accordance with Contract Documents.
4. The equipment and systems have been tested in the presence of the County's representative and are operational.
5. The work is completed and ready for final inspection.

B. The County shall make an inspection to verify the status of completion after receipt of such certification.

C. If the County determines that the Work is incomplete or defective:

1. The County shall promptly notify the Contractor in writing, listing the incomplete or defective work.
2. The Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to County that the work is complete.
3. The County shall reinspect the work.

D. Upon finding the Work to be acceptable under the Contract Documents, the County shall request the Contractor to make closeout submittals.

E. For each additional inspection beyond a total of three (3) inspections for substantial and final completion due to the incompleteness of the Work, the Contractor shall reimburse the County's fees.

1.04 CONTRACTOR'S CLOSEOUT SUBMITTALS TO COUNTY

A. Project Record Documents (prior to substantial completion).

B. Operation and maintenance manuals (prior to substantial completion).

C. Warranties and Bonds.

D. Evidence of Payment and Release of Liens: In accordance with requirements of General and Supplementary Conditions.

E. Certification letter from Florida Department of Transportation and Manatee County Department of Transportation, as applicable.

F. Certificate of Insurance for Products and Completed Operations.

G. Final Reconciliation, Warranty Period Declaration, and Contractor's Affidavit (Manatee County Project Management Form PMD-9).

1.05 FINAL ADJUSTMENT OF ACCOUNTS

A. Submit a final statement of accounting to the County.

B. Statement shall reflect all adjustments to the Contract Sum:

1. The original Contract Sum.
2. Additions and deductions resulting from:
   a. Previous Change Orders.
   b. Unit prices.
   c. Penalties and bonuses.
   d. Deductions for liquidated damages.
   e. Other adjustments.
3. Total Contract Sum, as adjusted.
4. Previous payments.
5. Sum remaining due.

C. Project Management shall prepare a final Change Order, reflecting approved adjustments to the Contract Sum which were not previously made by Change Orders.

1.06 FINAL APPLICATION FOR PAYMENT

A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01710
CLEANING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall execute cleaning during progress of the Work and at completion of the Work, as required by the General Conditions.

1.02 DISPOSAL REQUIREMENTS

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

PART 2 PRODUCTS

2.01 MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.

B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.

C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

A. Execute periodic cleaning to keep the Work, the Site and adjacent properties free from accumulation of waste materials, rubbish and wind-blown debris, resulting from construction operations.

B. Provide on-site containers for the collection of waste materials, debris, and rubbish.

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

3.02 DUST CONTROL

A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.

B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING

A. Employ skilled workmen for final cleaning.

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

C. Prior to final completion or County occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas to verify that the entire work is clean.

END OF SECTION

SECTION 01720
RECORD DRAWINGS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. When construction is complete, Record Drawings, indicating the locations and elevations of the improvements that have been built, shall be provided to Manatee County Public Works Department. The Record Drawings shall be a special revision of the approved Construction Drawings; and shall reflect all of the below requirements in content.

1.02 STANDARDS

A. Record Drawings shall be submitted to at least the level of detail in the Contract Documents. Original drawings in CAD format may be requested of the Engineer.

B. If necessary, the Contractor shall employ a Florida Licensed Surveyor and Mapper to collect and verify survey data and properly prepare Record Drawings.

C. The data required to properly prepare these Record Drawings shall be obtained at the Site, at no cost to the County by the Contractor or his/her duly appointed representative. The appointed representative shall be a qualified employee of a responsible professional on a project-by-project basis.

1.03 CERTIFICATIONS

A. Record Drawing survey information shall be certified by a Florida Licensed Surveyor and Mapper. The certification shall state that the "Record Locations and Elevations depicted on the Record Drawing are true and correct and were collected in the field by the Surveyor and Mapper or by a representative under the direct supervision of the Surveyor and Mapper."

B. All visible record features, including sewer inverts, must be measured and located by the Surveyor or by personnel under his or her direct supervision. The certifying Surveyor shall be fully responsible for the accuracy of the record locations and elevations shown on the Record Drawings. However, the Surveyor may include statements on the Record Drawings indicating the following:

1. With the exception of the beginning, ending and the surface locations of the Horizontal Directional Drilling (HDD) log readings, the Horizontal Directional Drilling (HDD) locations and elevations provided by the HDD Contractor have not been field verified.
2. Station and offset of pipe fittings are based on PVC pipe markers or 2-inch by 4-inch markers inserted by the Contractor on the top of pipe fittings.

3. Station, offset, and elevation of potable water mains, reclaimed water mains, and sanitary force mains are based on PVC pipe markers or 2-inch by 4-inch markers inserted by the Contractor on the top of pipe.

C. Record Drawings will also be certified by the Engineer, after the Engineer has reviewed the Record Drawings submitted by the Contractor. Contractor shall revise Record Drawing submittal as necessary for the Engineer to certify the Record Drawings as stipulated by the Manatee County Public Works Standards, and as necessary for the County to accept the Record Drawing submittal. Additional copies of certified Record Drawings may be requested by the Engineer and Contractor shall arranged to have the additional copies requested furnished to the Engineer.

1.04 SUBMITTALS

A. Record Drawing submittal materials shall be attached to a transmittal letter, which shall list the following information:

1. Date.
2. Project title and number.
3. Contractor's name and address.
4. Title and number of each Record Document.
5. Signature of Contractor or his authorized representative.

B. The following materials shall be submitted for review and approval:

1. Transmittal letter.
2. Two signed, dated, and sealed sets of the Record Drawings.
3. Final plats and/or easements when applicable.
4. Final breakdown of construction quantities and final costs when applicable.
5. Performance bond, defect security bond, warranties and associated cost estimates when applicable.
6. A copy of the bacteriological test results.
7. A copy of all of the infrastructure inspection reports, and
8. Up to four copies each of the water and wastewater Completion of Construction forms, fully signed, sealed and dated by the Owner and Engineer, of which one of each will be retained for the County's records.

C. Record Drawing submittal from Contractor shall consist of the following materials:

1. Transmittal letter.
2. One set original Mylar Record Drawings; signed, dated, and sealed by a Florida Licensed Surveyor and Mapper.
3. Two sets paper copies of the Record Drawings; signed, dated, and sealed by a Florida Licensed Surveyor and Mapper.

4. One copy of the Record Drawings plan set in AutoCAD and PDF formats on a DVD or CD.
5. Additional information such as SUE locations and findings, if previously done and readily available.

D. Prior to substantial completion, and prior to starting the bacteriological testing of water lines, deliver two signed and sealed sets of Record Drawing information to the Engineer. These will be reviewed and verified by the Engineer and the County inspector. If there are any required changes or additions, these changes shall be incorporated into the entire Record Drawing set resubmitted prior to final pay application. Record Drawing information is required as part of the submittal to FDEP requesting clearance to place a potable water main into service. Failure of the Contractor to provide Record Drawing information to the Engineer prior to the start of bacteriological testing may result in additional testing and/or delay in receiving approval to place a potable water line into service; and any additional cost incurred by the Contractor as a result shall be borne by the Contractor and at no additional expense to the County.

E. Complete and final Record Drawing information shall be submitted to Engineer prior to Contractor making a final pay application. Before final payment application can be recommended for payment by the Engineer, the final submittal of Record Drawing information shall have been accepted by the County.

PART 2 PRODUCTS

2.01 REQUIREMENTS AS TO FORM

A. Every set of Record Drawings shall have a cover sheet with a vicinity map, which shows where the project is located, and a key map, which shows where each sheet in the Record Drawing set is located inside the project boundaries. Each sheet used in the Construction Drawings shall be included as a sheet in the Record Drawing set.

B. Each sheet of the Record Drawings shall have the title “RECORD DRAWING” printed on it in large, bold lettering, near the title block. Each sheet shall also have the words “COUNTY MAINTAINED – WATER,” “- SEWER” or “-WATER AND SEWER,” or “PRIVATELY MAINTAINED – WATER,” “- SEWER,” or “- WATER AND SEWER” in large, bold lettering, near the title block, depending on which entity will be responsible for maintaining the utilities. If the project includes a new reclaimed water system, each sheet shall also have the words “COUNTY MAINTAINED - RECLAIMED WATER,” or “PRIVATELY MAINTAINED - RECLAIMED WATER,” in large, bold lettering, near the title block, depending on which entity will be responsible for maintaining the utilities.

C. Record Drawing information submitted in tabular form shall not be accepted. Record information notes shall be positioned individually on the Drawings near the depictions of the item to which each note corresponds.

D. Record information notes shall be bold or italics to identify them as record information.

E. Record Drawings shall have a revision note such as "Record Drawing" in the revision block and a date corresponding to the date the Record Drawing was issued.

F. Record information shall be presented in a clear and comprehensible form.

G. The drawing scales used in the Record Drawings shall be the same as were used in the construction drawings, and the sheet number of each Record Drawing sheet shall be the same as the sheet numbers that were used on the construction drawings from which the Record Drawings originate. If additional sheets need to be added, they shall be numbered with a letter following the preceding sheet number (e.g. a sheet number added between sheet 4 and 5 would be labeled 4a).

H. All sheets that were used to depict locations and elevations of utility structures in the construction drawings shall be included in the Record Drawing set.

I. Record Drawings shall accurately depict all existing improvements lying within the immediate vicinity of the constructed utilities. Existing improvements shall include, but not be limited to: sidewalks, walls, fences, road surfaces, buildings, and other utilities. Immediate vicinity includes areas within utility easements, includes areas within rights of way, and also includes areas within 15 feet of potable water mains, reclaimed water mains, sanitary force mains, and gravity sewer mains. Immediate vicinity also includes areas within 10 feet of potable water meters, reclaimed water meters, backflow preventers, and fire hydrants. Private irrigation mains that are not located within the rights of way shall also be located on the Record Drawings. Rights of way, easements, and property corners shall be shown and shall be of sufficient detail as to determine if the constructed utilities are within the easements or rights of way. A reference to the recording document (O.R. Book or Plat Book and Page) shall be included with any depiction of a right-of-way or easement. O.R. Book or Plat Book and Page are not required to be shown on the Record Drawings of a project for proposed rights of way, or proposed easements that will identified on the proposed final plat for the said project.

J. Each roadway depicted on the Drawings shall have the correct roadway name noted on it. Provisional roadway names, such as "Street A", shall not be allowed on the Record Drawings. Each new lot of a new subdivision shall have its street address number noted on the Record Drawings.

K. Horizontal locations required for valves, fittings, services, and other utility structures shall be to the center of each installation. Top of ground or pavement elevations required along pipelines shall be reported to the nearest 0.1 feet. Top of pipe elevations shall be to the nearest 0.1 feet. Elevations of manhole rims and manhole pipe inverts shall be reported to the nearest 0.01 feet. Horizontal locations of all features shall be reported to the nearest 0.1 feet.

L. Computer drawing files submitted shall be AutoCAD® 2012 or later release date versions.

1. All reference files required to recreate the signed and sealed Record Drawings shall be included in the submitted digital files.
2. All fonts, line types, shape files or other pertinent information used in the Drawing and not normally included in AutoCAD® shall be included on the media with a text file describing its relevance and use.
3. Computer drawing files format shall be DWG only and shall be Windows NT or Windows 2000 or Windows XP compatible.

M. Contractor shall prepare and submit review draft of Record Drawings. The review submittal shall consist of the following:

1. Four sets of paper prints (24 inches by 36 inches).
2. One CD containing a PDF file or scan of the draft Record Drawings.

N. When Records Drawings have been found to be satisfactory by the County, a final submittal of the Drawings shall be prepared by the Contractor to include the following:

1. One set of mylars (24 inches by 36 inches) consisting of each sheet of drawings included in the Record Drawing set.
2. One CAD CD of the Record Drawing set and PDF file of the Drawings. CAD file shall use etransmit or binding when saving onto the CD. All fonts, line types, shape files or other pertinent information used in the Drawing and not normally included in AutoCad shall be included on the media with a text file or attached note describing its relevance and use.
3. Three sets of paper prints (24 inches by 36 inches).
4. Mylars and paper prints shall be signed and sealed by the PSM and EOR.

2.02 MONUMENTATION

A. Record information shall be referenced by station and offset to a monumented baseline per Section 01050. The Contractor shall retain a Florida Licensed Surveyor and Mapper to establish baseline and station monumentation for the Work when required. The monumentation for the baseline shall be shown or described on the Record Drawing (i.e. iron rod and cap, nail and disk or other durable and identifiable monument). For each baseline, there shall be at least two monuments described and referenced. State Plane Coordinates for the monuments shall be shown in NAD 83 (99 adjustment) in feet. Developments not within existing or proposed subdivisions and not within 1.5 miles from existing Manatee County Primary Control Points or platted State Plane Coordinates may be exempted from the requirement for monuments to be based on State Plane Coordinates.

B. The alignment of the baseline shall be along the centerline or edge of one of the following: an existing paved road, recorded right-of-way, recorded easement, face of an existing building, existing sidewalk or other existing, identifiable reference line. Offsets from the baseline shall not exceed 150 feet. All elevations shown on Record Drawings shall be referenced to a minimum of two described bench marks. A minimum of two on-site bench marks shall be described including datum. All bench marks shall be based upon NAVD88. However, all Record Drawings shall be in NAVD88. Contract drawing elevations reported as NGVD29 datum shall be revised to be NAVD88 datum on the Record Drawings.

C. All locations and elevations shall be field located by or under the direct supervision of a Florida Licensed Surveyor and Mapper.

PART 3 EXECUTION

3.01 RECORD INFORMATION

A. Water distribution utility systems, reclaimed water (or irrigation) utility systems, and sanitary sewer collection utility systems shall be located and the locations shall be depicted and noted on the Record Drawings by station and offset from an established baseline, and by elevation relative to established benchmarks. For "single point" installations, N and E coordinates rather than station and offset may be allowed.

1. Elements of the utility systems that shall be located and noted by station, offset, and elevation:
    a. Top of pipe on water mains at connections to new work and at no greater than 20 feet apart (measured along the centerline).
    b. Valves.
    c. All fittings and bends.
    d. Flow meter sensor.
    e. Reclaimed water (or irrigation) services (center of meter or meter box).
    f. Other miscellaneous utility structures with features at or above the surface of the ground.
2. Elements of the utility systems that shall be located and noted by station and offset:
    a. Control and electrical panels.
    b. Pipe supports.
    c. Ground rod locations.
3. At locations where a top-of-pipe elevation is required for pipeline, a top-of-ground or top-of-pavement elevation shall also be measured and noted on the Drawings.

B. On Record Drawings, at locations where the horizontal positions of constructed pipelines or other utility structures deviate by more than 3 feet (as scaled on the Drawing) from the horizontal positions that were shown on the Construction Drawings, the actual positions of the constructed feature shall be measured and be depicted in the actual constructed position on the Record Drawings; and their original design positions shall be crossed-hatched out or screen shaded.

C. Record information shall include:

1. A thorough description of the pipes that have been installed, including type of pipe material or casing, size, class, diameter ratio, and other basic information.
2. Field changes of dimension and detail.
3. Changes made by Field Order or by Change Order.
4. Details not on original contract drawings.
5. Detailed wiring and panel layout drawings from panel fabricator.

D. For new valves, the manufacture type (as in gate, plug or butterfly), size (pipe nominal diameter) and make (manufacturer) of each valve shall be noted on the Record Drawings.

E. Record flow meter information, including make, model, year of manufacture, and serial number.

F. Abandoned infrastructure shall also be depicted as record information and noted as “abandoned”.

END OF SECTION

SECTION 01730
OPERATING AND MAINTENANCE DATA

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall compile product data and related information appropriate for County's maintenance and operation of products furnished under Contract.

B. Prepare operating and maintenance data as specified in this and as referenced in other pertinent sections of Specifications.

C. Instruct County's personnel in maintenance of products and equipment and systems.

D. Provide three sets of operating and maintenance data for products and equipment provided within this Contract. Also provide one CD with operating and maintenance data presented in a PDF file.

1.02 FORM OF SUBMITTALS

A. Assemble data into ring binder(s) for use by County's personnel.

B. Format:

1. Size: 8-1/2 inch by 11 inch.
2. Text: Manufacturer's printed data.
3. Drawings:
   a. Provide reinforced punched binder tab, bind in with text.
   b. Fold larger drawings to size of text pages.
4. Provide fly-leaf for each separate product or each piece of equipment.
   a. Provide typed description of product, supplier, and source for service and replacement parts.
   b. Provide indexed tabs.
5. Cover: Identify with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
   a. Title of Project.
   b. Name of Contractor.
   c. Identity of general subject matter covered in the manual.

C. Binders:

1. Commercial quality three-ring binders with durable and cleanable plastic covers.
2. Maximum ring size: 1 inch.
3. When multiple binders are used, correlate the data into related consistent groupings.

1.03 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit three copies of complete manual in final form.

B. Content for each unit of equipment and system, as appropriate:

1. Description of unit and component parts.
   a. Function, normal operating characteristics and limiting conditions.
   b. Performance curves, engineering data and tests.
   c. Complete nomenclature and commercial number of replaceable parts.
2. Operating Procedures:
   a. Start-up, break-in, routine and normal operating instructions.
   b. Regulation, control, stopping, shut-down and emergency instructions.
   c. Summer and winter operating instructions.
   d. Special operating instructions.
3. Maintenance Procedures:
   a. Routine operations.
   b. Guide to "trouble-shooting".
   c. Disassembly, repair and reassembly.
   d. Alignment, adjusting and checking.
4. Servicing and lubricating schedule.
   a. List of lubricants required.
5. Manufacturer's printed operating and maintenance instructions.
6. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
   a. List of predicted parts subject to wear.
   b. Items recommended to be stocked as spare parts.
7. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
8. Other data as required under pertinent sections of specifications.

C. Content, for each electric and electronic system, as appropriate:

1. Description of system and component parts.
   a. Function, normal operating characteristics and limiting conditions.
   b. Performance curves, engineering data and tests.
   c. Complete nomenclature and commercial number of replaceable parts.
2. Circuit directories of panelboards.
   a. Electrical service.
   b. Controls.
   c. Communications.
3. As-installed color-coded wiring diagrams.
4. Operating procedures:
   a. Routine and normal operating instructions.
   b. Sequences required.
   c. Special operating instructions.

5. Maintenance procedures:
    a. Routine operations.
    b. Guide to "trouble-shooting".
    c. Disassembly, repair and reassembly.
    d. Adjustment and checking.
    e. Set-up programming instructions.
6. Manufacturer's printed operating and maintenance instructions.
7. List of original manufacture's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.

D. Prepare and include additional data when the need for such data becomes apparent during instruction on County's personnel.

E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.04 SUBMITTAL SCHEDULE

A. Submit one copy of completed data in final form fifteen days prior to substantial completion. Copy will be returned after substantial completion, with comments (if any).

B. Submit three copies of approved data in final form. Final acceptance will not be provided until the completed manual is received and approved.

1.05 INSTRUCTION OF COUNTY'S PERSONNEL

A. Prior to final inspection or acceptance, fully instruct County's designated operating and maintenance personnel in operation, adjustment and maintenance of products, equipment and systems.

B. Operating and maintenance manual shall constitute the basis of instruction. Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01740
WARRANTIES AND BONDS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Compile specified warranties and bonds.

B. Compile specified service and maintenance contracts.

C. Co-execute submittals when so specified.

D. Review submittals to verify compliance with Contract Documents.

E. Submit to County for review and transmittal.

1.02 SUBMITTAL REQUIREMENTS

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

B. Number of original signed copies required: Two each.

C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.

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

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

B. Format:

1. Size 8-1/2 inch by 11-inch punched sheets for standard 3-ring binder. Fold larger sheets to fit into binders.

2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
   a. Title of Project.
   b. Name of Contractor.

C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.04 TIME OF SUBMITTALS

A. Make submittals within 10 days after date of substantial completion and prior to final request for payment.

B. For items of work, where acceptance is delayed materially beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.05 SUBMITTALS REQUIRED

A. Submit warranties, bonds, and service and maintenance contracts as specified in respective sections of Specifications.

B. Approval by the County of all documents required under this section is a pre-requisite to requesting a final inspection and final payment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01 88 15
ANCHORAGE AND BRACING

PART 1 GENERAL

1.01 SUMMARY

A. This section covers requirements for anchorage and bracing of equipment, distribution systems, and other nonstructural components required in accordance with the ICC 2015 International Building Code (IBC), for wind, gravity, soil, and operational loads.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Institute of Steel Construction (AISC) 360, Specification for Structural Steel Buildings.
2. American Society of Civil Engineers (ASCE): ASCE 7, Minimum Design Loads for Buildings and Other Structures.
3. International Code Council (ICC): International Building Code (IBC).
4. Florida Building Code.

1.03 DEFINITIONS

A. Authority Having Jurisdiction (AHJ): Permitting building agency; may be a federal, state, local, or other regional department, or individual including building official, fire chief, fire marshal, chief of a fire prevention bureau, labor department, or health department, electrical inspector; or others having statutory authority. AHJ may be Owner when authorized to be self-permitting by governmental permitting agency or when no governmental agency has authority.

1.04 DESIGN AND PERFORMANCE REQUIREMENTS

A. General:

1. Anchorage and bracing systems shall be designed by a qualified professional engineer registered in the State of Florida.
2. Design anchorage into concrete including embedment in accordance with ACI 318-14; Chapter 17 (or other industry standard approved by Engineer), and Project Specifications.
   a. Unless otherwise noted, design for cracked concrete condition.

3. Design anchorage and bracing of mechanical, and electrical components and systems in accordance with this section, unless a design is specifically provided within Contract Documents or where exempted hereinafter.
4. Design attachments, braces, and anchors for equipment, components, and distribution systems to structure for gravity, wind, and operational loading.
5. Anchor and brace piping and ductwork, whether exempt or not exempt for this section, so that lateral or vertical displacement does not result in damage or failure to essential mechanical, or electrical equipment.
6. Provide supplementary framing where required to transfer anchorage and bracing loads to structure.
7. Adjust equipment pad sizes or provide additional anchorage confinement reinforcing to provide required anchorage capacities.
8. For components exempted from design requirements of this section, provide bolted, welded, or otherwise positively fastened attachments to supporting structure.

B. Design Loads:

1. Gravity: Design anchorage and bracing for self-weight and superimposed loads on components and equipment.
2. Wind: Design anchorage and bracing for wind criteria provided on General Structural Notes on Drawings for exposed components and exterior and wind-exposed mechanical and electrical equipment. Alternately, manufacturer certification may be provided for components such as roofing and flashing to verify attachments meet Project-specific design criteria.
3. Operational: For loading supplied by equipment manufacturer for FBC required load cases.

1.05 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. List of mechanical, and electrical equipment requiring Contractor-designed anchorage and bracing, unless specifically exempted.
   b. Manufacturers' engineered hardware product data.
   c. Attachment assemblies' drawings; include connection hardware, braces, and anchors or anchor bolts for nonexempt components, equipment, and systems.
   d. Submittal will be rejected if proposed anchorage method would create excessive stress to supporting member. Revise anchorages and strengthen structural support to eliminate overstressed condition.

B. Informational Submittals:

1. Anchorage and Bracing Calculations: For attachments, braces, and anchorages, include FBC and Project-specific criteria as noted on General Structural Notes on Drawings, in addition to manufacturer's specific criteria used for design; sealed by an engineer registered in the State of Florida.
2. Manufacturer's hardware installation requirements.

PART 2 PRODUCTS

2.01 GENERAL

A. Design and construct attachments and supports transferring loads to structure of materials and products suitable for application and in accordance with design criteria shown on Drawings and nationally recognized standards.

B. Provide post-installed concrete anchors for anchorage of equipment to concrete in accordance with Section 05 05 19, Post-Installed Anchors. Provide post-installed anchors of the size, minimum embedment, and spacing designated in calculations submitted by Contractor and accepted by Engineer.

PART 3 EXECUTION

3.01 GENERAL

A. Make attachments, bracing, and anchorage in such a manner that component lateral force is transferred to lateral force resisting system of structure through a complete load path.

B. Provide piping anchorage that maintains design flexibility and expansion capabilities at flexible connections and expansion joints.

C. Anchor tall and narrow equipment such as motor control centers and telemetry equipment at base and within 12 inches from top of equipment, unless approved otherwise by Engineer.

3.02 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. In accordance with Section 05 05 19, Post-Installed Anchors.

END OF SECTION

SECTION 01 91 14
EQUIPMENT TESTING AND FACILITY STARTUP

PART 1 GENERAL

1.01 DEFINITIONS

A. System: Entire Project, or an agreed-upon portion, including all of its unit processes.

B. Functional Test: Test or tests in presence of Engineer and Owner to demonstrate that installed equipment meets manufacturer's installation, calibration, and adjustment requirements and other requirements as specified.

C. Performance Test: Test or tests performed after any required functional test in presence of Engineer and Owner to demonstrate and confirm individual equipment meets performance requirements specified in individual sections.

D. Unit Process: As used in this section, a unit process is a portion of the system that performs a specific process function, such as its computer system (SCADA).

E. System Performance Demonstration:

1. A demonstration, conducted by Contractor, with assistance of Owner, to demonstrate and document the performance of the entire operating system, both manually and automatically (if required), based on criteria developed in conjunction with Owner and as accepted by Engineer.
2. Such demonstration is for the purposes of (i) verifying to Owner entire system performs as a whole, and (ii) documenting performance characteristics of completed system for Owner's records. Neither the demonstration nor the evaluation is intended in any way to make performance of a unit process or entire system the responsibility of Contractor, unless such performance is otherwise specified.

1.02 SUBMITTALS

A. Informational Submittals:

1. System Performance Demonstration Plan.
2. Functional and performance test results.

1.03 SYSTEM AND PERFORMANCE DEMONSTRATION PLAN

A. Develop a written plan, in conjunction with Owner's operations personnel; to include the following: Step-by-step instructions for normal operation of equipment units.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. System Test Meetings: Schedule, in accordance with requirements of Section 01200 , Project Meetings, to discuss test schedule, test methods, materials, chemicals and liquids required, facilities operations interface, and Owner involvement.

B. Contractor's Testing Representative:

1. Designate and furnish one or more personnel to coordinate and expedite equipment and system testing.
2. Representative(s) shall be present during test meetings and shall be available at all times during testing.

C. Provide temporary valves, gauges, piping, test equipment and other materials and equipment required for testing.

D. Provide Subcontractor and equipment manufacturers' staff adequate to prevent delays. Schedule ongoing work so as not to interfere with or delay testing.

E. Owner will:

1. Provide water, power, chemicals, and other items as required for testing, unless otherwise indicated.
2. Operate equipment and system with support of Contractor.
3. Provide labor and materials as required for laboratory analyses.

3.02 EQUIPMENT TESTING

A. Preparation:

1. Complete installation before testing.
2. Furnish qualified manufacturers' representatives, when required by individual Specification sections.
3. Obtain and submit from equipment manufacturer's representative Manufacturer's Certificate of Proper Installation Form, when required by individual Specification sections.
4. Equipment Test Report Form: Provide written test report for each item of equipment to be tested, to include the minimum information:
   a. Owner/Project Name.
   b. Equipment or item tested.
   c. Date and time of test.

d. Type of test performed (Functional or Performance).
e. Test method.
f. Test conditions.
g. Test results.
h. Signature spaces for Contractor and Engineer as witness.

5. Cleaning and Checking: Prior to beginning functional testing:
   a. Calibrate testing equipment in accordance with manufacturer's instructions.
   b. Inspect and clean equipment, devices, connected piping, and structures to ensure they are free of foreign material.
   c. Lubricate equipment in accordance with manufacturer's instructions.
   d. Turn rotating equipment by hand when possible to confirm that equipment is not bound.
   e. Open and close valves by hand and operate other devices to check for binding, interference, or improper functioning.
   f. Check power supply to electric-powered equipment for correct voltage.
   g. Adjust clearances and torque.
   h. Test piping for leaks.
6. Ready-to-test determination will be by Engineer based at least on the following:
   a. Acceptable Operation and Maintenance Data.
   b. Notification by Contractor of equipment readiness for testing.
   c. Receipt of Manufacturer's Certificate of Proper Installation, if so specified.
   d. Adequate completion of work adjacent to, or interfacing with, equipment to be tested, including items to be furnished by Owner.
   e. Availability and acceptability of manufacturer's representative, when specified, to assist in testing of respective equipment.
   f. Satisfactory fulfillment of other specified manufacturer's responsibilities.
   g. Equipment and electrical tagging complete.
   h. Delivery of all spare parts and special tools.

B. Functional Testing:

1. Conduct as specified in individual Specification sections.
2. Notify Owner and Engineer in writing at least 10 days prior to scheduled date of testing.
3. Prepare Equipment Test Report summarizing test method and results.
4. When, in Engineer's opinion, equipment meets functional requirements specified, such equipment will be accepted for purposes of advancing to performance testing phase, if so required by individual Specification sections. Such acceptance will be evidenced by Engineer/Owner's signature as witness on Equipment Test Report.

C. Performance Testing:

1. Conduct as specified in individual Specification sections.
2. Notify Engineer and Owner in writing at least 10 days prior to scheduled date of test.
3. Performance testing shall not commence until equipment has been accepted by Engineer as having satisfied functional test requirements specified.
4. Type of fluid, gas, or solid for testing shall be as specified.
5. Unless otherwise indicated, furnish labor, materials, and supplies for conducting the test and taking samples and performance measurements.
6. Prepare Equipment Test Report summarizing test method and results.
7. When, in Engineer's opinion, equipment meets performance requirements specified, such equipment will be accepted as to conforming to Contract requirements. Such acceptance will be evidenced by Engineer's signature on Equipment Test Report.

3.03 SYSTEM PERFORMANCE DEMONSTRATION

A. Demonstrate proper operation of equipment. Document, as defined in System Performance Demonstration Plan, the performance of the facility, including its computer system (SCADA).

B. Certify that facility is capable of performing its intended function(s), including fully automatic and computerized operation.

END OF SECTION

SECTION 03 30 10
STRUCTURAL CONCRETE

PART 1 GENERAL

1.01 GENERAL

A. Work shall conform to requirements of ACI 301, Specifications for Structural Concrete, unless otherwise specified.

1.02 REFERENCES

A. In accordance with ACI 301 and the following:

1. American Concrete Institute (ACI):
   a. 301, Specifications for Structural Concrete.
   b. 305.1, Specification for Hot Weather Concreting.
   c. 306.1, Specification for Cold Weather Concreting.
   d. 308.1, Specification for Curing Concrete.
   e. SP-66, Detailing Manual.
2. ASTM International (ASTM):
   a. C1260, Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
   b. D1056, Specification for Flexible Cellular Materials—Sponge or Expanded Rubber.
3. Concrete Reinforcing Steel Institute (CRSI):
   a. Manual of Standard Practice.
   b. Placing Reinforcing Bars.
   c. ANSI/CRSI – RB 4.1, CRSI Standard for Supports for Reinforcement Used in Concrete.
4. National Ready Mixed Concrete Association (NRMCA).

1.03 DEFINITIONS

A. Cold Weather: When ambient temperature is below 40 degrees F or is approaching 40 degrees F and falling.

B. Defective Area: Surface defects that include honeycomb, rock pockets, indentations, and surface voids greater than 3/16-inch deep, surface voids greater than 3/4 inch in diameter, spalls, chips, embedded debris, sand streaks, mortar leakage from form joints, deviations in formed surface that exceed specified tolerances and include but are not limited to fins, form pop-outs, and other projections. At exposed concrete, defective areas also include texture irregularities, stains, and other color variations that cannot be removed by cleaning.

C. Hot Weather: As defined in ACI 305.1.

D. New Concrete: Concrete less than 60 days old.

E. Top Bars: Horizontal bars placed such that 12 inches of fresh concrete is cast below in single placement.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Formwork and Formwork Accessories: Unless otherwise specified, conform to requirements of ACI 301.
   b. Reinforcing steel prepared in accordance with CRSI Manual of Standard Practice and ACI SP-66 Detailing Manual:
      1) Bending lists.
      2) Placing drawings.
2. Mix Design:
   a. Contain proportions of materials and admixtures to be used on Project, signed by mix designer.
   b. Documentation of average strength for proposed mix design in accordance with ACI 301.
   c. Test Reports:
      1) Cement: Chemical analysis report.
      2) Supplementary Cementitious Materials: Chemical analysis report and report of other specified test analyses.
      3) Aggregates:
         a) Deleterious substances in fine aggregate per ASTM C33/C33M, Table 2.
         b) Deleterious substances in coarse aggregate per ASTM C33/C33M, Table 4.
      4) Water-Soluble Chloride-Ion Content in Hardened Concrete: One of the following:
         a) Test report in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.
         b) Calculation of water-soluble chloride content based on certified chloride content of each constituent material and proportion of constituent material in concrete mixture.

c) Or all of the following:
(1) Manufacturer's Certificate of Compliance that each admixture does not intentionally add chlorides and/or that the chloride content of each admixture does not exceed trace amounts.
(2) Verification that potable water is used in the concrete mix or test data documenting the chloride content of the water.
(3) Letter from the concrete supplier stating that fine and coarse aggregates are from sources that are not known to be susceptible to chlorides in the aggregates.

5) Alkali Aggregate Reactivity: Where required, in accordance with Article Concrete Mix Design. Include documentation of test results per applicable standards.

d. Product Data:
1) Admixtures: Manufacturer's product data sheets for each admixture used in proposed mix designs.

3. Detailed plan for curing and protection of concrete placed and cured in cold weather. Details shall include, but not be limited to, the following:
a. Procedures for protecting subgrade from frost and accumulation of ice or snow on reinforcement, other metallic embeds, and forms prior to placement.
b. Methods for temperature protection during placement.
c. Types of covering, insulation, housing, or heating to be provided.
d. Curing methods to be used during and following protection period.
e. Use of strength accelerating admixtures.
f. Methods for verification of in-place strength.
g. Procedures for preventing drying during dry, windy conditions.

4. Detailed plan for hot-weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F. Plan shall include, but not be limited to, the following:
a. Use of retarding admixture.
b. Methods for controlling temperature of reinforcement and other embedded items and concrete materials before and during placement.
c. Types of shading and wind protection to be provided.
d. Curing methods, including use of evaporation retardant.
e. Procedures for measuring and recording concrete temperatures.
f. Procedures for preventing drying during dry, windy conditions.

5. Concrete repair techniques.

B. Informational Submittals:

1. Preinstallation Conference minutes.
2. Statement of Qualification:
   a. Batch Plant: Certification as specified herein.
   b. Mix designer.
   c. Installer.
   d. Testing agency.
3. Concrete Delivery Tickets:
   a. For each batch of concrete before unloading at Site.
   b. In accordance with ASTM C94/C94M, including Requirement 14.2.1. through Requirement 14.2.10.
   c. Indicate amount of mixing water withheld and maximum amount that may be permitted to be added at Site.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Batch Plant: NRMCA Program for Certification of Ready-Mixed Concrete Production Facilities or approved equivalent program.
2. Mix Designer: Person responsible for developing concrete mixture proportions certified as NRMCA Concrete Technologist Level 2 or DOT certified mix designer in jurisdiction of the Work. Requirement may be waived if individual is Contractor's Licensed Design Engineer.
3. Flatwork Finisher: Unless otherwise permitted, at least one person on finishing crew shall be certified as an ACI Flatwork Finisher, or equivalent.
4. Testing Agency: Unless otherwise permitted, an independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C1077 and ASTM E329 for testing indicated.
   a. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.
   b. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician–Grade I. Testing Agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician–Grade II.

B. Preinstallation Conference:

1. Required Meeting Attendees:
   a. Contractor, including pumping, placing and finishing, and curing subcontractors.
   b. Ready-mix producer.

c. Testing and sampling personnel.
d. Engineer who authored Statement of Special Inspection Plan or Engineer's designee.

2. Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.
3. Agenda shall include:
   a. Admixture types, dosage, performance, and redosing at Site.
   b. Mix designs, test of mixes, and Submittals.
   c. Placement methods, techniques, equipment, consolidation, and form pressures.
   d. Slump and placement time to maintain slump.
   e. Finish, curing, and water retention.
   f. Steel reinforcement details.
   g. Protection procedures for weather conditions.
   h. Other specified requirements requiring coordination.

PART 2 PRODUCTS

2.01 FORMWORK

A. Form Materials:

1. For exposed areas, use hard plastic finished plywood, overlaid waterproof particle board, or steel in new and undamaged condition, of sufficient strength and surface smoothness to produce specified finish.
2. For unexposed areas, use new shiplap or plywood.
3. Earth cuts shall not be used for forming footings.

B. Beveled Edge Corner Strips: Nonabsorbent material, compatible with form surface, fully sealed on all sides prohibiting loss of paste or water between the two surfaces.

C. Form Ties:

1. Material: Steel.
2. Spreader Inserts:
   a. Conical or spherical type.
   b. Design to maintain positive contact with forming material.
   c. Furnish units that will leave no metal closer than 1-1/2 inches to concrete surface when forms, inserts, and tie ends are removed.
3. Wire ties not permitted.

2.02 CONCRETE

A. Materials:

1. Cementitious Materials:
   a. Cement:
      1) Portland Cement: Unless otherwise specified, conform to requirements of ASTM C150/C150M.
   b. Supplementary Cementitious Materials (SCM):
      1) Fly Ash (Pozzolan): Class F fly ash in accordance with ASTM C618, except as modified herein:
         a) ASTM C618, Table 1, Loss on Ignition: Unless permitted otherwise, maximum 3 percent.
2. Aggregates: Unless otherwise permitted, furnish from one source for each aggregate type used in a mix design.
   a. Aggregates:
      1) In accordance with ASTM C33/C33M, except as modified herein.
         a) Class Designation 4M unless otherwise specified.
         b) Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
         c) Alkali Silica Reactivity: See Article Concrete Mix Design.
      2) Fine Aggregates:
         a) Clean, sharp, natural sand.
         b) ASTM C33/C33M.
         c) Limit deleterious substances in accordance with ASTM C33/C33M, Table 2 and as follows:
            (1) Limit material finer than 75-µm (No. 200) sieve to 3 percent mass of total sample.
            (2) Limit coal and lignite to 0.5 percent.
      3) Coarse Aggregate:
         a) Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension more than five times the short dimension).
         b) Limit deleterious substances in accordance with ASTM C33/C33M, Table 4 for specified class designation.

3. Admixtures:
    a. Characteristics:
        1) Compatible with other constituents in mix.
        2) Contain at most, only trace amount chlorides in solution.
        3) Furnish type of admixture as recommended by manufacturer for anticipated temperature ranges.
    b. Air-Entraining Admixture: ASTM C260/C260M.
    c. Water-Reducing Admixture: ASTM C494/C494M, Type A or Type D.
    d. Retarding Admixture: ASTM C494/C494M, Type B.
    e. Accelerating Admixture: ASTM C 494/C494M, Type C.
    f. High-Range, Water-Reducing Admixture: ASTM C494/C494M, Type F or Type G.
    g. Plasticizing Admixture: ASTM C1017/C1017M, Type I or Type II.
    h. Do not use calcium chloride as an admixture.
4. Water and Ice: Mixing water for concrete and water used to make ice shall be potable water.

B. Concrete Mix Design:

1. General:
    a. See Supplement at the end of this section for mix design requirements for concrete used on Project.
    b. Prepare design mixture for strength of concrete, selecting and proportioning ingredients in accordance with requirements of ACI 301, unless otherwise specified.
    c. Selection of constituent materials and products in mix design are optional, unless specified otherwise.
    d. Use water-reducing admixture or water-reducing admixture and high-range, water-reducing admixture, or plasticizing admixture.
    e. Unless otherwise specified, desired fresh properties of concrete shall be determined by Contractor, and coordinated with concrete producer. Fresh properties of concrete shall remain stable to satisfaction of Contractor, for duration of placement and consolidation, and shall remain in conformance with requirements of Contract Documents.
2. Potential Alkali-Aggregate Reactivity of Concrete:
    a. Do not use aggregates known to be susceptible to alkali-carbonate reaction (ACR).

b. Use one of the three options below for qualifying concrete mixtures to reduce the potential of alkali-silica reaction. Option 3 shall not be used with natural pozzolans, or fly ash that has a CaO content more than 18 percent, or for aggregates with expansions greater than or equal to 0.24 percent when tested in accordance with ASTM C1293. Fly ash with an alkali content greater than 4.0 percent shall not be used in option 2) or 3).
   1) For each aggregate used in concrete, the expansion result determined in accordance with ASTM C1293 shall not exceed 0.04 percent at 1 year.
   2) For each aggregate used in concrete, the expansion result of the aggregate and cementitious materials combination determined in accordance with ASTM C1567 shall not exceed 0.10 percent at an age of 16 days. Submit supporting data for each aggregate showing expansion in excess of 0.10 percent at 16 days when tested in accordance with ASTM C1260.
   3) Alkali content in concrete (LBA), excluding that from supplementary cementitious materials and the pozzolans and slags in blended cements, shall not exceed 4 lb/yd^3 for aggregates with expansions more than or equal to 0.04 percent and less than 0.12 percent or 3 lb/yd^3 for aggregates with expansions greater than or equal to 0.12 percent and less than 0.24 percent. Reactivity shall be determined by testing in accordance with ASTM C1293. Alkali content shall be calculated as follows:
      a) LBA = (cement content, lb/yd^3) × (equivalent alkali content of portland cement in percent/100 percent).

3. Proportions:
   a. Design mix to meet aesthetic, durability, and strength requirements.
   b. Where fly ash is included in mix, minimum fly ash content shall be a minimum of 15 percent of weight of total cementitious materials.
4. Slump:
   a. Unless otherwise specified, Contractor shall select a target slump or slump flow at the point of delivery of concrete mixtures for each application.
   b. Selected target slump shall not exceed 9 inches.
   c. The target slump value shall be enforced for the duration of Project.

d. Determine the slump by ASTM C143/C143M.
e. Slump tolerances shall meet the requirements of ACI 117.
f. Design mixes that include a high-range, water-reducing or a plasticizing admixture shall have a minimum slump of 2 inches prior to addition of admixture. Unless otherwise permitted, slump shall be 8 inches maximum at point of delivery, for concrete with a high-range, water-reducing admixture.

C. Concrete Mixing:

1. General: In accordance with ACI 301, except as modified herein.
2. Truck Mixers:
   a. For every truck, test slump of samples taken per ASTM C94/C94M, Paragraph 12.5.1.
   b. Where specified slump is more than 4 inches, and if slump tests differ by more than 2 inches, discontinue use of truck mixer, unless causing condition is corrected and satisfactory performance is verified by additional slump tests.

2.03 REINFORCING STEEL

A. Deformed Steel Reinforcing Bars: ASTM A615/A615M, Grade 60. Welding of reinforcing bars is not permitted.

B. Fabrication: Follow CRSI Manual of Standard Practice.

2.04 ANCILLARY MATERIALS

A. Reinforcing Steel Accessories:

1. Plastic Protected Wire Bar Supports: In compliance with ANSI/CRSI – RB 4.1 Class 1 Reinforcement Supports.
2. Precast Concrete Bar Supports: In compliance with ANSI/CRSI – RB 4.1 Cementitious (Precast) Reinforcement Supports.
   a. Precast concrete bar supports shall have equal or greater strength than the surrounding concrete.
   b. Precast concrete bar supports shall be four square inches minimum, in plan.
   c. Precast concrete bar supports shall have tie wires.

B. Tie Wire:

1. Black, soft-annealed 16-gauge wire.
2. Nylon-coated, epoxy-coated, or plastic-coated wire.

C. Premolded Joint Filler:

1. Bituminous Type: ASTM D994/D994M or ASTM D1751.

D. Curing Compound:

1. Water-based, high-solids content, nonyellowing, curing compound meeting requirements of ASTM C1315 Type I, Class A.
2. Manufacturers and Products:
   a. Euclid Chemical Co., Cleveland, OH; Super Diamond Clear VOX.
   b. WR Meadows, Inc., Hampshire, IL; VOCOMP-30.
   c. Vexcon Chemical, Inc., Philadelphia, PA; Starseal 1315.
   d. Dayton Superior; Safe Cure and Seal 1315 EF.

E. Evaporation Retardant:

1. Optional: Fluorescent fugitive dye color tint that disappears completely upon drying.
2. Manufacturers and Products:
   a. BASF Construction Chemicals, Shakopee, MN; MasterKure ER 50.
   b. Euclid Chemical Co., Cleveland, OH; Eucobar.

F. Nonshrink Grout:

1. Nonmetallic, nongas-liberating.
2. Prepackaged natural aggregate grout requiring only the addition of water.
3. Aggregate shall show no segregation or settlement at fluid consistency at specified times or temperatures.
4. Test in accordance with ASTM C1107/C1107M:
   a. Fluid consistency 20 seconds to 30 seconds in accordance with ASTM C939.
   b. Temperatures of 40 degrees F, 80 degrees F, and 100 degrees F.
5. Pass fluid grout through flow cone with continuous flow 1 hour after mixing.
6. Minimum Strength of Fluid Grout:
   a. 3,500 psi at 1 day.
   b. 4,500 psi at 3 days.
   c. 7,500 psi at 28 days.

7. Maintain fluid consistency when mixed in 1 yard to 9 yard loads in ready-mix truck.
8. Manufacturers and Products:
    a. BASF Building Systems, Inc., Shakopee, MN; MasterFlow 928.
    b. Five Star Products Inc., Fairfield, CT; Five Star Fluid Grout 100.
    c. Euclid Chemical Co., Cleveland, OH; Hi Flow Grout.
    d. Dayton Superior Corp., Miamisburg, OH; Sure Grip High Performance Grout.

G. Repair Material:

1. Contain only trace amounts of chlorides and other chemicals that can potentially cause steel to oxidize.
2. Where repairs of exposed concrete are required, prepare mockup using proposed repair materials and methods, for confirmation of appearance compatibility prior to use.
3. Obtain Manufacturer's Certificate of Compliance that products selected are appropriate for specific applications.
4. Repair mortar shall be Site mixed.
5. Prepare concrete substrate and mix, place, and cure repair material in accordance with manufacturer's written recommendations.
6. Manufacturers and Products:
    a. BASF Building Systems Inc., Shakopee, MN; MasterEmaco S Series products.
    b. Sika Chemical Corp., Lyndhurst, NJ; SikaTop Series.

2.05 SOURCE QUALITY CONTROL

A. Source Quality Control Inspection: Engineer shall have access to and have right to inspect batch plants, cement mills, and supply facilities of suppliers, manufacturers, and subcontractors, providing products included in this section.

PART 3 EXECUTION

3.01 FORMWORK

A. Form Construction:

1. Construct forms and provide smooth-form finish.
2. Form 3/4-inch bevels at concrete edges, unless otherwise shown.
3. Make joints tight to prevent escape of mortar and to avoid formation of fins.

4. Brace as required to prevent distortion during concrete placement.
5. On exposed surfaces, locate form ties in uniform pattern or as shown.
6. Construct so ties remain embedded in the member with no metal within 1 inch of concrete surface when forms, inserts, and tie ends are removed.

B. Form Removal:

1. Nonsupporting forms (walls and similar parts of Work) may be removed after cumulatively curing at not less than 50 degrees F for 24 hours from time of concrete placement if:
   a. Concrete is sufficiently hard so as not to sustain damage by form removal operations.
   b. Curing and protection operations are maintained.
2. Remove forms with care to prevent scarring and damaging the surface.
3. Prior to form removal, provide thermal protection for concrete being placed under the requirements of cold weather concreting.

3.02 PLACING REINFORCING STEEL

A. Unless otherwise specified, in accordance with ACI 301.

B. Accessories:

1. Bar Supports in Contact with Ground: Provide precast concrete block supports.
   a. Do not use brick, broken concrete masonry units, spalls, rocks, construction debris, or similar material for supporting reinforcing steel.
2. Bar Supports in Contact with Forms: Unless otherwise noted, bar supports shall be plastic protected wire bar supports or stainless steel protected wire bar supports.
3. Bar supports shall have sufficient strength and stiffness to carry loads without failure, displacement, or significant deformation. Space bar supports so minimum concrete cover is maintained for reinforcing between supports, and location of reinforcement remains within tolerance throughout work.

C. Splices and Laps:

1. Lap Splice Reinforcing: Refer to Structural General Notes on Drawings for additional information.
2. Tie splices with 18-gauge annealed wire as specified in CRSI Standard.

3.03 CONCRETE PLACEMENT INTO FORMWORK

A. Inspection: Notify Engineer at least 1 work day in advance before starting to place concrete.

B. Placement into Formwork:

1. Reinforcement: Secure in position before placing concrete.
2. Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 1.5 feet deep, except for slabs that shall be placed full depth. Place and consolidate successive layers prior to initial set of first layer to prevent cold joints.
3. Placement frequency shall be such that lift lines will not be visible in exposed concrete finishes.
4. Use placement devices (such as, chutes, pouring spouts, and pumps) as required to prevent segregation.

C. Conveyor Belts and Chutes:

1. Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system for concrete to pass without becoming segregated.
2. Do not use chutes longer than 50 feet.
3. Wipe clean with device that does not allow mortar to adhere to belt.
4. Cover conveyor belts and chutes.

D. Retempering: Not permitted for concrete where cement has partially hydrated.

E. Pumping of Concrete:

1. Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to ensure completion of concrete placement without cold joints in case of primary placing equipment breakdown.
2. Minimum Pump Hose (Conduit) Diameter: 4 inches.
3. Replace pumping equipment and hoses (conduits) that are not functioning properly.

3.04 CONSOLIDATION AND VISUAL OBSERVATION

A. Provide at least one standby vibrator in operable condition at placement site prior to placing concrete.

3.05 COLD WEATHER PLACEMENT

A. Unless otherwise permitted, shall be in accordance with requirements of ACI 301, ACI 306.1, and as follows:

1. Cold weather requirements shall apply when ambient temperature is below 40 degrees F or approaching 40 degrees F and falling.
2. Do not place concrete over frozen earth or against surfaces with frost or ice present. Frozen earth shall be thawed to acceptance of Engineer.
3. Unless otherwise permitted, do not place concrete in contact with surfaces less than 35 degrees F; requirement is applicable to all surfaces including reinforcement and other embedded items.
4. Provide supplemental external heat as needed when other means of thermal protection are unable to maintain minimum surface temperature of concrete as specified in ACI 306.1.
5. Maintain minimum surface temperature of concrete as specified in ACI 306.1 for no less than 3 days during cold weather conditions.
6. Protect concrete from freezing until end of curing period and until concrete has attained a compressive strength of 3,500 psi or design compressive strength if less than 3,500 psi.

B. External Heating Units: Do not exhaust heater flue gases directly into enclosed area as it causes concrete carbonation as a result of concentrated carbon dioxide.

C. Cure as specified.

3.06 HOT WEATHER PLACEMENT

A. Prepare ingredients, mix, place, cure, and protect in accordance with ACI 301, ACI 305.1, and as follows:

1. Maintain concrete temperature below 95 degrees F at time of placement, or furnish test data or other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage, or cracking as a result of heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.
2. Internal concrete temperature in structure shall not exceed 158 degrees F, and maximum temperature differential between center of section and external surfaces of concrete shall not exceed 35 degrees F.
3. Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.
4. Cure as specified.

3.07 PREMOLDED JOINT FILLER INSTALLATION

A. Sufficient in width to completely fill joint space where shown.

B. Drive nails approximately 1 foot 6 inches on center through filler, prior to installing, to provide anchorage embedment into concrete during concrete placement.

C. Secure premolded joint filler in forms before concrete is placed.

3.08 FINISHING FORMED SURFACES

A. Provide surface finish 2.0 (SF-2.0) in accordance with ACI 301 and as herein specified.

B. Tie Holes: Unless otherwise specified, fill with specified repair material.

C. Prepare substrate and mix, place, and cure repair material per manufacturer's written recommendations.

D. Repair defective areas of concrete.

1. Cut edges perpendicular to surface at least 1/2 inch deep. Do not feather edges. Soak area with water for 24 hours.
2. Patch with specified repair material.
3. Repair concrete surfaces using specified materials. Select system, submit for review, and obtain approval from Engineer prior to use.
4. Develop repair techniques with material manufacturer on surface that will not be visible in final construction prior to starting actual repair work and show how finish color will blend with adjacent surfaces. Obtain approval from Engineer.
5. Obtain quantities of repair material and manufacturer's detailed instructions for use to provide repair with finish to match adjacent surface or apply sufficient repair material adjacent to repair to blend finish appearance.
6. Repair of concrete shall provide structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable to Engineer.

3.09 FINISHING UNFORMED SURFACES

A. General:

1. Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
2. Do not use “jitterbugs” or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar, which will be weak and cause surface cracks or delamination, to accumulate.
3. Do not dust surfaces with dry materials nor add water to surfaces.
4. Cure concrete as specified.

B. Slab Tolerances:

1. Exposed Slab Surfaces: Comprise of flat planes as required within tolerances specified.
2. Slab Finish Tolerances and Slope Tolerances: Crowns on floor surface not too high as to prevent 10-foot straightedge from resting on end blocks, nor low spots that allow block of twice the tolerance in thickness to pass under supported 10-foot straightedge.
3. Steel gauge block 5/16 inch thick.
4. Finish Slab Elevation: Slope slabs to floor drain and gutter, and shall adequately drain regardless of tolerances.
5. Thickness: Maximum 1/4 inch minus or 1/2 inch plus from thickness shown. Where thickness tolerance will not affect slope, drainage, or slab elevation, thickness tolerance may exceed 1/2 inch plus.

C. Exterior Slab Finish:

1. Provide broom finish unless specified otherwise.
2. Finish exposed edges with steel edging tool.

3.10 EXPOSED METAL OBJECTS

A. Remove metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, by chipping back concrete to depth of 1 inch and then cutting or removing metal object.

B. Repair area of chipped-out concrete as specified for defective areas.

3.11 PROTECTION AND CURING

A. Protect and cure concrete in accordance with requirements of ACI 301, ACI 308.1, and as follows:

1. Protect fresh concrete from direct rays of sunlight, drying winds, and wash by rain.
2. Keep concrete slabs continuously wet for a 7-day period. Intermittent wetting is not acceptable.
3. Use curing compound only where approved by Engineer.
4. Cure formed surfaces with curing compound applied in accordance with manufacturer's written instructions as soon as forms are removed and finishing is completed.
5. Remove and replace concrete damaged by freezing.
6. Repair areas damaged by construction, using specified repair materials and approved repair methods.

3.12 NONSHRINK GROUT

A. General: Mix, place, and cure nonshrink grout in accordance with grout manufacturer's written instructions.

3.13 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. General:

1. Provide adequate facilities for safe storage and proper curing of concrete test specimens onsite for first 24 hours and for additional time as may be required before transporting to test lab.
2. Unless otherwise specified, sample concrete for testing for making test specimens, from point of delivery.
3. When concrete is pumped, sample and test air content at point of delivery and at point of placement.
    a. For Each Concrete Mixture: Provided results of air content tests for first load of the day are within specified limits, testing need only be performed at point of delivery for subsequent loads of that concrete mixture except that testing should be performed at point of placement every 4 hours.
4. Evaluation will be in accordance with ACI 301 and Specifications.
5. Test specimens shall be made, cured, and tested in accordance with ASTM C31/C31M and ASTM C39/C39M.

6. Frequency of testing may be changed at discretion of Engineer.
7. Pumped Concrete: Take concrete samples for slump, ASTM C143/C143M, and test specimens, ASTM C31/C31M and ASTM C39/C39M.
8. If measured air content at delivery is greater than specified limit, check test of air content will be performed immediately on a new sample from delivery unit. If check test fails, concrete has failed to meet requirements of Contract Documents. If measured air content is less than lower specified limit, adjustments will be permitted in accordance with ASTM C94/C94M, unless otherwise specified. If check test of adjusted mixture fails, concrete has failed to meet requirements of Contract Documents. Concrete that has failed to meet requirements of Contract Documents shall be rejected.

B. Concrete Strength Test:

1. Unless otherwise specified, one specimen at age of 7 days for information, and two 6-inch diameter or when permitted three 4-inch diameter test specimens at age of 28 days for acceptance.
2. If result of 7-day concrete strength test is less than 50 percent of specified 28-day strength, extend period of moist curing by 7 additional days.
3. Provide a minimum of one spare test specimen per sample. Test spare cylinder as directed by Engineer.
4. Segregation Test Objective: Concrete shall stay together when slumped. Segregation is assumed to cause mortar to flow out of mix even though aggregate may stay piled enough to meet slump test.
5. Test Procedure: Make slump test and check for excessive slump. Observe to see if mortar or moisture flows from slumped concrete.
6. Reject concrete if mortar or moisture separates and flows out of mix.

C. Slab Finish Tolerances and Slope Tolerances:

1. Support 10-foot-long straightedge at each end with steel gauge blocks of thicknesses equal to specified tolerance.
2. Compliance with designated limits in four of five consecutive measurements is satisfactory, unless defective conditions are observed.

3.14 SUPPLEMENTS

A. Requirements of concrete mix designs following “End of Section,” are a part of this Specification and supplement requirements of Part 1 through Part 3 of this section:

1. Concrete Mix Design, Class 4000F1S1W0C1.

END OF SECTION

CONCRETE MIX DESIGN, CLASS 4000F1S1W0C1

A. Exposure Categories and Classifications: F1S1W0C1.

B. Mix Properties:

1. Limit water to cementitious materials ratio (W/Cm) in mix design to maximum value of 0.45.
2. Minimum concrete compressive strength (f'c) shall be 4,000 psi at 28 days.
   a. Unless otherwise specified, provide air content based on nominal maximum size of aggregate as follows:

Nominal Maximum Aggregate Size in. ‡	Air Content (%)*
3/8	6.0
1/2	5.5
3/4	5.0
1	4.5
1-1/2	4.5
2§	4.0
3§	3.5

‡See ASTM C33/C33M for tolerance on oversize for various nominal maximum size designations.

*Tolerance of air content is ±1-1/2 percent.

§Air contents apply to total mixture. When testing concretes, however, aggregate particles larger than 1-1/2 inches are to be removed by sieving and air content will be measured on sieved fraction (tolerance on air content as delivered applies to this value). Air content of total mixture is computed from value measured on sieved fraction passing 1-1/2-inch sieve in accordance with ASTM C231/C231M.

3. Provide cementitious materials in accordance with one of the following:
   a. ASTM C150/C150M Type II; inclusion of supplementary cementitious materials in design mix is optional.

b. ASTM C150/C150M types other than Type II, plus supplementary cementitious materials in accordance with one of the following:
   1) Tricalcium Aluminate Content of Total Cementitious Materials: Maximum 8 percent by weight.
   2) Provide documentation of test results in accordance with ASTM C1012/C1012M, for combinations of cementitious materials providing sulfate resistance with expansion less than 0.10 percent at 6 months.
   3) ASTM C595/C595M Type IP or Type IS (less than 70), tested to comply with moderate sulfate resistance option (MS).

4. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent, unless otherwise specified.
   a. Limits are stated in terms of chloride ions in percent by weight of cement.
   b. Unless otherwise permitted, provide documentation from concrete tested in accordance with ASTM C1218/C1218M at an age between 28 days and 42 days.

C. Refer to PART 1 through PART 3 of this section for additional requirements.

SECTION 03 63 00
CONCRETE DOWELING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. American National Standards Institute (ANSI).
2. ASTM International (ASTM):
   a. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
   b. E488, Standard Test Methods for Strength of Anchors in Concrete and Masonry Elements.
3. International Code Council (ICC):
   a. Florida Building Code Fifth Edition (2014).
   b. Evaluation Services Reports.

1.02 DEFINITIONS

A. ICC Evaluation Services Report: Published by ICC for products provided by concrete adhesive anchor manufacturers.

B. Inspection: As defined in the FBC.

1.03 SUBMITTALS

A. Action Submittals:

1. Product Data: Manufacturer's catalog information.

B. Informational Submittals:

1. Manufacturer's instructions for preparation, placement, drilling of holes, installation of anchors and adhesive, and handling of cartridges, nozzles, and equipment.
2. Manufacturer's written letter of certification identifying installer's qualifications to install products.
3. ICC Evaluation Services Report: Specific to proposed doweling system manufacturer.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Installer: Trained and certified by manufacturer.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Container Markings: Include manufacturer's name, product name, batch number, mix ratio by volume, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.

B. Store adhesive components in accordance with manufacturer's written instructions.

C. Dispose of when:

1. Shelf life has expired.
2. Stored other than per manufacturer's instructions.

PART 2 PRODUCTS

2.01 MATERIALS

A. Adhesive:

1. Approved by an ICC Evaluation Services Report for conformance to FBC requirements for doweling of steel reinforcing bars in cracked concrete.
2. Suitable for long-term loads as well as for wind loads.
3. Meet requirements of ASTM C881/C881M.
4. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments.
5. Disposable, Self-Contained Cartridge System:
6. Capable of dispensing both components in proper mixing ratio.
7. Fit into manually or pneumatically operated caulking gun.
8. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.
9. Manufacturers and Products:
   a. Hilti, Inc., Tulsa, OK; HIT-RE 500-SD or HIT-HY 200 Adhesive Anchors.
   b. Powers Fasteners, Brewster, NY; Power PURE110+ Epoxy Adhesive Anchor System.
   c. Simpson Strong-Tie Co., Inc., Pleasanton, CA; SET-XP Epoxy Adhesive Anchors.

B. Mixing Nozzles: Disposable, manufactured in several sizes to accommodate size of reinforcing dowels.

C. Reinforcing Dowels: As specified in Section 03 10 00, Structural Concrete.

PART 3 EXECUTION

3.01 INSTALLATION

A. Drilling Equipment:

1. Drilling Hammers for Dowel Holes:
   a. Electric or pneumatic rotary type with medium or light impact.
   b. Hollow drills with flushing air systems are preferred.
2. Where edge distances are less than 2 inches, use lighter impact equipment to prevent microcracking and concrete spalling during drilling process.

B. Hole Diameter: Use drill bit diameter meeting ICC Evaluation Services Report requirements and as recommended by manufacturer.

C. Obstructions in Drill Path: When existing steel reinforcement is encountered during drilling, obtain Engineer approval for proposed fix.

D. Doweling:

1. Install per details shown on Drawings and in accordance with adhesive manufacturer's instructions.
2. When using epoxy anchors, dowels may be prebent prior to installation to 15 degrees to align with other bars. Do not heat dowels to bend.
3. Bent Bar Dowels: Where edge distances are critical, and intersection with steel reinforcement is likely, drill hole at 10-degree angle or less and use prebent reinforcing bars.

E. Adhesive:

1. Install in accordance with written manufacturer's instructions.
2. Dispense components through specially designed static mixing nozzle that thoroughly mixes components and places mixed adhesive at base of predrilled hole.

3.02 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

A. Contractor-Furnished Quality Control: Inspection and testing as required in Section 01 45 16.13, Contractor Quality Control.

END OF SECTION

SECTION 05 05 19
POST-INSTALLED ANCHORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Concrete Institute (ACI):
   a. 318, Building Code Requirements for Structural Concrete.
   b. 355.2, Qualification of Post-Installed Mechanical Anchors in Concrete.
   c. 355.4, Qualification of Post-Installed Adhesive Anchors in Concrete.
2. American Iron and Steel Institute (AISI): Stainless Steel Type 316.
3. American National Standards Institute (ANSI).
4. ASTM International (ASTM):
   a. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special Purpose Applications.
   b. A194/A194M, Standard Specification for Carbon Steel, Alloy Steel, and Stainless Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
   c. A380/A380M, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
   d. A563, Standard Specification for Carbon and Alloy Steel Nuts.
   e. A780/A780M, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
   f. A967/A967M, Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.
   g. E488/E488M, Standard Test Methods for Strength of Anchors in Concrete Elements.
   h. F436/F436M, Standard Specification for Hardened Steel Washers.
   i. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Socket Head Cap Screws, and Studs for General Use.
   j. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
   k. F594, Standard Specification for Stainless Steel Nuts.
   l. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

5. International Association of Plumbing and Mechanical Officials Uniform ES (IAPMO-UES): Evaluation Reports for Concrete and Masonry Anchors.
6. International Code Council Evaluation Service (ICC-ES):
   a. Evaluation Reports for Concrete and Masonry Anchors.
   b. AC70, Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements.
   c. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
   d. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements. Evaluation Reports for Concrete and Masonry Anchors.
7. Specialty Steel Industry of North America (SSINA):
   a. Specifications for Stainless Steel.
   b. Design Guidelines for the Selection and Use of Stainless Steel.
   c. Stainless Steel Fabrication.
   d. Stainless Steel Fasteners.

1.02 DEFINITIONS

A. Exterior Area: Location not protected from weather by a building or other enclosed structure to include buried roof structures.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Specific instructions for concrete anchor installation, including drilled hole size and depth, preparation, placement, procedures, and instructions for safe handling of anchoring systems.

B. Informational Submittals:

1. Concrete Anchors:
   a. Manufacturer’s product description and installation instructions.
   b. Current ICC-ES or IAPMO-UES Report for each type of post-installed anchor to be used.
2. Passivation method for stainless steel members.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Package stainless steel items in a manner to provide protection from carbon impregnation.

B. Protect hot-dip galvanized finishes from damage as a result of metal banding and rough handling.

PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise indicated, meet the following requirements:

Item	ASTM Reference
Stainless Steel:	
Threaded Rods	F593, AISI Type 316, Condition CW
Nuts*	F594, AISI Type 316, Condition CW
Carbon Steel:	
Threaded Rods	F1554, Grade 36
Flat and Beveled Washers (Hardened)	F436/F436M
Nuts*	A194/A194M, Grade 2H
Galvanized Steel:	
All	A153/A153M
*Nuts of other grades and styles having specified proof load stresses greater than specified grade and style are also suitable. Nuts must have specified proof load stresses equal to or greater than minimum tensile strength of specified threaded rod.	

B. Bolts, Washers, and Nuts: Use stainless steel, hot-dip galvanized steel, and zinc-plated steel material types as indicated in Fastener Schedule at end of this section.

2.02 POST-INSTALLED CONCRETE ANCHORS

A. General:

1. AISI Type 316 stainless, hot-dip galvanized or zinc-plated steel, as shown in Fastener Schedule at end of this section.
2. Post-installed anchor systems used in concrete shall be approved by ICC Evaluation Services Report or equivalent for use in cracked concrete and for short-term and long-term loads including wind and earthquake.
3. Mechanical Anchors: Comply with the requirements of ICC-ES AC193 or ACI 355.2.
4. Adhesive Anchors: Comply with the requirements of ICC-ES AC308 or ACI 355.4.

B. Torque-Controlled Expansion Anchors (Wedge Anchors):

1. Manufacturers and Products:
   a. Hilti, Inc., Tulsa, OK; Kwik-Bolt –TZ (KB-TZ) Anchors (ESR-1917).
   b. DeWalt/Powers Fasteners, Brewster, NY; Power-Stud +SD1, +SD2, +SD4, or +SD6 Anchors (ESR-2502 and ESR-2818).
   c. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Strong-Bolt 2 Anchors (ESR-1771 and ESR-3037).

C. Self-Tapping Concrete Screw Anchors:

1. Manufacturers and Products:
   a. DeWalt/Powers Fasteners, Brewster, NY; Wedge-Bolt+ (ESR-2526).
   b. DeWalt/Powers Fasteners, Brewster, NY; Vertigo+ Rod Hanger Screw Anchor (ESR-2989).
   c. DeWalt/Powers Fasteners, Brewster, NY; Snake+ Flush Mount Screw Anchor (ESR-2272).
   d. Hilti, Inc., Tulsa, OK; HUS-EZ Screw Anchor (ESR-3027).
   e. Simpson Strong-Tie Co., Inc., Pleasanton, CA; Titen HD Screw Anchor (ESR-2713 and IAPMO UES-493).

D. Adhesive Anchors:

1. Threaded Rod:
   a. Diameter as shown on Drawings.
   b. Length as required to provide minimum depth of embedment indicated and thread projection required.
   c. Clean and free of grease, oil, or other deleterious material.
2. Adhesive:
   a. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments.
   b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.
3. Packaging and Storage:
   a. Disposable, self-contained system capable of dispensing both components in proper mixing ratio and fitting into a manually or pneumatically operated caulking gun.
   b. Store adhesive on pallets or shelving in a covered storage area.
   c. Package Markings: Include manufacturer’s name, product name, batch number, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.
   d. Dispose of When:
      1) Shelf life has expired.
      2) Stored other than in accordance with manufacturer’s instructions.

4. Manufacturers and Products:
   a. Hilti, Inc., Tulsa, OK; HIT Doweling Anchor System, HIT RE 500 V3 (ESR-3814).
   b. Simpson Strong-Tie Co., Inc., Pleasanton, CA; SET-3G Epoxy Adhesive Anchors. (ESR-4057).
   c. DeWalt/Powers Fasteners, Brewster NY; Pure 110+ Epoxy adhesive anchor system (ESR-3298).

E. Adhesive Threaded Inserts:

1. Type 316 stainless steel, internally threaded inserts.
2. Manufacturer and Product: Hilti, Inc., Tulsa, OK; HIS-RN Insert with HIT-RE 500-V3 or HIT-HY 200 adhesive.

PART 3 EXECUTION

3.01 CONCRETE ANCHORS

A. Begin installation only after concrete to receive anchors has attained design strength.

B. Locate existing reinforcing with Ground Penetrating Radar or other method approved by Engineer prior to drilling. Coordinate with Engineer to adjust anchor locations where installation would result in hitting reinforcing.

C. Install in accordance with written manufacturer's instructions.

A. Provide minimum embedment, edge distance, and spacing as indicated unless otherwise noted on Drawings:

Anchor Type	Minimum Embedment (Bolt Diameters)	Minimum Edge Distance (Bolt Diameters)	Minimum Spacing (Bolt Diameters)
Expansion	9	6	12
Undercut	9	12	16
Adhesive	9	9	13.5

B. Use only drill type and bit type and diameter recommended by anchor manufacturer.

C. Clean hole of debris and dust per manufacturer's requirements.

D. When unidentified embedded steel, rebar, or other obstruction is encountered in drill path, slant drill to clear obstruction. If drill must be slanted more than indicated in manufacturer's installation instructions to clear obstruction, notify Engineer for direction on how to proceed.

E. Adhesive Anchors:

1. Unless otherwise approved by Engineer and adhesive manufacturer:
   a. Do not install adhesive anchors when temperature of concrete is below 40 degrees F or above 100 degrees F.
   b. Do not install prior to concrete attaining an age of 21 days.
   c. Remove any standing water from hole with oil-free compressed air. Inside surface of hole shall be dry.
   d. Do not disturb anchor during recommended curing time.
   e. Do not exceed maximum torque as specified in manufacturer's instructions.

3.02 FIELD QUALITY ASSURANCE AND QUALITY CONTROL

3.03 FASTENER SCHEDULE

A. Unless indicated otherwise on Drawings, provide fasteners as follows:

Service Use and Location	Product	Remarks
1. Post-Installed Anchors for Metal Components to Cast-in-Place Concrete (such as, Ladders, Handrail Posts, Electrical Panels, Platforms, and Equipment)		
Exterior	Stainless steel anchors	Verify product acceptability and manufacturer's requirements if anchor installation will occur in an overhead application
All service uses and locations	Stainless steel anchors	

B. Antiseizing Lubricant: Use on all stainless steel threads.

END OF SECTION

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. The Aluminum Association, Inc. (AA): The Aluminum Design Manual.
2. American Galvanizers Association (AGA):
   a. Inspection of Hot-Dip Galvanized Steel Products.
   b. Quality Assurance Manual.
3. American Iron and Steel Institute (AISI): Stainless Steel Types.
4. American Ladder Institute (ALI): A14.3, Ladders - Fixed - Safety Requirements.
5. American National Standards Institute (ANSI).
6. American Society of Safety Engineers (ASSE): A10.11, Safety Requirements for Personnel and Debris Nets.
7. American Welding Society (AWS):
   a. D1.1/D1.1M, Structural Welding Code - Steel.
   b. D1.2/D1.2M, Structural Welding Code - Aluminum.
   c. D1.6/D1.6M, Structural Welding Code - Stainless Steel.
8. ASTM International (ASTM):
   a. A36/A36M, Standard Specification for Carbon Structural Steel.
   b. A48/A48M, Specification for Gray Iron Castings.
   c. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   d. A108, Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
   e. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   f. A143/A143M, Standard for Safeguarding Against Embrittlement of Hot-Dip Galvanized Structural Steel Products and Procedure for Detecting Embrittlement.
   g. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   h. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
   i. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.

j. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
k. A276, Standard Specification for Stainless Steel Bars and Shapes.
l. A283/A283M, Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates.
m. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tensile Strength.
n. A325, Standard Specification for Structural Bolts, Steel, Heat Treated 120/105 ksi Minimum Tensile Strength.
o. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
p. A384/A384M, Standard Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
q. A385/A385M, Standard Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
r. A489, Standard Specification for Carbon Steel Lifting Eyes.
s. A500/A500M, Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
t. A501, Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
u. A563, Standard Specification for Carbon and Alloy Steel Nuts.
v. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
w. A780/A780, Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
x. A786/A786M, Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates.
y. A793, Standard Specification for Rolled Floor Plate, Stainless Steel.
z. A967, Standard Specification for Chemical Passivation Treatments for Stainless Steel Parts.
aa. A992/A992M, Standard Specification for Structural Steel Shapes.
bb. B209, Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
cc. B308/B308M, Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles.
dd. B429/B429M, Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
ee. B632/B632M, Standard Specification for Aluminum-Alloy Rolled Tread Plate.
ff. C881/C881M, Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
gg. D1056, Standard Specification for Flexible Cellular Materials - Sponge or Expanded Rubber.

hh. F436, Standard Specification for Hardened Steel Washers.
ii. F468, Standard Specification for Nonferrous Bolts, Hex Cap Screws, and Studs for General Use.
jj. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
kk. F594, Standard Specification for Stainless Steel Nuts.
ll. F844, Standard Specification for Washers, Steel, Plain (Flat), Unhardened for General Use.
mm. F1554, Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.

9. International Code Council Evaluation Service (ICC-ES):
   a. AC01, Acceptance Criteria for Expansion Anchors in Masonry Elements.
   b. AC106, Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements.
   c. AC193, Acceptance Criteria for Mechanical Anchors in Concrete Elements.
   d. AC308, Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements.
   e. AC70, Acceptance Criteria for Fasteners Power-driven into Concrete, Steel and Masonry Elements.
10. NSF International (NSF): 61, Drinking Water System Components—Health Effects.
11. Occupational Safety and Health Administration (OSHA):
   a. 29 CFR 1910.27, Fixed Ladders.
   b. 29 CFR 1926.105, Safety Nets.
   c. 29 CFR 1926.502, Fall Protection Systems Criteria and Practices.
12. Specialty Steel Industry of North America (SSINA):
   a. Specifications for Stainless Steel.
   b. Design Guidelines for the Selection and Use of Stainless Steel.
   c. Stainless Steel Fabrication.
   d. Stainless Steel Fasteners.

1.02 DEFINITIONS

A. Anchor Bolt: Cast-in-place anchor; concrete or masonry.

B. Concrete Anchor: Post-installed concrete anchors listed in this Specification.

C. Corrosive Area: Containment area or area exposed to delivery, storage, transfer, or use of chemicals.

D. Exterior Area: Location not protected from weather by building or other enclosed structure.

E. Interior Dry Area: Location inside building or structure where floor is not subject to liquid spills or washdown, nor where wall or roof slab is common to a water-holding or earth-retaining structure.

F. Interior Wet Area: Location inside building or structure where floor is sloped to floor drains or gutters and is subject to liquid spills or washdown, or where wall, floor, or roof slab is common to a water-holding or earth-retaining structure.

G. Masonry Anchor: Post-installed masonry anchors listed in this specification.

H. Submerged: Location at or below top of wall of open water-holding structure, such as basin or channel, or wall, ceiling or floor surface inside a covered water-holding structure, or exterior belowgrade wall or roof surface of water-holding structure, open or covered.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Metal fabrications, including welding and fastener information.
   b. Specific instructions for concrete anchor installation, including drilled hole size, preparation, placement, procedures, and instructions for safe handling of anchoring systems.
2. Samples: Color samples of abrasive stair nosings.

B. Informational Submittals:

1. Concrete and Masonry Post-Installed Anchors:
   a. Manufacturer's product description and printed installation instructions.
   b. Current ICC-ES Report for each type of post-installed anchor to be used.
   c. Adhesive Anchor Installer Certification.
2. U-Channel Concrete Inserts:
   a. Manufacturer's product description.
   b. Allowable load tables.
3. Ladders: Letter of certification that ladder meets OSHA 29 CFR 1910.27 requirements.
4. Passivation method for stainless steel members.

1.04 QUALITY ASSURANCE

A. Qualifications:

1. Adhesive Anchor Installer: Trained to install adhesive anchors in accordance with manufacturer's printed installation instructions.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Insofar as practical, factory assemble specified items. Assemblies, because of necessity, have to be shipped unassembled shall be packaged and tagged in manner that will protect materials from damage and will facilitate identification and field assembly.

B. Package stainless steel items in a manner to provide protection from carbon impregnation.

C. Protect painted coatings and hot-dip galvanized finishes from damage as a result of metal banding and rough handling. Use padded slings and straps.

D. Store fabricated items in dry area, not in direct contact with ground.

E. Store adhesives anchors at service temperature ranges recommended by manufacturer.

PART 2 PRODUCTS

2.01 GENERAL

A. Unless otherwise indicated, meet the following requirements:

Item	ASTM Reference
Stainless Steel:	
Bars and Angles	A276, AISI Type 316 (316L for welded connections)
Shapes	A276, AISI Type 304 (304L for welded connections)
Steel Plate, Sheet, and Strip	A240/A240M, AISI Type 316 (316L for welded connections)
Bolts, Threaded Rods, Anchor Bolts, and Anchor Studs	F593, AISI Type 316, Condition CW
Nuts	F594, AISI Type 316, Condition CW
Aluminum Plates and Structural Shapes	B209 and B308/B308M, Alloy 6061-T6

B. Bolts, Washers, and Nuts: Use stainless steel as indicated in Fastener Schedule at end of this section.

2.02 ANCHOR BOLTS AND ANCHOR BOLT SLEEVES

A. Cast-In-Place Anchor Bolts:

1. Headed type, unless otherwise shown on Drawings.
2. Material type and protective coating as shown in Fastener Schedule at end of this section.

B. Anchor Bolt Sleeves:

1. Plastic:
   a. Single unit construction with corrugated sleeve.
   b. Top of sleeve shall be self-threading to provide adjustment of threaded anchor bolt projection.
   c. Material: High-density polyethylene.
   d. Manufacturer: Sinco Products, Inc., Middletown, CT, (800) 243-6753.
2. Fabricated Steel: ASTM A36/A36M.

2.03 POST-INSTALLED CONCRETE ANCHORS

A. General:

1. AISI Type 316 stainless as shown in Fastener Schedule at end of this section.
2. Current ICC-ES Report indicating acceptance per FBC 2014 for anchors at structural applications in cracked concrete.
3. Anchors shall be suitable for long-term loads, as well as for wind loads.

B. Adhesive Anchors (Epoxy Anchors):

1. If approved by Engineer, adhesive anchors used in sustained tension applications (such as overhead or cantilevered applications) shall have current ICC-ES Report that demonstrates compliance with ICC-ES AC308 for cracked concrete.
2. Threaded Rod:
   a. ASTM F593 stainless steel threaded rod, diameter as shown on Drawings.
   b. Length as required, to provide minimum depth of embedment.
   c. Clean and free of grease, oil, or other deleterious material.
   d. For hollow-unit masonry, provide galvanized or stainless steel wire cloth screen tube to fit threaded rod.
3. Adhesive:
   a. Two-component, insensitive to moisture, designed to be used in adverse freeze/thaw environments.
   b. Cure Temperature, Pot Life, and Workability: Compatible for intended use and anticipated environmental conditions.

c. Mixed Adhesive: Nonsag light paste consistency with ability to remain in 1-inch diameter overhead drilled hole without runout.
d. Meet requirements of ASTM C881/C881M.

4. Packaging and Storage:
   a. Disposable, self-contained cartridge system capable of dispensing both components in proper mixing ratio and fitting into manually or pneumatically operated caulking gun.
   b. Store adhesive cartridges and adhesive components on pallets or shelving in covered storage area.
   c. Container Markings: Include manufacturer's name, product name, batch number, mix ratio by volume, product expiration date, ANSI hazard classification, and appropriate ANSI handling precautions.
   d. Dispose of when:
      1) Shelf life has expired.
      2) Stored other than in accordance with manufacturer's instructions.
5. Manufacturers and Products:
   a. Hilti, Inc., Tulsa, OK; HIT Doweling Anchor System, HIT RE 500 SD.
   b. Simpson Strong-Tie Co., Inc., Pleasanton, CA; SET-XP Epoxy Adhesive Anchors.
   c. Powers Fasteners, Brewster NY, PE1000+ Adhesive anchoring system.

C. Adhesive Threaded Inserts:

1. Stainless steel, internally threaded inserts.
2. Manufacturer and Product: Hilti, Inc., Tulsa, OK; HIS-RN Insert with HIT-RE 500-SD adhesive.

2.04 POST-INSTALLED MASONRY ANCHORS

A. General: AISI Type 316 stainless, hot-dip galvanized, or zinc-plated steel, as shown in Fastener Schedule at end of this section.

B. Current ICC Evaluation Report indicating acceptance per FBC 2014 for anchors at structural applications in masonry.

C. Manufacturers and Products:

1. Hilti, Inc., Tulsa, OK;Kwik-Bolt-3 (KB-3) (ESR-1385), for grout-filled masonry.
2. Powers Fasteners, Brewster NY, T308+ Epoxy Adhesive Anchoring System in Unreinforced Masonry (ESR-3149), Power-Stud+ SD1 (ESR-2966) for grout-filled masonry, Wedgebolt+ (ESR-1678) for grout-filled masonry.

2.05 EMBEDDED STEEL SUPPORT FRAMES FOR FLOOR PLATE AND GRATING

A. Steel angle support frames to be embedded in concrete shall be stainless steel, ASTM A276, AISI Type 316, unless indicated otherwise.

B. Welded anchors for stainless steel support frames shall also be stainless steel.

2.06 U-CHANNEL CONCRETE INSERTS

A. Rolled ASTM A240/A240M, AISI Type 316 stainless steel, 0.105-inch-thick, 1-5/8 inches wide by 1-3/8 inches deep, with stainless steel anchors at 10-inch maximum spacing, styrofoam fillers, and end caps.

B. Nut and Bolt Hardware: Type 316 stainless steel, 5/8-inch minimum diameter, unless indicated otherwise. Manufacturer's standard to match insert.

C. Manufacturers and Products:

1. Power-Strut, Wayne, MI; PS 349 Series.
2. B-Line Systems, Inc., Highland, IL; B32 Series.
3. Halfen Anchoring Systems, Converse, TX; Channel Type 4141HTA.

2.07 ACCESSORIES

A. Antiseizing Lubricant for Stainless Steel Threaded Connections:

1. Suitable for potable water supply.
2. Resists washout.
3. Manufacturers and Products:
   a. Bostik, Middleton, MA; Neverseez.
   b. Saf-T-Eze Div., STL Corp., Lombard, IL; Anti-Seize.

B. Neoprene Gasket:

1. ASTM D1056, 2C1, soft, closed-cell neoprene gasket material, suitable for exposure to sewage and sewage gases, unless otherwise shown on Drawings.
2. Thickness: Minimum 1/4 inch.
3. Furnish without skin coat.
4. Manufacturer and Product: Monmouth Rubber and Plastics Corporation, Long Branch, NJ; Durafoam DK1111LD.

2.08 FABRICATION

A. General:

1. Finish exposed surfaces smooth, sharp, and to well-defined lines.
2. Furnish necessary rabbets, lugs, and brackets so work can be assembled in neat, substantial manner.
3. Conceal fastenings where practical; where exposed, flush countersink.
4. Drill metalwork and countersink holes as required for attaching hardware or other materials.
5. Grind cut edges smooth and straight. Round sharp edges to small uniform radius. Grind burrs, jagged edges, and surface defects smooth.
6. Fit and assemble in largest practical sections for delivery to Site.

B. Welding:

1. Weld connections and grind exposed welds smooth. When required to be watertight, make welds continuous.
2. Welded fabrications shall be free from twisting or distortion caused by improper welding techniques.
3. Aluminum: Meet requirements of AWS D1.2/D1.2M.
4. Stainless Steel: Meet requirements of AWS D1.6/D1.6M.
5. Welded Anchor Studs: Prepare surface to be welded and weld with stud welding gun in accordance with AWS D1.1/D1.1M, Section 7, and manufacturer's instructions.
6. Complete welding before applying finish.

C. Painting:

1. Shop prime with rust-inhibitive primer as specified in Section 09 90 04, Painting, unless otherwise indicated.
2. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 04, Painting, unless indicated otherwise.
3. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.

D. Galvanizing:

1. Fabricate steel to be galvanized in accordance with ASTM A143/A143M, ASTM A384/A384M, and ASTM A385/A385M. Avoid fabrication techniques that could cause distortion or embrittlement of the steel.
2. Provide venting and drain holes for tubular members and fabricated assemblies in accordance with ASTM A385/A385M.
3. Remove welding slag, splatter, burrs, grease, oil, paint, lacquer, and other deleterious material prior to delivery for galvanizing.

4. Remove by blast cleaning or other methods surface contaminants and coatings not removable by normal chemical cleaning process in the galvanizing operation.
5. Hot-dip galvanize steel members, fabrications, and assemblies after fabrication in accordance with ASTM A123/A123M.
6. Hot-dip galvanize bolts, nuts, washers, and hardware components in accordance with ASTM A153/A153M. Oversize holes to allow for zinc alloy growth. Shop assemble bolts and nuts.
7. Galvanized steel sheets in accordance with ASTM A653/A653M.
8. Galvanize components of bolted assemblies separately before assembly. Galvanizing of tapped holes is not required.

E. Electrolytic Protection: Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 04, Painting, unless indicated otherwise.

F. Watertight Seal: Where required or shown, furnish neoprene gasket covering full bearing surfaces.

G. Fitting: Where movement of fabrications is required or shown, cut, fit, and align items for smooth operation. Make corners square and opposite sides parallel.

H. Accessories: Furnish as required for a complete installation. Fasten by welding or with stainless steel bolts or screws.

2.09 SOURCE QUALITY CONTROL

A. Visually inspect all fabrication welds and correct deficiencies.

1. Aluminum: AWS D1.2/D1.2M.
2. Stainless Steel: AWS D1.6/D1.6M.

PART 3 EXECUTION

3.01 INSTALLATION OF METAL FABRICATIONS

A. General:

1. Install metal fabrications plumb and level, accurately fitted, free from distortion or defects.
2. Install rigid, substantial, and neat in appearance.
3. Install manufactured products in accordance with manufacturer’s recommendations.
4. Obtain Engineer approval prior to field cutting steel members or making adjustments not scheduled.

B. Aluminum:

1. Do not remove mill markings from concealed surfaces.
2. Remove inked or painted identification marks on exposed surfaces not otherwise coated after installed material has been inspected and approved.
3. Fabrication, mechanical connections, and welded construction shall be in accordance with the AA Aluminum Design Manual.

3.02 CAST-IN-PLACE ANCHOR BOLTS

A. Locate and hold anchor bolts in place with templates at time concrete is placed.

B. Use anchor bolt sleeves for location adjustment and provide two nuts and one washer per bolt of same material as bolt.

C. Minimum Bolt Size: 1/2-inch diameter by 12 inches long, unless otherwise shown.

3.03 CONCRETE AND MASONRY POST-INSTALLED ANCHORS

A. Begin installation only after concrete or masonry to receive anchors has attained design strength.

B. Install in accordance with manufacturer's instructions.

C. Provide minimum embedment, edge distance, and spacing as follows, unless indicated otherwise by anchor manufacturer's instructions or shown otherwise on Drawings:

Anchor Type	Minimum Embedment (Bolt Diameters)	Minimum Edge Distance (Bolt Diameters)	Minimum Spacing (Bolt Diameters)
Adhesive	9	9	13.5

D. Use only drill type and bit type and diameter recommended by anchor manufacturer. Clean hole of debris and dust with brush and compressed air per manufacturer's printed installation instructions.

E. When embedded steel or rebar is encountered in drill path, slant drill to clear obstruction. If drill must be slanted more than 10 degrees to clear obstruction, notify Engineer for direction on how to proceed.

F. Adhesive Anchors:

1. Do not install adhesive anchors when temperature of concrete is below 40 degrees F or above 100 degrees F, unless cold temperature adhesives, compliant with ACI 308 are used. Refer to the respective ICC-ES report and manufacturer's printed installation instructions.
2. Remove water from hole with oil-free compressed air. Damp or water filled holes may be allowed only if approved in manufacturer's printed installation instructions and ICC-ES report.
3. For hollow-unit masonry, install screen tube in accordance with manufacturer's printed installation instructions.
4. Do not disturb anchor during recommended curing time.
5. Do not exceed maximum torque as specified in manufacturer's printed installation instructions.

3.04 U-CHANNEL CONCRETE INSERTS

A. Provide as indicated for pipe supports and where otherwise shown on Drawings.

B. Except for interior dry areas, use plastic clips or similar dielectric material to isolate channel anchors from concrete reinforcing steel.

3.05 ELECTROLYTIC PROTECTION

A. Aluminum:

1. Coat surfaces of galvanized steel and aluminum fabricated items to be in direct contact with concrete, grout, masonry, or dissimilar metals, as specified in Section 09 90 04, Painting, unless indicated otherwise.
2. Do not apply protective coating to galvanized steel anchor bolts or galvanized steel welded anchor studs, unless indicated otherwise.
3. Allow coating to dry before installation of the material.
4. Protect coated surfaces during installation.
5. Should coating become marred, prepare and touch up in accordance with paint manufacturer's written instructions.

B. Stainless Steel:

1. During handling and installation, take necessary precautions to prevent carbon impregnation of stainless steel members.
2. After installation, visually inspect stainless steel surfaces for evidence of iron rust, oil, paint, and other forms of contamination.
3. Remove contamination using cleaning and passivation methods in accordance with requirements of ASTM A380 and ASTM A967.

4. Brushes used to remove foreign substances shall utilize only stainless steel or nonmetallic bristles.
5. After treatment, visually inspect surfaces for compliance.

3.06 PAINTING

A. Painted Galvanized Surfaces: Prepare as specified in Section 09 90 04, Painting.

3.07 FIELD QUALITY CONTROL

A. Owner-Furnished Quality Assurance.

B. Contractor-Furnished Quality Control:

1. Inspection and testing required in Section 01 45 16.13, Contractor Quality Control.
2. Manufacturer's Certificate of Compliance for test results, or calculations, or drawings that ensure material and equipment design.

3.08 FASTENER SCHEDULE

A. Unless indicated otherwise on Drawings, provide fasteners as follows:

Service Use and Location	**Product**	**Remarks**
1. Anchor Bolts Cast Into Concrete for Structural Steel, Metal Fabrications and Castings		
Exterior and Interior Wet Areas	Stainless steel headed anchor bolts	
Submerged and Corrosive Areas	Stainless steel headed anchor bolts with fusion bonded coating	See Section 09 90 04, Painting
2. Anchor Bolts Cast Into Concrete for Equipment Bases		
Submerged, Exterior, Interior Wet, and Corrosive Areas	Stainless steel headed anchor bolts with fusion bonded coating, unless otherwise specified with equipment	See Section 09 90 04, Painting

Service Use and Location	Product	Remarks
3. Drilled Anchors for Metal Components to Cast-in-Place Concrete (e.g., Ladders, Handrail Posts, Electrical Panels, and Equipment)		
Submerged, Exterior, Interior Wet, and Corrosive Areas	Adhesive stainless steel anchors	
4. Anchors in Hollow Concrete Masonry Units		
Exterior and Interior Wet and Dry Areas	Stainless steel sleeve anchors, or stainless steel adhesive anchors with screen tube	
5. Connections of Aluminum Components		
Submerged, Exterior and Interior Wet and Dry Areas	Stainless steel bolted connections, unless otherwise specified with equipment	
6. All Others		
Exterior and Interior Wet and Dry Areas	Stainless steel fasteners	

B. Antiseizing Lubricant: Use on stainless steel threads.

END OF SECTION

SECTION 05 52 16
ALUMINUM RAILINGS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Aluminum Association, Incorporated (AA): DAF45, Designation System for Aluminum Finishes.
2. American Concrete Institute (ACI) 318, Building Code Requirements for Structural Concrete.
3. American Iron and Steel Institute (AISI).
4. ASTM International (ASTM):
   a. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
   b. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
   c. E894, Standard Test Method for Anchorage of Permanent Metal Railing Systems and Rails for Buildings.
   d. E935, Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings.
   e. E985, Standard Specification for Permanent Metal Railing Systems and Rails for Buildings.
5. International Code Council (ICC): International Building Code (IBC).
6. Occupational Safety and Health Act (OSHA): 29 CFR 1910, Code of Federal Regulations.

1.02 DEFINITIONS

A. ICC Evaluation Services Report: ICC report on evaluation of manufactured concrete anchor systems.

B. Railings: This term includes guardrail systems, handrail systems, platform railing systems, ramp-rail systems, and stair-rail systems. Railings may be comprised of a framework of vertical, horizontal, or inclined members, grillwork or panels, accessories, or combination thereof.

1.03 DESIGN REQUIREMENTS

A. Structural Performance of Railing Systems: Design, test, fabricate, and install railings to withstand the following structural loads without exceeding allowable design working stress or allowable deflection. Apply each load to produce maximum stress and deflection in railing system components.

1. Top Rail: Capable of withstanding the following load cases applied:
   a. Concentrated load of 200 pounds applied at any point and in any direction in accordance with ICC IBC and OSHA.
   b. Uniform load of 50 pounds per linear foot applied in any direction in accordance with ICC IBC.
   c. Concentrated load need not be assumed to act concurrently with uniform loads in accordance with ICC IBC.
2. Intermediate Rail:
   a. Capable of withstanding a horizontally applied normal load of 50 pounds per linear foot applied in any direction.
   b. Horizontal concentrated load need not be assumed to act concurrently with loads on top rails of railings.
3. Calculated lateral deflection at top of posts shall not exceed 1 inch.

1.04 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Project-specific scaled plans and elevations of railings and detail drawings. Include railing profiles, sizes, connections, anchorage, size and type of fasteners, and accessories.
   b. Manufacturer’s literature and catalog data of railing and components.
   c. Design Data: Calculations or test data using specified design performance loads and including the following:
      1) Bending stress in, and deflection of, posts in accordance with ASTM E985 as modified herein.
      2) Design of post base connection.
      3) Documentation that concrete anchors have been designed in accordance with one of the following:
         a) ACI 318, Appendix D.
         b) ICC Evaluation Services Report for selected anchor.

B. Informational Submittals:

1. Manufacturer's assembly and installation instructions.
2. Test Reports: Test data may supplement load calculations providing data covers complete railing system, including anchorage:
   a. Test data for railing and components showing load and deflection as a result of load, in enough detail to prove railing is strong enough and satisfies national, state, local standards, regulations, code requirements, and OSHA 29 CFR 1910, using design loads specified. Include test data for the following:
      1) Railing and post connections.
      2) Railing wall connections.
      3) Railing expansion joint connections.
      4) Railing system gate assembly, including latch, gate stop, and hinges. Both gate latch and stop to support required loads applied independent of each other.
   b. Testing of anchorages shall be in accordance with ASTM E894 and ASTM E935 using applied loads in accordance with ICC IBC.
   c. Deflection Criteria: In accordance with ASTM E985 and design loads specified, except as follows: maximum calculated lateral deflection at top of posts shall not exceed 1 inch.
   d. Aluminum Rail Piping: Test data showing yield strength of pipe as delivered equals or exceeds specified values.
3. Manufacturer's written recommendations describing procedures for maintaining railings including cleaning materials, application methods, and precautions to be taken in use of cleaning materials.

1.05 QUALITY ASSURANCE

A. Qualifications: Calculations required for design data shall be stamped by a qualified engineer registered in the State of Florida.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Package and wrap railings to prevent scratching and denting during shipment, storage, and installation. Maintain protective wrapping to the extent possible until railing is completely installed.

B. Delivery: Deliver clear anodized railing pipe and posts with protective plastic wrap.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Thermal Movements: Allow for thermal movement resulting from the following maximum range in ambient temperature in design, fabrication, and installation of railings to prevent buckling, opening up of joints, over stressing of components, connections and other detrimental effects. Base design calculation on actual surface temperature of material as a result of both solar heat gain and night time sky heat loss. Temperature change is difference between high or low temperature and installation temperature.

1. Temperature Change Range: 70 degrees F, ambient; 100 degrees F, material surfaces.

PART 2 PRODUCTS

2.01 ALUMINUM RAILINGS

A. General:

1. Furnish pre-engineered and prefabricated railing systems as shown on Drawings.
2. Railing systems using pop rivets or glued railing construction are not permitted.
3. Sand cast accessories and components are not permitted.
4. Fasteners shall be AISI Type 316 stainless steel, unless otherwise noted.

B. Rails, Posts, and Formed Elbows:

1. Extruded Alloy 6105-T5, 6061-T6, or equivalent.
2. Tensile Strength: 38,000 psi, minimum.
3. Yield Strength: 35,000 psi, minimum.
4. Nominal Wall Thickness: 0.145 inch, minimum.
5. Posts and railings shall be nominal 1-1/2-inch diameter (1.90-inch outside diameter).

C. Accessories:

1. Fittings and Accessories:
   a. Extruded, machined bar stock, permanent mold castings, or die castings of sufficient strength to meet load requirements.
   b. Gauge metal components are not acceptable for load-resisting components.
   c. Fittings shall match color of pipe in railings.

2. Miscellaneous Extruded Aluminum Parts: Alloys 6063-T6, 6061-T6, or 6105 T5 aluminum, or equivalent, and of adequate strength for all loads.
3. Castings for Railings:
   a. Cast Al-mag with sufficient strength to meet load and test requirements.
   b. Anodizable grade finish with excellent resistance to corrosion when subjected to exposure of sodium chloride solution intermittent spray and immersion.
4. Post Anchorages:
   a. Refer to standard details for types of post anchorages and minimum requirements.
   b. Bolts at anchorages shall be minimum 1/2-inch diameter.
5. Wall Brackets: Adjustable wall fitting, with provision for minimum three 3/8-inch diameter AISI Type 316 stainless steel bolts or concrete anchors.

D. Finishes:

1. Pipe and Post: In accordance with AA DAF45, designation AA-M32-C22-A41.
2. Cast Fittings and Toeboards: In accordance with AA DAF45, designation AA-M10-C22-A41.

2.02 ANCHOR BOLTS, FASTENERS, AND CONCRETE ANCHORS

A. Locknuts, Washers, and Screws:

1. Elastic Locknuts, Steel Flat Washers, Round Head Machine Screws (RHMS): AISI Type 316 stainless steel.
2. Flat Washers: Molded nylon.

B. Bolts and Nuts for Bolting Railing to Metal Beams: ASTM A193/A193M and ASTM A194/A194M, Type 316 stainless steel.

C. Concrete Anchors:

1. Stainless steel, AISI Type 316.
2. Post-installed anchors in accordance with Section 05 05 19, Post-installed Anchors, unless otherwise specified herein.
3. Bolt Diameter: 1/2-inch, minimum.

2.03 FABRICATION

A. Shop Assembly:

1. Railing Posts Bolted to Metal or Concrete:
   a. In lieu of field cutting, provide approved fitting with sufficient post overlap, containing provisions for vertical adjustment.
   b. Field fit-up is required.
2. Free of burrs, nicks, and sharp edges when fabrication is complete.
3. Welding is not permitted.

B. Shop/Factory Finishing:

1. Use same alloy for uniform appearance throughout fabrication for railings.
2. Railing and Post Fittings: Match fittings with color of pipe in railing.

C. Shop Assembly:

1. Shop assemble rails, posts, and formed elbows with a close tolerance for tight fit.
2. Fit dowels tightly inside posts.

D. Repair of Defective Work: Remove stains and replace defective Work.

PART 3 EXECUTION

3.01 GENERAL

A. Field fabrication of aluminum railing systems is not permitted.

B. Where required, provide railing posts longer than needed and field cut to exact dimensions required in order to satisfy vertical variations on actual structure.

C. Install railing with base that provides plus or minus 1/4-inch vertical adjustment inside base fitting. If adjustment is required in field and exceeds plus or minus 1/4-inch, reduce post length not to exceed beyond bottom of lowest set-screw or bolt in base fitting.

D. Modification to supporting structure is not permitted where railing is to be attached.

E. Protection from Entrapped Water:

1. Make provisions in exterior and interior installations subject to high humidity to drain water from railing system.
2. For posts mounted in concrete, bends, and elbows occurring at low points, drill weep holes of 1/4-inch diameter at lowest possible elevations, one hole per post or rail. Drill hole in plane of rail.

3.02 RAILING INSTALLATION

A. Assembly and Installation: Perform in accordance with manufacturer's written recommendations for installation.

B. Posts and Rails:

1. Surface Mounted Posts:
   a. Bolt post baseplate connectors firmly in place.
   b. Shims, wedges, grout, and similar devices for railing post alignment not permitted.
2. Set posts plumb and aligned to within 1/8 inch in 12 feet.
3. Install posts and rails in same plane.
4. Remove projections or irregularities and provide a smooth surface for sliding hands continuously along top rail.
5. Use offset rail for use on stairs and platforms if post is attached to web of stringers or structural platform supports.
6. Support 1-1/2-inch rails directly above stairway stringers with offset fittings.

3.03 FIELD FINISHING

A. Corrosion Protection: Prevent galvanic action and other forms of corrosion caused from direct contact with concrete and dissimilar metals by coating metal surfaces.

3.04 CLEANING

A. Wash railing system thoroughly using clean water and soap. Rinse with clean water.

B. Do not use acid solution, steel wool, or other harsh abrasive.

C. If stain remains after washing, restore in accordance with railing manufacturer's recommendations or replace stained railings.

END OF SECTION

SECTION 09 90 04
PAINTING (CONDENSED)

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. NACE International (NACE): RP0188, Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.
2. NSF International (NSF):
   a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
   b. NSF/ANSI 372, Drinking Water System Components - Lead Content.
3. The Society for Protective Coatings (SSPC):
   a. PA 2, Measurement of Dry Coating Thickness with Magnetic Gages.
   b. PA 3, Guide to Safety in Paint Applications.
   c. SP 1, Solvent Cleaning.
   d. SP 2, Hand Tool Cleaning.
   e. SP 3, Power Tool Cleaning.
   f. SP 5, Joint Surface Preparation Standard White Metal Blast Cleaning.
   g. SP 6, Joint Surface Preparation Standard Commercial Blast Cleaning.
   h. SP 7, Joint Surface Preparation Standard Brush-Off Blast Cleaning.
   i. SP 10, Joint Surface Preparation Standard Near-White Blast Cleaning.
   j. SP 11, Power Tool Cleaning to Bare Metal.
   k. SP 12, Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Prior to Recoating.
   l. SP 13, Surface Preparation of Concrete.
   m. Guide 15, Field Methods for Retrieval and Analysis of Soluble Salts on Steel and Other Nonporous Substrates.

1.02 DEFINITIONS

A. Terms used in this section:

1. Coverage: Total minimum dry film thickness in mils or square feet per gallon.
2. FRP: Fiberglass Reinforced Plastic.
3. HCl: Hydrochloric Acid.
4. MDFT: Minimum Dry Film Thickness, mils.
5. MDFTPC: Minimum Dry Film Thickness per Coat, mils.
6. Mil: Thousandth of an inch.
7. PPDS: Paint Product Data Sheet.

8. PSDS: Paint System Data Sheet.
9. PVC: Polyvinyl Chloride.
10. SFPG: Square Feet per Gallon.
11. SFPGPC: Square Feet per Gallon per Coat.
12. SP: Surface Preparation.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Paint Product Data Sheets:
      1) For each product, furnish a Paint Product Data Sheet (PPDS), the manufacturer's technical data sheets, and paint colors available (where applicable). The PPDS form is appended to the end of this section.
      2) For each paint system, furnish a Paint System Data Sheet (PSDS). The PSDS form is appended to the end of this section.
      3) Furnish copies of paint system submittals to coating applicator.
      4) Indiscriminate submittal of manufacturer's literature is not acceptable.
   b. Detailed chemical and gradation analysis for each proposed abrasive material.
2. Samples:
   a. Reference Panel:
      1) Prior to start of surface preparation, furnish a 4-inch by 4-inch steel panel prepared to specified requirements for each grade of sandblast specified herein.
         a) Provide panel representative of steel used, and prevent from deterioration of surface quality.
         b) Upon approval by Engineer, preserve panel as reference source for inspection.
      2) Paint:
         a) Before painting work is started, prepare minimum 8-inch by 10-inch Sample with type of paint and application specified, on similar substrate to which paint is to be applied.
         b) Furnish additional Samples as required until colors, finishes, and textures are approved.
         c) Approved Samples to be quality standard for final finishes.

B. Informational Submittals:

1. Applicator's Experience: List of references substantiating this requirement as specified.
2. Manufacturer's written verification that submitted products are suitable for the intended use.
3. Factory Applied Coatings: Manufacturer's certification stating factory applied coating system meets or exceeds requirements specified herein.
4. If manufacturer of finish coating differs from that of shop primer, provide both manufacturers' written confirmation that materials are compatible.
5. Coating Manufacturer's Certificate of Compliance, in accordance with Section 01 61 00, Common Product Requirements.

1.04 QUALITY ASSURANCE

A. Applicator's Experience: Minimum 5 years' practical experience in application of specified products.

B. Regulatory Requirements:

1. Meet federal, state, and local requirements limiting emission of volatile organic compounds.
2. Perform surface preparation and painting in accordance with recommendations of the following:
   a. Paint manufacturer's instructions.
   b. SSPC PA 3, Guide to Safety in Paint Applications.
   c. Federal, state, and local agencies having jurisdiction.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in unopened containers that plainly show designated name, date of manufacture, color, and manufacturer.

B. Store paints in a protected area that is heated or cooled to maintain temperature range recommended by paint manufacturer.

1.06 PROJECT CONDITIONS

A. Environmental Requirements:

1. Do not apply paint in temperatures outside of manufacturer's recommended maximum or minimum allowable, or in dust, smoke-laden atmosphere, damp or humid weather.
2. Do not perform abrasive blast cleaning whenever relative humidity exceeds 85 percent, or whenever surface temperature is less than 5 degrees F above dewpoint of ambient air. Strictly adhere to coating manufacturer's recommendations.

1.07 EXTRA MATERIALS

A. Provide small quantity kits for touchup painting and for painting other small areas.

B. Fusion Bonded Coating: Provide appropriate liquid repair kits for field use.

PART 2 PRODUCTS

2.01 GENERAL

A. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 MANUFACTURERS

A. Paint manufacturer shall be nationally recognized manufacturer of paints and protective coatings and regularly engaged in production of such materials that have essentially identical service conditions as this Project.

B. Minimum of 5 years' verifiable experience in manufacture of specified products.

C. Each of the following manufacturers is capable of supplying most of the products specified herein:

1. Ameron.
2. Benjamin Moore.
3. Sherwin Williams.
4. Tnemec.

2.03 ABRASIVE MATERIALS

A. Select abrasive type and size to produce surface profile that meets coating manufacturer's recommendations for specific primer and coating system to be applied.

2.04 PAINT MATERIALS

A. General:

1. Material Quality: Manufacturer's highest quality products and suitable for the intended service.
2. Materials, Including Primer and Finish Coats: Produced by same paint manufacturer.
3. Thinners, Cleaners, Driers, and Other Additives: As recommended by paint manufacturer of particular coating.

B. Products:

Product	Definition
Acrylic Latex	Single component, gloss as specified
Acrylic Sealer	Clear acrylic
Alkyd Enamel	Optimum quality, gloss or semigloss finish as specified, medium long oil
Bituminous Paint	Single-component, coal-tar pitch based
Coal-Tar Epoxy	Amine, polyamide, or phenolic epoxy type; 70% volume solids minimum, suitable for immersion service
DTM Acrylic Primer	Surface tolerant, direct-to-metal water borne acrylic primer
DTM Acrylic Finish	Surface tolerant, direct-to-metal water borne acrylic finish coat
Epoxy Filler/Surfacer	100 percent solids epoxy trowel grade filler and surfacer, nonshrinking, suitable for application to concrete and masonry. Approved for potable water contact and conforming to NSF/ANSI 61, where required
Epoxy Primer	Converted epoxy primer containing rust-inhibitive pigments
High Build Epoxy	Polyamidoamine epoxy, minimum 69% volume solids, capability of 4 MDFT to 8 MDFT per coat

Product	Definition
Inorganic Zinc Primer	Solvent or water based, having 85% metallic zinc content in the dry film; follow manufacturer's recommendation for topcoating
NSF Epoxy	Polyamidoamine epoxy, approved for potable water contact and conforming to NSF/ANSI 61
Epoxy, High Solids	Polyamidoamine epoxy, 80% volume solids, minimum, suitable for immersion service
Polyurethane Enamel	Two-component, aliphatic or acrylic based polyurethane; high gloss finish
Rust-Inhibitive Primer	Single-package steel primers with anticorrosive pigment loading
Silicone/Silicone Acrylic	Elevated temperature silicone or silicone/acrylic based
Stain, Concrete	Acrylic, water repellent, penetrating stain

2.05 COLORS

A. Provide as selected by Owner or Engineer.

B. Formulate with colorants free of lead, lead compounds, or other materials, which might be affected by presence of hydrogen sulfide or other gas likely to be present at Site.

C. Proprietary identification of colors is for identification only. Any authorized manufacturer may supply matches.

2.06 SHOP FINISHES

A. Shop Blast Cleaning: Reference paragraph Shop Coating Requirements, this section.

B. Surface Preparation: Provide Engineer minimum 7 days' advance notice to start of shop surface preparation work and coating application work.

C. Shop Coating Requirements:

1. When required by equipment Specifications, such equipment shall be primed and finish coated in shop by manufacturer and touched up in field with identical material after installation.

2. Where manufacturer's standard coating is not suitable for intended service condition, Engineer may approve use of a tie-coat to be used between manufacturer's standard coating and specified field finish. In such cases, tie-coat shall be surface tolerant epoxy as recommended by manufacturer of specified field finish coat. Coordinate details of equipment manufacturer's standard coating with field coating manufacturer.

D. Pipe:

1. Ductile Iron Pipe:
   a. Use SSPC standards as a guide for desired prepared surface. Follow recommendations of pipe and coating manufacturers for means and methods to achieve SSPC-equivalent surface.
   b. Prior to blast cleaning, grind smooth surface imperfections including, but not limited to, delaminating metal or oxide layers.
   c. Surface preparation and application of primer coats shall be performed by pipe manufacturer.

PART 3 EXECUTION

3.01 GENERAL

A. Surface Preparation Inspection:

1. Inspect and provide substrate surfaces prepared in accordance with these Specifications and printed directions and recommendations of paint manufacturer whose product is to be applied. In event of conflict, more stringent shall apply.
2. Notify Engineer minimum 7 days' prior to start of surface preparation work or coating application work.
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 until completion of curing cycle.

C. The intention of these Specifications is for new surfaces to be painted, whether specifically mentioned or not, except as modified herein.

D. Perform painting in accordance with recommendations of the following:

1. Paint manufacturer's instructions.
2. Federal, state, and local agencies having jurisdiction.

3.02 PROTECTION OF MATERIALS NOT TO BE PAINTED

A. Protect all surfaces adjacent to, or downwind of Work area from overspray. Contractor shall be responsible for any damages resulting from overspray.

B. Remove, mask, or otherwise protect hardware, lighting fixtures, switchplates, aluminum surfaces, machined surfaces, couplings, shafts, bearings, nameplates on machinery, and other surfaces not specified elsewhere.

C. Provide drop cloths to prevent paint materials from falling on or marring adjacent surfaces.

D. Protect working parts of mechanical and electrical equipment from damage.

E. Mask openings in motors to prevent paint and other materials from entering the motors.

3.03 FIELD SANDBLASTING

A. Perform sandblasting for items and equipment where specified, and as required to restore damaged surfaces previously shop or field blasted and primed. Materials, equipment, procedures shall meet requirements of SSPC.

3.04 PREPARATION OF SURFACES

A. Metal Surface Preparation:

1. General:
    a. Submit samples prior to surface preparation blasting.
    b. Conform to current SSPC specifications as follows:
        1) Solvent Cleaning: SP 1.
        2) Hand Tool Cleaning: SP 2.
        3) Power Tool Cleaning: SP 3.
        4) White Metal Blast Cleaning: SP 5.
        5) Commercial Blast Cleaning: SP 6.
        6) Brush-Off Blast Cleaning: SP 7.
        7) Near-White Blast Cleaning: SP 10.
        8) Power Tool Cleaning to Bare Metal: SP 11.
        9) High Pressure Waterjetting: SP 12.
    c. Where OSHA or EPA regulations preclude standard abrasive blast cleaning, wet- or vacu-blast methods may be required. Follow coatings manufacturers' recommendations for wet-blast additives and first coat application.
    d. 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 subject to Engineer review.

B. Plastic and FRP Surface Preparation:

1. Hand sand with medium grit sandpaper to provide tooth for coating system.
2. Large areas may be power sanded or brush-off blasted, provided sufficient controls are employed so surface is roughened without removing excess material.

3.05 PAINT MIXING

A. Multiple-Component Coatings:

1. Prepare using contents of container for each component as packaged by paint manufacturer.
2. No partial batches will be permitted.
3. Do not use multiple-component coatings that have been mixed beyond their pot life.
4. Mix only components specified and furnished by paint manufacturer.
5. Do not intermix additional components for reasons of color or otherwise, even within same generic type of coating.

B. Keep paint materials sealed when not in use.

C. Where more than one coat of material is applied within given system, alternate color to provide visual reference that required number of coats has been applied.

3.06 PAINT APPLICATION

A. General:

1. Inspection: Schedule with Engineer in advance for cleaned surfaces and all coats prior to succeeding coat.
2. Apply coating in accordance with paint manufacturer’s recommendations. Allow sufficient time between coats to ensure thorough drying of previously applied paint.
3. Fusion Bonded Coating Application: Electrostatic, fluidized bed, or flocking.
4. Paint units to be bolted together and to structures, prior to assembly or installation.

5. Extent of Coating (Immersion): Coatings shall be applied to internal vessel and pipe surfaces, nozzle bores, flange gasket sealing surfaces, carbon steel internals, and stainless steel internals, unless otherwise specified.

B. Shop Primed or Factory Finished Surfaces:

1. Inspection: Schedule inspection for compliance with Specifications of shop primed or factory finished items with Engineer in advance of delivery to Site.
2. Hand or power sand areas of chipped, peeled, or abraded coating, feathering the edges. Follow with a spot primer using specified primer.
3. For two-package or converted coatings, consult coatings manufacturer for specific procedures as relates to manufacturer's products.
4. Prior to application of finish coats, clean shop-primed surfaces free of dirt, oil, and grease and apply mist coat of specified primer, 1-mil dry film thickness.
5. After welding, prepare and prime holdback areas as required for specified paint system. Apply primer in accordance with manufacturer's instructions.

C. Manufacturer Applied Paint Systems:

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

D. Film Thickness and Coverage:

1. Number of Coats:
   a. Minimum required, irrespective of coating thickness.
   b. Additional coats may be required to obtain minimum required paint thickness, depending on method of application, differences in manufacturers' products, and atmospheric conditions.
2. Application Thickness:
   a. Do not exceed coating manufacturer's recommendations.
   b. Use wet film thickness gauge to measure proper coating thickness during application.
3. Film Thickness Measurement and Electrical Inspection of Coated Surface:
   a. Perform with properly calibrated instruments.
   b. Recoat and repair as necessary for compliance with Specifications.
   c. Coats will be subject to inspection by Engineer and coating manufacturer's representative.
4. Visually inspect concrete, nonferrous metal, plastic, and wood surfaces to ensure proper and complete coverage has been attained.

5. Give particular attention to edges, angles, flanges, and other similar areas, where insufficient film thickness are likely to be present, and ensure proper millage in these areas.
6. Apply additional coats as required to complete hiding of underlying coats. Hiding shall be so complete that additional coats would not increase hiding.

3.07 PROTECTIVE COATINGS SYSTEMS AND APPLICATION SCHEDULE

A. System No. 5 Exposed Metal—Highly Corrosive:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Metal Blast Cleaning	Epoxy Primer	1 coat, 2.5 MDFT
	Polyamide High Build Epoxy	1 coat, 4 MDFT
	Polyurethane Enamel	1 coat, 3 MDFT

1. Use on the following items or areas:
   a. Exposed metal surfaces, except for stainless steel.

B. System No. 8 Buried Metal—General:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 10, Near-White Blast Cleaning	Standard Hot Coal-Tar Enamel -OR- Coal-Tar Epoxy	AWWA C203 2 coats, 16 MDFT

1. Use on the following items or areas:
   a. Buried, belowgrade portions of steel items, except buried stainless steel or ductile iron.

C. System No. 25 Exposed PVC:

Surface Prep.	Paint Material	Min. Coats, Cover
In accordance with Paragraph Plastic and FRP Surface Preparation	Acrylic Latex Semigloss	2 coats, 320 SFPGPC

1. Use on the following items or areas: All exposed-to-view PVC and CPVC surfaces.

D. System No. 27 Aluminum and Dissimilar Metal Insulation:

Surface Prep.	Paint Material	Min. Coats, Cover
SP 1, Solvent Cleaning	Prime in accordance with manufacturer's recommendations	
	Bituminous Paint	1 coat, 10 MDFT

1. Use on aluminum surfaces embedded or in contact with concrete.

3.08 FIELD QUALITY CONTROL

A. Testing Equipment:

1. Provide magnetic type dry film thickness gauge, to test coating thickness specified in mils, as manufactured by Nordson Corp., Anaheim, CA; Mikrotest.
2. Provide electrical holiday detector, low voltage, wet sponge type, to test completed coating systems, 20 mils or less MDFT, for holidays and discontinuities as manufactured by Tinker and Rasor, San Gabriel, CA, Model M-1.
3. Provide high voltage holiday detector for coatings in excess of 20 mils MDFT. Unit as recommended by coating manufacturer.

B. Testing:

1. Thickness and Continuity Testing:
   a. Measure coating thickness specified in mils with magnetic type dry film thickness gauge in accordance with SSPC PA 2.
   b. Check each coat for correct millage. Do not make measurement within 8 hours, minimum, after application of coating.
   c. Test finish coat, 20 mils thick or less, except zinc primer, galvanizing, and elastomeric coatings, for holidays and discontinuities with electrical holiday detector, low voltage, wet sponge type in accordance with NACE RP0188.
   d. Holiday detect coatings in excess of 20 mils MDFT with high voltage units recommended by coating manufacturer, and in accordance with NACE RP0188.
   e. After repaired and recoated areas have dried sufficiently, retest each repaired area. Final test may also be conducted by Engineer.

C. Unsatisfactory Application:

1. Clean and top coat surfaces found to have improper finish color or insufficient film thickness.

2. Evidence of runs, bridges, shiners, laps, or other imperfections shall be cause for rejection.
3. Repair defects in coating system per written recommendations of coating manufacturer.
4. Leave staging up until Engineer has inspected surface or coating. Replace staging removed prior to approval by Engineer.

D. Damaged Coatings, Pinholes, and Holidays:

1. Feather edges and repair in accordance with recommendations of paint manufacturer.
2. Hand or power sand visible areas of chipped, peeled, or abraded paint, and feather edges. Follow with primer and finish coat in accordance with Specifications. Depending on extent of repair and appearance, finish sanding and topcoat may be required.
3. Repair fusion bonded coatings as recommended by original applicator.
4. Apply finish coats, including touchup and damage-repair coats, in a manner, which will present uniform texture and color-matched appearance.

3.09 MANUFACTURER'S SERVICES

A. In accordance with Section 01 43 33, Manufacturers' Field Services, coating manufacturer's representative shall be present at Site as follows:

1. On first day of application of any coating.
2. As required to verify full cure of coating prior to coated surfaces being placed into immersion service.

3.10 CLEANUP

A. Place cloths and waste that might constitute fire hazard in closed metal containers or destroy at end of each day.

B. Upon completion of work, remove staging, scaffolding, and containers from Site or destroy in legal manner.

C. Completely remove paint spots, oil, or stains from adjacent surfaces and floors and leave entire job clean.

3.11 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:

1. Paint System Data Sheet (PSDS).
2. Paint Product Data Sheet (PPDS).

END OF SECTION

PAINT SYSTEM DATA SHEET

Complete this PSDS for each coating system, include all components of the system (surface preparation, primer, intermediate coats, and finish coats). Include all components of a given coating system on a single PSDS.

Paint System Number (from Spec.):		
Paint System Title (from Spec.):		
Coating Supplier:		
Representative:		
Surface Preparation:		
Paint Material (Generic)	**Product Name/Number (Proprietary)**	**Min. Coats, Coverage**

PAINT PRODUCT DATA SHEET

Complete and attach manufacturer's Technical Data Sheet to this PPDS for each product submitted. Provide manufacturer's recommendations for the following parameters at temperature (F)/relative humidity:

Temperature/RH	50/50	70/30	90/25
Induction Time			
Pot Life			
Shelf Life			
Drying Time			
Curing Time			
Min. Recoat Time			
Max. Recoat Time			

Provide manufacturer's recommendations for the following:

Mixing Ratio: _____

Maximum Permissible Thinning: _____

Ambient Temperature Limitations: min.: _____ max.: _____

Surface Temperature Limitations: min.: _____ max.: _____

Surface Profile Requirements: min.: _____ max.: _____

Attach additional sheets detailing manufacturer's recommended storage requirements and holiday testing procedures.

SECTION 26 05 02
BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.01 RELATED SECTIONS

A. Requirements specified within this section apply to all Divisions in Contract. Work specified herein shall be performed as if specified in the individual sections.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. National Electrical Contractors Association (NECA): National Electrical Installation Standards.
2. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. Z535.4, Product Safety Signs and Labels.
3. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).

1.03 DESIGN REQUIREMENTS

A. Provide lightning protection system design drawings and related information where required under Section 26 41 00, Facility Lightning Protection.

1.04 SUBMITTALS

A. Action Submittals:

1. Provide manufacturers' data for the following: Nameplates, signs, and labels.
2. Anchorage and bracing drawings and catalog information, as required by Section 01 88 15, Anchorage and Bracing, for loads in Section 01 61 00, Common Product Requirements.

B. Informational Submittals: Anchorage and bracing calculations, as required by Section 01 88 15, Anchorage and Bracing, for loads in Section 01 61 00, Common Product Requirements.

1.05 QUALITY ASSURANCE

A. Provide the Work in accordance with NFPA 70. Where required by Authority Having Jurisdiction (AHJ), material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ, in order to provide a basis for approval under the NEC.

B. Materials and equipment manufactured within the scope of standards published by UL shall conform to those standards and shall have an applied UL listing mark or label.

C. Provide materials and equipment acceptable to AHJ for Class, Division, and Group of hazardous area indicated.

1.06 ENVIRONMENTAL CONDITIONS

A. because of the potential for accumulation of hazardous concentrations of combustible gases, and for exposure to corrosive environment. Use materials and methods required for such areas.

1. Enclosed, belowgrade valve and metering vaults with closed piping systems containing wastewater.
2. Headworks.

B. The following areas are classified nonhazardous, wet, and corrosive. Use materials and methods required for such areas.

1. Inside of dewatering wet well.
2. Areas within Chemical Building.
3. Areas within Dewatering Building.

C. The following areas are classified nonhazardous and wet. Use materials and methods required for such areas.

1. Outdoor abovegrade areas not covered above.
2. Belowgrade vaults.

D. The following areas are classified as indoor and dry:

1. Administration and Laboratory Building.
2. Electrical Room.

E. The following areas are not classified. Use dust-tight and oil-tight NEMA 12 materials and methods.

1. Areas not covered above.

PART 2 PRODUCTS

2.01 GENERAL

A. Where two or more units of the same class of material or equipment are required, provide products of a single manufacturer. Component parts of materials or equipment need not be products of the same manufacturer.

B. Material and equipment installed in heated and ventilated areas shall be capable of continuous operation at their specified ratings within an ambient temperature range of 40 degrees F to 104 degrees F.

C. Materials and equipment installed outdoors shall be capable of continuous operation at their specified rating within the ambient temperature range stated in Section 01 61 00, Common Product Requirements.

D. Equip panels installed outdoors in direct sun with sun shields.

2.02 EQUIPMENT FINISH

A. Manufacturer's standard finish color, except where specific color is indicated. If manufacturer has no standard color, finish equipment in accordance with ANSI No. 61, light gray color**.**

2.03 NAMEPLATES

A. Material: Laminated plastic.

B. Attachment Screws:

1. Stainless steel.
2. Adhesive: Single-part, room temperature vulcanizing adhesive suitable for the environment and materials installed. Use adhesive on NEMA 4 or NEMA 4X enclosures only.

C. Color: Black, engraved to a white core.

D. Letter Height:

1. Pushbuttons/Selector Switches: 1/8 inch.
2. Other Electrical Equipment: 1/4 inch.

2.04 SIGNS AND LABELS

A. Sign size, lettering, and color shall be in accordance with NEMA Z535.4.

B. Warning labels for arc flash hazards shall be provided per NEC Code and Section 26 05 70, Electrical System Analysis.

PART 3 EXECUTION

3.01 GENERAL

A. Electrical Drawings show general locations of equipment, devices, and raceway, unless specifically dimensioned. Contractor shall be responsible for actual location of equipment and devices and for proper routing and support of raceways, subject to approval of Engineer. Coordinate the conduit installation with other trades and the actual equipment. Obtain information relevant to the placing at electrical work and in case of any interference with other work. Processed as directed by the Engineer and furnished all labor and materials necessary to complete the Work in an approved manner.

B. Check approximate locations of light fixtures, switches, electrical outlets, equipment, and other electrical system components shown on Drawings for conflicts with openings, structural members, and components of other systems and equipment having fixed locations. In the event of conflicts, notify Engineer in writing. Any adjustments required in the field shall be provided at no additional cost to the Owner.

C. Install work in accordance with NECA Standard of Installation, unless otherwise specified.

D. Keep openings in boxes and equipment closed during construction.

E. Lay out work carefully in advance. Do not cut or notch any structural member or building surface without specific approval of Engineer. Carefully perform cutting, channeling, chasing, or drilling of floors, walls, partitions, ceilings, paving, or other surfaces required for the installation, support, or anchorage of conduit, raceways, or other electrical materials and equipment. Following such work, restore surfaces to original condition.

F. Unless otherwise approved by the Engineer, conduit shown exposed shall be installed exposed; conduit shown concealed shall be installed concealed.

G. Where circuits are shown as “homeruns” all necessary fittings and boxes shall be provided for a complete raceway installation.

H. Circuit layouts are not intended to show the number of fittings, or other installation details. Furnish all labor and materials necessary to install and place in satisfactory operation all power, lighting, and other electrical systems shown. Additional circuits shall be installed wherever needed to conform to the specific requirements of the approved equipment at no additional cost to the Owner.

I. Redesign of electrical or mechanical work, which is required due to the Contractor's use of an alternate item, arrangement or equipment and/or layout other than specified herein, shall be done by the Contractor at his/her own expense. Redesign and detailed plans shall be submitted to the Engineer for approval. No additional compensation will be provided for changes in the work, either his/her own or others, caused by such redesign.

J. Surface mounted panel boxes, junction boxes, conduit, etc., shall be supported by 1/2-inch spacers to provide a clearance between wall and equipment.

K. All floor mounted electrical equipment shall be placed on 4-inch thick (3/4-inch, 45-degree chamfer at all exposed edges) concrete pads, provide reinforcement, anchors, etc.

L. The Contractor shall coordinate the work of the different trades so that interferences between conduits, piping, equipment, architectural and structural work will be avoided. All necessary offsets shall be furnished so as to take up a minimum space and all such offsets, fittings, etc, required to accomplish this shall be furnished and installed by the Contractor without additional expense to the Owner. In case interference develops, the Engineer is to decide which equipment, piping, etc., must be relocated, regardless of which was installed first.

M. Provide No. 10 wire instead of No. 12 wire for all 20 ampere 120 volt, 240 volt, or 208Y/120 volt circuits exceeding 150 feet conduit length.

N. Investigate each space in the structure through which equipment must pass to reach its final location. Coordinate shipping splits with the manufacturer to permit safe handling and passage through restricted areas in the structure.

O. The equipment shall be kept upright at all times during storage and handling. When equipment must be tilted for passage through restricted areas, brace the equipment to ensure that the tilting does not impair the functional integrity of the equipment.

3.02 ANCHORING, BRACING, AND MOUNTING

A. Equipment anchoring and mounting shall be in accordance with manufacturer's requirements for Project design criteria provided in Section 01 61 00, Common Product Requirements, to meet the requirements of Section 01 88 15, Anchorage and Bracing.

3.03 COMBINING CIRCUITS INTO COMMON RACEWAY

A. Homerun circuits shown on Drawings indicate functional wiring requirements for power and control circuits. Circuits may be combined into common raceways in accordance with the following requirements:

1. Analog control circuits from devices in same general area to same destination.
    a. No power or ac discrete control circuits shall be combined in same conduit with analog circuits.
    b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, paging system circuits shall be combined with power or Class 1 circuits.
    c. Analog circuits shall be continuous from source to destination. Do not add TJB, splice, or combine into a multi-pair cable without authorization of Engineer.
    d. Raceways shall be sized per General Circuit and Raceway Schedule and do not exceed 40 percent fill.
    e. Changes shall be documented on record drawings.
2. Discrete control circuits from devices in the same general area to the same destination.
    a. No power or analog control circuits shall be combined in same conduit with discrete circuits.
    b. No Class 2 or Class 3 circuits including, but not limited to, HVAC control circuits, fire alarm circuits, and paging system circuits shall be combined with power or Class 1 circuits.
    c. Raceways shall be sized per the General Circuit and Raceway Schedule and do not exceed 40 percent fill.
    d. Changes shall be documented on record drawings.
3. Power circuits from loads in same general area to same source location (such as: panelboard, switchboard, low voltage motor control center).
    a. Lighting Circuits: Combine no more than three circuits to a single raceway. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.
    b. Receptacle Circuits, 120 Volt Only: Combine no more than three circuits to a single raceway. Provide a separate neutral conductor for each circuit. Contractor shall be responsible for increasing conduit and conductor size if derating is required by NEC.
    c. All Other Power Circuits: Do not combine power circuits without authorization of Engineer.

3.04 NAMEPLATES, SIGNS, AND LABELS

A. Arc Flash Protection Warning Signs:

1. Field mark panelboards, control panels, etc. to warn qualified persons of potential arc-flash hazards. Locate marking so to be clearly visible to persons before working on energized equipment.
2. Use arc flash hazard boundary, energy level, PPE level and description, shock hazard, bolted fault current, and equipment name from study required in Section 26 05 70, Electrical Systems Analysis as basis for warning signs.

B. Multiple Power Supply Sign: Install permanent plaque or directory at each service disconnect location denoting other services, feeders, and branch circuits supplying a building, and the area served by each.

C. Equipment Nameplates:

1. Provide a nameplate to label electrical equipment including panelboards, motor starters, control panels, transformers, terminal junction boxes, disconnect switches, switches and control stations.
2. Terminal junction box nameplates shall include equipment designation.
3. Disconnect switch, starter, and control station nameplates shall include name and number of equipment powered or controlled by that device.
4. Panelboard nameplates shall include equipment designation, service voltage, and phases.

3.05 LOAD BALANCE

A. Drawings and Specifications indicate circuiting to electrical loads and distribution equipment.

B. Balance electrical load between phases as nearly as possible on panelboards, motor control centers, and other equipment where balancing is required.

C. When loads must be reconnected to different circuits to balance phase loads, maintain accurate record of changes made, and provide circuit directory that lists final circuit arrangement.

3.06 CLEANING AND TOUCHUP PAINTING

A. Cleaning: Throughout the Work, clean interior and exterior of devices and equipment by removing debris and vacuuming.

B. Touchup Paint:

1. Touchup scratches, scrapes and chips on exterior and interior surfaces of devices and equipment with finish matching type, color, and consistency and type of surface of original finish.

2. If extensive damage is done to equipment paint surfaces, refinish entire equipment in a manner that provides a finish equal to or better than factory finish, that meets requirements of Specification, and is acceptable to Engineer.

3.07 PROTECTION FOLLOWING INSTALLATION

A. Protect materials and equipment from corrosion, physical damage, and effects of moisture on insulation and contact surfaces.

B. When equipment intended for indoor installation is installed at Contractor's convenience in areas where subject to dampness, moisture, dirt or other adverse atmosphere until completion of construction, ensure adequate protection from these atmospheres is provided and acceptable to Engineer.

3.08 CHECKOUT AND STARTUP

A. Voltage Field Test:

1. Check voltage at point of termination of power company supply system to project when installation is essentially complete and is in operation.
2. Check voltage amplitude and balance between phases for loaded and unloaded conditions.
3. Record supply voltage (all three phases simultaneously on same graph) for 24 hours during normal working day.
   a. Submit Voltage Field Test Report within 5 days of test.
4. Unbalance Corrections:
   a. Make written request to power company to correct condition if balance (as defined by NEMA) exceeds 1 percent, or if voltage varies throughout the day and from loaded to unloaded condition more than plus or minus 4 percent of nominal.
   b. Obtain a written certification from a responsible power company official that the voltage variations and unbalance are within their normal standards if corrections are not made.

B. Equipment Line Current Tests:

1. Check line current in each phase for each piece of equipment.
2. Make line current check after power company has made final adjustments to supply voltage magnitude or balance.
3. If any phase current for any piece of equipment is above rated nameplate current, prepare Equipment Line Phase Current Report that identifies cause of problem and corrective action taken.

END OF SECTION

SECTION 26 05 04
BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A1011/A1011M, Standard Specification for Steel, Sheet, and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low Alloy and High-Strength Low Alloy Formability.
   b. E814, Method of Fire Tests of Through-Penetration Fire Stops.
2. Canadian Standards Association (CSA).
3. Institute of Electrical and Electronics Engineers, Inc. (IEEE): 18, Standard for Shunt Power Capacitors.
4. International Society of Automation (ISA): RP12.06.01, Wiring Practices for Hazardous (Classified) Locations Instrumentation–Part 1: Intrinsic Safety.
5. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. C12.1, Code for Electricity Metering.
   c. C12.6, Phase-Shifting Devices Used in Metering, Marking and Arrangement of Terminals.
   d. ICS 2, Industrial Control and Systems: Controllers, Contactors, and Overload Relays Rated 600 Volts.
   e. ICS 5, Industrial Control and Systems: Control Circuit and Pilot Devices.
   f. KS 1, Enclosed and Miscellaneous Distribution Switches (600 Volts Maximum).
6. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
7. Underwriters Laboratories, Inc. (UL):
   a. 98, Standard for Enclosed and Dead-Front Switches.
   b. 248, Standard for Low Voltage Fuses.
   c. 486E, Standard for Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors.
   d. 489, Standard for Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
   e. 508, Standard for Industrial Control Equipment.
   f. 810, Standard for Capacitors.
   g. 943, Standard for Ground-Fault Circuit-Interrupters.
   h. 1059, Standard for Terminal Blocks.
   i. 1479, Fire Tests of Through-Penetration Fire Stops.

1.02 SUBMITTALS

A. Action Submittals:

1. Provide manufacturers' data for the following:
   a. Control devices.
   b. Control relays.
   c. Circuit breakers.
   d. Fused switches.
   e. Nonfused switches.
   f. Timers.
   g. Fuses.
   h. Magnetic contactors.
   i. Intrinsic safety barriers.
   j. Firestopping.
   k. Enclosures: Include enclosure data for products having enclosures.

1.03 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following spare parts and special tools:

1. Fuses, 0 Volt to 600 Volts: Six of each type and each current rating installed.

PART 2 PRODUCTS

2.01 MOLDED CASE CIRCUIT BREAKER THERMAL MAGNETIC, LOW VOLTAGE

A. General:

1. Type: Molded case.
2. Trip Ratings: 15 amps to 800 amps.
3. Voltage Ratings: 120, 240, 277, 480, and 600V ac.
4. Suitable for mounting and operating in any position.
5. UL 489.

B. Operating Mechanism:

1. Overcenter, trip-free, toggle type handle.
2. Quick-make, quick-break action.
3. Locking provisions for padlocking breaker in OPEN position.
4. ON/OFF and TRIPPED indicating positions of operating handle.
5. Operating handle to assume a CENTER position when tripped.

C. Trip Mechanism:

1. Individual permanent thermal and magnetic trip elements in each pole.
2. Variable magnetic trip elements with a single continuous adjustment 3X to 10X for frames greater than 100 amps.
3. Two and three pole, common trip.
4. Automatically opens all poles when overcurrent occurs on one pole.
5. Test button on cover.
6. Calibrated for 40 degrees C ambient, unless shown otherwise.
7. Do not provide single-pole circuit breakers with handle ties where multi-pole circuit breakers are shown.

D. Short Circuit Interrupting Ratings:

1. Equal to, or greater than, available fault current or interrupting rating shown.
2. Equal to rating of existing equipment.
3. Not less than the following rms symmetrical currents for the indicated trip ratings:
   a. Less than 250V ac: 10,000 amps or as shown.
   b. 250V ac to 600V ac: 65,000 amps or as shown.
4. Series Connected Ratings: Do not apply series connected short circuit ratings.

E. Ground Fault Circuit Interrupter (GFCI): Where indicated, equip breaker as specified above with ground fault sensor and rated to trip on 5-mA ground fault within 0.025 second (UL 943, Class A sensitivity, for protection of personnel).

1. Ground fault sensor shall be rated same as circuit breaker.
2. Push-to-test button.

F. Equipment Ground Fault Interrupter (EGFI): Where indicated, equip breaker specified above with ground fault sensor and rated to trip on 30-mA ground fault (UL-listed for equipment ground fault protection).

G. Magnetic Only Type Breakers: Where shown; instantaneous trip adjustment which simultaneously sets magnetic trip level of each individual pole continuously through a 3X to 10X trip range.

H. Accessories: Shunt trip, auxiliary switches, handle lock ON devices, mechanical interlocks, key interlocks, unit mounting bases, double lugs as shown or otherwise required. Shunt trip operators shall be continuous duty rated or have coil-clearing contacts.

I. Connections:

1. Supply (line side) at either end.
2. Mechanical wire lugs, except crimp compression lugs where shown.
3. Lugs removable/replaceable for breaker frames greater than 100 amperes.
4. Suitable for 75 degrees C rated conductors without derating breaker or conductor ampacity.
5. Use bolted bus connections, except where bolt-on is not compatible with existing breaker provisions.

J. Enclosures for Independent Mounting:

1. See Article Enclosures.
2. Service Entrance Use: Breakers in required enclosure and required accessories shall be UL 489 listed.
3. Interlock: Enclosure and switch shall interlock to prevent opening cover with switch in the ON position. Provide bypass feature for use by qualified personnel.

2.02 FUSED SWITCH, INDIVIDUAL, LOW VOLTAGE

A. UL 98 listed for use and location of installation.

B. NEMA KS 1.

C. Short Circuit Rating: 200,000 amps rms symmetrical with Class R, Class J, or Class L fuses installed.

D. Quick-make, quick-break, motor rated, load-break, heavy-duty (HD) type with external markings clearly indicating ON/OFF positions.

E. Connections:

1. Mechanical lugs, except crimp compression lugs where shown.
2. Lugs removable/replaceable.
3. Suitable for 75 degrees C rated conductors at NEC 75 degrees C ampacity.

F. Fuse Provisions:

1. 30-amp to 600-amp rated shall incorporate rejection feature to reject all fuses except Class R.
2. 601-amp rated and greater shall accept Class L fuses, unless otherwise shown.

G. Enclosures: See Article Enclosures.

H. Interlock: Enclosure and switch to prevent opening cover with switch in ON position. Provide bypass feature for use by qualified personnel.

2.03 NONFUSED SWITCH, INDIVIDUAL, LOW VOLTAGE

A. NEMA KS 1.

B. Quick-make, quick-break, motor rated, load-break, heavy-duty (HD) type with external markings clearly indicating ON/OFF positions.

C. Lugs: Suitable for use with 75 degrees C wire at NEC 75 degrees C ampacity.

D. Auxiliary Contact:

1. Operation: Make before power contacts make and break before power contacts break.
2. Contact Rating: 7,200VA make, 720VA break, at 600V, NEMA ICS 5 Designation A600.

E. Enclosures: See Article Enclosures.

F. Interlock: Enclosure and switch to prevent opening cover with switch in ON position. Provide bypass feature for use by qualified personnel.

2.04 FUSE, 250-VOLT AND 600-VOLT

A. Power Distribution, General:

1. Current-limiting, with 200,000 ampere rms interrupting rating.
2. Provide to fit mountings specified with switches.
3. UL 248.

B. Power Distribution, Ampere Ratings 1 Amp to 600 Amps:

1. Class: RK-1.
2. Type: Dual element, with time delay.
3. Manufacturers and Products:
   a. Bussmann; Types LPS-RK (600 volts) and LPN-RK (250 volts).
   b. Littelfuse; Types LLS-RK (600 volts) and LLN-RK (250 volts).

C. Power Distribution, Ampere Ratings 601 Amps to 6,000 Amps:

1. Class: L.
2. Double O-rings and silver links.
3. Manufacturers and Products:
   a. Bussmann; Type KRP-C.
   b. Littelfuse, Inc.; Type KLPC.

D. Cable Limiters:

1. 600V or less; crimp to copper cable, bolt to bus or terminal pad.
2. Manufacturer and Product: Bussmann; K Series.

E. Ferrule:

1. 600V or less, rated for applied voltage, small dimension.
2. Ampere Ratings: 1/10 amp to 30 amps.
3. Dual-element time-delay, time-delay, or nontime-delay as required.
4. Provide with blocks or holders as indicated and suitable for location and use.
5. Manufacturers:
   a. Bussmann.
   b. Littlefuse, Inc.

2.05 PUSHBUTTON, INDICATING LIGHT, AND SELECTOR SWITCH

A. Contact Rating: 7,200VA make, 720VA break, at 600V, NEMA ICS 5 Designation A600.

B. Selector Switch Operating Lever: Standard.

C. Indicating Light: Push-to-test. LED, full voltage.

D. Pushbutton Color:

1. ON or START: Red.
2. OFF or STOP: Black or green.

E. Pushbutton and selector switch lockable in OFF position where indicated.

F. Legend Plate:

1. Material: Aluminum.
2. Engraving: Enamel filled in high contrasting color.
3. Text Arrangement: 11-character/spaces on one line, 14-character/spaces on each of two lines, as required, indicating specific function.
4. Letter Height: 7/64 inch.

G. Manufacturers and Products:

1. Heavy-Duty, Oil-Tight Type:
   a. General Electric Co.; Type CR 104P.
   b. Square D Co.; Type T.
   c. Eaton/Cutler-Hammer; Type 10250T.

2. Heavy-Duty, Watertight, and Corrosion-Resistant Type:
   a. Square D Co.; Type SK.
   b. General Electric Co.; Type CR 104P.
   c. Eaton/Cutler-Hammer; Type E34.
   d. Crouse-Hinds; Type NCS.

2.06 TERMINAL BLOCK, 600 VOLTS

A. UL 486E and UL 1059.

B. Size components to allow insertion of necessary wire sizes.

C. Capable of termination of control circuits entering or leaving equipment, panels, or boxes.

D. Screw clamp compression, dead front barrier type, with current bar providing direct contact with wire between compression screw and yoke.

E. Yoke, current bar, and clamping screw of high strength and high conductivity metal.

F. Yoke shall guide all strands of wire into terminal.

G. Current bar shall ensure vibration-proof connection.

H. Terminals:

1. Capable of wire connections without special preparation other than stripping.
2. Capable of jumper installation with no loss of terminal or rail space.
3. Individual, rail mounted.

I. Marking system, allowing use of preprinted or field-marked tags.

J. Manufacturers:

1. Weidmuller, Inc.
2. Ideal.
3. Electrovert USA Corp.

2.07 MAGNETIC CONTROL RELAY

A. Industrial control with field convertible contacts rated 10 amps continuous, 7,200VA make, 720VA break.

B. NEMA ICS 2, Designation: A600 (600 volts).

C. Time Delay Relay Attachment:

1. Pneumatic type, timer adjustable from 0.2 second to 60 seconds (minimum) or as shown.
2. Field convertible from ON delay to OFF delay and vice versa.

D. Latching Attachment: Mechanical latch, having unlatching coil and coil clearing contacts.

E. Manufacturers and Products:

1. Eaton/Cutler-Hammer; D26 Type M.
2. General Electric Co.; Type CR120B**.**
3. Square D; Type X.

2.08 TIME DELAY RELAY

A. Industrial relay with contacts rated 5 amps continuous, 3,600VA make, 360VA break.

B. NEMA ICS 2 Designation: B150 (150 volts).

C. Solid-state electronic, field convertible ON/OFF delay.

D. One normally open and one normally closed contact (minimum).

E. Repeat accuracy plus or minus 2 percent.

F. Timer adjustment from 1 second to 60 seconds, unless otherwise indicated on Drawings.

G. Manufacturers and Products:

1. Square D Co.; Type XO.
2. Eaton/Cutler-Hammer; Type D26MR.
3. General Electric Co.; Type CR120.

2.09 RESET TIMER

A. Drive: Synchronous motor, solenoid-operated clutch.

B. Mounting: Semiflush panel.

C. Contacts: 10 amps, 120 volts.

D. Manufacturers and Products:

1. Eagle Signal Controls; Bulletin 125.
2. Automatic Timing and Controls; Bulletin 305.

2.10 ELAPSED TIME METER

A. Drive: Synchronous motor.

B. Range: 0 hour to 99,999.9 hours, nonreset type.

C. Mounting: Semiflush panel.

D. Manufacturers and Products:

1. General Electric Co.; Type 240, 2-1/2-inch Big Look.
2. Eagle Signal Controls; Bulletin 705.

2.11 MAGNETIC CONTACTOR

A. UL listed.

B. Electrically operated, electrically held.

C. Main Contacts:

1. Power driven in one direction with mechanical spring dropout.
2. Silver alloy with wiping action and arc quenchers.
3. Continuous-duty, rated: 30 amperes or as shown.
4. Poles: As shown.

D. Control: As shown.

E. Auxiliary Contacts: One normally open and one normally closed, or quantity as shown, rated 7200VA make, 720VA break, at 600V, A600 per NEMA ICS 5.

F. Enclosures: See Article Enclosures.

G. Manufacturers and Products:

1. Eaton/Cutler-Hammer; Class A201.
2. General Electric Co.; CR 353.
3. Square D Co.; Class 8910.

2.12 PHASE MONITOR RELAY

A. Features:

1. Voltage and phase monitor relay shall drop out on low voltage, voltage unbalance, loss of phase, or phase reversal.
2. Contacts: Single-pole, double-throw, 10 amperes, 120/240V ac. Where additional contacts are shown or required, provide magnetic control relays.
3. Adjustable trip and time delay settings.
4. Transient Protection: 1,000V ac.
5. Mounting: Multipin plug-in socket base.

B. Manufacturer and Product: Automatic Timing and Controls; SLD Series.

2.13 SUPPORT AND FRAMING CHANNELS

A. PVC-Coated Framing Channel: Carbon steel framing channel with 40-mil polyvinyl chloride coating.

B. Stainless Steel Framing Channel: Rolled, Type 316 stainless steel, 12-gauge minimum.

C. Extruded Aluminum Framing Channel:

1. Material: Extruded from Type 6063-T6 aluminum alloy.
2. Fittings fabricated from Alloy 5052-H32.

D. Manufacturers:

1. B-Line Systems, Inc.
2. Unistrut Corp.
3. Aickinstrut.

2.14 INTRINSIC SAFETY BARRIER

A. Provides a safe energy level for exposed wiring in a Class I, Division 1 or Division 2 hazardous area when circuit is connected to power source in nonhazardous area.

B. Rating: Power source shall be rated 24 volts dc, nominal, with not more than 250 volts available under fault conditions.

C. Contact Rating: 5 amps, 250 volts ac.

D. Mounting: Rail or surface.

E. Manufacturers and Products:

1. MTL, Inc.; Series 2000 or Series 3000.
2. R. Stahl, Inc.

2.15 SWITCHBOARD MATTING

A. Provide matting having a breakdown of 20 kV minimum.

B. Manufacturer: U.S. Mat and Rubber Company.

2.16 FIRESTOPS

A. General:

1. Provide UL 1479 classified hourly fire rating equal to, or greater than, the assembly penetrated.
2. Prevent the passage of cold smoke, toxic fumes, and water before and after exposure to flame.
3. Sealants and accessories shall have fire-resistance ratings as established by testing identical assemblies in accordance with ASTM E814, by Underwriters Laboratories, Inc., or other testing and inspection agency acceptable to authorities having jurisdiction.

B. Firestop System:

1. Formulated for use in through-penetration firestopping around cables, conduit, pipes, and duct penetrations through fire-rated walls and floors.
2. Fill, Void, or Cavity Material: 3M Brand Fire Barrier Caulk CP25, Putty 303, Wrap/Strip FS195, Composite Sheet CS195 and Penetration Sealing Systems 7902 and 7904 Series.
3. Two-Part, Foamed-In-Place, Silicone Sealant: Dow Corning Corp. Fire Stop Foam, General Electric Co. Pensil 851.
4. Fire Stop Devices: See Section 26 05 33, Raceway and Boxes, for raceway and cable fittings.

2.17 ENCLOSURES

A. Finish: Sheet metal structural and enclosure parts shall be completely painted using an electrodeposition process so interior and exterior surfaces as well as bolted structural joints have a complete finish coat on and between them.

B. Color: Manufacturer’s standard color (gray) baked-on enamel, unless otherwise shown.

C. Barriers: Provide metal barriers within enclosures to separate wiring of different systems and voltage.

D. Enclosure Selections:

1. Except as shown otherwise, provide electrical enclosures according to the following table:

Enclosures			
Location	**Finish**	**Environment**	**NEMA 250 Type**
Indoor	Finished	Dry	1
Indoor	Unfinished	Dry	1
Indoor and Outdoor	Any	Denoted "WP"	3R
Indoor and Outdoor	Any	Wet and/or Corrosive	4X Type 316 Stainless Steel
Indoor and Outdoor	Any	Hazardous Gas	7
Indoor and Outdoor	Any	Hazardous Dust	9

PART 3 EXECUTION

3.01 GENERAL

A. Install equipment in accordance with manufacturer's recommendations.

3.02 PUSHBUTTON, INDICATING LIGHT, AND SELECTOR SWITCH

A. Install heavy-duty, oil-tight type in nonhazardous, indoor, dry locations, including motor control centers, control panels, and individual stations, unless otherwise shown.

B. Install heavy-duty, watertight and corrosion-resistant type in nonhazardous, outdoor, or normally wet areas, unless otherwise shown.

3.03 SUPPORT AND FRAMING CHANNEL

A. Install where required for mounting and supporting electrical equipment, raceway, and cable tray systems.

B. Channel Type:

1. Interior, Wet or Dry (Noncorrosive) Locations:
   a. Aluminum Raceway: Extruded aluminum or carbon steel with neoprene material isolators.
   b. PVC-Coated Conduit: PVC coated.
2. Interior, Corrosive (Wet or Dry) Locations:
   a. Aluminum Raceway: Extruded aluminum.
   b. PVC Conduit: Type 316 stainless steel.
   c. PVC-Coated Steel Conduit and Other Systems Not Covered: Type 316 stainless steel or PVC-coated steel.

3. Outdoor, Noncorrosive Locations:
   a. Aluminum Raceway and Other Systems Not Covered: Aluminum framing channel.
4. Outdoor Corrosive Locations:
   a. PVC Conduit: Type 316 stainless steel.
   b. Aluminum Raceway: Aluminum.
   c. PVC-Coated Steel Conduit and Other Systems Not Covered: Type 316 stainless steel or PVC-coated steel.

C. Paint cut ends prior to installation with the following:

1. PVC-Coated Channel: PVC patch.

3.04 INTRINSIC SAFETY BARRIERS

A. Install in compliance with ISA RP12.06.01.

B. Arrange conductors such that wiring from hazardous areas cannot short to wiring from nonhazardous area.

C. Stencil “INTRINSICALLY SAFE CIRCUIT” on all boxes enclosing barriers.

3.05 SWITCHBOARD MATTING

A. Install 36-inch width at switchgear, switchboard, motor control centers, and panelboards.

B. Matting shall run full length of all sides of equipment that have operator controls or afford access to devices.

3.06 FIRESTOPS

A. Install in strict conformance with manufacturer’s instructions. Comply with installation requirements established by testing and inspecting agency.

B. Sealant: Install sealant including forming, packing, and other accessory materials, to fill openings around electrical services penetrating floors and walls, to provide firestops with fire-resistance ratings indicated for floor or wall assembly in which penetration occurs.

END OF SECTION

SECTION 26 05 05
CONDUCTORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Association of Edison Illuminating Companies (AEIC): CS 8, Specification for Extruded Dielectric Shielded Power Cables Rated 5 kV through 46 kV.
2. ASTM International (ASTM):
   a. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   b. B3, Standard Specification for Soft or Annealed Copper Wire.
   c. B8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft.
   d. B496, Standard Specification for Compact Round Concentric-Lay-Stranded Copper Conductors.
3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. 48, Standard Test Procedures and Requirements for Alternating-Current Cable Terminations Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV Through 500 kV.
   b. 386, Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V.
   c. 404, Standard for Extruded and Laminated Dielectric Shielded Cable Joints Rated 2500 V to 500000 V.
4. Insulated Cable Engineer's Association, Inc. (ICEA):
   a. S-58-679, Standard for Control Cable Conductor Identification.
   b. S-73-532, Standard for Control Thermocouple Extensions and Instrumentation Cables.
   c. T-29-520, Conducting Vertical Cable Tray Flame Tests with Theoretical Heat Input of 210,000 Btu/hour.
5. National Electrical Manufacturers' Association (NEMA):
   a. CC 1, Electric Power Connectors for Substations.
   b. WC 57, Standard for Control, Thermocouple Extension, and Instrumentation Cables.
   c. WC 70, Standard for Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy.
   d. WC 71, Standard for Nonshielded Cables Rated 2001-5000 Volts for Use in the Distribution of Electric Energy.
   e. WC 74, 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.

6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
   b. 262, Standard Method of Test for Flame Travel and Smoke of Wires and Cables for Use in Air-Handling Spaces.
7. Telecommunications Industry Association (TIA): TIA-568-C, Commercial Building Telecommunications Cabling Standard.
8. Underwriters Laboratories Inc. (UL):
   a. 13, Standard for Safety for Power-Limited Circuit Cables.
   b. 44, Standard for Safety for Thermoset-Insulated Wires and Cables.
   c. 62, Standard for Safety for Flexible Cord and Cables.
   d. 486A-486B, Standard for Safety for Wire Connectors.
   e. 486C, Standard for Safety for Splicing Wire Connectors.
   f. 510, Standard for Safety for Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape.
   g. 854, Standard for Safety for Service-Entrance Cables.
   h. 1072, Standard for Safety for Medium-Voltage Power Cables.
   i. 1277, Standard for Safety for Electrical Power and Control Tray Cables with Optional Optical-Fiber Members.
   j. 1569, Standard for Safety for Metal-Clad Cables.
   k. 1581, Standard for Safety for Reference Standard for Electrical Wires, Cables, and Flexible Cords.

1.02 SUBMITTALS

A. Action Submittals:

1. Product Data:
   a. Wire and cable.
   b. Wire and cable accessories.
2. Cable Pulling Calculations:
   a. Ensure submitted and reviewed before cable installation.
   b. Provide for the following cable installations:
      1) Medium voltage cable runs that cannot be hand pulled.
      2) Multiconductor 600-volt cable sizes larger than 2 AWG that cannot be hand pulled.
      3) Power and control conductor, and control and instrumentation cable installations in ductbanks that cannot be hand pulled.
      4) Feeder circuits; single conductors #4/0 and larger.

B. Informational Submittals:

1. Certified Factory Test Report for conductors 600 volts and below.
2. Certified Factory Test Report per AEIC CS 8, including AEIC qualification report for conductors above 600 volts.

1.03 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70. Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by Underwriters Laboratories Inc. shall conform to those standards and shall have an applied UL listing mark.

PART 2 PRODUCTS

2.01 CONDUCTORS 600 VOLTS AND BELOW

A. Conform to applicable requirements of NEMA WC 70.

B. Conductor Type:

1. 120-Volt and 277-Volt Lighting, 10 AWG and Smaller: Solid copper.
2. 120-Volt Receptacle Circuits, 10 AWG and Smaller: Solid copper.
3. All Other Circuits: Stranded copper.

C. Insulation: Type THHN/THWN-2, except for sizes No. 6 and larger, with XHHW-2 insulation**.**

D. Direct Burial and Aerial Conductors and Cables:

1. Type USE/RHH/RHW insulation, UL 854 listed, or Type RHW-2/USE-2.
2. Conform to physical and minimum thickness requirements of NEMA WC 70.

E. Flexible Cords and Cables:

1. Type SOW-A/50 with ethylene propylene rubber insulation in accordance with UL 62.
2. Conform to physical and minimum thickness requirements of NEMA WC 70.

2.02 600-VOLT RATED CABLE

A. General:

1. Type TC, meeting requirements of UL 1277, including Vertical Tray Flame Test at 70,000 Btu per hour, and NFPA 70, Article 340, or UL 13 meeting requirements of NFPA 70, Article 725.

2. Permanently and legibly marked with manufacturer's name, maximum working voltage for which cable was tested, type of cable, and UL listing mark.
3. Suitable for installation in open air, in cable trays, or conduit.
4. Minimum Temperature Rating: 90 degrees C dry locations, 75 degrees C wet locations.
5. Overall Outer Jacket: PVC, flame-retardant, sunlight- and oil-resistant.

B. Type 1, Multiconductor Control Cable:

1. Conductors:
   a. 14 AWG, seven-strand copper.
   b. Insulation: 15-mil PVC with 4-mil nylon.
   c. UL 1581 listed as Type THHN/THWN rated VW-1.
   d. Conductor group bound with spiral wrap of barrier tape.
   e. Color Code: In accordance with ICEA S-58-679, Method 1, Table 2.
2. Cable: Passes the ICEA T-29-520, 210,000 Btu per hour Vertical Tray Flame Test.
3. Cable Sizes:

No. of Conductors	Max. Outside Diameter (Inches)	Jacket Thickness (Mils)
3	0.41	45
5	0.48	45
7	0.52	45
12	0.72	60
19	0.83	60
25	1.00	60
37	1.15	80

4. Manufacturers:
   a. Okonite Co.
   b. Southwire.

C. Type 2, Multiconductor Power Cable:

1. General:
   a. Meet or exceed UL 1581 for cable tray use.
   b. Meet or exceed UL 1277 for direct burial and sunlight-resistance.
   c. Overall Jacket: PVC.

2. Conductors:
   a. Class B stranded, coated copper.
   b. Insulation: Chemically cross-linked ethylene-propylene or cross-linked polyethylene.
   c. UL rated VW-1 or listed Type XHHW-2.
   d. Color Code:
      1) Conductors, size 8 AWG and smaller, colored conductors, ICEA S-58-679, Method 1, Table 1.
      2) Conductors, size 6 AWG and larger, ICEA S-73-532, Method 4.
3. Cable shall pass ICEA T-29-520, 210,000 Btu per hour Vertical Tray Flame Test.
4. Cable Sizes:

Conductor Size	Minimum Ground Wire Size	No. of Current Carrying Conductors	Max. Outside Diameter (Inches)	Nominal Jacket Thickness (Mils)
12	12	2 3 4	0.42 0.45 0.49	45
10	10	2 3 4	0.54 0.58 0.63	60
8	10	3 4	0.66 0.75	60
6	8	3 4	0.74 0.88	60
4	6	3 4	0.88 1.04	60 80
2	6	3 4	1.01 1.16	80
1	6	3 4	1.10 1.25	80
1/0	6	3 4	1.22 1.35	80
2/0	4	3 4	1.32 1.53	80
3/0	4	3 4	1.40 1.60	80
4/0	4	3 4	1.56 1.78	80 110

5. Manufacturers:
    a. Okonite Co.
    b. Southwire.

D. Type 3, 16 AWG, Twisted, Shielded Pair, Instrumentation Cable: Single pair, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 57 requirements.

1. Outer Jacket: 45-mil nominal thickness.
2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer overlapped to provide 100 percent coverage.
3. Dimension: 0.31-inch nominal OD.
4. Conductors:
    a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
    b. 20 AWG, seven-strand tinned copper drain wire.
    c. Insulation: 15-mil nominal PVC.
    d. Jacket: 4-mil nominal nylon.
    e. Color Code: Pair conductors, black and red.
5. Manufacturers:
    a. Okonite Co.
    b. Alpha Wire Corp.
    c. Belden.

E. Type 4, 16 AWG, Twisted, Shielded Triad Instrumentation Cable: Single triad, designed for noise rejection for process control, computer, or data log applications meeting NEMA WC 57 requirements.

1. Outer Jacket: 45-mil nominal.
2. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer, overlapped to provide 100 percent coverage.
3. Dimension: 0.32-inch nominal OD.
4. Conductors:
    a. Bare soft annealed copper, Class B, seven-strand concentric, meeting requirements of ASTM B8.
    b. 20 AWG, seven-strand, tinned copper drain wire.
    c. Insulation: 15-mil nominal PVC.
    d. Jacket: 4-mil nylon.
    e. Color Code: Triad conductors black, red, and blue.
5. Manufacturers:
    a. Okonite Co.
    b. Alpha Wire Corp.
    c. Belden.

F. Type 5, 18 AWG, Multitwisted Shielded Pairs, with a Common Overall Shield, Instrumentation Cable: Designed for use as instrumentation, process control, and computer cable, meeting NEMA WC 57 requirements.

1. Conductors:
   a. Bare soft annealed copper, Class B, seven-strand concentric, in accordance with ASTM B8.
   b. Tinned copper drain wires.
   c. Pair drain wire size AWG 20, group drain wire size AWG 18.
   d. Insulation: 15-mil PVC.
   e. Jacket: 4-mil nylon.
   f. Color Code: Pair conductors, black and red with red conductor numerically printed for group identification.
   g. Individual Pair Shield: 1.35-mil, double-faced aluminum/synthetic polymer.
2. Cable Shield: 2.35-mil, double-faced aluminum/synthetic polymer, overlapped for 100 percent coverage.
3. Cable Sizes:

Number of Pairs	Maximum Outside Diameter (Inches)	Nominal Jacket Thickness (Mils)
4	0.50	45
8	0.68	60
12	0.82	60
16	0.95	80
24	1.16	80
36	1.33	80
50	1.56	80

4. Manufacturers:
   a. Okonite Co.
   b. Alpha Wire Corp.
   c. Belden.

G. Type 6, 18 AWG, Multitwisted Pairs with Common Overall Shield Instrumentation Cable: Designed for use as instrumentation, process control, and computer cable meeting NEMA WC 57.

1. Conductors:
   a. Bare soft annealed copper, Class B, seven-strand concentric, in accordance with ASTM B8.
   b. Tinned copper drain wire size AWG 18.

c. Insulation: 15-mil nominal PVC.
d. Jacket: 4-mil nylon.
e. Color Code: Pair conductors, black and red with red conductor numerically printed for group identification.

2. Cable Shield: 2.35-mil, double-faced aluminum/synthetic polymer, overlapped for 100 percent coverage.

Cable Sizes: Number of Pairs	Maximum Outside Diameter (Inches)	Nominal Jacket Thickness (Mils)
4	0.48	45
8	0.63	60
12	0.75	60
16	0.83	60
24	1.10	80
36	1.21	80
50	1.50	80

3. Manufacturers:
a. Okonite Co.
b. Alpha Wire Corp.
c. Belden.

H. Type 7, Multiconductor Metal-Clad (UL Type MC) Power Cable:

1. Meeting requirements of UL 44 and UL 1569.
2. Conductors:
a. Class B stranded, coated copper.
b. Insulation: 600-volt cross-linked polyethylene, UL Type XHHW or EPR.
c. Grounding Conductors: Bare, stranded copper.
3. Sheath:
a. UL listed Type MC.
b. Continuous welded, corrugated aluminum sheath.
c. Suitable for use as grounding conductor.
4. Outer Jacket: PVC per UL 1569.
5. Cable shall pass ICEA T-29-520, 210,000 Btu per hour Vertical Tray Flame Test.

6. Cable Sizes:

Conductor Size	Minimum Ground Wire Size (AWG)	No. of Insulated Conductors	Max. Outside Diameter (Inches)	Jacket Thickness (Mils)
12 AWG	12 or 3x16	3 4	0.79 0.85	50
10 AWG	10 or 3x14	3 4	0.82 0.90	50
8 AWG	10 or 3x14	3 4	0.85 1.00	50
6 AWG	8 or 3x12	3 4	0.99 1.10	50
4 AWG	8 or 3x12	3 4	1.08 1.20	50
2 AWG	6 or 3x10	3 4	1.24 1.45	50
1 AWG	6 or 3x10	3 4	1.40 1.55	50
1/0 KCM	6 or 3x10	3 4	1.52 1.60	50
2/0 AWG	4 or 3x8	3 4	1.67 1.75	50
4/0 AWG	4 or 3x8	3 4	1.93 2.10	60
250 KCM	4 or 3x8	3 4	2.11 2.20	60
350 KCM	3 or 3x8	3 4	2.39 2.50	60
500 KCM	2 or 3x8	3 4	2.80 2.90	75

7. Manufacturers and Products:
   a. Okonite Co.; Type CLX.
   b. Southwire Type MC.
   c. General Cable, CCW Armored Power.

I. Type 8, Multiconductor Adjustable Frequency Drive Power Cable:

1. Conductors:
   a. Class B, stranded coated copper.
   b. Insulation: 600-volt cross-linked polyethylene, UL Type XHHW-2.
   c. Grounding Conductors: Insulated stranded copper.
2. Sheath:
   a. UL 1277 Type TC, 90 degrees C.
   b. Continuous shield, A1/polyester foil, drain wires, overall copper braid.
3. Outer Jacket: Polyvinyl chloride (PVC) per UL 1569.
4. Cable Sizes:

Conductor Size	Minimum Ground Wire Size (AWG)	No. of Insulated Conductors	Max. Outside Diameter (Inches)	Minimum Jacket Thickness (Mils)
12 AWG	12	4	0.655	50
10 AWG	10	4	0.769	50
8 AWG	8	4	0.940	50
6 AWG	6	4	1.038	50
4 AWG	4	4	1.180	50
2 AWG	2	4	1.351	50

5. Manufacturers and Products:
   a. Alpha Wire; Series V.
   b. Belden; Series 29500.
   c. LAPP USA; OLFLEX VFD Slim.

J. Type 9, Multiconductor Metal-Clad (UL Type MC) Power Cable for Adjustable Frequency Drive Applications:

1. Meeting requirements of UL 44 and UL 1569.
2. Conductors:
   a. Class B, stranded coated copper.
   b. Insulation: 600-volt cross-linked polyethylene, UL Type XHHW or EPR.
   c. Grounding Conductors: Bare, stranded copper. Provide three symmetrical grounding conductors.
3. Sheath:
   a. UL listed Type MC.
   b. Continuous welded, corrugated aluminum sheath.
   c. Suitable for use as grounding conductor.

4. Outer Jacket: PVC per UL 1569.
5. Cable shall pass ICEA T-29-520, 210,000 Btu per hour Vertical Tray Flame Test.
6. Cable Sizes:

Conductor Size	Minimum Ground Wire Size (AWG)	No. of Insulated Conductors	Max. Outside Diameter (Inches)	Jacket Thickness (Mils)
12 AWG	3x16	3 4	0.79 0.85	50
10 AWG	3x14	3 4	0.82 0.90	50
8 AWG	3x14	3 4	0.85 1.00	50
6 AWG	3x12	3 4	0.99 1.10	50
4 AWG	3x12	3 4	1.08 1.20	50
2 AWG	3x10	3 4	1.24 1.45	50
1 AWG	3x10	3 4	1.40 1.55	50
1/0 KCM	3x10	3 4	1.52 1.60	50
2/0 AWG	3x8	3 4	1.67 1.75	50
4/0 AWG	3x8	3 4	1.93 2.10	60
250 KCM	3x8	3 4	2.11 2.20	60
350 KCM	3x8	3 4	2.39 2.50	60
500 KCM	3x8	3 4	2.80 2.90	75

7. Manufacturer and Product: Okonite Co.; Type CLX MC-HL.

2.03 SPECIAL CABLES

A. Type 30, Unshielded Twisted Pair (UTP) Telephone and Data Cable, 300V:

1. Category 6 UTP, UL listed, and third party verified to comply with TIA/EIA 568-C Category 6 requirements.
2. Suitable for high speed network applications including gigabit ethernet and video. Cable shall be interoperable with other standards compliant products and shall be backward compatible with Category 5 and Category 5e.
3. Provide four each individually twisted pair, 23 AWG conductors, with FEP insulation and blue PVC jacket.
4. NFPA 70 Plenum (CMP) rated; comply with flammability plenum requirements of NFPA 70 and NFPA 262.
5. Cable shall withstand a bend radius of 1-inch minimum at a temperature of minus 20 degrees C maximum without jacket or insulation cracking.
6. Manufacturer and Product: Belden; 7852A.

B. Type 31, Modbus RTU/RS 485 Twin Axial Cable, 600V, Class 1, Twisted Shielded Pairs with Overall Shield:

1. Outer Jacket: PVC.
2. Shield: Aluminum foil-polyester tape, plus tinned copper braid, 20 AWG tinned copper drain wire.
3. Dimension: 0.460-inch nominal OD.
4. Conductors:
   a. 18 AWG stranded tinned copper.
   b. Insulation: Flame retardant polydefin (FRPO).
5. Manufacturer and Product: Belden; 3074 Twinax-Datatray.

2.04 GROUNDING CONDUCTORS

A. Equipment: Stranded copper with green, Type USE/RHH/RHW-XLPE or THHN/THWN, insulation.

B. Direct Buried: Bare stranded copper.

2.05 ACCESSORIES FOR CONDUCTORS 600 VOLTS AND BELOW

A. Tape:

1. General Purpose, Flame Retardant: 7-mil, vinyl plastic, Scotch Brand 33+, rated for 90 degrees C minimum, meeting requirements of UL 510.
2. Flame Retardant, Cold and Weather Resistant: 8.5-mil, vinyl plastic, Scotch Brand 88.
3. Arc and Fireproofing:
   a. 30-mil, elastomer.

b. Manufacturers and Products:
   1) 3M; Scotch Brand 77, with Scotch Brand 69 glass cloth tapebinder.
   2) Plymouth; 53 Plyarc, with 77 Plyglas glass cloth tapebinder.

B. Identification Devices:

1. Sleeve:
   a. Permanent, PVC, yellow or white, with legible machine-printed black markings.
   b. Manufacturers and Products:
      1) Raychem; Type D-SCE or ZH-SCE.
      2) Brady, Type 3PS.
2. Heat Bond Marker:
   a. Transparent thermoplastic heat bonding film with acrylic pressure sensitive adhesive.
   b. Self-laminating protective shield over text.
   c. Machine printed black text.
   d. Manufacturer and Product: 3M Co.; Type SCS-HB.
3. Marker Plate: Nylon, with legible designations permanently hot stamped on plate.
4. Tie-On Cable Marker Tags:
   a. Chemical-resistant white tag.
   b. Size: 1/2 inch by 2 inches.
   c. Manufacturer and Product: Raychem; Type CM-SCE.
5. Grounding Conductor: Permanent green heat-shrink sleeve, 2-inch minimum.

C. Connectors and Terminations:

1. Nylon, Self-Insulated Crimp Connectors:
   a. Manufacturers and Products:
      1) Thomas & Betts; Sta-Kon.
      2) Burndy; Insulug.
      3) ILSCO.
2. Nylon, Self-Insulated, Crimp Locking-Fork, Torque-Type Terminator:
   a. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
   b. Seamless.
   c. Manufacturers and Products:
      1) Thomas & Betts; Sta-Kon.
      2) Burndy; Insulink.
      3) ILSCO; ILSCONS.
3. Self-Insulated, Freespring Wire Connector (Wire Nuts):
   a. UL 486C.
   b. Plated steel, square wire springs.

c. Manufacturers and Products:
   1) Thomas & Betts.
   2) Ideal; Twister.

4. Self-Insulated, Set Screw Wire Connector:
   a. Two piece compression type with set screw in brass barrel.
   b. Insulated by insulator cap screwed over brass barrel.
   c. Manufacturers:
      1) 3M Co.
      2) Thomas & Betts.
      3) Marrette.

D. Cable Lugs:

1. In accordance with NEMA CC 1.
2. Rated 600 volts of same material as conductor metal.
3. Uninsulated Crimp Connectors and Terminators:
   a. Suitable for use with 75 degrees C wire at full NFPA 70, 75 degrees C ampacity.
   b. Manufacturers and Products:
      1) Thomas & Betts; Color-Keyed.
      2) Burndy; Hydent.
      3) ILSCO.
4. Uninsulated, Bolted, Two-Way Connectors and Terminators:
   a. Manufacturers and Products:
      1) Thomas & Betts; Locktite.
      2) Burndy; Quiklug.
      3) ILSCO.

E. Cable Ties:

1. Nylon, adjustable, self-locking, and reusable.
2. Manufacturer and Product: Thomas & Betts; TY-RAP.

F. Heat Shrinkable Insulation:

1. Thermally stabilized cross-linked polyolefin.
2. Single wall for insulation and strain relief.
3. Dual Wall, adhesive sealant lined, for sealing and corrosion resistance.
4. Manufacturers and Products:
   a. Thomas & Betts; SHRINK-KON.
   b. Raychem; RNF-100 and ES-2000.

G. Data Cable Accessories: Terminators, connectors, and junctions necessary for a complete Modbus RTU/RS 485 system.

2.06 PULLING COMPOUND

A. Nontoxic, noncorrosive, noncombustible, nonflammable, water-based lubricant; UL listed.

B. Suitable for rubber, neoprene, PVC, polyethylene, hypalon, CPE, and lead-covered wire and cable.

C. Approved for intended use by cable manufacturer.

D. Suitable for zinc-coated steel, aluminum, PVC, bituminized fiber, and fiberglass raceways.

E. Manufacturers:

1. Ideal Co.
2. Polywater, Inc.
3. Cable Grip Co.

2.07 SOURCE QUALITY CONTROL

A. Conductors 600 Volts and Below: Test in accordance with UL 44 and UL 854.

PART 3 EXECUTION

3.01 GENERAL

A. Conductor installation shall be in accordance with manufacturer's recommendations.

B. Conductor and cable sizing shown is based on copper conductors, unless noted otherwise.

C. Do not exceed cable manufacturer's recommendations for maximum pulling tensions and minimum bending radii.

D. Terminate conductors and cables, unless otherwise indicated.

E. Tighten screws and terminal bolts in accordance with UL 486A-486B for copper conductors.

F. Cable Lugs: Provide with correct number of holes, bolt size, and center-to-center spacing as required by equipment terminals.

G. Bundling: Where single conductors and cables in manholes, handholes, vaults, cable trays, and other indicated locations are not wrapped together by some other means, bundle conductors from each conduit throughout their exposed length with cable ties placed at intervals not exceeding 18 inches on center.

H. Ream, remove burrs, and clear interior of installed conduit before pulling wires or cables.

I. Concrete-Encased Raceway Installation: Prior to installation of conductors, pull through each raceway a mandrel approximately 1/4 inch smaller than raceway inside diameter.

3.02 POWER CONDUCTOR COLOR CODING

A. Conductors 600 Volts and Below:

1. 6 AWG and Larger: Apply general purpose, flame retardant tape at each end, and at accessible locations wrapped at least six full overlapping turns, covering area 1-1/2 inches to 2 inches wide.
2. 8 AWG and Smaller: Provide colored conductors.
3. Colors:

System	Conductor	Color
All Systems	Equipment Grounding	Green
240/120 Volts, Single-Phase, Three-Wire	Grounded Neutral One Hot Leg Other Hot Leg	White Black Red
208Y/120 Volts, Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	White Black Red Blue
240/120 Volts, Three-Phase, Four-Wire, Delta, Center Tap, Ground on Single-Phase	Grounded Neutral Phase A High (wild) Leg Phase C	White Black Orange Blue
480Y/277 Volts, Three-Phase, Four-Wire	Grounded Neutral Phase A Phase B Phase C	White Brown Orange Yellow
Note: Phase A, B, C implies direction of positive phase rotation.		

4. Tracer: Outer covering of white with identifiable colored strip, other than green, in accordance with NFPA 70.

3.03 CIRCUIT IDENTIFICATION

A. Identify power, instrumentation, and control conductor circuits at each termination, and in accessible locations such as manholes, handholes, panels, switchboards, motor control centers, pull boxes, and terminal boxes.

B. Circuits Appearing in Circuit Schedules: Identify using circuit schedule designations.

C. Circuits Not Appearing in Circuit Schedules:

1. Assign circuit name based on device or equipment at load end of circuit.
2. Where this would result in same name being assigned to more than one circuit, add number or letter to each otherwise identical circuit name to make it unique.

D. Method:

1. Conductors 3 AWG and Smaller: Identify with sleeves or heat bond markers.
2. Cables and Conductors 2 AWG and Larger:
   a. Identify with marker plates or tie-on cable marker tags.
   b. Attach with nylon tie cord.
3. Taped-on markers or tags relying on adhesives not permitted.

3.04 CONDUCTORS 600 VOLTS AND BELOW

A. Install 10 AWG or 12 AWG conductors for branch circuit power wiring in lighting and receptacle circuits.

B. Do not splice incoming service conductors and branch power distribution conductors 6 AWG and larger, unless specifically indicated or approved by Engineer.

C. Connections and Terminations:

1. Install wire nuts only on solid conductors. Wire nuts are not allowed on stranded conductors.
2. Install nylon self-insulated crimp connectors and terminators for instrumentation and control, circuit conductors.
3. Install self-insulated, set screw wire connectors for two-way connection of power circuit conductors 12 AWG and smaller.
4. Install uninsulated crimp connectors and terminators for instrumentation, control, and power circuit conductors 4 AWG through 2/0 AWG.
5. Install uninsulated, bolted, two-way connectors and terminators for power circuit conductors 3/0 AWG and larger.

6. Install uninsulated terminators bolted together on motor circuit conductors 10 AWG and larger.
7. Place no more than one conductor in any single-barrel pressure connection.
8. Install crimp connectors with tools approved by connector manufacturer.
9. Install terminals and connectors acceptable for type of material used.
10. Compression Lugs:
    a. Attach with a tool specifically designed for purpose. Tool shall provide complete, controlled crimp and shall not release until crimp is complete.
    b. Do not use plier type crimpers.

D. Do not use soldered mechanical joints.

E. Splices and Terminations:

1. Insulate uninsulated connections.
2. Indoors: Use general purpose, flame retardant tape or single wall heat shrink.
3. Outdoors, Dry Locations: Use flame retardant, cold- and weather-resistant tape or single wall heat shrink.
4. Below Grade and Wet or Damp Locations: Use dual wall heat shrink.

F. Cap spare conductors with UL listed end caps.

G. Cabinets, Panels, and Motor Control Centers:

1. Remove surplus wire, bridle and secure.
2. Where conductors pass through openings or over edges in sheet metal, remove burrs, chamfer edges, and install bushings and protective strips of insulating material to protect the conductors.

H. Control and Instrumentation Wiring:

1. Where terminals provided will accept such lugs, terminate control and instrumentation wiring, except solid thermocouple leads, with insulated, locking-fork compression lugs.
2. Terminate with methods consistent with terminals provided, and in accordance with terminal manufacturer’s instructions.
3. Locate splices in readily accessible cabinets or junction boxes using terminal strips.
4. Where connections of cables installed under this section are to be made under Section 40 90 00, Instrumentation and Control for Process Systems, leave pigtails of adequate length for bundled connections.

5. Cable Protection:
    a. Under Infinite Access Floors: May install without bundling.
    b. All Other Areas: Install individual wires, pairs, or triads in flex conduit under floor or grouped into bundles at least 1/2 inch in diameter.
    c. Maintain integrity of shielding of instrumentation cables.
    d. Ensure grounds do not occur because of damage to jacket over shield.

I. Extra Conductor Length: For conductors to be connected by others, install minimum 6 feet of extra conductor in freestanding panels and minimum 2 feet in other assemblies.

3.05 CONDUCTOR ARC AND FIREPROOFING

A. Install arc and fireproofing tape on 600-volt single conductors and cables, except those rated Type TC throughout entire exposed length in manholes, handholes, vaults, cable trays, and other indicated locations.

B. Wrap conductors of same circuit entering from separate conduit together as single cable.

C. Follow tape manufacturer's installation instructions.

D. Secure tape at intervals of 5 feet with bands of tapebinder. Each band to consist of a minimum of two wraps directly over each other.

3.06 UNDERGROUND DIRECT BURIAL CABLE

A. Install in trench as specified in Section 31 23 23.15, Trench Backfill.

B. Warning Tape: Install approximately 6 inches above cable, aligned parallel to, and within 12 inches of centerline of the run.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. Institute of Electrical and Electronics Engineers (IEEE): C2, National Electrical Safety Code (NESC).
2. National Fire Protection Association (NFPA): 70, National Electrical Code. (NEC).

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Product data for the following:
      1) Exothermic weld connectors.
      2) Compression connectors.
      3) Specialty tools.
      4) Ground rods.
      5) Grounding wells.

1.03 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, provide material and equipment labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ to provide a basis for approval under NEC.
2. Materials and equipment manufactured within the scope of standards published by UL:
   a. Confirm conformance with UL standards.
   b. Supply with an applied UL listing mark.

PART 2 PRODUCTS

2.01 GROUND ROD

A. Material: Copper-clad.

B. Diameter: Minimum 3/4 inch.

C. Length: 20 feet.

2.02 GROUND CONDUCTORS

A. As specified in Section 26 05 05, Conductors.

2.03 CONNECTORS

A. Exothermic Weld Type:

1. Outdoor Weld: Suitable for exposure to elements or direct burial.
2. Indoor Weld: Use low-smoke, low-emission process.
3. Manufacturers:
   a. Erico Products, Inc.**;** Cadweld and Cadweld Exolon.
   b. Thermoweld.

B. Compression Type:

1. Compress-deforming type; wrought copper extrusion material.
2. Single indentation for conductors 6 AWG and smaller.
3. Double indentation with extended barrel for conductors 4 AWG and larger.
4. Barrels prefilled with oxide-inhibiting and antiseizing compound and sealed.
5. Manufacturers:
   a. Burndy Corp.; Hyground Irreversible Compression.
   b. Thomas and Betts Co.
   c. ILSCO.

2.04 GROUNDING WELLS

A. H-20 rated precast concrete ground rod box complete with cast-iron riser ring and traffic cover marked “GROUND ROD”.

B. Manufacturers and Products:

1. Christy Co.; No. G5.
2. Lightning and Grounding Systems, Inc.; I-R Series.

PART 3 EXECUTION

3.01 GENERAL

A. Grounding: In compliance with NFPA 70 and IEEE C2.

B. Ground electrical service neutral at service entrance equipment with grounding electrode conductor to grounding electrode system.

C. Ground each separately derived system neutral with common grounding electrode conductor to grounding electrode system.

D. Bond together all grounding electrodes that are present at each building or structure served to form one common grounding electrode system.

E. Bond together system neutrals, service equipment enclosures, exposed noncurrent-carrying metal parts of electrical equipment, metal raceways, ground conductor in raceways and cables, receptacle ground connections, and metal piping systems.

F. Shielded Power Cables: Ground shields at each splice or termination in accordance with recommendations of splice or termination manufacturer.

G. Shielded Instrumentation Cables:

1. Ground shield to ground bus at power supply for analog signal.
2. Expose shield minimum 1 inch at termination to field instrument and apply heat shrink tube.
3. Do not ground instrumentation cable shield at more than one point.

3.02 WIRE CONNECTIONS

A. Ground Conductors: Install in conduit containing power conductors and control circuits above 50 volts.

B. Nonmetallic Raceways and Flexible Tubing: Install equipment grounding conductor connected at both ends to noncurrent-carrying grounding bus.

C. Connect ground conductors to raceway grounding bushings.

D. Extend and connect ground conductors to ground bus in all equipment containing a ground bus.

E. Connect enclosure of equipment containing ground bus to that bus.

F. Bolt connections to equipment ground bus.

G. Bond grounding conductors to metallic enclosures at each end, and to intermediate metallic enclosures.

H. Junction Boxes: Furnish materials and connect to equipment grounding system with grounding clips mounted directly on box, or with 3/8-inch machine screws.

I. Metallic Equipment Enclosures: Use furnished ground lug; if none furnished, tap equipment housing and install solderless terminal connected to box with machine screw. For circuits greater than 20 amps use minimum 5/16-inch diameter bolt.

3.03 MOTOR GROUNDING

A. Extend equipment ground bus via grounding conductor installed in motor feeder raceway; connect to motor frame.

B. Nonmetallic Raceways and Flexible Tubing: Install an equipment grounding conductor connected at both ends to noncurrent-carrying grounding bus.

C. Motors Less Than 10 hp: Use furnished ground lug in motor connection box. If none furnished, provide compression, spade-type terminal connected to conduit box mounting screw.

D. Motors 10 hp and Above: Use furnished ground lug in motor connection box. If none furnished, tap motor frame or equipment housing; furnish compression, one-hole, lug type terminal connected with minimum 5/16-inch brass threaded stud with bolt and washer.

E. Circuits 20 Amps or Above: Tap motor frame or equipment housing. Install solderless terminal with minimum 5/16-inch diameter bolt.

3.04 GROUND RODS

A. Install full length with conductor connection at upper end.

B. Install with connection point below finished grade, unless otherwise shown.

C. Space multiple ground rods by one rod length.

D. Install to 8 feet below local frost depth.

3.05 GROUNDING WELLS

A. Install for ground rods located inside buildings, asphalt and paved areas, and where shown on Drawings.

B. Install riser ring and cover flush with surface.

C. Place 12 inches of crushed rock in bottom of each well.

3.06 CONNECTIONS

A. General:

1. Abovegrade Connections: Install exothermic weld, mechanical, or compression-type connectors; or brazing.
2. Belowgrade Connections: Install exothermic weld or compression type connectors.
3. Remove paint, dirt, or other surface coverings at connection points to allow good metal-to-metal contact.
4. Notify Engineer prior to backfilling ground connections.

B. Exothermic Weld Type:

1. Wire brush or file contact point to bare metal surface.
2. Use welding cartridges and molds in accordance with manufacturer's recommendations.
3. Avoid using badly worn molds.
4. Mold to be completely filled with metal when making welds.
5. After completed welds have cooled, brush slag from weld area and thoroughly clean joint.

C. Compression Type:

1. Install in accordance with connector manufacturer's recommendations.
2. Install connectors of proper size for grounding conductors and ground rods specified.
3. Install using connector manufacturer's compression tool having proper sized dies and operate per manufacturer's instructions.

3.07 METAL STRUCTURE GROUNDING

A. Bond metal sheathing and exposed metal vertical structural elements to grounding system.

B. Bond electrical equipment supported by metal platforms to the platforms.

C. Provide electrical contact between metal frames and railings supporting pushbutton stations, receptacles, and instrument cabinets, and raceways carrying circuits to these devices.

3.08 MANHOLE AND HANDHOLE GROUNDING

A. Install one ground rod inside each manhole and handhole larger than 24-inch by 24-inch inside dimensions.

B. Ground Rod Floor Protrusion: 4 inches to 6 inches above floor.

C. Make connections of grounding conductors fully visible and accessible.

D. Connect all noncurrent-carrying metal parts and any metallic raceway grounding bushings to ground rod with 6 AWG copper conductor.

3.09 TRANSFORMER GROUNDING

A. Bond neutrals of transformers within buildings to system ground network and to any additional indicated grounding electrodes.

3.10 LIGHTNING PROTECTION SYSTEMS

A. Bond lightning protection system ground terminals to building or structure grounding electrode system.

3.11 SURGE PROTECTION EQUIPMENT GROUNDING

A. Connect surge arrestor ground terminals to equipment ground bus.

END OF SECTION

SECTION 26 05 33
RACEWAY AND BOXES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO): HB, Standard Specifications for Highway Bridges.
2. ASTM International (ASTM):
   a. A123/123M, Standard Specification for Zinc (Hot-Dipped Galvanized) Coatings on Iron and Steel Products.
   b. A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
   c. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
   d. C857, Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
   e. D149, Standard Test Method for Dielectric Breakdown Voltage and Dielectric Strength of Solid Electrical Insulating Materials at Commercial Power Frequencies.
3. Telecommunications Industry Association (TIA): 569B, Commercial Building Standard for Telecommunications Pathways and Spaces.
4. National Electrical Contractor's Association, Inc. (NECA): Installation standards.
5. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. C80.1, Electrical Rigid Steel Conduit (ERSC).
   c. C80.3, Steel Electrical Metallic Tubing (EMT).
   d. C80.5, Electrical Rigid Aluminum Conduit (ERAC).
   e. C80.6, Electrical Intermediate Metal Conduit (EIMC).
   f. RN 1, Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
   g. TC 2, Electrical Polyvinyl Chloride (PVC) Conduit.
   h. TC 3, Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
   i. TC 6, Polyvinyl Chloride (PVC) Plastic Utilities Duct for Underground Installation.
   j. TC 14, Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
   k. VE 1, Metallic Cable Tray Systems.

6. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
7. Underwriters Laboratories Inc. (UL):
   a. 1, Standard for Safety for Flexible Metal Conduit.
   b. 5, Standard for Safety for Surface Metal Raceways and Fittings.
   c. 6, Standard for Safety for Electrical Rigid Metal Conduit – Steel.
   d. 6A, Standard for Safety for Electrical Rigid Metal Conduit – Aluminum, Red Brass and Stainless.
   e. 360, Standard for Safety for Liquid-Tight Flexible Steel Conduit.
   f. 514B, Standard for Safety for Conduit, Tubing, and Cable Fittings.
   g. 651, Standard for Safety for Schedule 40 and 80 Rigid PVC Conduit and Fittings.
   h. 651A, Standard for Safety for Type EB and A Rigid PVC Conduit and HDPE Conduit.
   i. 797, Standard for Safety for Electrical Metallic Tubing – Steel.
   j. 870, Standard for Safety for Wireways, Auxiliary Gutters, and Associated Fittings.
   k. 1242, Standard for Safety for Electrical Intermediate Metal Conduit – Steel.
   l. 1660, Standard for Safety for Liquid-Tight Flexible Nonmetallic Conduit.
   m. 1684, Standard for Safety for Reinforced Thermosetting Resin Conduit (RTRC) and Fittings.
   n. 2024, Standard for Safety for Optical Fiber and Communication Cable Raceway.

1.02 SUBMITTALS

A. Action Submittals:

1. Manufacturer's Literature:
   a. Rigid aluminum conduit.
   b. PVC Schedule 40 conduit.
   c. PVC Schedule 80 conduit.
   d. PVC-coated rigid galvanized steel or aluminum conduit, submittal to include copy of manufacturer's warranty.
   e. Flexible metal, liquid-tight conduit.
   f. Flexible, nonmetallic, liquid-tight conduit.
   g. Flexible metal, nonliquid-tight conduit.
   h. Conduit fittings.
   i. Wireways.
   j. Device boxes for use in hazardous areas.
   k. Junction and pull boxes.
   l. Large junction and pull boxes.
   m. Terminal junction boxes.

2. Precast Manholes and Handholes:
   a. Dimensional drawings and descriptive literature.
   b. Traffic loading calculations.
   c. Accessory information.
3. Equipment and machinery proposed for bending metal conduit.
4. Method for bending PVC conduit less than 30 degrees.
5. Conduit Layout:
   a. Provide drawings for conduit installations underground and concealed conduits including, but not limited to ductbanks, under floor slabs, concealed in floor slabs, and concealed in walls.
   b. Provide plan and section showing arrangement and location of conduit and duct bank required for:
      1) Low voltage feeder and branch circuits.
      2) Instrumentation and control systems.
      3) Communications systems.
      4) Empty conduit for future use.
   c. Reproducible; scale not greater than 1 inch equals 20 feet.

B. Informational Submittals:

1. Seismic anchorage and bracing calculations as required by Section 01 88 15, Anchorage and Bracing.
2. Manufacturer's certification of training for PVC-coated rigid galvanized steel conduit installer.

1.03 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide the Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, material and equipment shall be labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ in order to provide a basis for approval under NEC.
2. Materials and equipment manufactured within scope of standards published by Underwriters Laboratories, Inc. shall conform to those standards and shall have an applied UL listing mark.

B. PVC-Coated, Rigid Galvanized Steel Conduit Installer: Certified by conduit manufacturer as having received minimum 2 hours of training on installation procedures.

PART 2 PRODUCTS

2.01 CONDUIT AND TUBING

A. Rigid Aluminum Conduit:

1. Meet requirements of NEMA C80.5 and UL 6A.
2. Material: Type 6063, copper-free aluminum alloy.

B. PVC Schedule 40 Conduit:

1. Meet requirements of NEMA TC 2 and UL 651.
2. UL listed for concrete encasement, underground direct burial, concealed or direct sunlight exposure, and 90 degrees C insulated conductors.
3. Furnish without factory-formed bell.

C. PVC Schedule 80 Conduit:

1. Meet requirements of NEMA TC 2 and UL 651.
2. UL listed for concrete encasement, underground direct burial, concealed or direct sunlight exposure, and 90 degrees C insulated conductors.

D. PVC-Coated Rigid Galvanized Steel Conduit:

1. Meet requirements of NEMA RN 1.
2. Material:
   a. Meet requirements of NEMA C80.1 and UL 6.
   b. Exterior Finish: PVC coating, 40-mil nominal thickness; bond to metal shall have tensile strength greater than PVC.
   c. Interior finish: Urethane coating, 2-mil nominal thickness.
3. Threads: Hot-dipped galvanized and factory coated with urethane.
4. Bendable without damage to interior or exterior coating.

E. PVC-Coated Rigid Aluminum Conduit:

1. Meet requirements of NEMA RN 1.
2. Material: Type 6063, copper-free aluminum alloy.
   a. Meet requirements of NEMA C80.5 and UL 6A.
   b. Exterior Finish: PVC coating, 40-mil nominal thickness; bond to metal shall have tensile strength greater than PVC.
   c. Interior Finish: Urethane coating, 2-mil nominal thickness.

F. Flexible Metal, Liquid-Tight Conduit:

1. UL 360 listed for 105 degrees C insulated conductors.
2. Material: Galvanized steel with extruded PVC jacket.

G. Flexible Metal, Nonliquid-Tight Conduit:

1. Meet requirements of UL 1.
2. Material: Aluminum.

H. Flexible, Nonmetallic, Liquid-Tight Conduit:

1. Material: PVC core with fused flexible PVC jacket.
2. UL 1660 listed for:
   a. Dry Conditions: 80 degrees C insulated conductors.
   b. Wet Conditions: 60 degrees C insulated conductors.
3. Manufacturers and Products:
   a. Carlon; Carflex or X-Flex.
   b. T & B; Xtraflex LTC or EFC.

I. Innerduct:

1. Resistant to spread of fire, per requirements of UL 2024.
2. Smooth or corrugated HDPE.
3. Textile Manufacturer: Maxcell.

2.02 FITTINGS

A. Rigid Aluminum Conduit:

1. General:
   a. Meet requirements of UL 514B.
   b. Type: Threaded, copper-free. Set screw fittings not permitted.
2. Insulated Bushing:
   a. Material: Cast aluminum, with integral insulated throat, rated for 150 degrees C.
   b. Manufacturer and Product: O-Z/Gedney; Type AB.
3. Grounding Bushing:
   a. Material: Cast aluminum with integral insulated throat, rated for 150 degrees, with solderless lugs.
   b. Manufacturer and Product: O-Z/Gedney; Type ABLG.
4. Conduit Hub:
   a. Material: Cast aluminum, with insulated throat.
   b. UL listed for use in wet locations.
   c. Manufacturers and Products:
      1) O-Z/Gedney; Type CHA.
      2) Thomas & Betts; Series 370AL.
      3) Meyers; Series SA.

5. Conduit Bodies:
   a. Manufacturers and Products (For Normal Conditions):
      1) Appleton; Form 85 threaded unilets.
      2) Crouse-Hinds; Mark 9 or Form 7-SA threaded condulets.
      3) Killark; Series O electrolets.
   b. Manufacturers (For Hazardous Locations):
      1) Appleton.
      2) Crouse-Hinds.
      3) Killark.
6. Couplings: As supplied by conduit manufacturer.
7. Conduit Sealing Fitting:
   a. Manufacturers and Products:
      1) Appleton; Type EYF-AL or EYM-AL.
      2) Crouse-Hinds; Type EYS-SA or EZS-SA.
      3) Killark; Type EY or Type EYS.
8. Drain Seal:
   a. Manufacturers and Products:
      1) Appleton; Type EYDM-A.
      2) Crouse-Hinds; Type EYD-SA or Type EZD-SA.
9. Drain/Breather Fitting:
   a. Manufacturers and Products:
      1) Appleton; Type ECDB.
      2) Crouse-Hinds; ECD.
10. Expansion Fitting:
    a. Manufacturers and Products:
       1) Deflection/Expansion Movement: Steel City; Type DF-A.
       2) Expansion Movement Only: Steel City; Type AF-A.
11. Cable Sealing Fittings:
    a. To form watertight nonslip cord or cable connection to conduit.
    b. Bushing: Neoprene at connector entry.
    c. Manufacturer and Product: Appleton; CG-S.

B. PVC Conduit and Tubing:

1. Meet requirements of NEMA TC 3.
2. Type: PVC, slip-on.

C. PVC-Coated Rigid Galvanized Steel Conduit:

1. Meet requirements of UL 514B.
2. Fittings: Rigid galvanized steel type, PVC coated by conduit manufacturer.
3. Conduit Bodies: Cast metal hot-dipped galvanized or urethane finish. Cover shall be of same material as conduit body. PVC coated by conduit manufacturer.
4. Finish: 40-mil PVC exterior, 2-mil urethane interior.
5. Overlapping pressure-sealing sleeves.

6. Conduit Hangers, Attachments, and Accessories: PVC-coated.
7. Manufacturers:
   a. Robroy Industries.
   b. Ocal.
8. Expansion Fitting:
   a. Manufacturer and Product: Ocal; OCAL-BLUE XJG.

D. PVC-Coated Rigid Aluminum Conduit:

1. Meet requirements of UL 514B.
2. Fittings: As listed for rigid aluminum conduit.
3. Finish: 40-mil PVC exterior, 2-mil urethane interior.
4. Overlapping pressure-sealing sleeves.
5. Conduit Hangers, Attachments, and Accessories: PVC-coated.
6. Manufacturers:
   a. Robroy Industries.
   b. Ocal.

E. Flexible Metal, Liquid-Tight Conduit:

1. Metal insulated throat connectors with integral nylon or plastic bushing rated for 105 degrees C.
2. Insulated throat and sealing O-rings.
3. Manufacturers and Products:
   a. Thomas & Betts; Series 5331.
   b. O-Z/Gedney; Series 4Q.

F. Flexible Metal, Nonliquid-Tight Conduit:

1. Meet requirements of UL 514B.
2. Body: Galvanized malleable iron.
3. Throat: Nylon insulated.
4. 1-1/4-Inch Conduit and Smaller: One screw body.
5. 1-1/2-Inch Conduit and Larger: Two screw body.
6. Manufacturer and Product: Appleton; Series 7400.

G. Flexible, Nonmetallic, Liquid-Tight Conduit:

1. Meet requirements of UL 514B.
2. Type: High strength plastic body, complete with lock nut, O-ring, threaded ferrule, sealing ring, and compression nut.
3. Body/compression nut (gland) design to ensure high mechanical pullout strength and watertight seal.
4. Manufacturers and Products:
   a. Carlon; Type LT.
   b. O-Z/Gedney; Type 4Q-P.
   c. Thomas & Betts; Series 6300.

H. Flexible Coupling, Hazardous Locations:

1. Approved for use in atmosphere involved.
2. Rating: Watertight and UL listed for use in Class I, Division 1 and 2 areas.
3. Outer bronze braid and an insulating liner.
4. Conductivity equal to a similar length of rigid metal conduit.
5. Manufacturers and Products:
   a. Crouse-Hinds; Type ECGJH or Type ECLK.
   b. Appleton; EXGJH or EXLK.

I. Watertight Entrance Seal Device:

1. New Construction:
   a. Material: Oversized sleeve, malleable iron body with sealing ring, pressure ring, grommet seal, and pressure clamp.
   b. Manufacturer and Product: O-Z/Gedney; Type FSK or Type WSK, as required.
2. Cored-Hole Application:
   a. Material: Assembled dual pressure disks, neoprene sealing ring, and membrane clamp.
   b. Manufacturer and Product: O-Z/Gedney; Series CSM.

2.03 OUTLET AND DEVICE BOXES

A. Cast Aluminum:

1. Material:
   a. Box: Cast, copper-free aluminum.
   b. Cover: Gasketed, weatherproof, cast copper-free aluminum with stainless steel screws.
2. Hubs: Threaded.
3. Lugs: Cast mounting.
4. Manufacturers and Products, Nonhazardous Locations:
   a. Crouse-Hinds; Type FS-SA or Type FD-SA.
   b. Appleton; Type FS or Type FD.
   c. Killark.
5. Manufacturers and Products, Hazardous Locations:
   a. Crouse-Hinds; Type GUA-SA.
   b. Appleton; Type GR.

B. PVC-Coated Cast Metal:

1. Type: One-piece.
2. Material: Malleable iron, cast ferrous metal, or cast aluminum.
3. Coating:
   a. Exterior Surfaces: 40-mil PVC.
   b. Interior Surfaces: 2-mil urethane.
4. Manufacturers:
   a. Robroy Industries.
   b. Ocal.

2.04 JUNCTION AND PULL BOXES

A. Outlet Box Used as Junction or Pull Box: As specified under Article Outlet and Device Boxes.

B. Conduit Bodies Used as Junction Boxes: As specified under Article Fittings.

C. Large Cast Metal Box, Hazardous Locations:

1. NEMA 250 Type 7 or Type 9 as required for Class, Division, and Group involved.
2. Box: Copper-free aluminum with drilled and tapped conduit entrances.
3. Cover: Nonhinged with screws.
4. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
5. Manufacturers and Products:
   a. Crouse-Hinds; Type EJB.
   b. Appleton; Type AJBEW.

D. Large Cast Aluminum Box:

1. NEMA 250 Type 4.
2. Box: Cast copper-free aluminum, with drilled and tapped conduit entrances and exterior mounting lugs.
3. Cover: Nonhinged.
4. Gasket: Neoprene.
5. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
6. Manufacturers and Products, Surface Mounted Type:
   a. Crouse-Hinds; Series W-SA.
   b. O-Z/Gedney; Series YS-A, YL-A.
   c. Killark.

E. Large Stainless Steel Box:

1. NEMA 250 Type 4X.
2. Box: 14-gauge, ASTM A240/A240M, Type 316 stainless steel, with white enamel painted interior mounting panel.
3. Cover: Hinged with clamps.
4. Hardware and Machine Screws: ASTM A167, Type 316 stainless steel.
5. Manufacturers:
   a. Hoffman Engineering Co.
   b. Robroy Industries.
   c. Wiegman.

F. Concrete Box, Traffic Areas:

1. Box: Reinforced, cast concrete with extension and bottom slab.
2. Cover: Steel checked plate; H/20 loading with screw down.
3. Cover Marking: ELECTRICAL, TELEPHONE, or as shown.
4. Manufacturers and Products:
   a. Christy, Concrete Products, Inc.; B1017BOX.
   b. Utility Vault Co.; 3030 SB.

2.05 TERMINAL JUNCTION BOX

A. Cover: Hinged, unless otherwise shown.

B. Interior Finish: Paint with white enamel or lacquer.

C. Terminal Blocks:

1. Separate connection point for each conductor entering or leaving box.
2. Spare Terminal Points: 25 percent, minimum.

2.06 METAL WIREWAYS

A. Meet requirements of UL 870.

B. Type: Aluminum or stainless steel-enclosed, lay-in type.

C. Cover: Removable, screw type.

D. Rating: Outdoor raintight.

E. Finish: Rust inhibiting phosphatizing primer and gray baked enamel.

F. Hardware: Plated to prevent corrosion; screws installed toward the inside protected by spring nuts or otherwise guarded to prevent wire insulation damage.

G. Knockouts: Without knockouts, unless otherwise indicated.

H. Manufacturers:

1. Circle AW.
2. Hoffman.
3. Square D.

2.07 PRECAST MANHOLES AND HANDHOLES

A. Concrete Strength: Minimum, 3,000 psi compressive, in 28 days.

B. Loading: AASHTO, H-20 in accordance with ASTM C857.

C. Access: Provide cast concrete 6-inch or 12-inch risers and access hole adapters between top of manhole and finished grade at required elevations.

D. Drainage:

1. Slope floors toward drain points, leaving no pockets or other nondraining areas.
2. Provide drainage outlet or sump at low point of floor constructed with a heavy, cast iron, slotted or perforated hinged cover, and a minimum 4-inch outlet and outlet pipe.

E. Raceway Entrances:

1. Provide on all four sides.
2. Provide knockout panels or precast individual raceway openings.
3. At entrances where raceways are to be installed by others, provide minimum 12-inch-high by 24-inch-wide knockout panels for future raceway installation.

F. Embedded Pulling Iron:

1. Material: 3/4-inch-diameter stock, fastened to overall steel reinforcement before concrete is placed.
2. Location:
   a. Wall: Opposite each raceway entrance and knockout panel for future raceway entrance.
   b. Floor: Centered below manhole or handhole cover.

G. Cable Racks:

1. Arms and Insulators: Adjustable, of sufficient number to accommodate cables for each raceway entering or leaving manhole, including spares.
2. Wall Attachment:
   a. Adjustable inserts in concrete walls. Bolts or embedded studs not permitted.
   b. Insert Spacing: Maximum 3 feet on center for inside perimeter of manhole.
   c. Arrange in order that spare raceway ends are clear for future cable installation.

H. Manhole Frames and Covers:

1. Material: Machined cast iron.
2. Diameter: 36-1/2 inch.
3. Cover Type: Indented, solid top design, with two drop handles each.
4. Cover Loading: AASHTO H-20.
5. Cover Designation: Cast, on upper side, in integral letters, minimum 2 inches in height, appropriate titles:
   a. Above 600 Volts: ELECTRIC HV.
   b. 600 Volts and Below: ELECTRIC LV.
   c. TELEPHONE.

I. Handhole Frames and Covers:

1. Material: Steel, hot-dipped galvanized.
2. Cover Type: Solid, bolt-on, hinged, torsion spring, of checkered design.
3. Cover Loading: AASHTO H-20.
4. Cover Designation: Burn by welder, on upper side in integral letters, minimum 2 inches in height, appropriate titles:
   a. 600 Volts and Below: ELECTRIC LV.
   b. TELEPHONE.

J. Hardware: Steel, hot-dip galvanized.

K. Furnish knockout for ground rod in each handhole and manhole.

L. Manufacturers:

1. Utility Vault Co.
2. Penn-Cast Products, Inc.
3. Concrete Conduit Co.
4. Associated Concrete Products, Inc.
5. Pipe, Inc.

2.08 ACCESSORIES

A. Duct Bank Spacers:

1. Modular Type:
   a. Nonmetallic, interlocking, for multiple conduit sizes.
   b. Suitable for all types of conduit.
   c. Manufacturers:
      1) Underground Device, Inc.
      2) Carlon.
2. Template Type:
   a. Nonmetallic, custom made one-piece spacers.
   b. Suitable for all types of conduit.
   c. Material: HDPE or polypropylene, 1/2-inch minimum thickness.
   d. Conduit openings cut 1 inch larger than conduit outside diameter.
   e. Additional openings for stake-down, rebar, and concrete flow through as required.
   f. Manufacturer and Product: SP Products; Quik Duct.

B. Identification Devices:

1. Raceway Tags:
   a. Material: Permanent, stainless steel.
   b. Shape: Round.
   c. Raceway Designation: Pressure stamped, embossed, or engraved.
   d. Tags relying on adhesives or taped-on markers not permitted.
2. Warning Tape:
   a. Material: Polyethylene, 4-mil gauge with detectable strip.
   b. Color: Red.
   c. Width: Minimum 3 inches.
   d. Designation: Warning on tape that electric circuit is located below tape.
   e. Identifying Letters: Minimum 1-inch-high permanent black lettering imprinted continuously over entire length.
   f. Manufacturers and Products:
      1) Panduit; Type HTDU.
      2) Reef Industries; Terra Tape.
3. Buried Raceway Marker:
   a. Material: Sheet bronze, consisting of double-ended arrows, straight for straight runs and bent at locations where runs change direction.
   b. Designation: Engrave to depth of 3/32 inch; ELECTRIC CABLES, in letters 1/4-inch high.
   c. Minimum Dimension: 1/4 inch thick, 10 inches long, and 3/4 inch wide.

C. Raceway Coating: Clean and paint in accordance with Section 09 90 04, Painting.

D. Heat Shrinkable Tubing:

1. Material: Heat-shrinkable, cross-linked polyolefin.
2. Semi-flexible with meltable adhesive inner liner.
3. Color: Black.
4. Manufacturers:
   a. Raychem.
   b. 3M.

E. Wraparound Duct Band:

1. Material: Heat-shrinkable, cross-linked polyolefin, precoated with hot-melt adhesive.
2. Width: 50 mm minimum.
3. Manufacturer and Product: Raychem; Type TWDB.

PART 3 EXECUTION

3.01 GENERAL

A. Conduit and tubing sizes shown are based on use of copper conductors.

B. Comply with NECA Installation Standards.

C. Crushed or deformed raceways not permitted.

D. Maintain raceway entirely free of obstructions and moisture.

E. Immediately after installation, plug or cap raceway ends with watertight and dust-tight seals until time for pulling in conductors.

F. Aluminum Conduit: Do not install in direct contact with concrete. Install in PVC sleeve or cored hole through concrete walls and slabs.

G. Sealing Fittings: Provide drain seal in vertical raceways where condensate may collect above sealing fitting.

H. Avoid moisture traps where possible. When unavoidable in exposed conduit runs, provide junction box and drain fitting at conduit low point.

I. Group raceways installed in same area.

J. Proximity to Heated Piping: Install raceways minimum 12 inches from parallel runs.

K. Follow structural surface contours when installing exposed raceways. Avoid obstruction of passageways.

L. Run exposed raceways parallel or perpendicular to walls, structural members, or intersections of vertical planes.

M. Block Walls: Do not install raceways in same horizontal course or vertical cell with reinforcing steel.

N. Install watertight fittings in outdoor, underground, or wet locations.

O. Paint threads and cut ends, before assembly of fittings, PVC-coated galvanized conduit installed in exposed or damp locations with zinc-rich paint or liquid galvanizing compound.

P. Metal conduit shall be reamed, burrs removed, and cleaned before installation of conductors, wires, or cables.

Q. Do not install raceways in concrete equipment pads, foundations, or beams without Engineer approval.

R. Horizontal raceways installed under floor slabs shall lie completely under slab, with no part embedded within slab.

S. Install concealed, embedded, and buried raceways so that they emerge at right angles to surface and have no curved portion exposed.

T. Install conduits for fiber optic cables, telephone cables, and Category 6 data cables in strict conformance with the requirements of TIA 569B.

U. All conduit of a given type shall be the product of one manufacturer.

V. Provide enclosures and boxes of same material as conduit and NEMA 250 Type as required in Specification section titled, Basic Electrical Materials and Methods.

3.02 REUSE OF EXISTING CONDUITS

A. Where Drawings indicate existing conduits may be reused, they may be reused only where they meet the following criteria.

1. Conduit is in useable condition with no deformation, corrosion, or damage to exterior surface.
2. Conduit is sized per the NEC.
3. Conduit is of the type specified in Contract Documents.
4. Conduit is supported as specified in Contract Documents.

B. Conduit shall be reamed with wire brush, then with a mandrel approximately 1/4 inch smaller than raceway inside diameter then cleaned prior to pulling new conductors.

3.03 INSTALLATION IN CAST-IN-PLACE STRUCTURAL CONCRETE

A. Minimum Cover: 2 inches, including fittings.

B. Conduit placement shall not require changes in reinforcing steel location or configuration.

C. Provide nonmetallic support during placement of concrete to ensure raceways remain in position.

D. Conduit larger than 1 inch shall not be embedded in concrete slabs, walls, foundations, columns, or beams unless approved by Engineer.

E. Slabs and Walls (Requires Engineer Approval):

1. Trade size of conduit not to exceed one-fourth of slab or wall thickness.
2. Install within middle two-fourths of slab or wall.
3. Separate conduit less than 2-inch trade size by a minimum ten times conduit trade size, center-to-center, unless otherwise shown.
4. Separate conduit 2-inch and greater trade size by a minimum eight times conduit trade size, center-to-center, unless otherwise shown.
5. Cross conduit at an angle greater than 45 degrees, with minimum separation of 1 inch.
6. Separate conduit by a minimum six times the outside dimension of expansion/deflection fittings at expansion joints.
7. Conduit shall not be installed below the maximum water surface elevation in walls of water holding structures.

F. Columns and Beams (Requires Engineer Approval):

1. Trade size of conduit not to exceed one-fourth of beam thickness.
2. Conduit cross-sectional area not to exceed 4 percent of beam or column cross section.

3.04 CONDUIT APPLICATION

A. Diameter: Minimum 3/4 inch.

B. Exterior, Exposed: Rigid aluminum.

C. Interior, Exposed: Rigid aluminum.

D. Interior, Concealed (Not Embedded in Concrete): Rigid aluminum.

E. Aboveground, Embedded in Concrete Walls, Ceilings, or Floors: PVC Schedule 40.

F. Direct Earth Burial: PVC Schedule 80.

G. Concrete-Encased Ductbank: PVC Schedule 40.

H. Under Slabs-On-Grade: PVC Schedule 40.

I. Transition from Underground or Concrete Embedded to Exposed: PVC-coated rigid steel conduit or aluminum.

J. Under Equipment Mounting Pads: PVC Schedule 80 conduit.

K. Exterior Light Pole Foundations: PVC Schedule 80 conduit.

L. Corrosive Areas:

1. PVC-coated rigid galvanized steel.
2. PVC-coated rigid aluminum.

M. Hazardous Gas Areas: Rigid galvanized steel.

3.05 FLEXIBLE CONNECTIONS

A. For motors, wall or ceiling mounted fans and unit heaters, dry type transformers, electrically operated valves, instrumentation, and other locations approved by Engineer where flexible connection is required to minimize vibration:

1. Conduit Size 4 Inches or Less: Flexible, liquid-tight conduit.
2. Conduit Size Over 4 Inches: Nonflexible.
3. Wet or Corrosive Areas: Flexible, nonmetallic or flexible metal liquid-tight.
4. Dry Areas: Flexible, metallic liquid-tight.
5. Hazardous Areas: Flexible coupling suitable for Class I, Division 1 and 2 areas.

B. Suspended Lighting Fixtures in Dry Areas: Flexible aluminum, nonliquid-tight conduit.

C. Outdoor Areas, Process Areas Exposed to Moisture, and Areas Required to be Oiltight and Dust-Tight: Flexible metal, liquid-tight conduit.

D. Flexible Conduit Length: 18 inches minimum, 60 inches maximum; sufficient to allow movement or adjustment of equipment.

3.06 PENETRATIONS

A. Make at right angles, unless otherwise shown.

B. Notching or penetration of structural members, including footings and beams, not permitted.

C. Fire-Rated Walls, Floors, or Ceilings: Firestop openings around penetrations to maintain fire-resistance rating as specified in Section 26 05 04, Basic Electrical Materials and Methods.

D. Apply heat shrinkable tubing or two layer of wraparound duct band to metallic conduit protruding through concrete floor slabs to a point 2 inches above and 2 inches below concrete surface.

E. Concrete Walls, Floors, or Ceilings (Aboveground): Provide nonshrink grout dry-pack, or use watertight seal device.

F. Entering Structures:

1. General: Seal raceway at first box or outlet with oakum or expandable plastic compound to prevent entrance of gases or liquids from one area to another.
2. Concrete Roof or Membrane Waterproofed Wall or Floor:
    a. Provide a watertight seal.
    b. Without Concrete Encasement: Install watertight entrance seal device on each side.
    c. With Concrete Encasement: Install watertight entrance seal device on accessible side.
    d. Securely anchor malleable iron body of watertight entrance seal device into construction with one or more integral flanges.
    e. Secure membrane waterproofing to watertight entrance seal device in a permanent, watertight manner.
3. Heating, Ventilating, and Air Conditioning Equipment:
    a. Penetrate equipment in area established by manufacturer.
    b. Terminate conduit with flexible nonmetallic conduit at junction box or condulet attached to exterior surface of equipment prior to penetrating equipment.
    c. Seal penetration with Type 5 sealant, as specified in Section 07 92 00, Joint Sealants.
    d. Seal penetration with one-part Polyurethane, Immersible:
        1) Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS or P, Class 25.
        2) Capable of being continuously immersed in water.

3) Manufacturers and Products for Nonsag:
a) Sika Chemical Corp.; Sikaflex-1a.
b) Tremco; Vulkem 116.
4) Manufacturers and Products for Self-leveling:
a) BASF; Sonneborn, SL-1.
b) Tremco; Vulkem 45.
c) Sika Chemical Corp.; Sikaflex 1c SL.

4. Corrosive-Sensitive Areas:
a. Seal conduit passing through chlorine and ammonia room walls.
b. Seal conduit entering equipment panel boards and field panels containing electronic equipment.
c. Seal penetration with one-part Polyurethane, Immersible:
1) Polyurethane base, single-component, moisture curing; ASTM C920, Type S, Grade NS or P, Class 25.
2) Capable of being continuously immersed in water.
3) Manufacturers and Products for Nonsag:
a) Sika Chemical Corp.; Sikaflex-1a.
b) Tremco; Vulkem 116.
4) Manufacturers and Products for Self-leveling:
a) BASF; Sonneborn, SL-1.
b) Tremco; Vulkem 45.
c) Sika Chemical Corp.; Sikaflex 1c SL.

5. Existing or Precast Wall (Underground): Core drill wall and install watertight entrance seal device.
6. Nonwaterproofed Wall or Floor (Underground, without Concrete Encasement):
a. Provide Schedule 40 galvanized pipe sleeve, or watertight entrance seal device.
b. Fill space between raceway and sleeve with expandable plastic compound or oakum and lead joint, on each side.
7. Manholes and Handholes:
a. Metallic Raceways: Provide insulated grounding bushings.
b. Nonmetallic Raceways: Provide bell ends flush with wall.
c. Install such that raceways enter as near as possible to one end of wall, unless otherwise shown.

3.07 SUPPORT

A. Support from structural members only, at intervals not exceeding NFPA 70 requirements. Do not exceed 10 feet in any application. Do not support from piping, pipe supports, or other raceways.

B. Multiple Adjacent Raceways: Provide ceiling trapeze. For trapeze-supported conduit, allow 20 percent extra space for future conduit.

C. Application/Type of Conduit Strap:

1. Aluminum Conduit: Aluminum or stainless steel.
2. PVC-Coated Rigid Steel or Aluminum Conduit: PVC-coated metal.
3. Nonmetallic Conduit: PVC-coated metal or stainless steel.

D. Provide and attach wall brackets, strap hangers, or ceiling trapeze as follows:

1. Wood: Wood screws.
2. Hollow Masonry Units: Toggle bolts.
3. Concrete or Brick: Expansion shields, or threaded studs driven in by powder charge, with lock washers and nuts.
4. Steelwork: Machine screws.
5. Location/Type of Hardware:
   a. Dry, Noncorrosive Areas: Stainless steel.
   b. Wet, Noncorrosive Areas: Stainless steel.
   c. Corrosive Areas: Stainless steel.

E. Nails or wooden plugs inserted in concrete or masonry for attaching raceway not permitted. Do not weld raceways or pipe straps to steel structures. Do not use wire in lieu of straps or hangers.

F. Support aluminum conduit on concrete surfaces with stainless steel or nonmetallic spacers, or aluminum or nonmetallic framing channel.

3.08 BENDS

A. Install concealed raceways with a minimum of bends in the shortest practical distance.

B. Make bends and offsets of longest practical radius. Bends in conduits and ducts being installed for fiber optic cables shall be not less than 20 times cable diameter, 15 inches minimum.

C. Install with symmetrical bends or cast metal fittings.

D. Avoid field-made bends and offsets, but where necessary, make with acceptable hickey or bending machine. Do not heat metal raceways to facilitate bending.

E. Make bends in parallel or banked runs from same center or centerline with same radius so that bends are parallel.

F. Factory elbows may be installed in parallel or banked raceways if there is change in plane of run, and raceways are same size.

G. PVC Conduit:

1. Bends 30 Degrees and Larger: Provide factory-made elbows.
2. 90-Degree Bends: Provide rigid steel or aluminum elbows, PVC-coated where direct buried.
3. Use manufacturer's recommended method for forming smaller bends.

H. Flexible Conduit: Do not make bends that exceed allowable conductor bending radius of cable to be installed or that significantly restricts conduit flexibility.

3.09 EXPANSION/DEFLECTION FITTINGS

A. Provide on raceways at structural expansion joints and in long tangential runs.

B. Provide expansion/deflection joints for 50 degrees F maximum temperature variation.

C. Install in accordance with manufacturer's instructions.

3.10 PVC CONDUIT

A. Solvent Welding:

1. Apply manufacturer recommended solvent to joints.
2. Install in order that joint is watertight.

B. Adapters:

1. PVC to Metallic Fittings: PVC terminal type.
2. PVC to Rigid Metal Conduit: PVC female adapter.

C. Belled-End Conduit: Bevel unbelled end of joint prior to joining.

3.11 PVC-COATED RIGID STEEL AND RIGID ALUMINUM CONDUIT

A. Install in accordance with manufacturer's instructions.

B. Tools and equipment used in cutting, bending, threading and installation of PVC-coated rigid conduit shall be designed to limit damage to PVC coating.

C. Provide PVC boot to cover exposed threading.

3.12 WIREWAYS

A. Install in accordance with manufacturer's instructions.

B. Locate with cover on accessible vertical face of wireway, unless otherwise shown.

C. Applications:

1. Metal wireway in indoor dry locations.
2. Nonmetallic wireway in indoor wet, outdoor, and corrosive locations.

3.13 TERMINATION AT ENCLOSURES

A. Cast Metal Enclosure: Install manufacturer's premolded insulating sleeve inside metallic conduit terminating in threaded hubs.

B. Nonmetallic, Cabinets, and Enclosures:

1. Terminate conduit in threaded conduit hubs, maintaining enclosure integrity.
2. Metallic Conduit: Provide ground terminal for connection to maintain continuity of ground system.

C. Sheet Metal Boxes, Cabinets, and Enclosures:

1. General:
   a. Install insulated bushing on ends of conduit where grounding is not required.
   b. Provide insulated throat when conduit terminates in sheet metal boxes having threaded hubs.
   c. Utilize sealing locknuts or threaded hubs on sides and bottom of NEMA 3R and NEMA 12 enclosures.
   d. Terminate conduits at threaded hubs at the tops of NEMA 3R and NEMA 12 boxes and enclosures.
   e. Terminate conduits at threaded conduit hubs at NEMA 4 and NEMA 4X boxes and enclosures.
2. Rigid Aluminum Conduit:
   a. Provide one lock nut each on inside and outside of enclosure.
   b. Install grounding bushing at source enclosure.
   c. Provide bonding jumper from grounding bushing to equipment ground bus or ground pad.
3. Flexible Metal Conduit: Provide two screw type, insulated, malleable iron connectors.
4. Flexible, Nonmetallic Conduit: Provide nonmetallic, liquid-tight strain relief connectors.

5. PVC-Coated Rigid Galvanized Steel or Aluminum Conduit: Provide PVC-coated, liquid-tight, metallic connector.
6. PVC Schedule 40 Conduit: Provide PVC terminal adapter with lock nut, except where threaded hubs required above.

D. Motor Control Center and Free-Standing Enclosures:

1. Terminate metal conduit entering bottom with grounding bushing; provide grounding jumper extending to equipment ground bus or grounding pad.
2. Terminate PVC conduit entering bottom with bell end fittings.

3.14 UNDERGROUND RACEWAYS

A. Grade: Maintain minimum grade of 4 inches in 100 feet, either from one manhole, handhole, or pull box to the next, or from a high point between them, depending on surface contour.

B. Cover: Maintain minimum 2-foot cover above conduit and concrete encasement, unless otherwise shown.

C. Make routing changes as necessary to avoid obstructions or conflicts.

D. Couplings: In multiple conduit runs, stagger so couplings in adjacent runs are not in same transverse line.

E. Union type fittings not permitted.

F. Spacers:

1. Provide preformed, nonmetallic spacers designed for such purpose, to secure and separate parallel conduit runs in a trench or concrete encasement.
2. Install at intervals not greater than that specified in NFPA 70 for support of the type conduit used, but in no case greater than 10 feet.

G. Support conduit so as to prevent bending or displacement during backfilling or concrete placement.

H. Transition from Underground to Exposed: PVC-coated rigid steel or aluminum conduit.

I. Installation with Other Piping Systems:

1. Crossings: Maintain minimum 12-inch vertical separation.
2. Parallel Runs: Maintain minimum 12-inch separation.
3. Installation over valves or couplings not permitted.

J. Metallic Raceway Coating: Along entire length, clean and paint in accordance with Section 09 90 04, Painting, apply wraparound duct band with one-half tape width overlap to obtain two complete layers or apply heat shrinkable tubing.

K. Provide expansion fittings that allow minimum of 4 inches of movement in vertical conduit runs from underground where exposed conduit will be fastened to or will enter building or structure.

L. Provide expansion/deflection fittings in conduit runs that exit building or structure belowgrade. Conduit from building wall to fitting shall be PVC-coated rigid steel.

M. Concrete Encasement:

1. As specified in Section 03 30 10, Structural Concrete.
2. Concrete Color: Top of ductbank dyed red while concrete is wet. Trial in red dyed to a minimum of 90 percent coverage of the ductbank.

N. Backfill:

1. As specified in Section 31 23 23.15, Trench Backfill. Controlled low strength fill is an acceptable bedding and pipe zone material.
2. Do not backfill until inspected by Engineer.

3.15 UNDER SLAB RACEWAYS

A. Make routing changes as necessary to avoid obstructions or conflicts.

B. Support raceways so as to prevent bending or displacement during backfilling or concrete placement.

C. Install raceways with no part embedded within slab and with no interference with slab on grade construction.

D. Raceway spacing, in a single layer or multiple layers:

1. 3 inches clear between adjacent 2-inch or larger raceway.
2. 2 inches clear between adjacent 1-1/2-inch or smaller raceway.

E. Multiple Layers of Raceways: Install under slab on grade in trench below backfill zone, as specified in Section 31 23 23.15, Trench Backfill.

F. Individual Raceways and Single Layer Multiple Raceways: Install at lowest elevation of backfill zone with spacing as specified herein. Where conduits cross at perpendicular orientation, installation of conduits shall not interfere with placement of under slab fill that meets compaction and void limitations of earthwork specifications.

G. Under slab raceways that emerge from below slab to top of slab as exposed, shall be located to avoid conflicts with structural slab rebar. Coordinate raceway stub ups with location of structural rebar.

H. Fittings:

1. Union type fittings are not permitted.
2. Provide expansion/deflection fittings in raceway runs that exit building or structure below slab. Locate fittings 18 inches, maximum, beyond exterior wall. Raceway type between building exterior wall to fitting shall be PVC-coated rigid steel.
3. Couplings: In multiple raceway runs, stagger so couplings in adjacent runs are not in same traverse line.

3.16 OUTLET AND DEVICE BOXES

A. General:

1. Install plumb and level.
2. Install suitable for conditions encountered at each outlet or device in wiring or raceway system, sized to meet NFPA 70 requirements.
3. Open no more knockouts in sheet steel device boxes than are required; seal unused openings.
4. Install galvanized mounting hardware in industrial areas.

B. Size:

1. Depth: Minimum 2 inches, unless otherwise required by structural conditions. Box extensions not permitted.
   a. Hollow Masonry Construction: Install with sufficient depth such that conduit knockouts or hubs are in masonry void space.
2. Ceiling Outlet: Minimum 4-inch octagonal device box, unless otherwise required for installed fixture.
3. Switch and Receptacle: Minimum 2-inch by 4-inch device box.

C. Locations:

1. Drawing locations are approximate.
2. To avoid interference with mechanical equipment or structural features, relocate outlets as directed by Engineer.
3. Light Fixture: Install in symmetrical pattern according to room layout, unless otherwise shown.

D. Mounting Height:

1. General:
   a. Dimensions given to centerline of box.
   b. Where specified heights do not suit building construction or finish, adjust up or down to avoid interference.
   c. Do not straddle CMU block or other construction joints.
2. Light Switch:
   a. 48 inches above floor.
   b. When located next to door, install on lock side of door.
3. Convenience Receptacle:
   a. General Interior Areas: 15 inches above floor.
   b. General Interior Areas (Counter Tops): Install device plate bottom or side flush with top of backsplash, or 6 inches above counter tops without backsplash.
   c. Industrial Areas, Workshops: 48 inches above floor.
   d. Outdoor Areas: 24 inches above finished grade.
4. Special-Purpose Receptacle: 15 inches above floor or as shown.
5. Switch, Motor Starting: 48 inches above floor, unless otherwise indicated on Drawings.

E. Flush Mounted:

1. Install with concealed conduit.
2. Install proper type extension rings or plaster covers to make edges of boxes flush with finished surface.
3. Holes in surrounding surface shall be no larger than required to receive box.

F. Supports:

1. Support boxes independently of conduit by attachment to building structure or structural member.
2. Install bar hangers in frame construction or fasten boxes directly as follows:
   a. Wood: Wood screws.
   b. Concrete or Brick: Bolts and expansion shields.
   c. Hollow Masonry Units: Toggle bolts.
   d. Steelwork: Machine screws.
3. Threaded studs driven in by powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.
4. Provide plaster rings where necessary.
5. Boxes embedded in concrete or masonry need not be additionally supported.

G. Install separate junction boxes for flush or recessed lighting fixtures where required by fixture terminal temperature.

H. Boxes Supporting Fixtures: Provide means of attachment with adequate strength to support fixture.

3.17 JUNCTION AND PULL BOXES

A. General:

1. Install plumb and level.
2. Installed boxes shall be accessible.
3. Do not install on finished surfaces.
4. Use outlet boxes as junction and pull boxes wherever possible and allowed by applicable codes.
5. Use conduit bodies as junction and pull boxes where no splices are required and allowed by applicable codes.
6. Install pull boxes where necessary in raceway system to facilitate conductor installation.
7. Install where shown and where necessary to terminate, tap-off, or redirect multiple conduit runs.
8. Install in conduit runs at least every 150 feet or after the equivalent of three right-angle bends.

B. Flush Mounted:

1. Install with concealed conduit.
2. Holes in surrounding surface shall be no larger than required to receive box.
3. Make edges of boxes flush with final surface.

C. Mounting Hardware:

1. Noncorrosive Dry Areas: Stainless steel.
2. Noncorrosive Wet Areas: Stainless steel.
3. Corrosive Areas: Stainless steel.

D. Supports:

1. Support boxes independently of conduit by attachment to building structure or structural member.
2. Install bar hangers in frame construction or fasten boxes directly as follows:
   a. Wood: Wood screws.
   b. Concrete or Brick: Bolts and expansion shields.
   c. Hollow Masonry Units: Toggle bolts.
   d. Steelwork: Machine screws.

3. Threaded studs driven in by powder charge and provided with lock washers and nuts are acceptable in lieu of expansion shields.
4. Boxes embedded in concrete or masonry need not be additionally supported.

E. At or Below Grade:

1. Install boxes for below grade conduit flush with finished grade in locations outside of paved areas, roadways, or walkways.
2. If adjacent structure is available, box may be mounted on structure surface just above finished grade in accessible but unobtrusive location.
3. Obtain Engineer's written acceptance prior to installation in paved areas, roadways, or walkways.
4. Use boxes and covers suitable to support anticipated weights.

F. Install Drain/breather fittings in NEMA 250 Type 4 and Type 4X enclosures.

3.18 MANHOLES AND HANDHOLES

A. Excavate, shore, brace, backfill, and final grade in accordance with Section 31 23 16, Excavation, and Section 31 23 23.15, Trench Backfill.

B. Do not install until final raceway grading has been determined.

C. Install such that raceway enters at nearly right angle and as near as possible to end of wall, unless otherwise shown.

D. Grounding: As specified in Section 26 05 26, Grounding and Bonding for Electrical Systems.

E. Identification: Field stamp covers with manhole or handhole number as shown. Stamped numbers to be 1-inch minimum height.

3.19 EMPTY RACEWAYS

A. Provide permanent, removable cap over each end.

B. Provide PVC plug with pull tab for underground raceways with end bells.

C. Provide nylon pull cord.

D. Identify, as specified in Article Identification Devices, with waterproof tags attached to pull cord at each end, and at intermediate pull point.

3.20 IDENTIFICATION DEVICES

A. Raceway Tags:

1. Identify origin and destination.
2. For exposed raceways, install tags at each terminus, near midpoint, and at minimum intervals of every 50 feet, whether in ceiling space or surface mounted.
3. Install tags at each terminus for concealed raceways.
4. Provide stainless steel wire for attachment.

B. Warning Tape: Install approximately 12 inches above underground or concrete-encased raceways. Align parallel to, and within 12 inches of, centerline of run.

C. Buried Raceway Marker:

1. Install at grade to indicate direction of underground raceway.
2. Install at bends and at intervals not exceeding 100 feet in straight runs.
3. Embed and secure to top of concrete base, sized 14 inches long, 6 inches wide, and 8 inches deep; top set flush with finished grade.

3.21 PROTECTION OF INSTALLED WORK

A. Protect products from effects of moisture, corrosion, and physical damage during construction.

B. Provide and maintain manufactured watertight and dust-tight seals over conduit openings during construction.

C. Touch up painted conduit threads after assembly to cover nicks or scars.

D. Touch up coating damage to PVC-coated conduit with patching compound approved by manufacturer. Compound shall be kept refrigerated according to manufacturers' instructions until time of use.

END OF SECTION

SECTION 26 05 70
ELECTRICAL SYSTEMS ANALYSIS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI).
2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C57.12.00, Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers.
   b. 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
   c. 399, Recommended Practice for Industrial and Commercial Power System Analysis.

1.02 SUBMITTALS

A. Action Submittals: Provide five copies of study in hard cover, three-ring binders, to include:

1. Short circuit study.
2. Protective Device Coordination Study.
3. Arc Flash Study.
4. Arc Flash Warning Labels.

1.03 QUALITY ASSURANCE

A. Short circuit and protective device coordination studies shall be prepared by the manufacturer furnishing the major electrical equipment or a professional electrical engineer registered in the State of Florida, in accordance with IEEE 242 and IEEE 399.

B. The studies shall be prepared by a professional Engineer registered in the State of Florida. That Engineer shall sign and seal all submittals, including preliminary and final.

1.04 SPECIAL PROJECT REQUIREMENTS

A. The complete short circuit, protective device coordination and arc-flash studies must be submitted, reviewed, and approved before the Engineer will approve any Shop Drawings for electrical equipment with short circuit interrupting or withstand ratings. It is imperative that the Electrical Subcontractor begin this work immediately after award of the contract. This task requires extensive

coordination and work with numerous vendors. Failure of the Electrical Subcontractor to provide the completed short circuit, protective device coordination and arc-flash studies before any Shop Drawings for any major electrical equipment will result in rejecting the Shop Drawings without review.

1.05 SEQUENCING AND SCHEDULING

A. Complete short circuit, protective device coordination and arc-flash studies must be submitted, reviewed, and approved before Engineer will approve Shop Drawings for panelboards and control panels.

B. The short circuit, protective device coordination, and arc-flash studies shall be updated prior to Project Substantial Completion. Utilize characteristics of as-installed equipment and materials.

C. Submit final arc flash labels described herein and in compliance with NEMA Z535.4 prior to project substantial completion.

1.06 GENERAL

A. Equipment and component titles used in the studies shall be identical to the equipment and component titles shown on the Drawings.

B. Perform studies using digital computer (i.e., SKM software) and verify results with handwritten computations.

C. Perform complete phase and ground fault calculations for each existing and proposed source combination.

D. Source combination may include present and future power company supply circuits, large motors, or generators. Obtain and verify with the power company in writing all information needed to conduct this study. Provide this correspondence and information including contacts and phone numbers with the study submittal.

E. Utilize proposed and existing load data for the study obtained from Contract Documents, Owner as-built record drawings, and from field investigation of system configuration, wiring information, and equipment.

F. Existing System and Equipment:

1. Extent of existing system to be included in study is limited to system elements that affect new system and equipment.
2. Include fault contribution of existing motors in the study.
3. Include impedance elements that affects new system and equipment.
4. Include protective devices in series with new equipment.
5. Obtain required existing equipment data.

G. Device coordination time-current curves for medium and low voltage distribution system(s); include: Individual protective device time-current characteristics.

1.07 SHORT CIRCUIT STUDY

A. General:

1. Prepare in accordance with IEEE 399.
2. Use cable impedances based on copper conductors.
3. Use bus impedances based on copper bus bars.
4. Use cable and bus resistances calculated at 25 degrees C.
5. Use medium voltage cable reactances based on use of typical dimensions of shielded cables with 133 percent insulation levels.
6. Use 600-volt cable reactances based on use of typical dimensions of THHN/THWN and XHHW conductors.
7. Use transformer impedances 92.5 percent of "nominal" impedance based on tolerances specified in IEEE C57.12.00.

B. Provide:

1. Calculation methods and assumptions.
2. Selected base per unit quantities.
3. One-line diagrams.
4. Source impedance data, including electric utility system and motor fault contribution characteristics.
5. Impedance diagrams.
6. Zero sequence impedance diagrams.
7. Typical calculation.
8. Tabulations of calculated quantities.
9. Results, conclusions, and recommendations.

C. Calculate short circuit interrupting and momentary (when applicable) duties for an assumed three-phase bolted fault at each:

1. Motor control centers in Dewatering Building and Electrical and Storage Building.
2. All branch circuit panelboards.
3. Other significant locations throughout the system.
4. Future load contributions as shown on one-line diagram.

D. Provide bolted line-to-ground fault current study for areas as defined for three-phase bolted fault short circuit study.

E. Provide bolted line-to-line fault current study for areas as defined for three-phase bolted fault short circuit study.

F. Verify:

1. Equipment and protective devices are applied within their ratings.
2. Adequacy of pad-mounted switchgear, unit substations, motor control centers, and panelboards bus bars to withstand short circuit stresses.
3. Adequacy of transformer windings to withstand short circuit stresses.
4. Cable and busway sizes for ability to withstand short circuit heating, besides normal load currents.

G. Tabulations:

1. General Data:
   a. Short circuit reactances of rotating machines.
   b. Cable and conduit material data.
   c. Bus data.
   d. Transformer data.
   e. Circuit resistance and reactance values.
2. Short Circuit Data (for each source combination):
   a. Fault impedances.
   b. X to R ratios.
   c. Asymmetry factors.
   d. Motor contributions.
   e. Short circuit kVA.
   f. Symmetrical and asymmetrical fault currents.
3. Equipment Evaluation:
   a. Equipment bus bracing, equipment short circuit rating, transformer, cable, busway.
   b. Maximum fault current available.

H. Written Summary:

1. Scope of studies performed.
2. Explanation of bus and branch numbering system.
3. Prevailing conditions.
4. Selected equipment deficiencies.
5. Results of short circuit study.
6. Comments or suggestions.

I. Suggest changes and additions to equipment rating and/or characteristics.

J. Notify Engineer in writing of existing circuit protective devices improperly rated for new fault conditions.

K. Revise data for “as-installed” condition.

1.08 PROTECTIVE DEVICE COORDINATION STUDY

A. Prepare in accordance with IEEE 242.

B. Proposed protective device coordination time-current curves for distribution system, graphically displayed on conventional log-log curve sheets.

C. Provide separate curve sheets for phase and ground fault coordination for each scenario.

D. Each curve sheet to have title and one-line diagram that applies to specific portion of system associated with time-current curves on that sheet. Limit number of devices show to six.

E. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fault current to which device is exposed.

F. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, instantaneous and other settings recommended.

G. Apply motor protection methods that comply with NFPA 70.

H. Plot Characteristics on Curve Sheets:

1. Low voltage equipment circuit breaker trip devices, including manufacturers tolerance bands.
2. Low-voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands.
3. Pertinent transformer full-load currents at 100 and 600 percent.
4. Transformer magnetizing inrush currents.
5. Transformer damage curves.
6. ANSI transformer withstand parameters.
7. Significant symmetrical and asymmetrical fault currents.
8. Ground fault protective device settings.
9. Motor overload relay settings.
10. Other system load protective devices for largest branch circuit and feeder circuit breaker in each motor control center.

I. Primary Protective Device Settings for Delta-Wye Connected Transformer:

1. Secondary Line-to-Ground Fault Protection: Primary protective device operating band within the transformer's characteristics curve, including a point equal to 58 percent of IEEE C57.12.00 withstand point.
2. Secondary Line-To-Line Faults: 16 percent current margin between primary protective device and associated secondary device characteristic curves.

J. Tabulate Recommended Protective Device Settings:

1. Relays:
   a. Current tap.
   b. Time dial.
   c. Instantaneous pickup.
   d. Electronic settings data file.
2. Circuit Breakers:
   a. Adjustable pickups.
   b. Adjustable time-current characteristics.
   c. Adjustable time delays.
   d. Adjustable instantaneous pickups.
   e. I^2t In/Out.
   f. Electronic settings data file.

K. Written Summary:

1. Scope of studies performed.
2. Summary of protective device coordination methodology.
3. Prevailing conditions.
4. Selected equipment deficiencies.
5. Results of coordination study.
6. Appendix of complete relay and circuit breaker electronic setting files, submit electronic data files from manufacturer's software.
7. Comments or suggestions.

1.09 ARC FLASH STUDY

A. Perform arc flash hazard study after short circuit and protective device coordination study has been completed.

B. Perform arc flash study in accordance with NFPA 70E, OSHA 29 CFR, Part 1910 Subpart S, and IEEE 1584.

C. Base Calculation: For each major part of the electrical power system, determine the following:

1. Arc Flash Hazard:
   a. Arc flash hazard protective boundary.
   b. Incident energy level.
   c. Working distance.
2. Shock Hazard:
   a. Limited approach boundary.
   b. Restricted approach boundary.
   c. Prohibited approach boundary.
   d. Bus voltage.
   e. Glove class.

D. Produce arc flash warning labels that list items in Paragraph Base Calculation and the following additional items.

1. Bus name.
2. Calculation method.
3. Label expiration date.
4. Reference to NFPA 70E for PPE requirements.

E. Produce bus detail sheets that list items in Paragraph Base Calculation and the following additional items:

1. Bus name.
2. Upstream protective device name, type, and settings.
3. Bus line to line voltage.

F. Produce arc flash evaluation summary sheet listing the following additional items:

1. Bus name.
2. Upstream protective device name, type, settings.
3. Bus line to line voltage.
4. Bus bolted fault.
5. Protective device bolted fault current.
6. Arcing fault current.
7. Protective device trip/delay time.
8. Breaker opening time.
9. Solidly grounded column.
10. Equipment type.
11. Gap.
12. Arc flash boundary.
13. Working distance.
14. Incident energy.
15. Required protective arc rated clothing type and class.
16. Table of required PPE.

G. Analyze short circuit, protective device coordination, and arc flash calculations and highlight equipment that is determined to be underrated or causes incident energy values greater than 40 cal/cm^2. Propose approaches to reduce the energy levels.

H. Prepare a report summarizing the arc flash study with conclusions and recommendations which may affect the integrity of electric power distribution system. As a minimum, include the following in the report:

1. Equipment manufacturer’s information used to prepare study.
2. Assumptions made during study.
3. Reduced copy of one-line drawing; 11 inches by 17 inches maximum.

4. Arc flash evaluations summary spreadsheet.
5. Bus detail sheets.
6. Arc flash warning labels printed in color on adhesive backed labels.

PART 2 PRODUCTS

2.01 ARC FLASH WARNING LABELS

A. Printed in multi-color on adhesive backed labels or laminated plastic and be riveted on equipment.

PART 3 EXECUTION

3.01 GENERAL

A. Adjust relay and protective device settings according to values established by coordination study.

B. Make minor modifications to equipment as required to accomplish conformance with the short circuit and protective device coordination studies.

C. Notify Engineer in writing of any required major equipment modifications.

D. If the thermal magnetic circuit breaker characteristic curves cannot be separated by the minimum 0.4-second time margin, the circuit breakers shall be replaced with electronic trip circuit breakers to activate the required separation.

E. Provide laminated one-line diagrams (minimum size 11 inches by 17 inches) to post on interior of electrical room.

F. Provide arc-flash warning labels on equipment as specified in this section.

END OF SECTION

SECTION 26 08 00
COMMISSIONING OF ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D877/D877M, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using Disk Electrodes.
   b. D923, Standard Practices for Sampling Electrical Insulating Liquids.
   c. D924, Standard Test Method for Dissipation Factor (or Power Factor) and Relative Permittivity (Dielectric Constant) of Electrical Insulating Liquids.
   d. D971, Standard Test Method for Interfacial Tension of Oil Against Water by the Ring Method.
   e. D974, Standard Test Method for Acid and Base Number by Color-Indicator Titration.
   f. D1298, Standard Test Method for Density, Relative Density, or API Gravity of Crude Petroleum and Liquid Petroleum Products by Hydrometer Method.
   g. D1500, Standard Test Method for ASTM Color of Petroleum Products (ASTM Color Scale).
   h. D1524, Standard Test Method for Visual Examination of Used Electrical Insulating Liquids in the Field.
   i. D1533, Standard Test Method for Water in Insulating Liquids by Coulometric Karl Fischer Titration.
   j. D1816, Standard Test Method for Dielectric Breakdown Voltage of Insulating Liquids Using VDE Electrodes.
2. Institute of Electrical and Electronics Engineers (IEEE):
   a. 43, Recommended Practice for Testing Insulation Resistance of Electric Machinery.
   b. 48, Standard Test Procedures and Requirements for Alternating-Current Cable Terminators Used on Shielded Cables Having Laminated Insulation Rated 2.5 kV through 765 kV or Extruded Insulation Rated 2.5 kV through 500 kV.
   c. 81, Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Ground System.
   d. 95, Recommended Practice for Insulation Testing of AC Electric Machinery (2300V and Above) with High Direct Voltage.
   e. 386, Standard for Separable Insulated Connector Systems for Power Distribution Systems Above 600V.

f. 400, Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above.
g. 450, Recommended Practice for Maintenance, Testing, and Replacement of Vented Lead-Acid Batteries for Stationary Applications.
h. C2, National Electrical Safety Code.
i. C37.20.1, Standard for Metal-Enclosed Low-Voltage (1000 Vac and below, 3200 Vdc and below) Power Circuit Breaker Switchgear.
j. C37.20.2, Standard for Metal-Clad Switchgear.
k. C37.20.3, Standard for Metal-Enclosed Interrupter Switchgear.
l. C37.23, Standard for Metal-Enclosed Bus.
m. C62.33, Standard Test Methods and Performance Values for Metal-Oxide Varistor Surge Protective Components.

3. Insulated Cable Engineers Association (ICEA):
   a. S-93-639, 5-46 kV Shielded Power Cables for Use in the Transmission and Distribution of Electric Energy.
   b. S-94-649, Concentric Neutral Cables Rated 5 through 46 kV.
   c. S-97-682, Standard for Utility Shielded Power Cables Rated 5 through 46 kV.
4. National Electrical Manufacturers Association (NEMA):
   a. AB 4, Guidelines for Inspection and Preventive Maintenance of Molded Case Circuit Breakers Used in Commercial and Industrial Applications.
   b. PB 2, Deadfront Distribution Switchboards.
   c. WC 74, 5-46 kV Shielded Power Cable for Use in the Transmission and Distribution of Electric Energy.
5. InterNational Electrical Testing Association (NETA): ATS, Acceptance Testing Specifications for Electrical Power Equipment and Systems.
6. National Fire Protection Association (NFPA):
   a. 70, National Electrical Code (NEC).
   b. 70B, Recommended Practice for Electrical Equipment Maintenance.
   c. 70E, Standard for Electrical Safety in the Workplace.
   d. 101, Life Safety Code.
7. National Institute for Certification in Engineering Technologies (NICET).
8. Occupational Safety and Health Administration (OSHA): CFR 29, Part 1910, Occupational Safety and Health Standards.

1.02 SUBMITTALS

A. Informational Submittals:

1. Submit 30 days prior to performing inspections or tests:
   a. Schedule for performing inspection and tests.
   b. List of references to be used for each test.
   c. Sample copy of equipment and materials inspection form(s).

d. Sample copy of individual device test form.
e. Sample copy of individual system test form.

2. Energization Plan: Prior to initial energization of electrical distribution equipment; include the following:
   a. Owner's representative sign-off form for complete and accurate arc flash labeling and proper protective device settings for equipment to be energized.
   b. Staged sequence of initial energization of electrical equipment.
   c. Lock-Out-Tag-Out plan for each stage of the progressive energization.
   d. Barricading, signage, and communication plan notifying personnel of newly energized equipment.
3. Submit test or inspection reports and certificates for each electrical item tested within 30 days after completion of test:
4. Operating and Maintenance Data:
   a. In accordance with Section 01730, Operating and Maintenance Data.
   b. After test or inspection reports and certificates have been reviewed by Engineer and returned, insert a copy of each in Operation and Maintenance Manual.
5. Programmable Settings: At completion of Performance Demonstration Test, submit final hardcopy printout and electronic files on compact disc of as-left setpoints, programs, and device configuration files for:
   a. Protective relays.
   b. Intelligent overload relays.
   c. Adjustable frequency drives.
   d. Power metering devices.
   e. Uninterruptible power supplies.
   f. Electrical communications modules.

1.03 QUALITY ASSURANCE

A. Testing Firm Qualifications:

1. Corporately and financially independent organization functioning as an unbiased testing authority.
2. Professionally independent of manufacturers, suppliers, and installers of electrical equipment and systems being tested.
3. Employer of engineers and technicians regularly engaged in testing and inspecting of electrical equipment, installations, and systems.
4. Supervising engineer accredited as Certified Electrical Test Technologist by NICET or NETA and having a minimum of 5 years' testing experience on similar projects.
5. Technicians certified by NICET or NETA.
6. Assistants and apprentices assigned to Project at ratio not to exceed two certified to one noncertified assistant or apprentice.

7. Registered Professional Engineer to provide comprehensive Project report outlining services performed, results of such services, recommendations, actions taken, and opinions.
8. In compliance with OSHA CFR 29, Part 1910.7 criteria for accreditation of testing laboratories or a full member company of NETA.

B. Test equipment shall have an operating accuracy equal to or greater than requirements established by NETA ATS.

C. Test Instrument Calibration: In accordance with NETA ATS.

1.04 SEQUENCING AND SCHEDULING

A. Perform inspection and electrical tests after equipment listed herein has been installed.

B. Perform tests with apparatus de-energized whenever feasible.

1. Scheduled with Owner prior to de-energization.
2. Minimized to avoid extended period of interruption to the operating plant equipment.

C. Notify Owner at least 24 hours prior to performing tests on energized electrical equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Perform tests in accordance with requirements of Section 01 91 14, Equipment Testing and Facility Startup.

B. Tests and inspections shall establish:

1. Electrical equipment is operational within industry and manufacturer's tolerances and standards.
2. Installation operates properly.
3. Equipment is suitable for energization.
4. Installation conforms to requirements of Contract Documents and NFPA 70, NFPA 70E, NFPA 101, and IEEE C2.

C. Perform inspection and testing in accordance with NETA ATS, industry standards, and manufacturer's recommendations.

D. Set, test, and calibrate protective relays, circuit breakers, fuses and other applicable devices in accordance with values established by short circuit, and coordination, studies as specified in Section 26 05 70, Electrical Systems Analysis.

E. Adjust mechanisms and moving parts of equipment for free mechanical movement.

F. Adjust and set electromechanical electronic relays and sensors to correspond to operating conditions, or as recommended by manufacturer.

G. Verify nameplate data for conformance to Contract Documents and approved Submittals.

H. Realign equipment not properly aligned and correct unlevelness.

I. Properly anchor electrical equipment found to be inadequately anchored.

J. Tighten accessible bolted connections, including wiring connections, with calibrated torque wrench/screw driver to manufacturer's recommendations, or as otherwise specified in NETA ATS.

K. Clean contaminated surfaces with cleaning solvents as recommended by manufacturer.

L. Provide proper lubrication of applicable moving parts.

M. Inform Engineer of working clearances not in accordance with NFPA 70.

N. Investigate and repair or replace:

1. Electrical items that fail tests.
2. Active components not operating in accordance with manufacturer's instructions.
3. Damaged electrical equipment.

O. Electrical Enclosures:

1. Remove foreign material and moisture from enclosure interior.
2. Vacuum and wipe clean enclosure interior.
3. Remove corrosion found on metal surfaces.
4. Repair or replace, as determined by Engineer door and panel sections having dented surfaces.
5. Repair or replace, as determined by Engineer poor fitting doors and panel sections.
6. Repair or replace improperly operating latching, locking, or interlocking devices.

7. Replace missing or damaged hardware.
8. Finish:
    a. Provide matching paint and touch up scratches and mars.
    b. If required because of extensive damage, as determined by Engineer, refinish entire assembly.

P. Replace fuses and circuit breakers that do not conform to size and type required by the Contract Documents or approved Submittals.

3.02 CHECKOUT AND STARTUP

A. Voltage Field Test:

1. Check voltage at point of termination of power company supply system to Project when installation is essentially complete and is in operation.
2. Check voltage amplitude and balance between phases for loaded and unloaded conditions.
3. Record supply voltage (all three phases simultaneously on same graph) for 24 hours during normal working day.
    a. Submit Voltage Field Test Report within 5 days of test.
4. Unbalance Corrections:
    a. Make written request to power company to correct condition if balance (as defined by NEMA) exceeds 1 percent, or if voltage varies throughout the day and from loaded to unloaded condition more than plus or minus 4 percent of nominal.
    b. Obtain written certification from responsible power company official that voltage variations and unbalance are within their normal standards if corrections are not made.

B. Equipment Line Current Tests:

1. Check line current in each phase for each piece of equipment.
2. Make line current check after power company has made final adjustments to supply voltage magnitude or balance.
3. If phase current for a piece of equipment is above rated nameplate current, prepare Equipment Line Phase Current Report that identifies cause of problem and corrective action taken.

3.03 PANELBOARDS

A. Visual and Mechanical Inspection: Include the following inspections and related work:

1. Inspect for defects and physical damage, labeling, and nameplate compliance with requirements of up-to-date drawings and panelboard schedules.

2. Exercise and perform operational tests of mechanical components and other operable devices in accordance with manufacturer's instruction manual.
3. Check panelboard mounting, area clearances, and alignment and fit of components.
4. Check tightness of bolted electrical connections with calibrated torque wrench. Refer to manufacturer's instructions for proper torque values.
5. Perform visual and mechanical inspection for overcurrent protective devices.

B. Electrical Tests: Include the following items performed in accordance with manufacturer's instruction:

1. Insulation Resistance Tests:
   a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
   b. Each phase of each bus section.
   c. Phase-to-phase and phase-to-ground for 1 minute.
   d. With breakers open.
   e. With breakers closed.
   f. Control wiring except that connected to solid state components.
   g. Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
2. Ground continuity test ground bus to system ground.

3.04 DRY TYPE TRANSFORMERS

A. Visual and Mechanical Inspection:

1. Physical and insulator damage.
2. Proper winding connections.
3. Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.
4. Defective wiring.
5. Proper operation of fans, indicators, and auxiliary devices.
6. Removal of shipping brackets, fixtures, or bracing.
7. Free and properly installed resilient mounts.
8. Cleanliness and improper blockage of ventilation passages.
9. Verify tap-changer is set at correct ratio for rated output voltage under normal operating conditions.
10. Verify proper secondary voltage phase-to-phase and phase-to-ground after energization and prior to loading.

B. Electrical Tests:

1. Insulation Resistance Tests:
   a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.5 for each:
      1) Winding-to-winding.
      2) Winding-to-ground.
   b. Test Duration: 10 minutes with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
   c. Results temperature corrected in accordance with NETA ATS, Table 100.14.
   d. Temperature corrected insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
   e. Insulation resistance test results to compare within 1 percent of adjacent windings.
2. Perform tests and adjustments for fans, controls, and alarm functions as suggested by manufacturer.

3.05 LOW VOLTAGE CABLES, 600 VOLTS MAXIMUM

A. Visual and Mechanical Inspection:

1. Inspect each individual exposed power cable No. 6 and larger for:
   a. Physical damage.
   b. Proper connections in accordance with single-line diagram.
   c. Cable bends not in conformance with manufacturer's minimum allowable bending radius where applicable.
   d. Color coding conformance with specification.
   e. Proper circuit identification.
2. Mechanical Connections for:
   a. Proper lug type for conductor material.
   b. Proper lug installation.
   c. Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.
3. Shielded Instrumentation Cables for:
   a. Proper shield grounding.
   b. Proper terminations.
   c. Proper circuit identification.
4. Control Cables for:
   a. Proper termination.
   b. Proper circuit identification.
5. Cables Terminated Through Window Type CTs: Verify neutrals and grounds are terminated for correct operation of protective devices.

B. Electrical Tests for Conductors No. 6 and Larger:

1. Insulation Resistance Tests:
   a. Utilize 1,000-volt dc megohmmeter for 600-volt insulated conductors.
   b. Test each conductor with respect to ground and to adjacent conductors for 1 minute.
   c. Evaluate ohmic values by comparison with conductors of same length and type.
   d. Investigate values less than 50 megohms.
2. Continuity test by ohmmeter method to ensure proper cable connections.

3.06 SAFETY SWITCHES, 600 VOLTS MAXIMUM

A. Visual and Mechanical Inspection:

1. Proper blade pressure and alignment.
2. Proper operation of switch operating handle.
3. Adequate mechanical support for each fuse.
4. Proper contact-to-contact tightness between fuse clip and fuse.
5. Cable connection bolt torque level in accordance with NETA ATS, Table 100.12.
6. Proper phase barrier material and installation.
7. Verify fuse sizes and types correspond to one-line diagram or approved Submittals.
8. Perform mechanical operational test and verify mechanical interlocking system operation and sequencing.

B. Electrical Tests:

1. Insulation Resistance Tests:
   a. Applied megohmmeter dc voltage in accordance with NETA ATS, Table 100.1.
   b. Phase-to-phase and phase-to-ground for 1 minute on each pole.
   c. Insulation resistance values equal to, or greater than, ohmic values established by manufacturer.
2. Contact Resistance Tests:
   a. Contact resistance in microhms across each switch blade and fuse holder.
   b. Investigate deviation of 50 percent or more from adjacent poles or similar switches.

3.07 MOLDED AND INSULATED CASE CIRCUIT BREAKERS

A. General: Inspection and testing limited to circuit breakers rated 60 amperes and larger and to motor circuit protector breakers rated 40 amperes and larger.

B. Visual and Mechanical Inspection:

1. Proper mounting.
2. Proper conductor size.
3. Feeder designation according to nameplate and one-line diagram.
4. Cracked casings.
5. Connection bolt torque level in accordance with NETA ATS, Table 100.12.
6. Operate breaker to verify smooth operation.
7. Compare frame size and trip setting with circuit breaker schedules or one-line diagram.
8. Verify that terminals are suitable for 75 degrees C rated insulated conductors.

C. Electrical Tests:

1. Insulation Resistance Tests:
   a. Utilize 1,000-volt dc megohmmeter for 480-volt and 600-volt circuit breakers and 500-volt dc megohmmeter for 240-volt circuit breakers.
   b. Pole-to-pole and pole-to-ground with breaker contacts opened for 1 minute.
   c. Pole-to-pole and pole-to-ground with breaker contacts closed for 1 minute.
   d. Test values to comply with NETA ATS, Table 100.1.
2. Contact Resistance Tests:
   a. Contact resistance in microhms across each pole.
   b. Investigate deviation of 50 percent or more from adjacent poles and similar breakers.
3. Primary Current Injection Test to Verify:
   a. Long-time minimum pickup and delay.
   b. Short-time pickup and delay.
   c. Ground fault pickup and delay.
   d. Instantaneous pickup by run-up or pulse method.
   e. Trip characteristics of adjustable trip breakers shall be within manufacturer's published time-current characteristic tolerance band, including adjustment factors.
   f. Trip times shall be within limits established by NEMA AB 4, Table 5-3. Alternatively, use NETA ATS, Table 100.7.
   g. Instantaneous pickup value shall be within values established by NEMA AB 4, Table 5-4. Alternatively, use NETA ATS, Table 100.8.

3.08 PROTECTIVE RELAYS

A. Visual and Mechanical Inspection:

1. Visually check each relay for:
   a. Tight cover gasket and proper seal.
   b. Unbroken cover glass.

c. Condition of spiral spring and contacts.
d. Disc clearance.
e. Condition of case shorting contacts if present.

2. Mechanically check each relay for:
   a. Freedom of movement.
   b. Proper travel and alignment.
3. Verify each relay:
   a. Complies with Contract Documents, approved Submittal, and application.
   b. Is set in accordance with recommended settings from Coordination Study.

B. Electrical Tests:

1. Insulation resistance test on each circuit to frame, except for solid state devices.
2. Test on nominal recommended setting for:
   a. Pickup parameters on each operating element.
   b. Timing at three points on time-current curve.
   c. Pickup target and seal-in units.
   d. Special tests as required to check operation of restraint, directional, and other elements in accordance with manufacturer's instruction manual.
3. Phase angle and magnitude contribution tests on differential and directional relays after energization to vectorially verify proper polarity and connections.
4. Current Injection Tests:
   a. For entire current circuit in each section.
   b. Secondary injection for current flow of 1 ampere.
   c. Test current at each device.

3.09 INSTRUMENT TRANSFORMERS

A. Visual and Mechanical Inspection:

1. Visually check current, potential, and control transformers for:
   a. Cracked insulation.
   b. Broken leads or defective wiring.
   c. Proper connections.
   d. Adequate clearances between primary and secondary circuit wiring.
2. Verify Mechanically:
   a. Grounding and shorting connections have good contact.
   b. Withdrawal mechanism and grounding operation, when applicable, operate properly.
3. Verify proper primary and secondary fuse sizes for potential transformers.

B. Electrical Tests:

1. Current Transformer Tests:
   a. Insulation resistance test of transformer and wiring-to-ground at 1,000 volts dc for 30 seconds.
   b. Polarity test.
   c. Ratio and accuracy test.
2. Potential Transformer Tests:
   a. Insulation resistance test at test voltages in accordance with NETA ATS, Table 100.9, for 1 minute on:
      1) Winding-to-winding.
      2) Winding-to-ground.
   b. Polarity test to verify polarity marks or H1-X1 relationship as applicable.
   c. Ratio and accuracy test.
3. Insulation resistance measurement on instrument transformer shall not be less than that shown in NETA ATS, Table 100.5.

3.10 METERING

A. Visual and Mechanical Inspection:

1. Verify meter connections in accordance with appropriate diagrams.
2. Verify meter multipliers.
3. Verify meter types and scales conform to Contract Documents.
4. Check calibration of meters at cardinal points.
5. Check calibration of electrical transducers.

3.11 GROUNDING SYSTEMS

A. Visual and Mechanical Inspection:

1. Equipment and circuit grounds in motor control center, panelboard, and control panels assemblies for proper connection and tightness.
2. Ground bus connections in motor control center, panelboard, and control panels assemblies for proper termination and tightness.
3. Effective transformer core and equipment grounding.
4. Accessible connections to grounding electrodes for proper fit and tightness.
5. Accessible exothermic-weld grounding connections to verify that molds were fully filled and proper bonding was obtained.

B. Electrical Tests:

1. Fall-of-Potential Test:
   a. In accordance with IEEE 81, Section 8.2.1.5 for measurement of main ground system's resistance.
   b. Main ground electrode system resistance to ground to be no greater than 5 ohm(s).

2. Two-Point Direct Method Test:
    a. In accordance with IEEE 81, Section 8.2.1.1 for measurement of ground resistance between main ground system, equipment frames, and system neutral and derived neutral points.
    b. Equipment ground resistance shall not exceed main ground system resistance by 50 ohm.
3. Neutral Bus Isolation:
    a. Test each neutral bus individually with neutral bonding jumper removed at service entrance or separately derived system.
    b. Evaluate ohmic values by measuring resistance between ground bus and neutral bus.
    c. Investigate values less than 50 megohms.

3.12 GROUND FAULT SYSTEMS

A. Inspection and testing limited to:

1. Zero sequence grounding systems.
2. Residual ground fault systems.

B. Visual and Manual Inspection:

1. Neutral main bonding connection to ensure:
    a. Zero sequence sensing system is grounded ahead of neutral disconnect link.
    b. Ground strap sensing system is grounded through sensing device.
    c. Neutral ground conductor is solidly grounded.
2. Verify control power has adequate capacity for system.
3. Manually operate monitor panels for:
    a. Trip test.
    b. No trip test.
    c. Nonautomatic rest.
4. Zero sequence system for symmetrical alignment of core balance transformers about current carrying conductors.
5. Relay check for pickup and time under simulated ground fault conditions.
6. Verify nameplate identification by device operation.

C. Electrical Tests:

1. Test system neutral insulation resistance with neutral ground link removed; minimum 1 megohm.
2. Determine relay pickup by primary current injection at the sensor. Relay pickup current within plus or minus 10 percent of device dial or fixed setting.

3. Test relay timing by injecting 300 percent of pick-up current or as specified by manufacturer. Relay operating time in accordance with manufacturer's time-current characteristic curves.
4. Test system operation at 55 percent rated control voltage, if applicable.
5. Test zone interlock system by simultaneous sensor current injection and monitoring zone blocking functions.

3.13 AC INDUCTION MOTORS

A. General: Inspection and testing limited to motors rated 1/2 horsepower and larger.

B. Visual and Mechanical Inspection:

1. Proper electrical and grounding connections.
2. Shaft alignment.
3. Blockage of ventilating air passageways.
4. Operate motor and check for:
   a. Excessive mechanical and electrical noise.
   b. Overheating.
   c. Correct rotation.
   d. Check vibration detectors, resistance temperature detectors, or motor inherent protectors for functionability and proper operation.
   e. Excessive vibration, in excess of values in NETA ATS, Table 100.10.
5. Check operation of space heaters.

C. Electrical Tests:

1. Insulation Resistance Tests:
   a. In accordance with IEEE 43 at test voltages established by NETA ATS, Table 100.1 for:
      1) Motors above 200 horsepower for 10-minute duration with resistances tabulated at 30 seconds, 1 minute, and 10 minutes.
      2) Motors 200 horsepower and less for 1-minute duration with resistances tabulated at 30 seconds and 60 seconds.
   b. Insulation resistance values equal to, or greater than, ohmic values established by manufacturers.

3.14 LOW-VOLTAGE MOTOR CONTROL

A. Visual and Mechanical Inspection:

1. Proper barrier and shutter installation and operation.
2. Proper operation of indicating and monitoring devices.
3. Proper overload protection for each motor.
4. Improper blockage of air-cooling passages.
5. Proper operation of drawout elements.

6. Integrity and contamination of bus insulation system.
7. Check door and device interlocking system by:
   a. Closure attempt of device when door is in OFF or ON position.
   b. Opening attempt of door when device is in ON or CLOSED position.
8. Check nameplates for proper identification of:
   a. Equipment title and tag number with latest one-line diagram.
   b. Circuit breakers.
9. Verify fuse and circuit breaker sizes and types conform to Contract Documents.
10. Verify current and potential transformer ratios conform to Contract Documents.
11. Check bus connections for high resistance by low-resistance ohmmeter and calibrated torque wrench applied to bolted joints.
12. Ohmic value to be zero.
    a. Bolt torque level in accordance with NETA ATS, Table 100.12, unless otherwise specified by manufacturer.
13. Check operation and sequencing of electrical and mechanical interlock systems by:
    a. Closure attempt for locked open devices.
    b. Opening attempt for locked closed devices.
    c. Key exchange to operate devices in OFF-NORMAL positions.
14. Verify performance of each control device and feature furnished as part of motor control center.
15. Control Wiring:
    a. Compare wiring to local and remote control, and protective devices with elementary diagrams.
    b. Check for proper conductor lacing and bundling.
    c. Check for proper conductor identification.
    d. Check for proper conductor lugs and connections.
16. Exercise active components.
17. Inspect contactors for:
    a. Correct mechanical operations.
    b. Correct contact gap, wipe, alignment, and pressure.
    c. Correct torque of connections.
18. Compare overload heater rating with full-load current for proper size.
19. Perform phasing check on double-ended motor control centers to ensure proper bus phasing from each source.

3.15 LOW VOLTAGE SURGE ARRESTORS

A. Visual and Mechanical Inspection:

1. Adequate clearances between arrestors and enclosures.
2. Ground connections to ground bus.

B. Electrical Tests:

1. Varistor Type Arrestors:
   a. Clamping voltage test.
   b. Rated RMS voltage test.
   c. Rated dc voltage test.
   d. Varistor arrestor test values in accordance with IEEE C62.33, Section 4.4 and Section 4.9.

END OF SECTION

SECTION 26 20 00
LOW-VOLTAGE AC INDUCTION MOTORS

PART 1 GENERAL

1.01 RELATED SECTIONS

A. This section applies to low-voltage AC induction motors, whether or not referenced by a motor-driven equipment specification. If equipment specification section deviates from this section in requirements such as, application, horsepower, enclosure type, mounting, shaft type, or synchronous speed, then those listed requirements shall take precedence over this section.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Bearing Manufacturers Association (ABMA):
   a. 9, Load Ratings and Fatigue Life for Ball Bearings.
   b. 11, Load Ratings and Fatigue Life for Roller Bearings.
2. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. 112, Standard Test Procedure for Polyphase Induction Motors and Generators.
   b. 620, Guide for the Presentation of Thermal Limit Curves for Squirrel Cage Induction Machines.
   c. 841, Standard for Petroleum and Chemical Industry—Premium Efficiency Severe Duty Totally Enclosed Fan-Cooled (TEFC) Squirrel Cage Induction Motors—Up to and Including 370 kW (500 hp).
3. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. C50.41, Polyphase Induction Motors for Power Generating Stations.
   c. MG 1, Motors and Generators.
4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
5. UL:
   a. 83, Standard for Safety for Thermoplastic-Insulated Wire and Cables.
   b. 674, Standard for Safety for Electric Motors and Generators for Use in Division 1 Hazardous (Classified) Locations.
   c. 2111, Standard for Safety for Overheating Protection for Motors.

1.03 DEFINITIONS

A. CISD-TEFC: Chemical industry, severe-duty enclosure.

B. DIP: Dust-ignition-proof enclosure.

C. EXP: Explosion-proof enclosure.

D. Inverter Duty Motor: Motor meeting applicable requirements of NEMA MG 1, Section IV, Parts 30 and 31.

E. Inverter Ready Motor: Motor meeting applicable requirements of NEMA MG 1, Section IV, Part 31.4.4.2.

F. Motor Nameplate Horsepower: That rating after any derating required to allow for extra heating caused by the harmonic content in the voltage applied to the motor by its controller.

G. ODP: Open drip-proof enclosure.

H. TEFC: Totally enclosed, fan-cooled enclosure.

I. TENV: Totally enclosed, nonventilated enclosure.

J. VPI: Vacuum pressure impregnated.

K. WPI: Open weather protected enclosure, Type I.

L. WPII: Open weather protected enclosure, Type II.

1.04 SUBMITTALS

A. Action Submittals:

1. Descriptive information.
2. Nameplate data in accordance with NEMA MG 1.
3. Additional Rating Information:
    a. Service factor.
    b. Locked rotor current.
    c. No load current.
    d. Multispeed load classification (for example, variable torque).
    e. Adjustable frequency drive motor load classification (for example, variable torque) and minimum allowable motor speed for that load classification.
    f. Guaranteed minimum full load efficiency and power factor.
4. Enclosure type and mounting (such as, horizontal, vertical).

5. Dimensions and total weight.
6. Conduit box dimensions and usable volume as defined in NEMA MG 1 and NFPA 70.
7. Bearing type.
8. Bearing lubrication.
9. Bearing life.
10. Space heater voltage and watts.
11. Description, ratings, and wiring diagram of motor thermal protection.
12. Motor sound power level in accordance with NEMA MG 1.
13. Maximum brake horsepower required by the equipment driven by the motor.
14. Description and rating of submersible motor moisture sensing system.

B. Informational Submittals:

1. Factory test reports, certified.
2. Operating and Maintenance Data: As specified in Section 01730, Operating and Maintenance Data.
3. Manufacturer's Certificate of Proper Installation, in accordance with Section 01 43 33, Manufacturers' Field Services.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:

1. General Electric.
2. Siemens Energy and Automation, Inc., Motors and Drives Division.
3. TECO-Westinghouse Motor Co.
4. Toshiba International Corp., Industrial Division.

2.02 GENERAL

A. For multiple units of the same type of equipment, furnish identical motors and accessories of a single manufacturer.

B. In order to obtain single source responsibility, use a single supplier to provide drive motor, its driven equipment, and specified motor accessories.

C. Meet requirements of NEMA MG 1.

D. For motors used in hazardous (classified) locations, Class I, Division 1, Groups B, C, and D, and Class II, Division 1, Groups E, F, and G provide motors that conform to UL 674 and have an applied UL listing mark.

E. Provide motors specifically designed for the use and conditions intended, with a NEMA design letter classification to fit the application.

F. Lifting lugs on motors weighing 100 pounds or more.

G. Operating Conditions:

1. Maximum ambient temperature not greater than 40 degrees C.
2. Provide motors suitable for operating conditions without reduction in nameplate rated horsepower or exceeding rated temperature rise.
3. Overspeed in either direction in accordance with NEMA MG 1.

2.03 HORSEPOWER RATING

A. As designated in motor-driven equipment specification.

B. Constant Speed Applications: Brake horsepower of driven equipment at any operating condition or at any head capacity point on pump curve not to exceed motor nameplate horsepower rating, excluding service factor.

C. Adjustable Frequency and Adjustable Speed Applications (Inverter Duty Motor, Inverter Ready Motor): Driven equipment brake horsepower at any operating condition or at any head capacity point on pump curve not to exceed motor nameplate horsepower rating, excluding service factor.

2.04 SERVICE FACTOR

A. Inverter-Duty Motors: 1.0 at rated ambient temperature, unless otherwise noted.

B. Other Motors: 1.15 minimum at rated ambient temperature, unless otherwise noted.

2.05 VOLTAGE AND FREQUENCY RATING

A. System Frequency: 60 Hz.

B. Voltage Rating: Unless otherwise indicated in motor-driven equipment specification:

Voltage Rating		
Size	**Voltage**	**Phase**
1/2 hp and smaller	115	1
3/4 hp and larger	460	3

C. Suitable for full voltage starting.

D. 50 hp and larger also suitable for reduced voltage starting with 65 percent or 80 percent voltage tap settings on reduced inrush motor starters.

E. Suitable for accelerating the connected load with supply voltage at motor starter supply terminals dipping to 90 percent of motor rated voltage.

2.06 EFFICIENCY AND POWER FACTOR

A. For all motors except single-phase, under 1 hp, multispeed, short-time rated and submersible motors, or motors driving gates, valves, elevators, cranes, trolleys, and hoists:

1. Efficiency:
   a. Tested in accordance with NEMA MG 1, Paragraph 12.59.
   b. Guaranteed minimum at full load in accordance with NEMA MG 1 Table 12-12, Full-load Efficiencies for NEMA Premium Efficiency Electric Motors Rated 600 Volts or Less (Random Wound), or as indicated in motor-driven equipment specification.
2. Power Factor: Guaranteed minimum at full load shall be manufacturer's standard or as indicated in motor-driven equipment specification.

2.07 LOCKED ROTOR RATINGS

A. Locked rotor kVA Code F or lower, if motor horsepower not covered by NEMA MG 1 tables.

B. Safe Stall Time: 12 seconds or greater.

2.08 INSULATION SYSTEMS

A. Single-Phase, Fractional Horsepower Motors: Manufacturer's standard winding insulation system.

B. Motors Rated Over 600 Volts: VPI windings in accordance with NEMA MG 1.

C. Three-phase and Integral Horsepower Motors: Unless otherwise indicated in motor-driven equipment specification, Class F with Class B rise at nameplate horsepower and designated operating conditions, except provide Class B with Class B rise insulation for EXP and DIR motors.

D. Motors With Form-Wound Coils: Locked coil bracing system in accordance with NEMA C50.41.

2.09 ENCLOSURES

A. Conform to NEMA MG 1.

B. TEFC and TENV: Furnish with drain hole with porous drain/weather plug.

C. Explosion-Proof (EXP):

1. TEFC listed to meet UL 674 and NFPA 70 requirements for Class I, Division 1, Group C and D hazardous locations.
2. Drain holes with drain and breather fittings.
3. Integral thermostat opening on excessive motor temperature in accordance with UL 2111 and NFPA 70.
4. Terminate thermostat leads in terminal box separate from main terminal box.

D. Dust-Ignition-Proof (DIP):

1. TEFC listed to meet UL 674 and NFPA 70 requirements for Class II, Division 1, Group E.
2. Integral thermostat opening on excessive motor temperature in accordance with UL 2111 and NFPA 70.
3. Thermostat leads to terminate in a terminal box separate from main terminal box.

E. Submersible: In accordance with Article Special Motors.

F. Chemical Industry, Severe-Duty (CISD-TEFC): In accordance with Article Special Motors.

2.10 TERMINAL (CONDUIT) BOXES

A. Oversize main terminal boxes for motors.

B. Diagonally split, rotatable to each of four 90-degree positions. Threaded hubs for conduit attachment.

C. Except ODP, furnish gaskets between box halves and between box and motor frame.

D. Minimum usable volume in percentage of that specified in NEMA MG 1, Section 1, Paragraph 4.19 and NFPA 70, Article 430:

Terminal Box Usable Values		
Voltage	**Horsepower**	**Percentage**
Below 600	15 through 125	500

Terminal Box Usable Values		
Voltage	**Horsepower**	**Percentage**
Below 600	150 through 300	275
Below 600	350 through 600	225

E. Terminal for connection of equipment grounding wire in each terminal box.

F. Coordinate motor terminal box conduit entries versus size and quantity of conduits shown on Drawings.

2.11 BEARINGS AND LUBRICATION

A. Horizontal Motors:

1. 3/4 hp and Smaller: Permanently lubricated and sealed ball bearings, or regreasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
2. 1 hp through 400 hp: Regreasable ball bearings in labyrinth sealed end bells with removable grease relief plugs.
3. Above 400 hp: Regreasable antifriction bearings in labyrinth sealed end bells with removable grease relief plugs.
4. For Direct Drive Equipment: Minimum 100,000 hours L-10 bearing life for ball and roller bearings as defined in ABMA 9 and ABMA 11.
5. For Belt Driven Equipment: Minimum 30,000 hours L-10 bearing life for ball and roller bearings as defined in ABMA 9 and ABMA 11.

B. Vertical Motors:

1. Thrust Bearings:
   a. Antifriction bearing.
   b. Manufacturer’s standard lubrication 100 hp and smaller.
   c. Oil lubricated 125 hp and larger.
   d. Minimum 50,000 hours L-10 bearing life.
2. Guide Bearings:
   a. Manufacturer’s standard bearing type.
   b. Manufacturer’s standard lubrication 200 hp and smaller.
   c. Oil lubricated 250 hp and larger.
   d. Minimum 100,000 hours L-10 bearing life.

C. Regreasable Antifriction Bearings:

1. Readily accessible, grease injection fittings.
2. Readily accessible, removable grease relief plugs.

D. Oil Lubrication Systems:

1. Oil reservoirs with sight level gauge.
2. Oil fill and drain openings with opening plugs.
3. Provisions for necessary oil circulation and cooling.

E. Inverter Duty Rated Motors Larger than 5 hp, Bearing Isolation: Provide electrically isolated bearings to prevent stray current damage.

2.12 NOISE

A. Measured in accordance with NEMA MG 1.

B. Maximum Sound Level for Motors Controlled by Adjustable Frequency Drive Systems: 3 dBA higher than NEMA MG 1.

2.13 BALANCE AND VIBRATION CONTROL

A. In accordance with NEMA MG 1, Part 7.

2.14 EQUIPMENT FINISH

A. Protect Motor for Service Conditions:

1. ODP Enclosures: Indoor industrial atmospheres.
2. Other Enclosures: Outdoor industrial atmospheres, including moisture and direct sunlight exposure.

B. External Finish: Prime and finish coat manufacturer's standard.

C. Internal Finish: Bore and end turns coated with clear polyester or epoxy varnish.

2.15 SPECIAL FEATURES AND ACCESSORIES

A. Screen Over Air Openings: Stainless steel on motors with ODP, WPI, and WPII enclosures meeting requirements for guarded machine in NEMA MG 1, and attached with stainless steel screws.

B. Winding Thermal Protection:

1. Thermostats:
   a. Motors for constant speed application 10 hp through 100 hp. Motors for adjustable speed application 10 hp through 100 hp.
   b. Bi-metal disk or rod type thermostats embedded in stator windings.

c. Automatic reset contacts rated 120 volts ac, 5 amps minimum, opening on excessive temperature. (Provide manual reset at motor controller.)
d. Leads extending to separate terminal box for motors 100 hp and larger.

2. Thermistors:
a. Motors for constant speed application 125 hp and larger. Motors for adjustable speed application 125 hp and larger.
b. Thermistor embedded in each stator phase winding before winding dip and bake process.
c. In intimate contact with winding conductors.
d. Epoxy-potted, solid-state thermistor control module mounted in NEMA 250 Type 4 box on motor, by motor manufacturer, individual thermistor circuits factory-wired to control module.
e. Control module rated for 120V ac power supply.
f. Control module automatically reset contact for external use rated 120V ac, 5 amps minimum, opening on abnormally high winding temperature. Provide manual reset at motor controller.

C. Space Heaters:

1. Motors 10 hp and larger.
2. Provide winding space heaters with leads wired out to separate condulet or terminal box.
3. Provide extra hole or hub on motor terminal box as required.
4. Unless shown otherwise, heater shall be suitable for 120V ac supply, with wattage suitable for motor frame size.

D. Nameplates:

1. Raised or stamped letters on stainless steel or aluminum.
2. Display motor data required by NEMA MG 1, Paragraph 10.39 and Paragraph 10.40 in addition to bearing numbers for both bearings.
3. Premium efficiency motor nameplates to display NEMA nominal efficiency, guaranteed minimum efficiency, full load power factor, and maximum allowable kVAR for power factor correction capacitors.

E. Anchor Bolts: Provide meeting manufacturer's recommendations and of sufficient size and number for specified seismic condition.

2.16 SPECIAL MOTORS

A. Requirements in this article take precedence over conflicting features specified elsewhere in this section.

B. Chemical Industry, Severe-Duty (CISD-TEFC):

1. In accordance with IEEE 841.
2. TEFC in accordance with NEMA MG 1.
3. Suitable for indoor or outdoor installation in severe-duty applications including high humidity, chemical (corrosive), dirty, or salty atmospheres.
4. Motor Frame, End Shields, Terminal Box, and Fan Cover: Cast iron.
5. Ventilating Fan: Corrosion-resistant, nonsparking, external.
6. Drain and Breather Fittings: Stainless steel.
7. Nameplate: Stainless steel.
8. Gaskets between terminal box halves and terminal box and motor frame.
9. Extra slinger on rotor shaft to prevent moisture seepage along shaft into motor.
10. Double shielded bearings.
11. 125,000 hours minimum L-10 bearing life for direct-connected loads.
12. External Finish: Double-coated epoxy enamel.
13. Coated rotor and stator air gap surfaces.
14. Insulation System, Windings, and Connections:
    a. Class F insulation, Class B rise or better at 1.0 service factor.
    b. Multiple dips and bakes of nonhygroscopic polyester varnish.
15. Service Factor:
    a. At 40 Degrees C Ambient: 1.15.
    b. At 65 Degrees C Ambient: 1.00.
16. Safe Stall Time Without Injurious Heating: 20 seconds minimum.

C. Severe-duty Explosion-proof: Meet requirements for EXP enclosures and CISD-TEFC motors.

D. Severe-duty, Dust-ignition-proof: Meet requirements for DIP enclosures and CISD-TEFC motors.

E. Multispeed: Meet requirements for speeds, number of windings, and load torque classification indicated in motor-driven equipment specification.

F. Inverter Duty Motor:

1. Motor Supplied Power by Adjustable Voltage and Adjustable Frequency Drives: Inverter duty rated in accordance with NEMA Parts 30 and 31.
2. Provide winding insulation rated 1,600 peak volts, minimum.
3. Meet or exceed NEMA MG 1 corona inception voltage rating.
4. Provide one insulated bearing.
5. Suitable for operation over entire speed range indicated.
6. Provide forced ventilation where speed ratio is greater than published range for motor provided.

7. When installed in Division 1 hazardous (classified) location, provide motor identified by manufacturer as suitable use with a variable speed drive in a Division 1 location.
8. When installed in Division 2 hazardous (classified) locations, provide motor identified by manufacturer as suitable for use with a variable speed drive in a Division 2 location.
9. Shaft Grounding Device, Motors Larger than 5 hp: Furnish with shaft grounding brush or conductive micro fiber shaft grounding ring solidly bonded to grounded motor frame in accordance with manufacturer's recommendations.
    a. Manufacturers:
        1) Grounding Brush: Sohre Turbomachinery, Inc.
        2) Grounding Ring: EST-Aegis.

G. Submersible Pump Motor:

1. Manufacturers:
    a. Reliance Electric.
    b. Xylem Flygt Corp.
2. At 100 Percent Load:
    a. Motors with Speeds Less than 1,200 rpm: Manufacturer's standard.
    b. Motors with Speeds 1,200 rpm and Greater:

Submersible Pump Motors		
Horsepower	**Guaranteed Minimum Efficiency**	**Guaranteed Minimum Power Factor**
5 through 10	80	82
10.1 through 50	85	82
50.1 through 100	87	82
Over 100	89	82

3. Insulation System: Manufacturer's standard Class B or Class F.
4. Motor capable of running dry continuously.
5. Enclosure:
    a. Hermetically sealed, watertight, for continuous submergence up to 65-foot depth.
    b. Listed to meet UL 674 and NFPA 70 requirements for Class I, Division 1, Group D hazardous atmosphere.
    c. Seals: Tandem mechanical.
6. Bearing and Lubrication:
    a. Permanently sealed and lubricated, replaceable antifriction guide and thrust bearings.
    b. Minimum 15,000 hours L-10 bearing life.

7. Inrush kVA/horsepower no greater than NEMA MG 1 and NFPA 70, Code F.
8. Winding Thermal Protection:
    a. Thermal sensor and switch assembly, one each phase, embedded in stator windings and wired in series.
    b. Switches normally closed, open upon excessive winding temperature, and automatically reclose when temperature has cooled to safe operating level.
    c. Switch contacts rated at 5 amps, 120V ac.
9. Motor Seal Failure Moisture Detection:
    a. Probes or sensors to detect moisture beyond seals.
    b. Probe or sensor monitoring module for mounting in motor controller, suitable for operation from 120V ac supply.
    c. Monitoring module with control power transformer, probe test switch and test light, and two independent 120V ac contacts, one opening and one closing when flux of moisture is detected.
10. Bearing Overtemperature Protection for Motors Larger than 100 hp:
    a. Sensor on lower bearing housing monitoring bearing temperature.
    b. Any monitoring relay necessary to provide 120V ac contact opening on bearing overtemperature.
11. Winding thermal protection, moisture detection, and bearing overtemperature specified above may be monitored by single device providing two independent 120V ac contacts, one closing and one opening on malfunction.
12. Connecting Cables:
    a. Two separate cables, one containing power and grounding conductors, and the other containing control and grounding conductors.
    b. Each cable suitable for hard service, submersible duty with watertight seal where cable enters motor.
    c. Length: 30 feet minimum.
    d. UL 83 listed and sized in accordance with NFPA 70.

H. Inclined Motors:

1. Motors suitable for operation only in horizontal position not acceptable.
2. Provide bearings designed for thrust imposed by driven equipment and by motor rotor when motor is in inclined position.
3. Provide lubrication system designed to provide adequate bearing lubrication when motor is in inclined position.

2.17 FACTORY TESTING

A. Tests:

1. In accordance with IEEE 112 for polyphase motors.
2. Routine (production) tests in accordance with NEMA MG 1. Test multispeed motors at all speeds.
3. For energy efficient motors, test efficiency and power factor at 50 percent, 75 percent, and 100 percent of rated horsepower:
   a. In accordance with IEEE 112, Test Method B, and NEMA MG 1, Paragraph 12.59. and Paragraph 12.60.
   b. For motors 500 hp and larger where facilities are not available to test by dynamometer (Test Method B), determine efficiency by IEEE 112, Test Method F.
   c. On motors of 100 hp and smaller, furnish certified copy of motor efficiency test report on an identical motor.
4. Vibration (balance).
5. Provide certified test reports for all polyphase motors.

B. Test Report Forms:

1. Routine Tests: IEEE 112, Form A-1.
2. Efficiency and power factor by Test Method B, IEEE 112, Form A-2, and NEMA MG 1, Table 12-12.
3. Efficiency and power factor by Test Method F, IEEE 112, Forms F-1, F-2, and F-3.
4. Temperature Test: IEEE 112, Form A-2.

PART 3 EXECUTION

3.01 INSTALLATION

A. In accordance with manufacturer's instructions and recommendations.

B. Align motor carefully and properly with driven equipment.

C. Secure equipment to mounting surface with anchor bolts.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. National Electrical Contractor's Association (NECA): 407, Recommended Practice for Installing and Maintaining Panelboards.
2. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. 289, Application Guide for Ground Fault Circuit Interrupters.
   c. KS 1, Enclosed Switches.
   d. PB 1, Panelboards.
   e. PB 1.1, General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
3. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
4. Underwriters Laboratories, Inc. (UL):
   a. 67, Standard for Panelboards.
   b. 98, Standard for Enclosed and Dead-Front Switches.
   c. 486E, Standard for Equipment Wiring Terminals for use with Aluminum and/or Copper Conductors.
   d. 489, Molded-Case Circuit Breakers, Molded-Case Switches, and Circuit Breaker Enclosures.
   e. 508, Standard for Industrial Control Equipment.
   f. 870, Wireways, Auxiliary Gutters and Associated Fittings.
   g. 943, Ground-Fault Circuit-Interrupters.
   h. 1699, Standard for Arc-Fault Circuit-Interrupters.

1.02 SUBMITTALS

A. Action Submittals:

1. Manufacturer's data sheets for each type of panelboard, protective device, accessory item, and component.
2. Manufacturer's shop drawings including dimensioned plan, section, and elevation for each panelboard type, enclosure, and general arrangement.
3. Tabulation of features for each panelboard to include the following:
   a. Protective devices with factory settings.
   b. Provisions for future protective devices.
   c. Space for future protective devices.
   d. Voltage, frequency, and phase ratings.

e. Enclosure type.
f. Bus and terminal bar configurations and current ratings.
g. Provisions for circuit terminations with wire range.
h. Short circuit current rating of assembled panelboard at system voltage.
i. Features, characteristics, ratings, and factory settings of auxiliary components.
j. Wiring and schematic diagrams detailing control wiring, and differentiating between manufacturer-installed and field-installed wiring.

B. Informational Submittals: Manufacturer's recommended installation instructions.

1.03 QUALITY ASSURANCE

A. Listing and Labeling: Provide products specified in this section that are listed and labeled as defined in NEC Article 100.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Materials, equipment, and accessories specified in this section shall be products of:

1. General Electric Co.
2. Square D Co.
3. Siemens.

2.02 GENERAL

A. Provide low voltage panelboards for application at 600V or less in accordance with this section.

B. Provide equipment in accordance with NEMA PB 1, NFPA 70, and UL 67.

C. Wire Terminations:

1. Provide panelboard assemblies, including protective devices, suitable for use with 75 degrees C or greater wire insulation systems at NFPA 70, 75 degrees C conductor ampacity, and in accordance with UL 486E.

D. Load Current Ratings:

1. Unless otherwise indicated, load current ratings for panelboard assemblies, including bus and circuit breakers, are noncontinuous as defined by NEC. Continuous ratings shall be 80 percent of noncontinuous rating.

2. Where indicated “continuous” or “100 percent”, selected components and protective devices shall be rated for continuous load current at value shown.

E. Short Circuit Current Rating (SCCR): Integrated equipment short circuit rating for each panelboard assembly shall be no less than the indicated SCCR or following:

1. Minimum SCCR at 208Y/120 or 120/240 volts shall be 10,000 amperes rms symmetrical, unless otherwise shown.
2. Minimum SCCR at 480Y/277 volts shall be 35,000 amperes rms symmetrical, unless otherwise shown.

F. Series-Connected Short Circuit Current Ratings: Panelboards shall be fully rated; application of series-connected device ratings is unacceptable.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Overcurrent Device Mounting and Arrangement: Design panelboards to accommodate device installation and replacement without disturbing adjacent devices and without removing main bus.

B. Overcurrent Protective Devices: In accordance with NEMA KS 1, UL 98, and UL 489. Protective devices shall be adapted to panelboard installation.

C. Provisions for Future Overcurrent Device:

1. Provide space, mountings and bus connections such that like device may be installed without additional hardware.
2. Panel openings shall be closed with individual removable cover for each provision for future device.
3. Unless otherwise indicated, “spaces” in panelboards shall be fully equipped provision for future like devices.
4. Provisions for future devices shall be suitable devices rated no less than 60 amperes.

D. Protective Device Locking: Furnish provisions for handle padlocking for main, subfeed, and branch devices where indicated.

E. Branch Protective Devices:

1. Provide Wire Lug Load Connections: Mechanical or crimp compression type, removable/replaceable, and suitable for 75 degrees C rated conductors without derating switch nor conductor ampacity.
2. Provide a nameplate for each circuit, blanks for spares.

2.04 CIRCUIT BREAKERS

A. General: Thermal-magnetic unless otherwise indicated, quick-make, quick-break, molded case, of indicating type showing ON/OFF and TRIPPED positions of operating handle. Circuit breakers shall comply with Section 26 05 04, Basic Electrical Materials and Methods.

B. Bus Connection: Bolt-on circuit breakers in all panelboards.

C. Trip Mechanism:

1. Individual permanent thermal and magnetic trip elements in each pole.
2. Variable magnetic trip elements with a single continuous adjustment 3X to 10X for frames greater than 100 amps.
3. Two and three pole, common trip.
4. Automatically opens all poles when overcurrent occurs on one pole.
5. Test button on cover.
6. Calibrated for 40 degrees C ambient, unless shown otherwise.

D. Unacceptable Substitution:

1. Do not substitute single-pole circuit breakers with handle ties for multi-pole breakers.
2. Do not use tandem or dual circuit breakers in normal single-pole spaces.

E. Specialty Breakers: Where indicated, provide breakers with the following features:

1. Ground Fault Circuit Interrupter (GFCI): Rated to trip on 5-mA ground fault within 0.025 second (UL 943, Class A sensitivity, for protection of personnel). Ground fault sensor shall be rated same as circuit breaker. Breaker shall include push-to-test and reset buttons.

F. Solid State Trip Units: Where indicated, equip breakers with solid state trip units.

1. Long (Time) Short (Time) Instantaneous (LSI): Electronic trip unit with fixed long-time trip, adjustable short-time trip and delay, and adjustable instantaneous trip settings.
2. Long (Time) Short (Time) Instantaneous Ground (Fault) (LSIG): Electronic trip unit as above and also with adjustable ground fault trip and delay settings.

2.05 ENCLOSURES

A. General:

1. Provide as specified in Section 26 05 04, Basic Electrical Materials and Methods.
2. Type 1, Type 3R, and Type 3S material code-gauge, hot-dip galvanized sheet steel with reinforced steel frame.
3. Provide surface-mount panelboard from trim with same dimensions as box front.

B. Finish: Rust inhibitor prime followed by manufacturer's standard gray baked enamel or lacquer. NEMA Type 1 enclosure box may be unfinished galvanized sheet steel.

C. NEMA 250 Type 1 Branch Panelboard Enclosure:

1. Secure front trim to box with concealed trim clamps.
2. Overlap flush panelboards front trims with box nominal 3/4 inch on all sides.
3. Provide door in panelboard front trim, with concealed hinges, to access protective device operating handles.
4. Provide multi-point latching for doors over 30 inches in height.
5. Door Lock: Secure with flush catch and tumbler lock; all panelboards keyed alike, with two milled keys each lock.
6. Circuit Directory: Metal frame with transparent plastic face and enclosed card, mounted inside each panel door.
7. Hinged Front Cover (Door In Door): Entire front trim hinged to surface box with standard door within hinged trim cover.

D. Multi-Section Panelboards: Where more than one section is required, provide multiple panelboard sections with separate fronts.

1. Sections shall be suitable for individual mounting to be field interconnected to form a single electrical unit.
2. Recessed-mount sections of the same panel shall all have the same size tubs and flush covers.
3. Surface-mount multi-section panelboards may be comprised of sections of unequal heights.
4. Provide feed-through and main lugs in individual sections as required for field assembly of a complete multi-section panelboard. Unless otherwise indicated, provide feed-through lugs on each section but last.
5. Provide neutral and ground terminal bars in each section.

2.06 BUSSING AND TERMINAL BARS

A. Bus:

1. Material: Tin-plated copper, full sized throughout length.
2. Provide for mounting of future protective devices along full length of bus regardless of number of units and spaces shown. Machine, drill, and tap as required for current and future positions.

B. Equipment Ground Terminal Bus: Copper with suitably sized provisions for termination of ground conductors, and bonded to box.

1. Provide individual mechanical termination points no less than the quantity of breaker pole positions.
2. Provide individual termination points for all other grounding conductors such as feeder, grounding electrode, etc.
3. Termination points shall be bolted crimp compression lugs for conductors 6 AWG and larger.

C. Neutral Terminal Bus: Tin-plated copper with suitably sized provisions for termination of neutral conductors, and isolated from box.

1. Provide individual mechanical termination points no less than the quantity of breaker pole positions.
2. Provide individual termination points for all other neutral conductors.
3. Termination Points: Bolted crimp compression lugs for conductors 6 AWG and larger.
4. Oversize Neutral: Provide oversized neutral terminal bus as indicated.

D. Provision for Future Devices: Equip with mounting brackets, bus connections, and necessary appurtenances for future protective device ampere ratings indicated.

2.07 SPECIAL FEATURES

A. General: Where indicated on Drawings or schedules, provide special features as specified.

B. Service Equipment Approval: Listed for use as service equipment for panelboards having service disconnecting means.

C. Extra Gutter Space: Dimensions and arrangement indicated.

D. Gutter Barrier: Arranged to isolate section of gutter as shown.

E. Subfeed: Protective device or lugs indicated, with additional terminals on neutral and ground bus to accommodate feeder.

F. Feed-Through Lugs: At opposite end of phase bus from mains, with additional terminals on neutral and ground buses, sized to accommodate feeders indicated.

G. Double Main Lugs: Furnish additional terminals on neutral and ground buses, sized to accommodate feeders indicated.

H. Surge Arresters:

1. Comply with Section 26 43 00, Surge Protection Devices.
2. Provide protective device within panelboard as disconnecting means and short circuit protection per manufacturer's recommendation.
3. Provide factory mounting within panelboard utilizing UL-recognized mounting device.

PART 3 EXECUTION

3.01 GENERAL

A. Install in accordance with NECA 407, NEMA PB 1.1, and manufacturers' written installation instructions.

B. Install securely, plumb, in-line and square with walls.

C. Install top of cabinet trim 78 inches above floor, unless otherwise shown. Install cabinet so tops of protective device operating handles are no more than 78 inches above the floor.

D. Ground Fault Protection: Install panelboard ground fault circuit interrupter devices in accordance with installation guidelines of NEMA 289.

E. Install filler plates in unused spaces.

F. Wiring in Panel Gutters: Train conductors neatly in groups; bundle and wrap with nylon wire ties.

G. Mount flush panels uniformly flush with wall finish.

H. Provide typewritten circuit directory for each panelboard.

I. Provide engraved identification for each protective device.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM): A167, Standard Specification for Stainless and Heat-Resisting Chromium-Nickel Steel Plate, Sheet, and Strip.
2. Federal Specifications (FS):
   a. W-C-596G, General Specification for Connector, Electrical, Power.
   b. W-S-896F, Switches, Toggle (Toggle and Lock), Flush Mounted (General Specification).
3. Institute of Electrical and Electronic Engineers, Inc. (IEEE):
   a. C62.41.2, Recommended Practice on Characterization of Surges in Low-Voltage (1000V and less) AC Power Circuits.
   b. C62.45, Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000V and less) AC Power Circuits.
4. National Electrical Contractors Association (NECA): 1, Standard Practice of Good Workmanship in Electrical Contracting.
5. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
   b. FB 11, Plugs, Receptacles, and Connectors of the Pin and Sleeve Type for Hazardous Locations.
   c. WD 1, General Color Requirements for Wiring Devices.
   d. WD 6, Wiring Devices – Dimensional Specifications.
6. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
7. UL:
   a. 498, Standard for Safety for Attachment Plugs and Receptacles.
   b. 508, Standard for Safety for Industrial Control Equipment.
   c. 943, Standard for Safety for Ground-Fault Circuit-Interrupters.
   d. 1010, Standard for Safety for Receptacle-Plug Combinations for Use in Hazardous (Classified) Locations.
   e. 1436, Standard for Safety for Outlet Circuit Testers and Similar Indicating Devices.
   f. 1449, Standard for Safety for Surge Protective Devices (SPD).

1.02 SUBMITTALS

A. Action Submittals: Manufacturer’s product data for wiring devices.

PART 2 PRODUCTS

2.01 SWITCHES

A. Switch, General Purpose:

1. NEMA WD 1 and FS W-S-896F.
2. Totally enclosed, ac type, with quiet tumbler switch and screw terminal.
3. Rivetless one-piece brass or copper alloy contact arm with silver alloy contact.
4. Capable of controlling 100 percent tungsten filament and fluorescent lamp loads.
5. Rating: 20 amps, 120/277 volts.
6. Automatic grounding clip and integral grounding terminal on mounting strap.
7. Special Features:
   a. Provide the following features in comparable devices where indicated: Three-way and four-way.
8. Manufacturers and Products, Industrial Grade:
   a. Cooper Arrow Hart; AH1220 Series.
   b. Bryant; 4901 Series.
   c. Hubbell; 1221 Series.
   d. Leviton; 1221 Series.

B. Switch, Motor Rated:

1. Type: Two-pole or three-pole, manual motor starting/disconnect switch without overload protection.
2. UL 508 listed.
3. Totally enclosed snap-action switch. Quick-make, slow-break design with silver alloy contacts.
4. Minimum General Purpose Rating: 30 amperes, 600V ac.
5. Minimum Motor Ratings:
   a. 2 horsepower for 120V ac, single-phase, two-pole.
   b. 3 horsepower for 240V ac, single-phase, two-pole.
   c. 15 horsepower for 480V ac, three-phase, three-pole.
6. Screw-type terminal.
7. Manufacturers and Products:
   a. Cooper Arrow Hart.
   b. Hubbell Bryant: HBL78 Series.
   c. Leviton.

2.02 RECEPTACLES

A. Receptacle, General Purpose:

1. NEMA WD 1 and FS W-C-596G.
2. Duplex, two-pole, three-wire grounding type with screw type wire terminals.
3. Impact resistant nylon cover and body, with finder grooves in face, unless otherwise indicated.
4. One-piece mounting strap with integral ground contact (rivetless construction).
5. Contact Arrangement: Contact to be made on two sides of each inserted blade without detent.
6. Rating: 125 volts, NEMA WD 1, Configuration 5-20R, 20 amps, unless otherwise indicated.
7. Size: For 2-inch by 4-inch outlet box.
8. Special Features: Provide the following features in comparable devices where indicated:
   a. Listed weather-resistant per NEC 406.8 for installation in damp or wet locations.
9. Industrial Grade Manufacturers and Products:
   a. Cooper Arrow Hart; 5362 Series.
   b. Hubbell Bryant; HBL5362 Series.
   c. Leviton; 5362 Series.

B. Receptacle, Ground Fault Circuit Interrupter:

1. Meet requirements of general-purpose receptacle.
2. Listed Class A to UL 943, tripping at 5 mA.
3. Rectangular smooth face with push-to-test and reset buttons.
4. Listed weather-resistant per NEC 406.8 for installation in damp or wet locations.
5. Feed-through Capability: 20 amps.
6. Manufacturers and Products:
   a. Hubbell Bryant; GFTR20 Series.
   b. Cooper Arrow Hart; WRVGF20 Series.
   c. Leviton; 7899 Series.

C. Receptacle, Special-Purpose:

1. Rating and number of poles as indicated or required for anticipated purpose.
2. Where indicated provide matching plug with cord-grip features for each special-purpose receptacle.

2.03 HAZARDOUS (CLASSIFIED) LOCATION DEVICES

A. Wiring devices for hazardous (classified) locations shall comply with NEMA FB 11 and UL 1010.

B. Switch:

1. Industrial grade, totally enclosed, ac type, with tumbler switch.
2. Capable of three-way or four-way operation where indicated on Drawings.
3. Rating: 20 amps at 120/277 volts.
4. Material: Cast aluminum back body and cover.
5. Hazardous Area Ratings: NEMA 7D, suitable for Class I, Group C and Group D; Class 2, Groups E, F and G; and Class 3, locations.
6. Manufacturers and Products:
   a. Killark: XS Series.
   b. Appleton: EDS Series.

C. Switch, Motor Rated:

1. Enclosed manual motor starter-type, three-pole, non-reversing without overloads.
2. Minimum Motor Rating: 10 horsepower, 480V ac, three-phase, three-pole.
3. Enclosure: NEMA 250, Type 7.
4. Operator: External handle with padlocking provisions.
5. Manufacturer and Product: Eaton, Type B101.

D. Receptacles, General:

1. Contain integral switch which must be closed to energize circuit.
2. Design shall permit only an approved plug to be energized.
   a. Actuation of switch shall require plug be inserted and rotated approximately 45 degrees.
   b. Plug shall lock into this position preventing unintended disengagement.
   c. To remove, plug shall be turned opposite direction as engagement and pulled straight out.

E. General Purpose Receptacle, Explosion Proof, 125 Volts, 20 Amps:

1. Dead front, interlocked, circuit breaking.
2. Receptacle Cover: Spring loaded closes when plug is removed.
3. Enclosure: Corrosion-resistant, aluminum alloy with less than 0.4 percent copper.
4. Finish: Electrostatically applied and baked powder epoxy/polyester.
5. External Hardware: Type 316 stainless steel.
6. Switch Chamber: Factory sealed to contain switch’s arcing components

7. Hazardous Area Ratings: Suitable for 7BCD, 9FG.
8. Manufacturers and Products:
    a. Cooper Crouse-Hinds; Ark Guard 2, Series ENR.
    b. EGS/Appleton Electric; U-Line.
    c. Killark, a division of Hubbell Inc.; UGR/UGP.

2.04 DEVICE PLATES

A. Sectional type plate not permitted.

B. Plastic or Nylon:

1. Material: Specification grade, 0.10-inch minimum thickness, noncombustible, thermosetting.
2. Color: To match associated wiring device.
3. Mounting Screw: Oval-head metal, color matched to plate.

C. Stainless Steel:

1. Material: Specification grade, one-piece, 0.040-inch nominal thickness stainless steel.
2. Finish: ASTM A167, Type 302/304, satin.
3. Mounting Screw: Oval-head, finish matched to plate.

D. Cast Metal:

1. Material: Copper-free aluminum with gaskets.
2. Screw: Oval-head stainless steel.

E. Sheet Steel:

1. Finish: Zinc electroplate.
2. Screws: Oval-head stainless steel.
3. Manufacturers:
    a. Appleton.
    b. Crouse-Hinds.

F. Weatherproof:

1. Receptacle, Weatherproof Type 1:
    a. Gasketed, cast-aluminum, with individual cap over each receptacle opening.
    b. Mounting Screw and Cap Spring: Stainless steel.
    c. Manufacturers and Products:
        1) Crouse-Hinds; Type WLRD-1.
        2) Appleton; Type FSK-WRD.

2. Receptacle, Weatherproof Type 2:
   a. UL listed for wet location while in use.
   b. Die cast metal cover.
   c. Manufacturer and Product: TayMac; Type Multi-Mac.
3. Switch:
   a. Gasketed, cast-metal or cast-aluminum, incorporating external operator for internal switch.
   b. Mounting Screw: Stainless steel.
   c. Manufacturers and Products:
      1) Crouse-Hinds; DS-181 or DS-185.
      2) Appleton; FSK-1VTS or FSK-1VS.

G. Raised Sheet Steel: 1/2-inch high zinc- or cadmium-plated steel designed for one-piece drawn type sheet steel box.

2.05 FINISHES

A. Wiring device catalog numbers specified in this section do not designate device color. Unless otherwise indicated, or required by code, provide colors as specified below.

B. Wiring Device: Gray.

C. Special purpose and hazardous location devices may be manufacturer's standard color (black).

PART 3 EXECUTION

3.01 INSTALLATION, GENERAL

A. Comply with NECA 1.

B. Coordination with Other Trades:

1. Ensure device and its box are protected. Do not place wall finish materials over device box and do not cut holes for box with router that is guided by riding against outside of box.
2. Keep outlet box free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate raceway system, conductors, and cables.
3. Install device box in brick or block wall such that cover plate does not cross a joint, unless otherwise indicated. Where indicated or directed to cross joint, trowel joint flush with face of wall.
4. Install wiring device after wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. Length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:
   a. Cut back and pigtail, or replace damaged conductors.
   b. Straighten conductors that remain and remove corrosion and foreign matter.
   c. Pigtailing existing conductors is permitted provided outlet box is large enough.

D. Device Installation:

1. Replace devices that have been in temporary use during construction or that show signs they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (150 mm) in length.
5. Use torque screwdriver when a torque is recommended or required by manufacturer.
6. When conductors larger than 12 AWG are installed on 15-amp or 20-amp circuits, splice 12 AWG pigtails for device connections.
7. Tighten unused terminal screws on device.
8. Device Plates:
   a. Do not use oversized or extra deep plate.
   b. Repair wall finishes and remount outlet box when standard device plate does not fit flush or does not cover rough wall opening.

3.02 SWITCH INSTALLATION

A. Switch, General Purpose:

1. Mounting Height: See Section 26 05 33, Raceway and Boxes.
2. Install with switch operation in vertical position.
3. Install single-pole, two-way switch such that toggle is in up position when switch is on.

B. Switch, Motor Rated:

1. Mounting Height: See Section 26 05 33, Raceway and Boxes.
2. Install with switch operation in vertical position such that toggle is in up position when ON.
3. Install within sight of motor when used as disconnect switch.

C. Occupancy Sensor, Wall Switch: Install in accordance with manufacturer's instructions.

3.03 RECEPTACLE INSTALLATION

A. Duplex Receptacle:

1. Install with grounding slot down, except where horizontal mounting is shown, in which case install with neutral slot down.
2. Ground receptacle to box with grounding wire only.
3. Weatherproof Receptacle:
   a. Install in cast metal box.
   b. Install such that hinge for protective cover is above receptacle opening.
4. Ground Fault Interrupter: Install feed-through model at locations where ground fault protection is specified for "downstream" conventional receptacles.
5. Special-Purpose Receptacle: Install in accordance with manufacturer's instructions.

3.04 DEVICE PLATE INSTALLATION

A. Securely fasten to wiring device; ensure tight fit to box.

B. Flush Mounted: Install with all four edges in continuous contact with finished wall surface without use of mat or similar material. Plaster fillings will not be acceptable.

C. Surface Mounted: Plate shall not extend beyond sides of box, unless plate has no sharp corners or edges.

D. Install with alignment tolerance to box of 1/16 inch.

E. Type (Exterior):

1. Switch: Weatherproof.
2. Receptacle in Damp Location: Weatherproof Type 1.
3. Receptacle in Wet Location: Weatherproof Type 2.

F. Type (Interior):

1. Flush Mounted Box: Stainless steel.
2. Surface Mounted, Metal Box:
   a. General Purpose Areas (Dry, Non-process): Sheet Steel.
   b. Other Areas: Cast metal.
3. Surface Mounted, Aluminum Box:
   a. General Purpose Areas: Stamped.
   b. Other Areas: Cast metal.
4. Surface Mounted, Sheet Steel Box: Raised sheet steel.
5. Surface Mounted, Cast Box: Cast.
6. Surface Mounted, Nonmetallic Box: Manufacturer's standard.
7. Receptacle Shown as Weatherproof on Drawings: Weatherproof Type 1.

3.05 IDENTIFICATION

A. Use tape labels for identification of individual wall switches and receptacles in dry indoor locations.

1. Degrease and clean device plate surface to receive tape labels.
2. Use 3/16-inch Kroy black letters on white background, unless otherwise indicated.
3. Identify panelboard and circuit number from which item is served on face of plate.

B. Identify conductors with durable wire markers or tags inside outlet.

3.06 FIELD QUALITY CONTROL

A. Perform tests and inspections, and prepare test reports.

B. Test Instrument for 125-Volt 20-Amp Receptacle: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

C. Using test plug, verify device and its outlet box are securely mounted.

D. Line Voltage Range: 105 volts to 132 volts.

E. Percent Voltage Drop under 15-Amp Load: Less than 6 percent; 6 percent or higher is not acceptable.

F. Ground Impedance: 2 ohms, maximum.

G. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.

H. Tests shall be diagnostic, indicating damaged conductors, high resistance at circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION

SECTION 26 43 00
SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American National Standards Institute (ANSI).
2. Department of Defense: MIL-STD-220C, Test Method Standard – Method of Insertion Loss Measurement.
3. Institute of Electrical and Electronics Engineers, Inc. (IEEE):
   a. C62.41.1, IEEE Guide on the Surge Environment in Low-Voltage (1000 V and less) AC Power Circuits.
   b. C62.41.2, IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits.
   c. C62.45, IEEE Recommended Practice on Surge Testing for Equipment Connected to Low-Voltage (1000 V and less) AC Power Circuits.
4. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
5. UL:
   a. 497A, Standard for Secondary Protectors for Communications Circuits.
   b. 1283, Standard for Electromagnetic Interference Filters.
   c. 1449, Standard for Surge Protective Devices.

1.02 SUBMITTALS

A. Action Submittals:

1. Product data on each suppressor type, indicating component values, part numbers, and conductor sizes. Include dimensional drawing for each, showing mounting arrangements.
2. Electrical single-line diagram showing location of each SPD.
3. Manufacturer’s UL certified test data and nameplate data for each surge protective device (SPD).

1.03 QUALITY ASSURANCE

A. UL Compliance and Labeling:

1. SPDs for Power and Signal Circuits: Comply with UL 1449 and complimentary listed to UL 1283 as an electromagnetic interference filter. Provide units listed and labeled by UL.

2. SPDs for Telephone Circuit Protection: Comply with UL 497A.

B. ANSI Compliance: Use SPD devices in compliance with the recommendations of IEEE C62.41.1, IEEE C62.41.2, and IEEE C62.45.

PART 2 PRODUCTS

2.01 MANUFACTURER

A. Eaton, SPD Series.

B. General Electric, Tranquell.

C. Square D, Surelogic.

D. Advanced Protection Technologies, Inc.

E. CITEL, MDS Series.

2.02 GENERAL

A. Unless indicated otherwise, provide direct bus-connected and factory-installed SPDs inside distribution equipment.

B. SPD Operating Conditions: Capable of performing at ambient temperatures between minus 40 degrees C and 60 degrees C, at relative humidity ranging from 0 percent to 95 percent, and at altitudes ranging from sea level to 12,000 feet.

C. Connect SPDs through a fused switch or circuit breaker as selected by manufacturer. Provide overcurrent protection to allow full surge handling capabilities and afford safety protection from thermal overloads and short circuits.

D. SPD Short Circuit Current Rating (SCCR): No less than the SCCR of distribution equipment.

E. Design SPD devices to protect all modes (L-L, L-N, L-G, N-G) of electrical system being used.

F. Power Filter: Include a high-frequency extended range power filter for each SPD complimentary listed to UL 1283 as an electromagnetic interference filter.

G. Provide SPDs with the following monitoring and diagnostics:

1. LED-type indication lights to show normal and failed status of each protected phase.
2. Surge event counter.
3. Form C dry contact which operates when unit fails.

H. Provide UL Type 2 SPDs.

I. EMI/RFI Noise Suppression: -50dB attenuation at 100 kHz, tested per MIL-STD 220C.

J. Voltage Protection Rating (VPR):

Voltage Rating	L-N	N-G	L-G	L-L
208Y/120	800	800	800	1200
480Y/277	1200	1200	1200	2000
240 Δ	--	--	1200	1200
480 Δ	--	--	2000	2000

2.03 SERVICE ENTRANCE AND DISTRIBUTION SPD

A. Provide SPD meeting IEEE C62.41.1 and IEEE C62.41.2 Location in accordance with Category C.

B. Surge Current Capacity:

1. Service Entrance:
   a. 240 kA per phase.
   b. 120 kA per mode.
2. Distribution:
   a. 160 kA per phase.
   b. 80 kA per mode.

C. Maximum Continuous Operating Voltage (MCOV): Not less than 115 percent of nominal system voltage.

D. Nominal Discharge Current (I_N): 20kA.

2.04 PANELBOARD SPD

A. Provide SPD meeting IEEE C62.41.1 and IEEE C62.41.2 Location in accordance with Category B.

B. Surge Current Capacity:

1. Distribution: 160 kA per phase; 80 kA per mode.
2. Branch: 120 kA per phase; 60 kA per mode.

C. Maximum Continuous Operating Voltage (MCOV): Not less than 125% of the nominal system voltage.

D. Nominal Discharge Current (I_N): 10kA.

2.05 PAIRED CABLE DATA LINE INTERIOR SUPPRESSORS

A. Provide units meeting IEEE C62.41, Location Category A.

B. Use bi-polar 1,500-watt silicon avalanche diodes between protected conductor and earth ground.

C. Provide units with a maximum single impulse current rating of 80 amperes (10 by 1,000 microsecond-waveform).

D. Breakdown voltage shall not exceed 36 volts.

2.06 PAIRED CABLE DATA LINE EXTERIOR SUPPRESSORS

A. Provide units meeting IEEE C62.41, Location Category A.

B. Design Requirements: A hybrid design with a minimum of three stages, using solid-state components and operating bi-directionally.

C. Meet or exceed the following criteria:

1. Maximum single impulse current rating of 10,000 amperes (8 by 20 microsecond-waveform).
2. Pulse Life Rating: 3,000 amperes (8 by 20 microsecond-waveform); 2,000 occurrences.
3. Maximum clamping voltage at 10,000 amperes (8 by 20 microsecond current waveform), shall not exceed the peak of normal applied signal voltage by 200 percent.

PART 3 EXECUTION

3.01 APPLICATION REQUIREMENTS

A. Provide SPDs when indicated on Drawings or in the equipment specifications.

B. Provide factory-installed SPDs as integral components to new switchgear, switchboards, motor control centers, panelboards and transfer switches. Externally mounted SPDs are not acceptable for new distribution equipment.

C. Externally mounted SPDs are acceptable for SPDs added to existing equipment as described below.

D. Electronic Equipment Paired Cable Conductors: Install data line suppressors at the low voltage input and output of each piece of equipment, including telephone cable entrance.

1. Use secondary protectors on lines that do not exit the structure.
2. Use primary protectors on lines that exit and enter the structure.

3.02 GENERAL INSTALLATION REQUIREMENTS

A. Install suppressors according to manufacturer's recommendations.

B. Install suppressors directly to the cabinet which houses the circuit to be protected so that the suppressor leads are straight and short, with conductors laced, running directly to the point of connection within the panel, without loops or bends. If bends are unavoidable, no bend may exceed 90 degrees and bending radius may not be less than 6 inches.

C. Provide connecting wires as short as possible with gently twisted conductors, tied together, to prevent separation.

1. Maximum Length: 24 inches.

D. Field Installed Conductors: As specified for building wire, not smaller than 8 AWG and not larger than 4 AWG. Provide device leads not longer than the maximum length recommended by manufacturer, unless specifically reviewed and approved by manufacturer.

E. Provide dedicated disconnecting means for SPD devices installed at main service entrance location, switchgear, and motor control centers. Provide dedicated 30-60-ampere circuit breakers (size dependent upon wire size used) with number of poles as required, as disconnecting means for SPD devices. Provide circuit breakers with interrupting capacity equal to that specified for other breakers at that location.

END OF SECTION

SECTION 26 50 00
LIGHTING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   b. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   c. A572/A572A, Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
   d. A588/A588M, Standard Specification for High-Strength Low-Alloy Structural Steel, with 50 ksi [345 MPa] Minimum Yield Point to 4-in. [100-mm] Thick.
   e. A595/A595M, Standard Specification for Steel Tubes, Low-Carbon or High-Strength Low-Alloy, Tapered for Structural Use.
   f. A615/A615M, Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   g. A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
   h. D6576, Standard Specification for Flexible Cellular Rubber Chemically Blown.
   i. G154, Standard Practice for Operating Fluorescent Light Apparatus for UV Exposure of Nonmetallic Materials.
2. American Wood Protection Association (AWPA): M6, Brands Used on Forest Products.
3. Canadian Standards Association (CSA).
4. Certified Ballast Manufacturer (CBM).
5. Federal Communications Commission (FCC).
6. Illuminating Engineering Society of North America (IESNA).
   a. HB-9, Lighting Handbook.
   b. LM-79, IES Electrical and Photometric Measurements of Solid-State Lighting Products.
   c. LM-80, IESNA Approved Method for Measuring Lumen Maintenance of LED Light Sources.
   d. RP (Recommended Practices) Series.
   e. TM-21, Projecting Long Term Lumen Maintenance of LED Light Sources.

7. Institute of Electrical and Electronics Engineers (IEEE): C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
8. National Electrical Manufacturers Association (NEMA):
9. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
10. ICS 6, Industrial Control and Systems: Enclosures.
11. National Energy Policy Act.
12. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC) – Softbound Version.
13. Rural Utilities Service (RUS): 1728F-700, Specification for Wood Poles, Stubs and Anchor Logs.
14. Underwriters Laboratories, Inc. (UL):
    a. 773, UL Standard for Safety Plug-In Locking Type Photocontrols for Use with Area Lighting - Fourth Edition; Reprint with Revisions Through and Including March 08, 2002.
    b. 844, Electric Lighting Fixtures for Use in Hazardous (Classified) Locations.
    c. 924, Emergency Lighting and Power Equipment.
    d. 1598, UL Standard for Safety Luminaires.
    e. 2108, UL Standard for Safety Low Voltage Lighting Systems - First Edition; Reprint with Revisions through and Including February 24, 2014.
    f. 8750, UL Standard for Safety Light Emitting Diode (LED) Equipment for Use in Lighting Products - First Edition; Reprint with Revisions Through and Including April 1, 2015.
15. U.S. Environmental Protection Agency and U.S. Department of Energy: Energy Star.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
    a. General:
        1) Provide catalog data sheets and pictures for all products listed below.
        2) Proposed Luminaire Substitutions (Interior and Exterior): Provide an electronic photometric file in standard '.ies' file format per the Illumination Engineering Society of North America (IESNA) for any proposed luminaire substitution not identified on the project Luminaire Schedule. Obtain file from the luminaire manufacturer or approved independent photometric testing laboratory. Include the proposed substitute luminaire with all options identified on the project Luminaire Schedule.

b. Interior Luminaires:
   1) Catalog data sheets with pictures.
   2) Luminaire material, finish, dimensions, and metal gauge.
   3) Lens material, pattern, and thickness.
   4) Candle power distribution curves in two or more planes.
   5) Candle power chart 0 degree to 90 degrees.
   6) Lumen output chart.
   7) Average maximum brightness data in foot lamberts.
   8) Coefficients of utilization for zonal cavity calculations.
   9) Mounting or suspension details.

c. Exterior Luminaires:
   1) Catalog data sheets with pictures. Luminaire material, finish, dimensions, and metal gauge.
   2) Lens material, pattern, and thickness. Filters.
   3) IESNA lighting classification (BUG rating).
   4) Isolux diagram.
   5) Lighting distribution data and lighting distribution classification type as defined in IESNA HB 9.
   6) Fastening details to wall, pendant, or pole.
   7) Ballast type, location, and method of fastening.
   8) For light poles, submit catalog sheet, wind loading, pole deflection with fixture attached, total weight, all accessories, complete dimensions, and finish.

d. Lamps:
   1) Voltages.
   2) Watts.
   3) Correlated Color Temperature (CCT).
   4) Color Rendering Index (CRI).
   5) Published rated life (in hours). Provide number of hours per start and operating temperature for published rated life hours indicated.
   6) Published rated initial and mean lumens.
   7) Lumen maintenance curve.
   8) Lamp type (ANSI designation, dimensions, shape, and base).

e. Ballasts:
   1) Type.
   2) Wiring diagram.
   3) Ballast factor.
   4) Nominal watts and input watts.
   5) Input voltage and power factor.
   6) Starting current, line current, and restrike current values.
   7) Sound rating.
   8) Temperature rating.
   9) Efficiency ratings.
   10) Low temperature characteristics.

11) Emergency Ballasts:
    a) Electrical ratings.
    b) Lamp type compatibility.
    c) Battery capacity.

f. LED Source Systems:
    1) General:
        a) IESNA LM-80 test reports.
        b) IESNA TM-21 ratings.
        c) Operating temperature range. Data sheet (chart/graph) describing life as a function of temperature.
        d) Warranty: Light engine and driver.
        e) Rated life.
        f) Surge protection.
        g) Thermal control device, heat sink.
        h) Enclosure and wiring information.
        i) Operating voltage range.
    2) Electronic Module/Light Engine:
        a) Correlated Color Temperature (CCT).
        b) Color Rendering Index (CRI).
    3) Drivers:
        a) Input Current Total Harmonic Distortion.
        b) Power factor.
        c) Sound rating.

g. Photoelectric Switches (Photocells):
    1) Voltage.
    2) Power consumption.
    3) Load capacity (watts).
    4) Contact ratings and configuration.
    5) Time delay.
    6) Light operating level controls.
    7) Enclosure type and dimensions.
    8) Mounting type.
    9) Temperature range.
    10) Features and options.

B. Informational Submittals:

1. Manufacturer's printed installation instructions.
2. Operating and Maintenance Data as specified in Section 01730, Operating and Maintenance Data.

1.03 QUALITY ASSURANCE

A. Authority Having Jurisdiction (AHJ):

1. Provide Work in accordance with NFPA 70, National Electrical Code (NEC). Where required by the AHJ, provide material and equipment labeled or listed by a nationally recognized testing laboratory or other organization acceptable to the AHJ to provide a basis for approval under NEC.
2. Provide materials and equipment manufactured within the scope of standards published by Underwriters Laboratories, Inc. in conformance with those standards and with an applied UL listing mark.

B. Standard Products:

1. Provide materials and equipment of manufacturers regularly engaged in the production of products specified in this section and that are of equal material, design, and workmanship.
2. Provide products that have been in satisfactory commercial or industrial use for 2 years prior to Bid opening in similar applications under similar circumstances and of similar size. Provide products that have been on sale on the commercial market through advertisements, manufacturers' catalogs, or brochures during the 2-year period.
3. Material and Equipment Manufacturing Date: Do not use products manufactured more than 3 years prior to date of delivery to Site.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Concrete Poles:

1. Do not store poles on ground.
2. Support poles so they are at least 1 foot above ground level and growing vegetation.
3. Ship poles with bolt circle template, base cover, handhold cover, and shaft cap or tenon.

PART 2 PRODUCTS

2.01 LUMINAIRES

A. Specific requirements relative to execution of the Work of this section are located in Luminaire Schedule on Drawings.

B. Provide luminaires and components tested, listed, and labeled by UL, or other approved testing agency.

C. Provide luminaires with Illumination Engineering Society of North America (IESNA) formatted photometric files, ".ies" format, certified by the luminaire manufacturer for use with lighting software.

D. Luminaire Labels:

1. External label per ANSI C136.15.
2. Internal label per ANSI C136.22.

E. Provide luminaires rated by the manufacturer to start and operate to their full lumen capacity for rated life of the luminaire at the minimum low and maximum high ambient temperatures as defined in the Contract Documents at their installation location.

F. Feed-through type, or separate junction box.

G. Wire Leads: Minimum 18 AWG.

H. Component Access: Accessible and replaceable without removing luminaire from ceiling.

I. Exterior Installations:

1. UL Labeled: SUITABLE FOR WET LOCATIONS.
2. Ballast: Removable, prewired.
3. When factory-installed photocells are provided, entire assembly shall have UL label.

J. Hazardous Classified Areas:

1. UL Labeled: CLASS I, DIVISION 2, GROUPS C AND D. As indicated in the Luminaire Schedule.
2. Fixture Enclosure and Fittings: Copper-free, cast aluminum in accordance with UL 844.

2.02 LED SOURCE SYSTEMS

A. General:

1. Provide IESNA LM-80 test reports.
2. Provide Energy Star compliance for solid state luminaires.
3. Listed To: UL 8750 Standard for Safety for Light Emitting Diode (LED) Equipment for use in Lighting Products.
4. Provide RoHS compliant LED light source(s) and driver(s).
5. Rated operating temperature range as indicated on the Luminaire Schedule.
6. Warranty: 5 years minimum.

B. Electronic Module/Light Engine:

1. Mount all components to a single plate and factory prewired with quick-disconnect plugs.
2. Include a driver, thermal control device, thermal protector device, and surge protector device.
   a. Provide surge protector tested in accordance with IEEE/ANSI C62.41.2 to Category C Low.
3. Provide LEDs mounted to a metal-core circuit board and aluminum heat sink for optimal thermal management and long life.
4. Light Engine Rating per TM-21: 100,000 at 25 degrees C, L70.
5. Correlated Color Temperature (CCT): As indicated on the Luminaire Schedule.
6. Color Rendering Index (CRI): Minimum of 80.

C. Drivers:

1. Expected life of 100,000 hours at 25 degrees C.
2. Provide drivers mounted in an all metal can.
3. Operating Voltage Range: 50/60-Hz input source voltage range as indicated on the Luminaire Schedule with sustained variations of plus or minus 10 percent voltage with no damage to the driver.
4. Input Current Total Harmonic Distortion: Less than 20 percent up to 50 percent of full load rating.
5. Power Factor: Greater than 0.90 for primary application up to 50 percent of full load rating.
6. Sound rating: Class A.
7. Comply with NEMA 410 for inrush current limits.

2.03 LIGHTING CONTROL

A. Photoelectric Switch (Photocell):

1. Automatic Solid State ON/OFF Switching Photo Control:
   a. Dry Contacts:
      1) Configuration: SPST.
      2) Rating: 1,800VA tungsten.
      3) Compatible with connected load device indicated on Drawings.
2. Housing: Self-contained, die-cast aluminum, unaffected by moisture, vibration, or temperature changes.
3. Mounting Type: Twist lock plug.
4. Setting: ON at dusk and OFF at dawn.
5. Time delay feature to prevent false switching.
6. Field adjustable to control operating light levels.
7. Integral surge protection.

8. Manufacturers:
   a. Tork.
   b. Intermatic.
   c. Paragon Electric Company.

2.04 POLES

A. General:

1. Design for wind load as specified in Section 01 61 00, Common Product Requirements, while supporting luminaires and other appurtenances. Use effective projected areas (EPA) of luminaires and appurtenances in calculations specific to the actual products proposed on each pole.
2. Poles 40 feet and Shorter: One-piece construction.
3. Pole Height: As indicated on Luminaire Schedule.
4. Handhole:
   a. Provide oval-shaped handhole having a minimum clear opening of 2.5 inches by 5 inches.
   b. Secure cover with stainless steel captive screws.
   c. Metal Poles: Provide an internal grounding connection accessible from handhole near bottom of each pole.
5. Do not install scratched, stained, chipped, or dented poles.

B. Concrete Poles:

1. Cross-Sectional Shape: Round or multi-sided.
2. Steel Reinforcing:
   a. Prestressed Concrete Pole Shafts: Reinforce with steel prestressing members.
   b. Design for internal longitudinal loading by either pretensioning or post-tensioning of longitudinal reinforcing members.
3. Tensioned Reinforcing:
   a. Primary Reinforcement Steel Used for a Prestressed Concrete Pole Shaft: Tension to between 60 percent and 70 percent of its ultimate strength.
   b. Design reinforcement so that when reinforcement is tensioned to 70 percent of its ultimate strength, the total resultant tensile force does not exceed the minimum section compressive strength of the concrete.
4. Coating and Sleeves for Reinforcing Members:
   a. Where minimum internal coverage cannot be maintained next to required core openings, such as handhole and wiring inlet, protect reinforcing with a vaporproof noncorrosive sleeve over the length without the 1/2-inch concrete coverage.
   b. Coat each steel reinforcing member to be post-tensioned with a nonmigrating slipper coating prior to the addition of concrete to ensure uniformity of stress throughout length of such member.

5. Strength Requirement:
    a. Naturally cured to achieve a 28-day compressive strength of 7,000 psi.
    b. Do not subject to severe temperature changes during curing period.
6. Shaft Preparation:
    a. Completed Prestressed Concrete Pole Shaft Surface:
        1) Hard, smooth, and nonporous.
        2) Resistant to soil acids, road salts, and attacks of water and frost.
        3) Clean, smooth, and free of surface voids and internal honeycombing.
    b. Install a minimum of 15 days after manufacture.

2.05 EQUIPMENT IDENTIFICATION

A. Manufacturer's Nameplate: Provide each item of equipment with a nameplate bearing manufacturer's name, address, model number, and serial number securely affixed in a conspicuous place; nameplate of distributing agent will not be acceptable.

B. Provide clear markings located to be readily visible to service personnel.

2.06 FACTORY FINISH

A. Provide electrical equipment with factory-applied painting systems that, at minimum, meet the requirements of NEMA 250 corrosion-resistance test.

2.07 SOURCE QUALITY CONTROL

A. Flexural Strength and Deflection Test: Test loading shall be as a cantilever beam with pole butt as fixed end and a force simulating wind load at the free end.

PART 3 EXECUTION

3.01 LUMINAIRES

A. General:

1. Install in accordance with manufacturer's recommendations.
2. Provide proper hangers, pendants, and canopies as necessary for complete installation.
3. Provide additional ceiling bracing, hanger supports, and other structural reinforcements to building and to concrete pole bases required to safely mount.
4. Install plumb and level.
5. Install each luminaire outlet box with galvanized stud.

B. Mounting:

1. General:
   a. Coordinate mounting, fastening, and environmental conditions with Section 26 05 02, Basic Electrical Requirements.
   b. Refer to Fastener Schedule in Section 05 50 00, Metal Fabrications.
2. Wall Mounted: Measure mounting heights from center of mounting plate to finished floor or finished grade, whichever is applicable.
3. Pendant Mounted:
   a. Space single-stem hangers on continuous-row fluorescent luminaires nominally 48 inches apart.
   b. Provide twin-stem hangers on single luminaires.
   c. Measure mounting heights from bottom of luminaire to finished floor or finished grade, whichever is applicable.
4. Pole Mounted: Provide precast concrete base.

C. Swinging Type: Provide, at each support, safety cable capable of supporting four times vertical load from structure to luminaire.

3.02 LIGHTING CONTROL

A. Outdoor Luminaires: Photocells switch lights ON at dusk and OFF at dawn.

3.03 POLES

A. Electrical Installations: Conform to IEEE C2 and requirements specified herein.

B. Pole Setting:

1. Depth: As indicated on Drawings or footing detail.
2. Install poles in straight runs in a straight line.
3. Setting Depth:

Length of Pole (feet)	**Setting in Soil (feet)**
20	5.0
25	5.5
30	5.5
35	6.0
40	6.0
45	6.5
50	7.0
55	7.5
60	8.0

4. Soil Setting: Depths shall apply where pole holes are in soil, sand, or gravel or any combination of these.
5. Setting on Sloping Ground: On sloping ground, measure depth of hole from low side of hole.
6. Backfill: Tamp pole backfill for the full depth of hole and mound excess fill around pole.
7. Dig holes large enough to permit the proper use of tampers to the full depth of the hole.
8. Place backfill in the hole in 6-inch maximum layers and thoroughly tamp.
9. Place surplus earth around the pole in a conical shape and pack tightly to drain water away.

C. Concrete Poles: Install according to pole manufacturer's instructions.

D. Photocell Switch Aiming: Mount and aim switch according to manufacturer's recommendations.

E. Grounding: Ground noncurrent-carrying parts of equipment including metal poles, luminaires, mounting arms, brackets, and metallic enclosures as specified in Section 26 05 26, Grounding and Bonding for Electrical Systems. Where copper grounding conductor is connected to a metal other than copper, provide specially treated or lined connectors suitable for this purpose.

3.04 FIELD FINISHES

A. Paint electrical equipment as required to match finish of adjacent surfaces or to meet the indicated or specified safety criteria. Paint as specified in Section 09 90 04, Painting.

3.05 FIELD QUALITY CONTROL

A. Upon completion of installation, verify equipment is properly installed, connected, and adjusted. Conduct an operating test to show equipment operates in accordance with the requirements of this section.

B. Coordinate lighting and controls installation and testing with commissioning as specified in Section 01 91 14, Equipment Testing and Facility Startup.

3.06 CLEANING

A. Remove labels and markings, except UL listing mark.

B. Wipe luminaires inside and out to remove construction dust.

C. Clean luminaire plastic lenses with antistatic cleaners only.

D. Touch up painted surfaces of luminaires and poles with matching paint ordered from manufacturer.

E. Replace defective lamps at time of Substantial Completion.

END OF SECTION

SECTION 31 10 00
SITE CLEARING

PART 1 GENERAL

1.01 DEFINITIONS

A. Interfering or Objectionable Material: Trash, rubbish, and junk; vegetation and other organic matter, whether alive, dead, or decaying; topsoil.

B. Clearing: Removal of interfering or objectionable material lying on or protruding above ground surface.

C. Grubbing: Removal of vegetation and other organic matter including stumps, buried logs, and roots greater than 2-inch caliper to a depth of 6 inches below subgrade.

D. Project Limits: Areas, as shown or specified, within which Work is to be performed.

1.02 SCHEDULING AND SEQUENCING

A. Prepare Site only after adequate erosion and sediment controls are in place. Limit areas exposed uncontrolled to erosion during installation of temporary erosion and sediment controls.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Clear, grub areas actually needed for Site improvements within limits shown or specified.

B. Do not injure or deface vegetation that is not designated for removal.

3.02 LIMITS

A. As follows, but not to extend beyond Project limits.

1. Excavation 5 feet beyond top of cut slopes.
2. Fill:
   a. Clearing and Grubbing: 5 feet beyond toe of permanent fill.
3. Structures: 15 feet outside of new structures.

4. Roadways: Clearing and grubbing: 30 feet from centerline.
5. Other Areas: As shown.

B. Remove rubbish, trash, and junk from entire area within Project limits.

3.03 TEMPORARY REMOVAL OF INTERFERING PLANTINGS

A. Remove and store shrubs and trees that are not designated for removal but do interfere with construction or could be damaged by construction activities.

B. Photograph and document location, orientation, and condition of each plant prior to its removal. Record sufficient information to uniquely identify each plant removed and to assure accurate replacement.

3.04 CLEARING

A. Clear areas within limits shown or specified.

B. Fell trees so that they fall away from facilities and vegetation not designated for removal.

C. Cut stumps not designated for grubbing to within 6 inches of ground surface.

D. Cut off shrubs, brush, weeds, and grasses to within 2 inches of ground surface.

3.05 GRUBBING

A. Grub areas within limits shown or specified.

3.06 DISPOSAL

A. Clearing and Grubbing Debris:

1. Dispose of debris offsite.
2. Burning of debris onsite will not be allowed.
3. Woody debris may be chipped. Chips may be sold to Contractor's benefit or used for landscaping onsite as mulch or uniformly mixed with topsoil, provided that resulting mix will be fertile and not support combustion. Maximum dimensions of chipped material used onsite shall be 1/4 inch by 2 inches. Dispose of chips that are unsaleable or unsuitable for landscaping or other uses with unchipped debris.
4. Limit offsite disposal of clearing and grubbing debris to locations that are approved by federal, state, and local authorities, and that will not be visible from Project.

END OF SECTION

SECTION 31 23 13
SUBGRADE PREPARATION

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lb/ft^3 (600 kN-m/m^3)).
   b. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   c. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   d. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.02 DEFINITIONS

A. Optimum Moisture Content: As defined in Section 31 23 23, Fill and Backfill.

B. Prepared Ground Surface: Ground surface after completion of clearing and grubbing, scalping of sod, stripping of topsoil, excavation to grade, and scarification and compaction of subgrade.

C. Relative Compaction: As defined in Section 31 23 23, Fill and Backfill.

D. Subgrade: Layer of existing soil after completion of clearing, grubbing, scalping of topsoil prior to placement of fill, roadway structure or base for floor slab.

E. Proof-Rolling: Testing of subgrade by compactive effort to identify areas that will not support the future loading without excessive settlement.

1.03 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Section 31 10 00, Site Clearing and Section 31 23 16, Excavation, prior to subgrade preparation.

1.04 QUALITY ASSURANCE

A. Notify Engineer when subgrade is ready for compaction or proof-rolling or whenever compaction or proof-rolling is resumed after a period of extended inactivity.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Keep subgrade free of water, debris, and foreign matter during compaction or proof-rolling.

B. Bring subgrade to proper grade and cross-section and uniformly compact surface.

C. Do not use sections of prepared ground surface as haul roads. Protect prepared subgrade from traffic.

D. Maintain prepared ground surface in finished condition until next course is placed.

3.02 COMPACTION

A. Under Earthfill: Compact upper 12 inches to minimum of 90 percent relative compaction as determined in accordance with ASTM D1557.

B. Under Pavement Structure, Floor Slabs On Grade, or Granular Fill Under Structures: Proof-roll the subgrade with at least 15 overlapping passes, using a vibratory roller having a minimum dynamic force of 10 tons. After proof-rolling, compact the upper 12 inches to minimum of 95 percent relative compaction as determined in accordance with ASTM D1557.

3.03 MOISTURE CONDITIONING

A. Dry Subgrade: Add water, then mix to make moisture content uniform throughout.

B. Wet Subgrade: Aerate material by blading, discing, harrowing, or other methods, to hasten drying process.

3.04 TESTING

A. The Contractor shall retain an independent soil testing company to determine in-place density and moisture content.

B. One test per every 2,000 square feet of prepared subgrade, or minimum of one test per structure or facility.

C. Test in accordance with ASTM D1556 or ASTM D6938.

3.05 CORRECTION

A. Soft or Loose Subgrade:

1. Adjust moisture content and recompact, or
2. Over excavate as specified in Section 31 23 16, Excavation, and replace with suitable material from the excavation, as specified in Section 31 23 23, Fill and Backfill.

B. Unsuitable Material: Over excavate as specified in Section 31 23 16, Excavation, and replace with suitable material from the excavation, as specified in Section 31 23 23, Fill and Backfill.

END OF SECTION

SECTION 31 23 16
EXCAVATION

PART 1 GENERAL

1.01 QUALITY ASSURANCE

A. Provide adequate survey control to avoid unauthorized overexcavation.

B. Monitor potential adverse impacts on adjacent facilities and completed work.

1.02 WEATHER LIMITATIONS

A. Material excavated during inclement weather shall not be used as fill or backfill until after material drains and dries sufficiently for proper compaction.

1.03 SEQUENCING AND SCHEDULING

A. Clearing and Grubbing: Complete applicable Work specified in Section 31 10 00, Site Clearing, prior to excavating.

B. Dewatering: Conform to applicable requirements of Section 31 23 19.01, Dewatering, prior to initiating excavation.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. Excavate to lines, grades, and dimensions shown and as necessary to accomplish Work. Excavate to within tolerance of plus or minus 0.1 foot, except where dimensions or grades are shown or specified as maximum or minimum. Allow for forms, working space, granular base, topsoil, and similar items, wherever applicable. Trim to neat lines where concrete is to be deposited against earth.

B. Do not overexcavate without written authorization of Engineer.

C. Conduct excavation in accordance with OSHA Standards 29 CFR Part 1926.650 Subpart P. Trenching and Excavation regulations and requirements.

3.02 UNCLASSIFIED EXCAVATION

A. Excavation is unclassified. Complete all excavation regardless of the type, nature, or condition of the materials encountered.

3.03 TRENCH WIDTH

A. Minimum Width of Trenches:

1. Single Pipes, Conduits, Direct-Buried Cables, and Duct Banks:
   a. Less than 4-inch Outside Diameter or Width: 18 inches.
   b. Greater than 4-inch Outside Diameter or Width: 18 inches greater than outside diameter or width of pipe, conduit, direct-buried cable, or duct bank.
2. Multiple Pipes, Conduits, Cables, or Duct Banks in Single Trench: inches greater than aggregate width of pipes, conduits, cables, duct banks, plus space between.

B. Maximum Trench Width: Unlimited, unless otherwise shown or specified, or unless excess width will cause damage to existing facilities, adjacent property, or completed Work.

3.04 EMBANKMENT AND CUT SLOPES

A. Shape, trim, and finish cut slopes to conform with lines, grades, and cross-sections shown.

B. Remove stones and rock that exceed 3-inch diameter and that are loose and may roll down slope. Remove exposed roots from cut slopes.

C. Round tops of cut slopes in soil to not less than a 6-foot radius, provided such rounding does not extend offsite or outside easements and rights-of-way, or adversely impacts existing facilities, adjacent property, or completed Work.

3.05 STOCKPILING EXCAVATED MATERIAL

A. Stockpile excavated material that is suitable for use as fill or backfill until material is needed.

B. Post signs indicating proposed use of material stockpiled. Post signs that are readable from all directions of approach to each stockpile. Signs should be clearly worded and readable by equipment operators from their normal seated position.

C. Confine stockpiles to within easements, rights-of-way, and approved work areas. Do not obstruct roads or streets.

D. Do not stockpile excavated material adjacent to trenches and other excavations, unless excavation side slopes and excavation support systems are designed, constructed, and maintained for stockpile loads.

E. Do not stockpile excavated materials near or over existing facilities, adjacent property, or completed Work, if weight of stockpiled material could induce excessive settlement.

3.06 DISPOSAL OF SPOIL

A. Dispose of excavated materials, which are unsuitable or exceed quantity needed for fill or backfill, offsite.

B. Dispose of debris resulting from removal of organic matter, trash, refuse, and junk as specified in Section 31 10 00, Site Clearing, for clearing and grubbing debris.

END OF SECTION

SECTION 31 23 19.01
DEWATERING

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Discharge permits.
2. Water Level Elevations: Submit same day measured.
3. Settlement Benchmark: Submit weekly record.

B. Coordinate dewatering and water control submittal with the excavation support submittals.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SURFACE WATER CONTROL

A. Intercept surface water and divert it away from excavations through the use of diversion ditches, dikes, pipes, or other approved means.

B. Remove surface runoff controls when no longer needed.

3.02 DEWATERING SYSTEMS

A. Provide, operate, and maintain dewatering systems of sufficient size and capacity to permit excavation and subsequent construction in dry and to lower and maintain groundwater level a minimum of 2 feet below the lowest point of excavation. Continuously maintain excavations free of water, regardless of source, and until backfilled to final grade.

B. Dewatering operations shall be conducted in a manner that does not cause loss or ground or disturbance to the soil that supports overlying or adjacent utilities or structures.

C. Dewatering systems shall include wells or well points, and other equipment and appurtenances installed sufficiently below lowest point of excavation, or to maintain specified water elevation.

D. Design and Operate Dewatering Systems:

1. To prevent loss of ground as water is removed.
2. To avoid inducing settlement or damage to existing facilities, completed Work, or adjacent property.
3. To relieve artesian pressures and resultant uplift of excavation bottom.

E. Provide sufficient redundancy in each system to keep excavation free of water in event of component failure.

F. Provide supplemental ditches and sumps only as necessary to collect water from local seeps. Do not use ditches and sumps as primary means of dewatering.

G. If method of dewatering does not properly dewater the trench or excavation as specified, install groundwater observation wells and do not proceed with any work until the readings obtained from the observation wells indicate that the groundwater has been lowered a minimum of 2 feet below the bottom of the final excavation.

H. Remove dewatering system only when groundwater control is no longer required and as approved by the Engineer.

3.03 SETTLEMENT

A. Monitoring Dewatering-Induced Settlement: Establish monuments for monitoring settlement at adjacent facility locations selected by Engineer. Monitor vertical movement of each settlement monument, relative to remote benchmark selected by Engineer, at least weekly.

3.04 MONITORING FLOWS

A. Monitor volume of water pumped per calendar day from excavations, as Work progresses. Also monitor volume of water introduced each day into excavations for performance of Work. Monitor flows using measuring devices acceptable to Engineer.

3.05 DISPOSAL OF WATER

A. Obtain discharge permit for water disposal from authorities having jurisdiction.

B. All water discharged from the dewatering system shall be treated to remove solids and sediment prior to discharge.

C. Discharge water as required by discharge permit and in manner that will not cause erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property.

END OF SECTION

SECTION 31 23 23
FILL AND BACKFILL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. C117, Standard Test Method for Materials Finer Than 75-Micrometers (No. 200) Sieve in Mineral Aggregates by Washing.
   b. C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
   c. D75, Standard Practice for Sampling Aggregates.
   d. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
   e. D1556, Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
   f. D1557, Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   g. D6938, Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.02 DEFINITIONS

A. Relative Compaction:

1. Ratio, in percent, of as-compacted field dry density to laboratory maximum dry density as determined in accordance with ASTM D1557.
2. Apply corrections for oversize material to either as-compacted field dry density or maximum dry density, as determined by Engineer.

B. Optimum Moisture Content:

1. Determined in accordance with ASTM Standard specified to determine maximum dry density for relative compaction.
2. Determine field moisture content on basis of fraction passing 3/4-inch sieve.

C. Prepared Ground Surface: Ground surface after completion of required demolition, clearing and grubbing, excavation to grade, and subgrade preparation.

D. Completed Course: A course or layer that is ready for next layer or next phase of Work.

E. Lift: Loose (uncompacted) layer of material.

F. Geosynthetics: Geotextiles, geogrids, or geomembranes.

G. Well-Graded:

1. A mixture of particle sizes with no specific concentration or lack thereof of one or more sizes.
2. Does not define numerical value that must be placed on coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.
3. Used to define material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids.

H. Influence Area: Area within planes sloped downward and outward at 60-degree angle from horizontal measured from:

1. 1 foot outside outermost edge at base of foundations or slabs.
2. 1 foot outside outermost edge at surface of roadways or shoulder.
3. 0.5 foot outside exterior at spring line of pipes or culverts.

I. Borrow Material: Material from required excavations or from designated borrow areas on or near Site.

J. Selected Backfill Material: Materials available onsite that Engineer determines to be suitable for specific use.

K. Imported Material: Materials obtained from sources offsite, suitable for specified use.

L. Structural Fill: Fill materials as required under structures, pavements, and other facilities.

M. Embankment Material: Fill materials required to raise existing grade in areas other than under structures.

1.03 SUBMITTALS

A. Informational Submittals: Certified test results from independent testing agency.

1.04 QUALITY ASSURANCE

A. Notify Engineer when:

1. Structure or tank is ready for backfilling, and whenever backfilling operations are resumed after a period of inactivity.
2. Soft or loose subgrade materials are encountered wherever embankment or site fill is to be placed.
3. Fill material appears to be deviating from Specifications.

1.05 SEQUENCING AND SCHEDULING

A. Complete applicable Work specified in Section 31 10 00, Site Clearing; Section 31 23 16, Excavation; and Section 31 23 13, Subgrade Preparation, prior to placing fill or backfill.

B. Backfill against concrete structures only after concrete has attained 28 day compressive strength, specified in Section 03 30 10, Structural Concrete. Obtain Engineer's acceptance of concrete work and attained strength prior to placing backfill.

C. Do not place granular base, subbase, or surfacing until after subgrade has been prepared as specified in Section 31 23 13, Subgrade Preparation.

PART 2 PRODUCTS

2.01 SOURCE QUALITY CONTROL

A. Gradation Tests: By Contractors testing laboratory, as necessary to locate acceptable sources of imported material.

2.02 EARTHFILL

A. Excavated material from required excavations free from rocks larger than 3 inches, from roots and other organic matter, ashes, cinders, trash, debris, and other deleterious materials.

B. Provide imported material of equivalent quality, if required to accomplish Work.

2.03 GRANULAR FILL

A. 1-inch minus crushed gravel or crushed rock.

B. Free from dirt, clay balls, and organic material.

C. Well-graded from coarse to fine and containing sufficient fines to bind material when compacted, but with maximum 8 percent by weight passing No. 200 sieve.

2.04 WATER FOR MOISTURE CONDITIONING

A. Free of hazardous or toxic contaminates, or contaminants deleterious to proper compaction.

PART 3 EXECUTION

3.01 GENERAL

A. Keep placement surfaces free of water, debris, and foreign material during placement and compaction of fill and backfill materials.

B. Place and spread fill and backfill materials in horizontal lifts of uniform thickness, in a manner that avoids segregation, and compact each lift to specified densities prior to placing succeeding lifts. Slope lifts only where necessary to conform to final grades or as necessary to keep placement surfaces drained of water.

C. During filling and backfilling, keep level of fill and backfill around each structure and buried tank even.

D. If pipe, conduit, duct bank, or cable is to be laid within fill or backfill:

1. Fill or backfill to an elevation 2 feet above top of item to be laid.
2. Excavate trench for installation of item.
3. Install bedding, if applicable, as specified in Section 31 23 23.15, Trench Backfill.
4. Install item.
5. Backfill envelope zone and remaining trench, as specified in Section 31 23 23.15, Trench Backfill, before resuming filling or backfilling specified in this section.

E. Tolerances:

1. Final Lines and Grades: Within a tolerance of 0.1 foot unless dimensions or grades are shown or specified otherwise.
2. Grade to establish and maintain slopes and drainage as shown. Reverse slopes are not permitted.

F. Settlement: Correct and repair any subsequent damage to structures, pavements, curbs, slabs, piping, and other facilities, caused by settlement of fill or backfill material.

3.02 BACKFILL UNDER AND AROUND STRUCTURES

A. Under Facilities: Within influence area beneath structures, slabs, pavements, curbs, piping, conduits, duct banks, and other facilities, backfill with granular fill, unless otherwise shown. Place granular fill in lifts of 6-inch maximum thickness and compact each lift to minimum of 98 percent relative compaction as determined in accordance with ASTM D1557.

B. Other Areas: Backfill with earthfill to lines and grades shown. Place in lifts of 6-inch maximum thickness and compact each lift to minimum 90 percent relative compaction as determined in accordance with ASTM D1557.

3.03 FILL

A. Outside Influence Areas beneath Structures, Tanks, Pavements, Curbs, Slabs, Piping, and Other Facilities: Unless otherwise shown, place earthfill as follows:

1. Allow for 4-inch thickness of topsoil where required.
2. Maximum 8-inch thick lifts.
3. Place and compact fill across full width of embankment.
4. Compact to minimum 90 percent relative compaction as determined in accordance with ASTM D1557.
5. Dress completed embankment with allowance for crest surfacing, and slope protection, where applicable.

3.04 SITE TESTING

A. Gradation:

1. One sample from each 500 tons of finished product or more often as determined by Engineer, if variation in gradation is occurring, or if material appears to depart from Specifications or the approved samples.
2. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.
3. Remove material placed in Work that does not meet Specification requirements.

B. In-Place Density Tests: In accordance with ASTM D1556 or ASTM D6938. During placement of materials, test as follows:

1. Granular Fill and Earthfill: One test for every 2,000 square feet of each lift; or one test per lift, whichever requires more lifts.

3.05 REPLACING OVEREXCAVATED MATERIAL

A. Replace excavation carried below grade lines shown or established by Engineer as follows:

1. Beneath Footings: Granular fill.
2. Beneath Fill or Backfill: Same material as specified for overlying fill or backfill.
3. Beneath Slabs-On-Grade: Granular fill.
4. Trenches:
   a. Unauthorized Overexcavation: Granular Fill.
   b. Authorized Overexcavation: Granular Fill.
5. Permanent Cut Slopes (Where Overlying Area is Not to Receive Fill or Backfill):
   a. Flat to Moderate Steep Slopes (3:1, Horizontal Run: Vertical Rise or Flatter): Earthfill.
   b. Steep Slopes (Steeper than 3:1):
      1) Correct overexcavation by transitioning between overcut areas and designed slope adjoining areas, provided such cutting does not extend offsite or outside easements and right-of-ways, or adversely impacts existing facilities, adjacent property, or completed Work.
      2) Backfilling overexcavated areas is prohibited, unless in Engineer's opinion, backfill will remain stable, and overexcavated material is replaced as compacted earthfill.

END OF SECTION

SECTION 31 23 23.15
TRENCH BACKFILL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Public Works Association (APWA): Uniform Color Code.
2. ASTM International (ASTM):
   a. C33/C33M, Standard Specification for Concrete Aggregates.
   b. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   c. C117, Standard Test Method for Materials Finer than 75 Micrometer (No. 200) Sieve in Mineral Aggregates by Washing.
   d. C136, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
   e. C150/C150M, Standard Specification for Portland Cement.
   f. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
   g. D698, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft^3 (600 kN-m/m^3)).
   h. D1140, Standard Test Methods for Amount of Material in Soils Finer than No. 200 (75 micrometer) Sieve.
   i. D1557, Standard Test Methods for Laboratory Compaction Characteristics of Soil using Modified Effort (56,000 ft-lbf/ft^3 (2,700 kN-m/m^3)).
   j. D3776, Standard Test Methods for Mass Per Unit Area (Weight) of Fabric
   k. D4253, Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
   l. D4254, Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
   m. D4318, Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
   n. D4533, Standard Test Method for Trapezoid Tearing Strength of Geotextiles.
   o. D4832, Standard Test Method for Preparation and Testing of Controlled Low Strength Material (CLSM) Test Cylinders.
   p. D4991, Standard Test Method for Leakage Testing of Empty Rigid Containers by Vacuum Method.

q. D5034, Standard Test Method for Breaking Strength and Elongation of Textile Fabrics (Grab Test).

3. National Electrical Manufacturers Association (NEMA): Z535.1, Safety Colors.

1.02 DEFINITIONS

A. Bedding Material: Granular material upon which pipes, conduits, cables, or duct banks are placed.

B. Imported Material: Material obtained by Contractor from source(s) offsite.

C. Lift: Loose (uncompacted) layer of material.

D. Pipe Zone: Backfill zone that includes full trench width and extends from prepared trench bottom to an upper limit above top outside surface of pipe, conduit, cable or duct bank.

E. Prepared Trench Bottom: Graded trench bottom after excavation and installation of stabilization material, if required, but before installation of bedding material.

F. Selected Backfill Material: Material available onsite that Engineer determines to be suitable for a specific use.

G. Well-Graded: A mixture of particle sizes that has no specific concentration or lack thereof of one or more sizes producing a material type that, when compacted, produces a strong and relatively incompressible soil mass free from detrimental voids. Well-graded does not define any numerical value that must be placed on the coefficient of uniformity, coefficient of curvature, or other specific grain size distribution parameters.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings: Manufacturer’s descriptive literature for marking tapes.

B. Informational Submittals:

1. Certified Gradation Analysis: Submit not less than 30 days prior to delivery for imported materials or anticipated use for excavated materials, except for trench stabilization material that will be submitted prior to material delivery to Site.
2. Controlled Low Strength Material: Certified mix design and test results. Include material types and weight per cubic yard for each component of mix.

PART 2 PRODUCTS

2.01 MARKING TAPE

A. Nondetectable:

1. Inert polyethylene, impervious to known alkalis, acids, chemical reagents, and solvents likely to be encountered in soil.
2. Thickness: Minimum 5 mils.
3. Width: 6 inches.
4. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.
5. Manufacturers and Products:
   a. Reef Industries; Terra Tape.
   b. Mutual Industries; Non-detectable Tape.
   c. Presco; Non-detectable Tape.

B. Detectable:

1. Solid aluminum foil, visible on unprinted side, encased in protective high visibility, inert polyethylene plastic jacket.
2. Foil Thickness: Minimum 0.35 mils.
3. Laminate Thickness: Minimum 5 mils.
4. Width: 6 inches.
5. Identifying Lettering: Minimum 1-inch high, permanent black lettering imprinted continuously over entire length.
6. Joining Clips: Tin or nickel-coated furnished by tape manufacturer.
7. Manufacturers and Products:
   a. Reef Industries; Terra Tape, Sentry Line Detectable.
   b. Mutual Industries; Detectable Tape.
   c. Presco; Detectable Tape.

C. Color: In accordance with APWA Uniform Color Code.

Color*	Facility
Red	Electric power lines, cables, conduit, and lightning cables
Orange	Communicating alarm or signal lines, cables, or conduit
Yellow	Gas, oil, steam, petroleum, or gaseous materials
Green	Sewers and drain lines
Blue	Potable water
Purple	Reclaimed water, irrigation, and slurry lines
*As specified in NEMA Z535.1, Safety Color Code.	

2.02 TRENCH STABILIZATION MATERIAL

A. Granular Fill: As specified in Section 31 23 23, Fill and Backfill.

2.03 BEDDING MATERIAL AND PIPE ZONE MATERIAL

A. Granular Fill: As specified in Section 31 23 23, Fill and Backfill.

2.04 EARTH BACKFILL

A. Earthfill: As specified in Section 31 23 23, Fill and Backfill.

2.05 CONTROLLED LOW STRENGTH MATERIAL (CLSM)

A. Select and proportion ingredients to obtain compressive strength between 50 psi and 150 psi at 28 days in accordance with ASTM D4832.

B. Materials:

1. Cement: ASTM C150/C150M, Type I or Type II.
2. Aggregate: ASTM C33/C33M, Size 7.
3. Fly Ash (Pozzolan): Class C fly ash in accordance with ASTM C618, except as modified herein:
4. Water: Clean, potable, containing less than 500 ppm of chlorides.

2.06 SOURCE QUALITY CONTROL

A. Contractor's testing laboratory to perform gradation analysis in accordance with ASTM C136.

PART 3 EXECUTION

3.01 TRENCH PREPARATION

A. Water Control:

1. Promptly remove and dispose of water entering trench as necessary to grade trench bottom and to compact backfill and install manholes, pipe, conduit, direct-buried cable, or duct bank. Do not place concrete, lay pipe, conduit, direct-buried cable, or duct bank in water. As specified in Section 31 23 19.01, Dewatering.
2. Remove water in a manner that minimizes soil erosion from trench sides and bottom.
3. Provide continuous water control until trench backfill is complete.

B. Remove foreign material and backfill contaminated with foreign material that falls into trench.

3.02 TRENCH BOTTOM

A. Firm Subgrade: Grade with hand tools, remove loose and disturbed material, and trim off high areas and ridges left by excavating bucket teeth. Allow space for bedding material if shown or specified.

B. Soft Subgrade: If subgrade is encountered that may require removal to prevent pipe settlement, notify Engineer. Engineer will determine depth of overexcavation, if any required.

3.03 TRENCH STABILIZATION MATERIAL INSTALLATION

A. Rebuild trench bottom with trench stabilization material.

B. Place material over full width of trench in 6-inch lifts to required grade, providing allowance for bedding thickness.

C. Compact each lift so as to provide a firm, unyielding support for the bedding material prior to placing succeeding lifts.

3.04 BEDDING

A. Furnish imported bedding material where, in the opinion of Engineer, excavated material is unsuitable for bedding or insufficient in quantity.

B. Place over full width of prepared trench bottom in two equal lifts when required depth exceeds 8 inches.

C. Hand grade and compact each lift to provide a firm, unyielding surface.

D. Minimum Thickness: As follows.

1. Pipe 15 Inches and Smaller: 4 inches.
2. Pipe 18 Inches to 36 Inches: 6 inches.
3. Pipe 42 Inches and Larger: 8 inches.
4. Conduit: 4 inches.
5. Direct-Buried Cable: 4 inches.
6. Duct Banks: 4 inches.

E. Check grade and correct irregularities in bedding material. Loosen top 1 inch to 2 inches of compacted bedding material with a rake or by other means to provide a cushion before laying each section of pipe, conduit, direct-buried cable, or duct bank.

F. Install to form continuous and uniform support except at bell holes, if applicable, or minor disturbances resulting from removal of lifting tackle.

G. Bell or Coupling Holes: Excavate in bedding at each joint to permit proper assembly and inspection of joint and to provide uniform bearing along barrel of pipe or conduit.

3.05 BACKFILL PIPE ZONE

A. Upper limit of pipe zone shall not be less than following:

1. Pipe: 12 inches, unless shown otherwise.
2. Conduit: 3 inches, unless shown otherwise.
3. Direct-Buried Cable: 3 inches, unless shown otherwise.
4. Duct Bank: 3 inches, unless shown otherwise.

B. Restrain pipe, conduit, cables, and duct banks as necessary to prevent their movement during backfill operations.

C. Place material simultaneously in lifts on both sides of pipe and, if applicable, between pipes, conduit, cables, and duct banks installed in same trench.

1. Pipe 10-Inch and Smaller Diameter: First lift less than or equal to 1/2 pipe diameter.
2. Pipe Over 10-Inch Diameter: Maximum 6-inch lifts.

D. Thoroughly tamp each lift, including area under haunches, with handheld tamping bars supplemented by “walking in” and slicing material under haunches with a shovel to ensure voids are completely filled before placing each succeeding lift.

E. Do not use power-driven impact compactors to compact pipe zone material. After full depth of pipe zone material has been placed as specified, compact material by a minimum of three passes with a vibratory plate compactor only over area between sides of pipe and trench walls.

3.06 MARKING TAPE INSTALLATION

A. Continuously install marking tape along centerline of buried piping, on top of last lift of pipe zone material. Coordinate with piping installation drawings.

1. Detectable Marking Tape: Install with nonmetallic piping and waterlines.
2. Nondetectable Marking Tape: Install with metallic piping.

3.07 BACKFILL ABOVE PIPE ZONE

A. General:

1. Process excavated material to meet specified gradation requirements.
2. Adjust moisture content as necessary to obtain specified compaction.

3. Do not allow backfill to free fall into trench or allow heavy, sharp pieces of material to be placed as backfill until after at least 2 feet of backfill has been provided over top of pipe.
4. Do not use power driven impact type compactors for compaction until at least 4 feet of backfill is placed over top of pipe.
5. Backfill to grade with proper allowances for crushed rock surfacing, and pavement thicknesses, wherever applicable.
6. Backfill around structures with same class backfill as specified for adjacent trench, unless otherwise shown or specified.

B. Backfill areas to be grassed:

1. Place in lifts not exceeding thickness of 8 inches.
2. Mechanically compact each lift to a minimum of 90 percent relative compaction (ASTM D1557).

C. Backfill for Areas Under Facilities and Asphalt or Portland Cement Concrete Paving:

1. Backfill trench above pipe zone with granular fill in lifts not to exceed 6 inches. Compact each lift to a minimum of 98 percent relative compaction (ASTM D1557) prior to placing succeeding lifts.

D. Controlled Low Strength Material:

1. Discharge from truck mounted drum type mixer into trench.
2. Place in lifts as necessary to prevent uplift (flotation) of new and existing facilities.

3.08 MAINTENANCE OF TRENCH BACKFILL

A. After each section of trench is backfilled, maintain surface of backfilled trench even with adjacent ground surface until final surface restoration is completed.

B. Asphaltic Pavement: Replace settled areas or fill with asphalt as specified in Section 32 12 16, Asphalt Paving.

C. Other Areas: Add excavated material where applicable and keep surface of backfilled trench level with adjacent ground surface.

3.09 SITE TESTING

A. Gradation:

1. One sample from each 150 tons of finished product or more often as determined by Engineer, if variation in gradation is occurring, or if material appears to depart from Specifications.

2. If test results indicate material does not meet Specification requirements, terminate material placement until corrective measures are taken.
3. Remove material placed in Work that does not meet Specification Requirements.

B. In-Place Density Tests: In accordance with ASTM D1556 or ASTM D6938. During placement of materials, test as follows:

1. Granular fill and pipe zone fill: One test for every 300 feet of each lift; or one test per lift, whichever requires more tests.

3.10 SETTLEMENT OF BACKFILL

A. Settlement of trench backfill, or of fill, or facilities constructed over trench backfill will be considered a result of defective compaction of trench backfill.

END OF SECTION

SECTION 31 41 00
SHEETING AND SHORING

PART 1 GENERAL

1.01 SCOPE

A. Work under this section consists of furnishing all labor, tools, equipment and materials necessary for providing secure and stable trench excavation.

1.02 QUALITY ASSURANCE

A. Provide surveys to monitor movements of critical structures.

B. Conform to the requirements of the OSHA Standards and Interpretations: "29 CFR Part 1926.650 Subpart P — Excavation, Trenching, and Shoring," and all other applicable laws, regulations, rules, and codes.

PART 2 PRODUCTS

2.01 MATERIALS

A. Trench box sizes for each pipe and utility excavation with structural capacity of retaining soil types as described in OSHA's 29 CFR Part 1926 Subpart P.

PART 3 EXECUTION

3.01 GENERAL

A. Contractor is responsible for design, provide, and maintain shoring, sheeting, and bracing system as necessary to support the sides of excavations and to prevent detrimental settlement and lateral movement of existing facilities, adjacent property, and completed the Work.

B. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he/she may order additional supports placed at the expense of the Contractor. Compliance with such order shall not relieve the Contractor from his/her responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

C. Shoring system shall provide suitable room for installing pipe, structures and appurtenances.

D. When movable trench bracing such as trench boxes, movable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the screened gravel backfill.

1. When installing rigid pipe (R.C., V.C., A.C., etc), any portion of the box extending below mid-diameter shall be raised above this point prior to moving the box ahead to install the next pipe. This is to prevent the separation of installed pipe joints due to movement of the box.
2. When installing flexible pipe (PVC, etc), trench boxes, movable sheeting, shoring, or plates shall not be allowed to extend below mid-diameter of the pipe. As trench boxes, movable sheeting, shoring or plates are moved, screened gravel shall be placed to fill any voids created and the screened gravel and backfill shall be recompacted to provide uniform side support for the pipe.

3.02 REMOVAL OF EXCAVATION SUPPORT

A. Remove excavation support in a manner that will maintain support as excavation is backfilled.

B. Do not begin to remove excavation support until support can be removed without damage to existing facilities, completed Work, or adjacent property.

C. Remove excavation support in a manner that does not leave voids in the backfill. Immediately backfill all voids left or caused by withdrawal of temporary excavation support systems with gravel or sand by tamping with tools specifically adapted for that purpose.

3.03 TRENCHES

A. For trench excavation exceeding 5 feet in depth, provide adequate safety system meeting requirements of applicable state and local construction safety orders, and federal requirements.

B. All excavation, trenching, and related sheeting, bracing, etc, shall comply with the requirements of OSHA excavation safety standards (29 CFR Part 1926.650 Subpart P) and State requirements. Where conflict between OSHA and State regulations exists, the more stringent requirements shall apply.

END OF SECTION

SECTION 32 11 23
AGGREGATE BASE COURSES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. T180, Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18-in) Drop.
   b. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction (Standard Specifications).

1.02 DEFINITIONS

A. Completed Course: Compacted, unyielding, free from irregularities, with smooth, tight, even surface, true to grade, line, and cross-section.

B. Completed Lift: Compacted with uniform cross-section thickness.

C. Standard Specifications: When referenced in this section, shall mean the Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, current edition.

1.03 SUBMITTALS

A. Informational Submittals:

1. Certified Test Results on Source Materials: Submit copies from commercial testing laboratory 20 days prior to delivery of materials to Project showing materials meeting the physical qualities specified.
2. Certified results of in-place density tests from independent testing agency.

PART 2 PRODUCTS

2.01 BASE COURSE

A. As specified in Section 911 of the Standard Specifications.

2.02 SOURCE QUALITY CONTROL

A. Perform tests necessary to locate acceptable source of materials meeting specified requirements.

B. Final approval of aggregate material will be based on test results of installed materials.

C. Should separation of coarse from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

PART 3 EXECUTION

3.01 SUBGRADE PREPARATION

A. As specified in Section 31 23 13, Subgrade Preparation.

B. Obtain Engineer's acceptance of subgrade before placing base course or surfacing material.

C. Do not place base course or surfacing materials on soft, muddy subgrade.

3.02 EQUIPMENT

A. In accordance with Sections 200 and 300 of the Standard Specifications.

3.03 HAULING AND SPREADING

A. In accordance with Sections 200 and 300 of the Standard Specifications.

3.04 CONSTRUCTION OF COURSES

A. Construction of Courses: In accordance with Sections 200 and 300 of the Standard Specifications.

3.05 SURFACE TOLERANCES

A. Blade or otherwise work surfacing as necessary to maintain grade and cross-section at all times, and to keep surface smooth and thoroughly compacted.

B. Finished Surface of Limerock Base Course: Within plus or minus 0.05 foot of grade shown at any individual point.

3.06 CLEANING

A. Remove excess material from the Work area. Clean stockpile and staging areas of all excess aggregate.

END OF SECTION

SECTION 32 12 16
ASPHALT PAVING

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Association of State Highway and Transportation Officials (AASHTO):
   a. M17, Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
   b. M81, Standard Specification for Cut-Back Asphalt (Rapid Curing Type).
   c. M82, Standard Specification for Cut-Back Asphalt (Medium Curing Type).
   d. M140, Standard Specification for Emulsified Asphalt.
   e. M208, Standard Specification for Cationic Emulsified Asphalt.
   f. T166, Standard Method of Test for Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens.
   g. T176 Standard Method of Test for Plastic Fines in Graded Aggregates and Soils by Use of the Sand Equivalent Test.
   h. T230, Standard Method of Test for Determining Degree of Pavement Compaction of Bituminous Aggregate Mixtures.
   i. T245, Standard Method of Test for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus.
   j. T246, Standard Method of Test for Resistance to Deformation and Cohesion of Bituminous Mixtures by Means of Hveem Apparatus.
   k. T247, Standard Method of Test for Preparation of Test Specimens of Bituminous Mixtures by Means of California Kneading Compactor.
   l. T283, Standard Method of Test for Resistance of Compacted Bituminous Mixture to Moisture Induced Damage.
   m. T304, Standard Method of Test for Uncompacted Void Content of Fine Aggregate (Method A).
2. Asphalt Institute (AI):
   a. Manual Series No. 2 (MS-2), Mix Design Methods for Asphalt Concrete.
   b. Superpave Series No. 2 (SP-2), Superpave Mix Design.

3. ASTM International (ASTM):
    a. D2041, Test Method for Theoretical Maximum Specific Gravity and Density of Bituminous Paving Mixtures.
    b. D4318, Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
    c. D4791, Test Method for Flat Particles, Elongated Particles, or Flat and Elongated Particles in Coarse Aggregate.
    d. D5821, Test Method for Determining the Percentage of Fractured Particles in Coarse Aggregate.
    e. E329, Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.

1.02 DEFINITIONS

A. Combined Aggregate: All mineral constituents of asphalt concrete mix, including mineral filler and separately sized aggregates.

B. RAP: Reclaimed asphalt pavement.

C. Standard Specifications: Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

1.03 DESIGN REQUIREMENTS

A. Prepare asphalt concrete mix design, meeting the following design criteria, tolerances, and other requirements of Section 334 of the Standard Specifications.

1.04 SUBMITTALS

A. Informational Submittals:

1. Asphalt Concrete Mix Formula:
    a. Submit minimum of 15 days prior to start of production.
    b. Submittal to include the following information:
        1) Properties as stated in Section 334 of the Standard Specifications.
2. Manufacturer's Certificate of Compliance, in accordance with Section 01 43 33, Manufacturers' Field Services, for the following materials:
    a. Aggregate: Gradation, source test results as defined in Section 334 of the Standard Specifications.
    b. Asphalt for Binder: Type, grade, and viscosity-temperature curve.
    c. Prime Coat: Type and grade of asphalt.
    d. Tack Coat: Type and grade of asphalt.
    e. Additives.
    f. Mix: Conforms to job-mix formula.

3. Statement of qualification for independent testing laboratory.
4. Test Results:
    a. Mix design.
    b. Asphalt concrete core.
    c. Gradation and asphalt content of uncompacted mix.

1.05 QUALITY ASSURANCE

A. Qualifications:

1. Independent Testing Laboratory: In accordance with ASTM E329.
2. Asphalt concrete mix formula shall be prepared by approved certified independent laboratory under the supervision of a certified asphalt technician.

1.06 ENVIRONMENTAL REQUIREMENTS

A. Moisture: Do not apply asphalt materials or place asphalt mixes when application surface is wet.

PART 2 PRODUCTS

2.01 MATERIALS

A. Prime Coat: Cut-back asphalt, conform to Section 300 of the Standard Specifications.

B. Tack Coat: Emulsified asphalt, conform to Section 300 of the Standard Specifications.

2.02 ASPHALT CONCRETE MIX

A. General:

1. Mix formula shall not be modified except with written approval of Engineer.
2. Source Changes:
    a. Should material source(s) change, establish new asphalt concrete mix formula before new material(s) is used.
    b. Make adjustments in gradation or asphalt content as necessary to meet design criteria.

B. Asphalt Concrete: As specified in the Drawings in accordance with Section 334 of the Standard Specifications.

C. Composition: Hot-plant mix of aggregate, mineral filler if required, and paving grade asphalt cement. The several aggregate fractions shall be sized, uniformly graded, and combined in such proportions that resulting mixture meets grading requirements of mix formula.

D. Aggregate:

1. General: As specified in Section 334 of the Standard Specifications.

E. Mineral Filler: In accordance with Section 334 of the Standard Specifications.

F. Asphalt Cement: Paving Grade as specified in Section 334 of the Standard Specifications.

PART 3 EXECUTION

3.01 GENERAL

A. Traffic Control: Minimize inconvenience to traffic, but keep vehicles off freshly treated or paved surfaces to avoid pickup and tracking of asphalt.

3.02 LINE AND GRADE

A. Provide and maintain intermediate control of line and grade, independent of underlying base, to meet finish surface grades and minimum thickness.

B. Shoulders: Construct to line, grade, and cross-section shown.

3.03 APPLICATION EQUIPMENT

A. In accordance with Section 320 of the Standard Specifications.

3.04 PREPARATION

A. Prepare subgrade as specified in Section 31 23 13, Subgrade Preparation.

B. Existing Roadway:

1. Modify profile by grinding, milling, or overlay methods as approved, to provide meet lines and surfaces and to produce smooth riding connection to existing facility.
2. Remove existing material to a minimum depth of 25 millimeters (1 inch).
3. Paint edges of meet line with tack coat prior to placing new pavement.

C. Thoroughly coat edges of contact surfaces (curbs, manhole frames) with emulsified asphalt or asphalt cement prior to laying new pavement. Prevent staining of adjacent surfaces.

3.05 PAVEMENT APPLICATION

A. General: Place asphalt concrete mixture on approved, prepared base in conformance with Section 330 of the Standard Specifications.

B. Prime Coat:

1. Heat cut-back asphalt as specified in Section 330 of the Standard Specifications, prior to application.
2. Apply uniformly to clean, dry surfaces avoiding overlapping of applications.
3. Do not apply when moisture content of upper 75 millimeters (3 inches) of base exceeds optimum moisture content of base, or if free moisture is present.
4. Remove or redistribute excess material.
5. Allow a minimum of 5 full days for curing of primed surface before placing asphalt concrete.

C. Tack Coat:

1. Prepare material, as specified in Section 330 of the Standard Specifications, prior to application.
2. Apply uniformly to clean, dry surfaces avoiding overlapping of applications.
3. Do not apply more tack coat than necessary for the day's paving operation.
4. Touch up missed or lightly coated surfaces and remove excess material.

D. Pavement Mix:

1. Prior to Paving:
   a. Sweep primed surface free of dirt, dust, or other foreign matter.
   b. Patch holes in primed surface with asphalt concrete pavement mix.
   c. Blot excess prime material with sand.
2. Place asphalt concrete pavement mix as specified on the Drawings.
3. Total Compacted Thickness: As shown.
4. Apply such that meet lines are straight and edges are vertical.
5. Collect and dispose of segregated aggregate from raking process. Do not scatter material over finished surface.
6. Joints:
   a. Offset edge of each layer a minimum of 150 millimeters (6 inches) so joints are not directly over those in underlying layer.
   b. Offset longitudinal joints in roadway pavements so longitudinal joints in wearing layer coincide with pavement centerlines and lane divider lines.
   c. Form transverse joints by cutting back on previous day's run to expose full vertical depth of layer.

7. Succeeding Lifts: Apply tack coat to pavement surface between each lift.
8. After placement of pavement, seal meet line by painting a minimum of 150 millimeters (6 inches) on each side of joint with cut-back or emulsified asphalt. Cover immediately with sand.

E. Compaction: In accordance with Section 330 of the Standard Specifications.

F. Tolerances:

1. General: In accordance with Section 330 of the Standard Specifications.

3.06 PATCHING

A. Preparation:

1. Remove damaged, broken, or unsound asphalt concrete adjacent to patches. Trim to straight lines exposing smooth, sound, vertical edges.
2. Prepare patch subgrade as specified in Section 31 23 13, Subgrade Preparation.

B. Application:

1. Patch Thickness: 75 millimeters (3 inches) or thickness of adjacent asphalt concrete, whichever is greater.
2. Place asphalt concrete mix across full width of patch in layers of equal thickness.
3. Spread and grade asphalt concrete with hand tools or mechanical spreader, depending on size of area to be patched.

C. Compaction:

1. Roll patches with power rollers capable of providing compression of 350 to 525 Newtons per linear centimeter (200 to 300 pounds per linear inch). Use hand tampers where rolling is impractical.
2. Begin rolling top course at edges of patches, lapping adjacent asphalt surface at least 1/2 the roller width. Progress toward center of patch overlapping each preceding track by at least 1/2 width of roller.
3. Make sufficient passes over entire area to remove roller marks and to produce desired finished surface.

D. Tolerances:

1. Finished surface shall be flush with and match grade, slope, and crown of adjacent surface.
2. Tolerance: Surface smoothness shall not deviate more than plus 6 millimeters (1/4 inch) or minus 0 millimeter when straightedge is laid across patched area between edges of new pavement and surface of old surfacing.

3.07 FIELD QUALITY CONTROL

A. General: Provide services of approved certified independent testing laboratory to conduct tests.

B. Field Density Tests:

1. Perform tests from cores or sawed samples in accordance with AASHTO T230 and AASHTO T166.
2. Measure with properly operating and calibrated nuclear density gauge in accordance with ASTM D2950.
3. Maximum Density: In accordance with ASTM D2041, using sample of mix taken prior to compaction from same location as density test sample.

C. Testing Frequency:

1. Quality Control Tests:
   a. Asphalt Content, Aggregate Gradation: Once per every 400 mg (500 tons) of mix or once every 4 hours, whichever is greater.
   b. Mix Design Properties, Measured Maximum (Rice's) Specific Gravity: Once every 900 mg (1,000 tons) or once every 8 hours, whichever is greater.
2. Density Tests: Once every 450 mg (500 tons) of mix or once every 4 hours, whichever is greater.

END OF SECTION

SECTION 32 31 13
CHAIN LINK FENCES AND GATES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. ASTM International (ASTM):
   a. A121, Standard Specification for Metallic-Coated Carbon Steel Barbed Wire.
   b. A313/A313M, Standard Specification for Stainless Steel Spring Wire.
   c. A392, Standard Specification for Zinc-Coated Steel Chain-Link Fence Fabric.
   d. A491, Standard Specification for Aluminum-Coated Steel Chain-Link Fence Fabric.
   e. A497/A497M, Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete.
   f. A615/A615M, Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
   g. A780, Standard Specification for Repair of Damaged and Uncoated Areas of Hot-Dipped Galvanized Coatings.
   h. A824, Standard Specification for Metallic-Coated Steel Marcelled Tension Wire for Use with Chain Link Fence.
   i. A1011/A1011M, Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
   j. C94/C94M, Standard Specification for Ready-Mixed Concrete.
   k. C150, Standard Specification for Portland Cement.
   l. C387, Standard Specifications for Packaged, Dry, Combined Materials for Mortar and Concrete.
   m. F552, Standard Terminology Relating to Chain Link Fencing.
   n. F567, Standard Practice for Installation of Chain-Link Fence.
   o. F626, Standard Specification for Fence Fittings.
   p. F900, Standard Specification for Industrial and Commercial Swing Gates.
   q. F1043, Standard Specification for Strength and Protective Coatings on Metal Industrial Chain Link Fence Framework.
   r. F1083, Standard Specification for Pipe, Steel, Hot-Dipped Zinc-Coated (Galvanized) Welded, for Fence Structures.

s. F1183, Standard Specifications for Aluminum Alloy Chain Link Fence Fabric.
t. F1916, Standard Specification for Selecting Chain Link Barrier Systems with Coated Chain Link Fence Fabric and Round Posts for Detention Applications.

1.02 DEFINITIONS

A. Terms as defined in ASTM F552.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
   a. Product Data: Include construction details, material descriptions, dimensions of individual components, and finishes for chain link fences and gates.
      1) Fence, gate posts, rails, and fittings.
      2) Chain link fabric.
      3) Gates and hardware.
2. Test Reports: Field test result for compliance of installation of chain link fence, gates.

B. Informational Submittals:

1. Manufacturer's recommended installation instructions.
2. Evidence of Supplier and installer qualifications.

1.04 QUALITY ASSURANCE

A. Design, supply of equipment and components, installation, and on-call service shall be product of individual company with record of installations meeting requirements specified.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to Site in undamaged condition. Store materials off the ground to provide protection against oxidation caused by ground contact.

1.06 SCHEDULING AND SEQUENCING

A. Complete necessary Site preparation and grading before installing chain link fence and gates.

B. Interruption of Existing Utility Service: Notify owner of utility 72 hours prior to interruption of utility services. Do not proceed with interruption of utility service without written permission from utility owner.

1.07 SPECIAL GUARANTEE

A. Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at the option of the Owner, removal and replacement of the following items found defective during a period of 5 years after the date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in the General Conditions.

1. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
2. Deflection of fence fabric beyond limits.

PART 2 PRODUCTS

2.01 GENERAL

A. Match style, finish, and color of each fence component with that of other fence components.

2.02 CHAIN LINK FENCE FABRIC

A. Galvanized fabric conforming to ASTM A392, Type II, Class 1, 1.2 ounces per square foot; galvanized after weaving.

B. Height: 72 inches, unless otherwise shown.

C. Core Wire Gauge: No. 9.

D. Pattern: 2-inch diamond-mesh.

E. Diamond Count: Manufacturer's standard and consistent for fabric furnished of same height.

F. Loops of Knuckled Selvages: Closed or nearly closed with space not exceeding diameter of wire.

G. Wires of Twisted Selvages:

1. Twisted in a closed helix three full turns.
2. Cut at an angle to provide sharp barbs that extend minimum 1/4 inch beyond twist.

2.03 POSTS

A. General:

1. Strength and Stiffness Requirements: ASTM F1043, heavy industrial fence except as modified in this section.
2. Round Steel Pipe, Schedule 40: ASTM F1083.
3. Lengths: Manufacturer's standard with allowance for minimum embedment below finished grade of 34 inches.
4. Protective Coatings:
   a. Zinc Coating: ASTM F1043, Type A external and internal coating.

B. Line Posts:

1. Round Steel Pipe:
   a. Outside Diameter: 2.375 inches.
   b. Weight: 3.65 pounds per foot.

C. End, Corner, Angle, and Pull Posts:

1. Round Steel Pipe:
   a. Outside Diameter: 2.875 inches.
   b. Weight: 5.79 pounds per foot.

D. Posts for Removable Fence Panels: As specified for end, corner, angle, and pull posts.

E. Posts for Swing Gates 8 Feet High and Under:

1. ASTM F900.
2. Round Steel Pipe:
   a. Outside Diameter: 2.875 inches.
   b. Weight: 4.64 pounds per foot.

2.04 TOP AND BRACE RAILS

A. Galvanized Round Steel Pipe:

1. ASTM F1083.
2. Outside Diameter: 1.66 inches.
3. Weight: 2.27 pounds per foot.

B. Protective Coatings: As specified for posts.

C. Strength and Stiffness Requirements: ASTM F1043, top rail, heavy industrial fence.

2.05 FENCE FITTINGS

A. General: In conformance with ASTM F626, except as modified by this article.

B. Post and Line Caps: Designed to accommodate passage of top rail through cap, where top rail required.

C. Tension and Brace Bands: No exceptions to ASTM F626.

D. Tension Bars:

1. One-piece.
2. Length not less than 2 inches shorter than full height of chain link fabric.
3. Provide one bar for each gate and end post, and two for each corner and pull post.

E. Truss Rod Assembly: 3/8-inch diameter, steel, hot-dip galvanized after threading rod and turnbuckle or other means of adjustment.

F. Tie Wires, Clips, and Fasteners: According to ASTM F626.

2.06 TENSION WIRE

A. Zinc-coated steel marcelled tension wire conforming to ASTM A824, Type II, Class 2.

2.07 GATES

A. General:

1. Gate Operation: Opened and closed easily by one person.
2. Metal Pipe and Tubing: Galvanized steel. Comply with ASTM F1043 and ASTM F1083 for materials and protective coatings.

3. Frames and Bracing: Fabricate members from round galvanized steel tubing with outside dimension and weight according to ASTM F900.
4. Gate Fabric Height: Same as for adjacent fence height.
5. Welded Steel Joints: Paint with zinc-based paint.
6. Chain Link Fabric: Attached securely to gate frame at intervals not exceeding 15 inches.
7. Latches: Arranged for padlocking so padlock will be accessible from both sides of gate.

B. Swing Gates: Comply with ASTM F900 for single swing gate types.

1. Leaf Width: As shown.
2. Hinges: Offset type, malleable iron.
   a. Furnished with large bearing surfaces for clamping in position.
   b. Designed to swing either 180 degrees outward, 180 degrees inward, or 90 degrees in or out, as shown, and not twist or turn under action of gate.
3. Latches: Plunger bar arranged to engage stop, except single gates of openings less than 10 feet wide may each have forked latch.
4. Gate Stops: Mushroom type or flush plate with anchors, suitable for setting in concrete.
5. Locking Device and Padlock Eyes: Integral part of latch, requiring one padlock for locking both leaves of double gate.
6. Hold-Open Keepers: Designed to automatically engage gate leaf and hold it in open position until manually released.

2.08 CONCRETE

A. Provide as specified in Section 03 30 10, Structural Concrete.

2.09 FENCE GROUNDING

A. Conductors: Bare, solid wire for No. 6 AWG and smaller; stranded wire for No. 4 AWG and larger.

1. Material above Finished Grade: Copper.
2. Material on or below Finished Grade: Copper.
3. Bonding Jumpers: Braided copper tape, 1-inch wide, woven of No. 30 AWG bare copper wire, terminated with copper ferrules.

B. Connectors and Grounding Rods: Comply with UL 467.

1. Connectors for Below-Grade Use: Exothermic welded type.
2. Grounding Rods: Copper-clad steel.

PART 3 EXECUTION

3.01 GENERAL

A. Install chain link fences and gates in accordance with ASTM F567, except as modified in this section, and in accordance with fence manufacturer's recommendations, as approved by Engineer. Erect fencing in straight lines between angle points.

B. Provide necessary hardware for a complete fence and gate installation.

C. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM A780.

3.02 PREPARATION

A. Clear area on either side of fence to the extent specified in Section 31 10 00, Site Clearing. Eliminate ground surface irregularities along fence line to the extent necessary to maintain a 2-inch clearance between bottom of fabric and finish grade.

B. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

C. Embedment Coating: Coat portion of galvanized or aluminum-coated steel posts that will be embedded in concrete as specified in Section 09 90 04, Painting. Extend coating 1 inch above top of concrete.

3.03 POST SETTING

A. Drill or hand-excavate holes for posts to diameters and spacing indicated, in firm, undisturbed soil. Driven posts are not acceptable. Postholes shall be clear of loose materials. Waste materials from postholes shall be removed from Site or regraded into slopes on Site.

B. Posthole Depth:

1. Minimum 3 feet below finished grade.
2. 2 inches deeper than post embedment depth below finish grade.

C. Set posts with minimum embedment below finished grade of 34 inches and with top rail at proper height above finished grade. Verify posts are set plumb, aligned, and at correct height and spacing. Brace posts, as necessary, to maintain correct position and plumbness until concrete sets.

D. Backfill postholes with concrete to 2 inches above finished grade. Vibrate or tamp concrete for consolidation. Protect above ground portion of posts from concrete splatter.

E. Before concrete sets, crown and finish top of concrete to readily shed water.

F. Terminal Posts: Locate terminal end, corner, and gate posts per ASTM F567 and terminal pull posts at changes in horizontal or vertical alignment of 15 degrees or more.

G. Line Posts: Space line posts uniformly at 10 feet on centers between terminal end, corner, and gate posts.

3.04 POST BRACING

A. Install according to ASTM F567, maintaining plumb position, and alignment of fencing. Install braces at gate, end, pull, and corner posts diagonally to adjacent line posts to ensure stability. Install braces on both sides of corner and pull posts.

1. Locate horizontal braces at mid-height of fabric or higher, on fences with top rail, and 2/3-fabric height on fences without top rail. Install so posts are plumb when diagonal truss rod assembly is under proper tension.

3.05 TOP RAILS

A. Install according to ASTM F567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps and terminating into rail end attached to posts or posts caps fabricated to receive rail at terminal posts. Install top rail sleeves with springs at 105 feet maximum spacing to permit expansion in rail.

3.06 TENSION WIRE

A. Install according to ASTM F567 and ASTM F1916, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with tie wires at a maximum spacing of 24 inches on center.

B. Install tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

3.07 CHAIN LINK FABRIC

A. Do not install fabric until concrete has cured minimum 7 days.

B. Apply fabric to outside of enclosing framework. Pull fabric taut to provide a smooth and uniform appearance free from sag, without permanently distorting fabric diamond or reducing fabric height. Tie fabric to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

C. Splicing shall be accomplished according to ASTM F1916 by weaving a single picket into the ends of the rolls to be joined.

D. Leave 2 inches between finish grade or surface and bottom selvage, unless otherwise indicated.

E. Tension or Stretcher Bars: Thread through fabric and secure to end, corner, pull, and gate posts with tension bands spaced not more than 15 inches on center.

F. Tie Wires: Fasten ties to wrap a full 360 degrees around rail or post and a minimum of one complete diamond of fabric. Twist ends of tie wire three full twists, and cut off protruding ends to preclude untwisting by hand.

1. Maximum Spacing: Tie fabric to line posts at 12 inches on center and to brace and top rails at 24 inches on center.

3.08 GATES

A. Install gates according to manufacturer's written instructions, level, plumb and secure for full opening without interference. Attach fabric and hardware to gate using tamper-resistant or concealed means. Adjust hardware for smooth operation and lubricate where necessary so gates operate satisfactorily from open or closed position.

3.09 ELECTRICAL GROUNDING

A. Ground fences at a maximum interval of 1,000 feet in accordance with applicable requirements of IEEE C2, National Electrical Safety Code.

B. Protection at Crossings of Overhead Electrical Power Lines: Ground fence at location of crossing and at a maximum distance of 150 feet on each side of crossing.

C. Grounding Method: At each grounding location, drive a grounding rod vertically until top is 6 inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at grounding location.

3.10 FIELD QUALITY CONTROL

A. Post and Fabric Testing: Test fabric tension and line post rigidity according to ASTM F1916.

B. Gate Tests:

1. Prior to acceptance of installed gates, demonstrate proper operation of gates under each possible open and close condition specified.
2. Adjust gate to operate smoothly, easily, and quietly, free of binding, warp, excessive deflection, distortion, nonalignment, misplacement, disruption, or malfunction, throughout entire operational range.
3. Confirm that latches and locks engage accurately and securely without forcing and binding.

3.11 MANUFACTURER'S SERVICES

A. Provide manufacturer's representative at Site in accordance with Section 01 43 33, Manufacturers' Field Services, to train Owner's personnel to adjust, operate, and maintain gates.

3.12 CLEANUP

A. Remove excess fencing materials and other debris from Site.

END OF SECTION

SECTION 32 92 00
TURF AND GRASSES

PART 1 GENERAL

1.01 DEFINITIONS

A. Maintenance Period: Begin maintenance immediately after each area is planted (sod) and continue for a period of 8 weeks after all planting under this section is completed.

B. Standard Specifications: Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition.

C. Satisfactory Stand: Grass or section of grass of 10,000 square feet or larger that has:

1. No bare spots larger than 3 square feet.
2. Not more than 10 percent of total area with bare spots larger than 1 square foot.
3. Not more than 15 percent of total area with bare spots larger than 6 square inches.

1.02 SUBMITTALS

A. Action Submittals: Product labels/data sheets.

B. Informational Submittals:

1. Certification of sod; include source and harvest date of sod, and sod seed mix.
2. Description of required maintenance activities and activity frequency.

1.03 DELIVERY, STORAGE, AND PROTECTION

A. Sod:

1. Do not harvest if sod is excessively dry or wet to the extent survival may be adversely affected.
2. Harvest and deliver sod only after laying bed is prepared for sodding.
3. Roll or stack to prevent yellowing.
4. Deliver and lay within 24 hours of harvesting.
5. Keep moist and covered to protect from drying from time of harvesting until laid.

1.04 WEATHER RESTRICTIONS

A. Perform Work under favorable weather and soil moisture conditions as determined by accepted local practice.

1.05 SEQUENCING AND SCHEDULING

A. Complete Work under this section within 3 days following completion of soil preparation.

B. Notify Engineer at least 3 days in advance of:

1. Each material delivery.
2. Start of planting activity.

C. Planting Season: Those times of year that are normal for such Work as determined by accepted local practice.

1.06 MAINTENANCE SERVICE

A. Contractor: Perform maintenance operations during maintenance period to include:

1. Watering: Keep surface moist.
2. Washouts: Repair by filling with soil, fertilizing, seeding, and mulching.
3. Mulch: Replace wherever and whenever washed or blown away.
4. Mowing: Mow to 2 inches after grass height reaches 3 inches, and mow to maintain grass height from exceeding 3-1/2 inches.
5. Resod unsatisfactory areas or portions thereof immediately at the end of the maintenance period if a satisfactory stand has not been produced.
6. Resod/replant entire area if satisfactory stand does not develop by July 1 of the following year.

PART 2 PRODUCTS

2.01 SOD

A. All sod shall be Bahia grass in accordance with Section 981 of the Standard Specifications. Sod shall be a minimum of 1-1/4-inch thick including a 3/4-inch thick layer of roots and topsoil.

B. Strongly rooted pads, capable of supporting own weight and retaining size and shape when suspended vertically from a firm grasp on upper 10 percent of pad.

1. Age: Not less than 10 months or more than 30 months.
2. Condition: Healthy, green, moist; free of diseases, nematodes and insects, and of undesirable grassy and broadleaf weeds. Yellow sod, or broken pads, or torn or uneven ends will not be accepted.

2.02 WEED BARRIER

A. 6 mils (0.006 inch) black polyethylene sheet.

PART 3 EXECUTION

3.01 PREPARATION

A. Grade areas to smooth, even surface with loose, uniformly fine texture.

1. Roll and rake, remove ridges, fill depressions to meet finish grades.
2. Limit such Work to areas to be planted within immediate future.
3. Remove debris, and stones larger than 1-1/2-inch diameter, and other objects that may interfere with planting and maintenance operations.

B. Moisten prepared areas before planting if soil is dry. Water thoroughly and allow surface to dry off before seeding. Do not create muddy soil.

C. Restore prepared areas to specified condition if eroded or otherwise disturbed after preparation and before planting.

3.02 SODDING

A. Lay sod to form solid mass with tightly fitted joints; butt ends and sides, do not overlap.

1. Stagger strips to offset joints in adjacent courses.
2. Work from boards to avoid damage to subgrade or sod.
3. Tamp or roll lightly to ensure contact with subgrade; work sifted soil into minor cracks between pieces of sod, remove excess to avoid smothering adjacent grass.
4. Complete sod surface true to finished grade, even, and firm.

B. Fasten sod on slopes to prevent slippage with wooden pins 6 inches long driven through sod into subgrade, until flush with top of sod. Install at sufficiently close intervals to securely hold sod.

C. Water sod with fine spray immediately after planting. During first week, water daily or more frequently to maintain moist soil to depth of 4 inches.

D. Apply top dress fertilizer at rate of 1 pound per 1,000 square feet.

3.03 FIELD QUALITY CONTROL

A. 8 weeks after sodding is complete and on written notice from Contractor, Engineer will, within 15 days of receipt, determine if a satisfactory stand has been established.

B. If a satisfactory stand has not been established, Engineer will make another determination after written notice from Contractor following the next growing season.

END OF SECTION

SECTION 40 05 15
PIPING SUPPORT SYSTEMS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Civil Engineers (ASCE): 7, Minimum Design Loads for Buildings and Other Structures.
2. American Society of Mechanical Engineers (ASME): B31.1, Power Piping.
3. ASTM International (ASTM):
   a. A123/A123M, Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
   b. A653/A653M, Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvanealed) by the Hot-Dip Process.
   c. E84, Standard Test Method for Surface Burning Characteristics of Building Materials.
4. International Code Council (ICC):
5. International Building Code (IBC).
6. International Mechanical Code (IMC).
7. Manufacturers' Standardization Society (MSS):
   a. SP 58, Pipe Hangers and Supports—Materials, Design and Manufacture.
   b. SP 127, Bracing for Piping Systems Seismic-Wind-Dynamic Design, Selection, and Application.

1.02 DEFINITIONS

A. Wetted or Submerged: Submerged, less than 1 foot above liquid surface, below top of channel wall, under cover or slab of channel or tank, or in other damp locations.

1.03 SUBMITTALS

A. Action Submittals:

1. Catalog information and drawings of piping support system, locating each support, sway brace, seismic brace, hanger, guide, component, and anchor for all piping. Identify support, hanger, guide, and anchor type by catalog number and Shop Drawing detail number.
2. Calculations for each type of pipe support, attachment and anchor.
3. Revisions to support systems resulting from changes in related piping system layout or addition of flexible joints.

1.04 QUALIFICATIONS

A. Piping support systems shall be designed and Shop Drawings prepared and sealed by a Registered Professional Engineer in the State of Florida.

1.05 DESIGN REQUIREMENTS

A. General:

1. Design, size, and locate piping support systems throughout facility, whether shown or not.
2. Supports are shown only where specific types and locations are required; additional pipe supports may be required.
3. Meet requirements of MSS SP 58 and ASME B31.1 or as modified by this section.

B. Pipe Support Systems:

1. Design pipe support systems for gravity and thrust loads imposed by weight of pipes or internal pressures, including insulation and weight of fluid in pipes.
2. Wind loads in accordance with governing
3. Maximum Support Spacing and Minimum Rod Size: In accordance MSS SP 58 Table 3 and Table 4.
   a. Ductile-iron Pipe 8 Inches and Under: Maximum span limited to that for standard weight steel pipe for water service.
   b. Ductile-iron Pipe 10 Inches and Larger: Maximum span limited to 20 feet.

C. Anchoring Devices: Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor support, to withstand shear and pullout loads imposed by loading and spacing on each particular support.

PART 2 PRODUCTS

2.01 GENERAL

A. When specified items are not available, fabricate pipe supports of correct material and to general configuration indicated.

B. Special support and hanger details may be required for cases where standard catalog supports are not applicable.

C. Materials: All parts shall be Type 316 Stainless Steel.

2.02 PIPE SADDLES

A. Provide 90-degree to 120-degree pipe saddle for pipe 6 inches and larger with baseplates drilled for anchors bolts.

1. In accordance with Standard Detail 4005-515.
2. Sizes 20 inches though 60 inches, Piping Technology & Products, Inc.; Fig. 2000.

B. Saddle Supports, Pedestal Type:

1. Minimum standard weight pipe stanchion, saddle, and anchoring flange.
2. Nonadjustable Saddle: MSS SP , Type 37 with U-bolt.
   a. Anvil; Figure 259, sizes 4 inches through 36 inches with Figure 63C base.
   b. B-Line; Figure B3095, sizes 1 inch through 36 inches with B3088S base.
3. Adjustable Saddle: MSS SP 58, Type 38 without clamp.
   a. Anvil; Figure 264, sizes 2-1/2 inches through 36 inches with Figure 62C base.
   b. B-Line; Figure B3092, sizes 3/4 inch through 36 inches with Figure B3088S base.

2.03 CHANNEL TYPE SUPPORT SYSTEMS

A. Channel Size: 12-gauge, 1-5/8-inch wide minimum steel, or 1-1/2-inch wide, minimum FRP.

B. Members and Connections: Design for loads using one-half of manufacturer's allowable loads.

C. Fasteners: Vinyl ester fiber, polyurethane base composite nuts and bolts, or encapsulated steel fasteners.

D. Manufacturers and Products:

1. B-Line; Strut System.
2. Unistrut.
3. Anvil; Power-Strut.

2.04 PIPE ANCHORS

A. Type: Anchor chair with U-bolt strap.

B. Manufacturer and Product: B-Line; Figure B3147A or Figure B3147B.

2.05 ACCESSORIES

A. Anchor Bolts:

1. Size and Material: Sized by Contractor for required loads, 1/2-inch minimum diameter and as specified in Section 05 50 00, Metal Fabrications.
2. Bolt Length (Extension Above Top of Nut):
   a. Minimum Length: Flush with top of nut preferred. If not flush, shall be no more than one thread recessed below top of nut.
   b. Maximum Length: No more than a full nut depth above top of nut.

B. Dielectric Barriers:

1. Plastic coated hangers, isolation cushion, or tape.
2. Manufacturer and Products:
   a. B-Line; B1999 Vibra Cushion.
   b. B-Line; Iso Pipe, Isolation Tape.

PART 3 EXECUTION

3.01 INSTALLATION

A. General:

1. Install support systems in accordance with MSS SP 58, unless shown otherwise.
2. Install pipe hanger rods plumb, within 4 degrees of vertical during shut down, start up or operations.
3. Support piping connections to equipment by pipe support and not by equipment.
4. Support large or heavy valves, fittings, and appurtenances independently of connected piping.
5. Support no pipe from pipe above it.
6. Support pipe at changes in direction or in elevation, adjacent to flexible joints and couplings, and where shown.
7. Do not use adhesive anchors for attachment of supports to ceiling or walls.
8. Do not install pipe supports and hangers in equipment access areas or bridge crane runs.
9. Brace hanging pipes against horizontal movement by both longitudinal and lateral sway bracing and to reduce movement after startup.
10. Install lateral supports for seismic loads at changes in direction.
11. Install pipe anchors where required to withstand expansion thrust loads and to direct and control thermal expansion.
12. Repair mounting surfaces to original condition after attachments are completed.

B. Standard Pipe Supports:

1. Horizontal Piping Supported from Floors:
   a. Saddle Supports:
      1) Pedestal Type, elbow and flange.
      2) Provide minimum 1-1/2-inch grout beneath baseplate.
   b. Floor Mounted Channel Supports:
      1) Use for pipe smaller than 3-inch running along floors and in trenches at pipe elevations lower than can be accommodated using pedestal pipe supports.
      2) Attach channel framing to floors with baseplate on minimum 1-1/2-inch nonshrink grout and with anchor bolts.
      3) Attach pipe to channel with clips or pipe clamps.
   c. Concrete Cradles: Use for pipe larger than 3 inches along floor and in trenches at pipe elevations lower than can be accommodated using stanchion type.

C. Saddles for Steel or Concrete Pipe: Provide 90-degree to 120-degree pipe saddle for pipe sizes 6 inches and larger when installed on top of steel or concrete beam or structure, pipe rack, trapeze, or where similar concentrated point supports would be encountered.

D. Accessories:

1. Dielectric Barrier:
   a. Provide between painted or galvanized carbon steel members and copper or stainless steel pipe or between stainless steel supports and nonstainless steel ferrous metal piping.
   b. Install rubber wrap between submerged metal pipe and oversized clamps.

END OF SECTION

SECTION 40 27 00
PROCESS PIPING—GENERAL

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section and any supplemental Data Sheets:

1. Air Force: A-A-58092, Tape, Antiseize, Polytetrafluorethylene.
2. American Association of State Highway and Transportation Officials (AASHTO): HB-17, Standard Specifications for Highway Bridges.
3. American Petroleum Institute (API): SPEC 5L, Specification for Line Pipe.
4. American Society of Mechanical Engineers (ASME):
   a. Boiler and Pressure Vessel Code, Section IX, Qualification Standard for Welding and Brazing Procedures, Welders, Brazers, and Welding and Brazing Operators.
   b. B1.20.1, Pipe Threads, General Purpose (Inch).
   c. B16.1, Gray Iron Pipe Flanges and Flanged Fittings Classes 25, 125, and 250.
   d. B16.3, Malleable Iron Threaded Fittings Classes 150 and 300.
   e. B16.5, Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
   f. B16.9, Factory-Made Wrought Buttwelding Fittings.
   g. B16.11, Forged Fittings, Socket-Welding and Threaded.
   h. B16.15, Cast Copper Alloy Threaded Fittings Classes 125 and 250.
   i. B16.21, Nonmetallic Flat Gaskets for Pipe Flanges.
   j. B16.22, Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.
   k. B16.24, Cast Copper Alloy Pipe Flanges and Flanged Fittings Classes 150, 300, 600, 900, 1500, and 2500.
   l. B16.25, Buttwelding Ends.
   m. B16.42, Ductile Iron Pipe Flanges and Flanged Fittings Classes 150 and 300.
   n. B31.1, Power Piping.
   o. B31.3, Process Piping.
   p. B31.9, Building Services Piping.
   q. B36.10M, Welded and Seamless Wrought Steel Pipe.
5. American Society for Nondestructive Testing (ASNT): SNT-TC-1A, Recommended Practice for Personal Qualification and Certification in Nondestructive Testing.
6. American Water Works Association (AWWA):
   a. C104/A21.4, Cement-Mortar Lining for Ductile-Iron Pipe and Fittings.

b. C105/A21.5, Polyethylene Encasement for Ductile-Iron Pipe Systems.
c. C110/A21.10, Ductile-Iron and Gray-Iron Fittings.
d. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
e. C115/A21.15, Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
f. C151/A21.51, Ductile-Iron Pipe, Centrifugally Cast.
g. C153/A21.53, Ductile-Iron Compact Fittings.
h. C207, Steel Pipe Flanges for Waterworks Service, Sizes 4 In. Through 144 In. (100 mm Through 3,600 mm).
i. C606, Grooved and Shouldered Joints.

7. American Welding Society (AWS):
   a. Brazing Handbook.
   b. A5.8M/A5.8, Specification for Filler Metals for Brazing and Braze Welding.
   c. D1.1/D1.1M, Structural Welding Code - Steel.
   d. QC1, Standard for AWS Certification of Welding Inspectors.
8. ASTM International (ASTM):
   a. A47/A47M, Standard Specification for Ferritic Malleable Iron Castings.
   b. A53/A53M, Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
   c. A105/A105M, Standard Specification for Carbon Steel Forgings for Piping Applications.
   d. A106/A106M, Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service.
   e. A126, Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
   f. A135/A135M, Standard Specification for Electric-Resistance-Welder Steel Pipe.
   g. A139/A139M, Standard Specification for Electro-Fusion (Arc)–Welded Steel Pipe (NPS 4 Inches and Over).
   h. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   i. A181/A181M, Standard Specification for Carbon Steel Forgings, for General-Purpose Piping.
   j. A182/A182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
   k. A183, Standard Specification for Carbon Steel Track Bolts and Nuts.
   l. A193/A193M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.

m. A194/A194M, Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
n. A197/A197M, Standard Specification for Cupola Malleable Iron.
o. A216/A216M, Standard Specification for Steel Castings, Carbon, Suitable for Fusion Welding, for High-Temperature Service.
p. A234/A234M, Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.
q. A240/A240M, Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
r. A276, Standard Specification for Stainless Steel Bars and Shapes.
s. A269, Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
t. A307, Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
u. A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
v. A320/A320M, Standard Specification for Alloy-Steel and Stainless Steel Bolting for Low-Temperature Service.
w. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
x. A395/A395M, Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
y. A403/A403M, Standard Specification for Wrought Austenitic Stainless Steel Piping Fittings.
z. A409/A409M, Standard Specification for Welded Large Diameter Austenitic Steel Pipe for Corrosive or High-Temperature Service.
aa. A536, Standard Specification for Ductile Iron Castings.
bb. A563, Standard Specification for Carbon and Alloy Steel Nuts.
cc. A587, Standard Specification for Electric-Resistance-Welded Low-Carbon Steel Pipe for the Chemical Industry.
dd. A743/A743M, Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
ee. A744/A744M, Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service.
ff. A774/A774M, Standard Specification for As-Welded Wrought Austenitic Stainless Steel Fittings for General Corrosive Service at Low and Moderate Temperatures.
gg. A778, Standard Specification for Welded, Unannealed Austenitic Stainless Steel Tubular Products.
hh. B32, Standard Specification for Solder Metal.
ii. B43, Standard Specification for Seamless Red Brass Pipe, Standard Sizes.

jj. B61, Standard Specification for Steam or Valve Bronze Castings.
kk. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
ll. B75/B75M, Standard Specification for Seamless Copper Tube.
mm. B88, Standard Specification for Seamless Copper Water Tube.
nn. B98/B98M, Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes.
oo. B462, Standard Specification for Forged or Rolled UNS N06030, UNS N06022, UNS N06035, UNS N06200, UNS N06059, UNS N10362, UNS N06686, UNS N08020, UNS N08024, UNS N08026, UNS N08367, UNS N10276, UNS N10665, UNS N10675, UNS N10629, UNS N08031, UNS N06045, UNS N06025, and UNS R20033 Alloy Pipe Flanges, Forged Fittings, and Valves and Parts for Corrosive High-Temperature Service.
pp. B464, Standard Specification for Welded UNS N08020 Alloy Pipe.
qq. B474, Standard Specification for Electric Fusion Welded Nickel and Nickel Alloy Pipe.
rr. C582, Standard Specification for Contact-Molded Reinforced Thermosetting Plastic (RTP) Laminates for Corrosion-Resistant Equipment.
ss. D412, Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.
tt. D413, Standard Test Methods for Rubber Property-Adhesion to Flexible Substrate.
uu. D543, Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents.
vv. D1248, Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
ww. D1330, Standard Specification for Rubber Sheet Gaskets.
xx. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
yy. D1785, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
zz. D2000, Standard Classification System for Rubber Products in Automotive Applications.
aaa. D2310, Standard Classification for Machine-Made “Fiberglass” (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
bbb. D2464, Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
ccc. D2466, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
ddd. D2467, Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.

eee. D2564, Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
fff. D2837, Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials or Pressure Design Basis for Thermoplastic Pipe Products.
ggg. D2996, Standard Specification for Filament-Wound "Fiberglass" (Glass-Fiber-Reinforced Thermosetting-Resin) Pipe.
hhh. D3222, Standard Specification for Unmodified Poly(Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
iii. D3350, Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
jjj. D4101, Standard Specification for Polypropylene Injection and Extrusion Materials.
kkk. D4894, Standard Specification for Polytetrafluoroethylene (PTFE) Granular Molding and Ram Extrusion Materials.
lll. D4895, Standard Specification for Polytetrafluoroethylene (PTFE) Resin Produced from Dispersion.
mmm. F423, Standard Specification for Polytetrafluoroethylene (PTFE) Plastic-Lined Ferrous Metal Pipe, Fittings, and Flanges.
nnn. F436, Standard Specification for Hardened Steel Washers.
ooo. F437, Standard Specification for Threaded Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
ppp. F439, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.
qqq. F441/F441M, Standard Specification for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
rrr. F493, Standard Specification for Solvent Cements for Chlorinated Poly(Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
sss. F593, Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
ttt. F656, Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

9. FM Global (FM).
10. Manufacturers Standardization Society of the Valve and Fittings Industry, Inc. (MSS): SP-43, Wrought and Fabricated Butt-Welding Fittings for Low-Pressure, Corrosion Resistant Applications.
11. NSF International (NSF):
    a. ANSI 61: Drinking Water System Components - Health Effects.
    b. ANSI 372: Drinking Water System Components - Lead Content.
12. National Electrical Manufacturers Association (NEMA): LI 1, Industrial Laminating Thermosetting Products.
13. National Fire Protection Association (NFPA): 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

1.02 DESIGN REQUIREMENTS

A. Where pipe diameter, thickness, pressure class, pressure rating, or thrust restraint is not shown or specified, design piping system in accordance with the following:

1. Process Piping: ASME B31.3, normal fluid service unless otherwise specified.
2. Buried Piping: H20-S16 traffic load with 1.5 impact factor, AASHTO HB-17, as applicable.
3. Thrust Restraints:
   a. Design for test pressure shown in Piping Schedule.
   b. Allowable Soil Pressure: 1,000 pounds per square foot.
   c. Low Pressure Pipelines:
      1) When bearing surface of the fitting against soil provides an area equal to or greater than area required for thrust restraint, concrete thrust blocks will not be required.
      2) Determine bearing area for fittings without thrust blocks by projected area of 70 percent of internal diameter multiplied by chord length for fitting centerline curve.

1.03 SUBMITTALS

A. Action Submittals:

1. Shop Fabricated Piping:
   a. Detailed pipe fabrication or spool drawings showing special fittings and bends, dimensions, coatings, and other pertinent information.
   b. Layout drawing showing location of each pipe section and each special length; number or otherwise designate laying sequence on each piece.
2. Pipe Wall Thickness: Identify wall thickness and rational method or standard applied to determine wall thickness for each size of each different service including exposed, submerged, buried, and concrete-encased installations for Contractor-designed piping.
3. Hydraulic Thrust Restraint for Restrained Joints: Details including materials, sizes, assembly ratings, and pipe attachment methods.
4. Thrust Blocks: Concrete quantity, bearing area on pipe, and fitting joint locations.

B. Informational Submittals:

1. Manufacturer’s Certification of Compliance, in accordance with Section 01 61 00, Common Product Requirements:
   a. Pipe and fittings.
   b. Factory applied resins and coatings.

2. Flanged Pipe and Fittings: Manufacturer's product data sheets for gaskets including torqueing requirements and bolt tightening procedures.
3. Section 01 45 33, Special Inspection, Observation, and Testing.

1.04 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01 61 00, Common Product Requirements, and:

1. Flanges: Securely attach metal, hardboard, or wood protectors over entire gasket surface.
2. Threaded or Socket Welding Ends: Fit with metal, wood, or plastic plugs or caps.
3. Linings and Coatings: Prevent excessive drying.
4. Cold Weather Storage: Locate products to prevent coating from freezing to ground.
5. Handling: Use heavy canvas or nylon slings to lift pipe and fittings.

PART 2 PRODUCTS

2.01 GENERAL

A. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 PIPING

A. As specified on Piping Data Sheet(s) and Piping Schedule located at the end of this section as Supplement.

B. Diameters Shown:

1. Standardized Products: Nominal size.
2. Fabricated Steel Piping (Except Cement-Lined): Outside diameter, ASME B36.10M.
3. Cement-Lined Steel Pipe: Lining inside diameter.

2.03 JOINTS

A. Flanged Joints:

1. Flat-faced, carbon steel, or alloy flanges when mating with flat-faced cast or ductile iron flanges.
2. Higher pressure rated flanges as required to mate with equipment when equipment flange is of higher pressure rating than required for piping.

B. Threaded Joints: NPT taper pipe threads in accordance with ASME B1.20.1.

C. Mechanical Joint Anchor Gland Follower:

1. Ductile iron anchor type, wedge action, with break-off tightening bolts.
2. Thrust rated to 250 psi minimum.
3. Rated operating deflection not less than:
   a. 3 degrees for sizes through 12 inches.
   b. 2 degrees for sizes 14 inches through 16 inches.
   c. 1.5 degrees for sizes 18 inches through 24 inches.
   d. 1 degree for sizes 30 inches through 48 inches.
4. UL and FM approved.

D. Flexible Mechanical Compression Joint Coupling:

1. Stainless steel, ASTM A276, Type 305 bands.
2. Manufacturers:
   a. Pipeline Products Corp.
   b. Fernco Joint Sealer Co.

2.04 GASKET LUBRICANT

A. Lubricant shall be supplied by pipe manufacturer and no substitute or “or-equal” will be allowed.

2.05 PIPE CORROSION PROTECTION

A. Coatings: See Section 09 90 04, Painting, for details of coating requirements.

B. Polyethylene Encasement (Bagging):

1. Encasement Tube: Black polyethylene encasement tube, 8 mils minimum thickness, conforming to AWWA C105/A21.5, free of gels, streaks, pinholes, foreign matter, undispersed raw materials, and visible defects such as tears, blisters, and thinning at folds.
2. Securing Tape: Thermoplastic tape, 8 mils minimum thickness, 1 inch wide, pressure sensitive adhesive face capable of bonding to metal, bituminous coating, and polyethylene encasement tube.

C. Insulating Flanges, Couplings, and Unions:

1. Materials:
   a. In accordance with applicable piping material specified in Pipe Data Sheet. Complete assembly shall have ASME B31.3 working pressure rating equal to or higher than that of joint and pipeline.
   b. Galvanically compatible with piping.
   c. Resistant for intended exposure, operating temperatures, and products in pipeline.
2. Union Type, 2 Inches and Smaller:
   a. Screwed or solder-joint.
   b. O-ring sealed with molded and bonded insulation to body.
3. Flange Type, 2-1/2 Inches and Larger:
   a. Flanged, complete with bolt insulators, dielectric gasket, bolts, and nuts.
   b. Bolt insulating sleeves shall be provided full length between insulating washers.
   c. Ensure fit-up of components of insulated flange assembly to provide a complete functioning installation.
   d. AWWA C207 steel flanges may be drilled oversize up to 1/8-inch to accommodate insulating sleeves.
   e. No less than minimum thread engagement in accordance with specified bolting standards will be permitted to accommodate thicknesses of required washers, flanges, and gasket.
4. Flange Insulating Kits:
   a. Gaskets: Full-face, Type E with elastomeric sealing element. Sealing element shall be retained in a groove within retainer portion of gasket.
   b. Insulating Sleeves: Full-length**:** mylar.
   c. Insulating Washers: High-strength phenolic.
   d. Steel Washers: Type 316 stainless steel, 1/8 inch thick.
      1) Flange Diameters 36 Inches or Less: Provide two washers per bolt.
      2) Flange Diameters Larger Than 36 Inches: Provide four washers per bolt.
5. Manufacturers and Products:
   a. Dielectric Flanges and Unions:
      1) PSI, Houston, TX.
      2) Advance Products and Systems, Lafayette, LA.
   b. Insulating Couplings:
      1) Dresser; STAB-39.
      2) Baker Coupling Company, Inc.; Series 216.

2.06 THRUST BLOCKS

A. Concrete: As specified in Section 03 30 10, Structural Concrete.

2.07 FABRICATION

A. Mark each pipe length on outside with the following:

1. Size or diameter and class.
2. Manufacturer's identification and pipe serial number.
3. Location number on laying drawing.
4. Date of manufacture.

B. Code markings according to approved Shop Drawings.

C. Shop fabricate flanged pipe in shop, not in field, and delivered to Site with flanges in place and properly faced. Threaded flanges shall be individually fitted and machine tightened on matching threaded pipe by manufacturer.

2.08 FINISHES

A. Factory prepare, prime, and finish coat in accordance with Pipe Data Sheet(s) and Piping Schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify size, material, joint types, elevation, horizontal location, and pipe service of existing pipelines to be connected to new pipelines or new equipment.

B. Inspect size and location of structure penetrations to verify adequacy of wall pipes, sleeves, and other openings.

3.02 PREPARATION

A. See Piping Schedule and Section 09 90 04, Painting, for additional requirements.

B. Notify Engineer at least 2 weeks prior to field fabrication of pipe or fittings.

C. Inspect pipe and fittings before installation, clean ends thoroughly, and remove foreign matter and dirt from inside.

D. Damaged Coatings and Linings: Repair using original coating and lining materials in accordance with manufacturer's**.**

3.03 WELDING

A. Perform in accordance with Section IX, ASME Boiler and Pressure Vessel Code and ASME B31.3 for Pressure Piping, as may be specified on Piping Data Sheets, and if recommended by piping or fitting manufacturer.

B. Weld Identification: Keep paper record of which welder welded each joint.

C. Pipe End Preparation:

1. Machine Shaping: Preferred.
2. Oxygen or Arc Cutting: Smooth to touch, true, and slag removal by chipping or grinding.
3. Beveled Ends for Butt Welding: ASME B16.25.

D. Surfaces:

1. Clean and free of paint, oil, rust, scale, slag, or other material detrimental to welding.
2. Clean stainless steel joints with stainless steel wire brushes or stainless steel wool prior to welding.
3. Thoroughly clean each layer of deposited weld metal, including final pass, prior to deposition of each additional layer of weld metal with a power-driven wire brush.

E. Alignment and Spacing:

1. Align ends to be joined within existing commercial tolerances on diameters, wall thicknesses, and out-of-roundness.
2. Root Opening of Joint: As stated in qualified welding procedure.
3. Minimum Spacing of Circumferential Butt Welds: Minimum four times pipe wall thickness or 1 inch, whichever is greater.

F. Climatic Conditions:

1. Do not perform welding if there is impingement of any rain, snow, sleet, or wind exceeding 5 mph on the weld area, or if ambient temperature is below 32 degrees F.

G. Tack Welds: Performed by qualified welder using same procedure as for completed weld, made with electrode similar or equivalent to electrode to be used for first weld pass, and not defective. Remove those not meeting requirements prior to commencing welding procedures.

H. Surface Defects: Chip or grind out those affecting soundness of weld.

I. Weld Quality: Meet requirements of governing welding codes.

3.04 INSTALLATION—GENERAL

A. Join pipe and fittings in accordance with manufacturer’s instructions, unless otherwise shown or specified.

B. Remove foreign objects prior to assembly and installation.

C. Flanged Joints:

1. Install perpendicular to pipe centerline.
2. Bolt Holes: Straddle vertical centerlines, aligned with connecting equipment flanges or as shown.
3. Use torque-limiting wrenches to ensure uniform bearing and proper bolt tightness.
4. Plastic Flanges: Install annular ring filler gasket at joints of raised-face flange.
5. Grooved Joint Flange Adapters: Include stainless steel washer plates as required for mating to serrated faces and lined valves and equipment.
6. Raised-Face Flanges: Use flat-face flange when joining with flat-faced ductile or cast iron flange.
7. Verify compatibility of mating flange to adapter flange gasket prior to selecting grooved adapter flanging.
8. Flange fillers are to be avoided, but if necessary, may be used to make up for small angles up to 6 degrees and for filling gaps up to 2 inches between flanges. Stacked flange fillers shall not be used.
9. Threaded flanged joints shall be shop fabricated and delivered to Site with flanges in-place and properly faced.
10. Manufacturer: Same as pipe manufacturer or grooved joint flange adapter manufacturer.

D. Threaded and Coupled Joints:

1. Conform to ASME B1.20.1.
2. Produce sufficient thread length to ensure full engagement when screwed home in fittings.
3. Countersink pipe ends, ream and clean chips and burrs after threading.
4. Make connections with not more than three threads exposed.
5. Lubricate male threads only with thread lubricant or tape as specified on Piping Data Sheets.

E. Pipe Connections at Concrete Structures: As specified in Article Piping Flexibility Provisions in Section 40 27 01, Process Piping Specialties.

F. PVC and CPVC Piping:

1. Provide Schedule 80 threaded nipple where necessary to connect to threaded valve or fitting.
2. Use strap wrench for tightening threaded plastic joints. Do not overtighten fittings.
3. Do not thread Schedule 40 pipe.

G. Ductile Iron Piping:

1. Cutting Pipe: Cut pipe with milling type cutter, rolling pipe cutter, or abrasive blade cutter. Do not flame cut.
2. Dressing Cut Ends:
   a. General: As required for the type of joint to be made.
   b. Rubber Gasketed Joints: Remove sharp edges or projections.
   c. Push-On Joints: Bevel, as recommended by pipe manufacturer.
   d. Flexible Couplings, Flanged Coupling Adapters, and Grooved End Pipe Couplings: As recommended by the coupling or adapter manufacturer.

3.05 INSTALLATION—EXPOSED PIPING

A. Piping Runs:

1. Parallel to building or column lines and perpendicular to floor, unless shown otherwise.
2. Piping upstream and downstream of flow measuring devices shall provide straight lengths as required for accurate flow measurement.

B. Supports: As specified in Section 40 05 15, Piping Support Systems.

C. Group piping wherever practical at common elevations; install to conserve building space and not interfere with use of space and other work.

D. Unions or Flanges: Provide at each piping connection to equipment or instrumentation on equipment side of each block valve to facilitate installation and removal.

E. Install piping so that no load or movement in excess of that stipulated by equipment manufacturer will be imposed upon equipment connection; install to allow for contraction and expansion without stressing pipe, joints, or connected equipment.

F. Piping clearance, unless otherwise shown:

1. Over Walkway and Stairs: Minimum of 7 feet 6 inches, measured from walking surface or stair tread to lowest extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
2. Between Equipment or Equipment Piping and Adjacent Piping: Minimum 3 feet, measured from equipment extremity and extremity of piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.

3. From Adjacent Work: Minimum **2** inch(es) from nearest extremity of completed piping system including flanges, valve bodies or mechanisms, insulation, or hanger/support systems.
4. Do not route piping in front of or to interfere with access ways, ladders, stairs, platforms, walkways, openings, doors, or windows.
5. Headroom in front of openings, doors, and windows shall not be less than the top of the opening.
6. Do not install piping containing liquids or liquid vapors in transformer vaults or electrical equipment rooms.
7. Do not route piping over, around, in front of, in back of, or below electrical equipment including controls, panels, switches, terminals, boxes, or other similar electrical work.

3.06 INSTALLATION—BURIED PIPE

A. Placement:

1. Keep trench dry until pipe laying and joining are completed.
2. Pipe Base and Pipe Zone: As specified in Section 31 23 23.15, Trench Backfill.
3. Exercise care when lowering pipe into trench to prevent twisting or damage to pipe.
4. Measure for grade at pipe invert, not at top of pipe.
5. Excavate trench bottom and sides of ample dimensions to permit visual inspection and testing of entire flange, valve, or connection.
6. Prevent foreign material from entering pipe during placement.
7. Close and block open end of last laid pipe section when placement operations are not in progress and at close of day's work.
8. Lay pipe upgrade with bell ends pointing in direction of laying.
9. Deflect pipe at joints for pipelines laid on a curve using unsymmetrical closure of spigot into bell. If joint deflection of standard pipe lengths will not accommodate horizontal or vertical curves in alignment, provide:
   a. Shorter pipe lengths.
   b. Special mitered joints.
   c. Standard or special fabricated bends.
10. After joint has been made, check pipe alignment and grade.
11. Place sufficient pipe zone material to secure pipe from movement before next joint is installed.
12. Prevent uplift and floating of pipe prior to backfilling.

B. PVC, CPVC, or HDPE Pipe Placement:

1. Lay pipe snaking from one side of trench to other.
2. Offset: As recommended by manufacturer for maximum temperature variation between time of solvent welding and during operation.

3. Do not lay pipe when temperature is below 40 degrees F, or above 90 degrees F when exposed to direct sunlight.
4. Shield ends to be joined from direct sunlight prior to and during the laying operation.

C. Tolerances:

1. Deflection from Horizontal Line, Except PVC, CPVC, or HDPE: Maximum 2 inches.
2. Deflection From Vertical Grade: Maximum 1/4 inch(es).
3. Joint Deflection: Maximum of 75 percent of manufacturer's recommendation.
4. Horizontal position of pipe centerline on alignment around curves maximum variation of 1.75 feet from position shown.
5. Pipe Cover: Minimum 3 feet, unless otherwise shown.

3.07 PIPE CORROSION PROTECTION

A. Ductile Iron Pipe:

1. Exposed: As specified in Section 09 90 04, Painting, and as shown in Piping Schedule.
2. Buried: Wrap with polyethylene bagging.

B. Piping Accessories:

1. Exposed:
   a. Field paint black and galvanized steel, brass, copper, and bronze piping components as specified in Section 09 90 04, Painting, as applicable to base metal material.
   b. Accessories include, but are not limited to, pipe hangers, supports, expansion joints, pipe guides, flexible couplings, vent and drain valves, and fasteners.
2. Buried:
   a. Ferrous Metal and Stainless Steel Components: Coat with coal-tar epoxy as specified in Section 09 90 04, Painting.
   b. Bolts, Nuts, and Similar Items: Coat with bituminous paint.
   c. Buried Valves and Similar Elements on Wrapped Pipelines: Coat with bituminous paint and wrap entire valve in polyethylene encasement.
   d. Cement-Coated Pipelines: Cement coat appurtenances same as pipe.

C. Polyethylene Encasement: Install in accordance with AWWA C105/A21.5 and manufacturer's instructions.

D. Tape Coating System: As specified in Section 09 90 04, Painting.

E. Heat Shrink Wrap: Apply in accordance with manufacturer's instructions to surfaces that are cleaned, prepared, and primed.

F. Insulating Flanges, Couplings, and Unions:

1. Applications:
   a. Dissimilar metal piping connections.
   b. Where required for electrically insulated connection.

3.08 THRUST RESTRAINT

A. Location:

1. Buried Piping: At all joints in piping. Exposed Piping: At all joints in piping.

B. Thrust Ties:

1. Flanged Coupling Adapters: For exposed installations, install manufacturer's anchor studs through coupling sleeve or use dismantling joints.

C. Mechanical Joint Valve Restraint in Proprietary Restrained Joint Piping: Install pipe joint manufacturer's adapter gland follower and pipe end retainer, or mechanical joint anchor gland follower.

D. Thrust Blocking:

1. Place between undisturbed ground and fitting to be anchored.
2. Quantity of Concrete: Sufficient to cover bearing area on pipe and provide required soil bearing area as shown.
3. Place blocking so that pipe and fitting joints will be accessible for repairs.
4. Place concrete in accordance with Section 03 30 10, Structural Concrete.

3.09 SLAB, FLOOR, WALL, AND ROOF PENETRATIONS

A. Application and Installation: As specified in Section 40 27 01, Process Piping Specialties.

3.10 BRANCH CONNECTIONS

A. Do not install branch connections smaller than 1/2-inch nominal pipe size, including instrument connections, unless shown otherwise.

B. When line of lower pressure connects to a line of higher pressure, requirements of Piping Data Sheet for higher pressure rating prevails up to and including first block valve in the line carrying the lower pressure, unless otherwise shown.

C. Threaded Pipe Tap Connections:

1. Ductile Iron Piping: Connect only with service saddle or at tapping boss of a fitting, valve body, or equipment casting.
2. Welded Steel or Alloy Piping: Connect only with welded threadolet or half-coupling as specified on Piping Data Sheet.
3. Limitations: Threaded taps in pipe barrel are unacceptable.

3.11 VENTS AND DRAINS

A. Vents and drains at high and low points in piping required for completed system may or may not be shown. Install vents on high points and drains on low points of pipelines as shown.

3.12 FIELD FINISHING

A. Notify Engineer at least 3 days prior to start of surface preparation or coating application work.

B. As specified in Section 09 90 04, Painting (Short Form).

3.13 FIELD QUALITY CONTROL

A. Pressure Leakage Testing: As specified in Section 40 80 01, Process Piping Leakage Testing.

3.14 CLEANING

A. Following assembly and testing, and prior to final acceptance, flush pipelines, except as stated below, with water at 2.5 fps minimum flushing velocity until foreign matter is removed.

B. If impractical to flush large diameter pipe at 2.5 fps or blow velocity, clean in-place from inside by brushing and sweeping, then flush or blow line at lower velocity.

C. Insert cone strainers in flushing connections to attached equipment and leave in-place until cleaning is complete.

D. Remove accumulated debris through drains 2 inches and larger or by removing spools and valves from piping.

3.15 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are a part of this Specification:

1. Piping Schedule Legend.
2. Piping Schedule.
3. Data Sheets.

Number	Title
40 27 00.01	Cement-Mortar Ceramic-Lined Ductile Iron Pipe and Fittings
40 27 00.08	Stainless Steel Pipe and Fittings—General Service
40 27 00.10	Polyvinyl Chloride (PVC) Pipe and Fittings

END OF SECTION

PIPING SCHEDULE LEGEND

SERVICE

DR	Drain (Pumped)
RW	Reclaimed Water
V	Vents

EXPOSURE

ALL	All
BUR	Buried
EXP	Exposed

MATERIAL

CLDI	Cement-Lined Ductile Iron
PVC	Polyvinyl Chloride
SST	Stainless Steel (Type 316)

JOINT TYPE

FL	Flanged
PRJ	Proprietary Restrained
RM	Restrained Mechanical
S	Screwed
W	Welded (including solvent and fusion)

PRESSURE TEST

G	Gravity Service: Test pressure is not shown on gravity services. Test to highest liquid level that pipe can be subject to.
H	Hydrostatic
I	In Service
P	Pneumatic
PC	Test per Uniform Plumbing Code
NA	Not Applicable

Piping Schedule										
Service	**Legend**	**Size(s) (In.)[1]**	**Exposure**	**Piping Material**	**Specification Section**	**Joint Type**	**Lining/ Coating[2]**	**Test Pressure and Type (psig-x), x = Type indicated in Legend**	**Pipe Color and Label**	**Remarks**
Drain	DR	ALL	BUR	PVC	40 27 00.10	W/S	NA	100/H	NA	
Drain	DR	ALL	EXP	SST	40 27 00.08	FL/W	NA	100/H	NA	
Reclaimed Water	RW	ALL	EXP/ BUR	CLDI	40 27 00.01	FL for EXP PRJ or RM for BUR	Cement lining, System 4 Costing for exposed, bituminous and bagging for buried	100/H	Purple	
Vent	V	ALL	EXP	PVC	40 27 00.10	FL/W	Coated with System No. 25.	NA	Purple	

[1]">" Greater Than
"<" Less Than
"<=" Less Than or Equal To
">=" Greater Than or Equal To
"All" All Sizes

[2]Coating system number as specified in Section 09 90 04, Painting, and as specified in Article Pipe Corrosion Protection.

SECTION 40 27 00.01 CEMENT-MORTAR-LINED DUCTILE IRON PIPE AND FITTINGS	
Item	**Description**
General	Materials in contact with potable water shall conform to NSF 61 acceptance. Pipe manufacturer shall submit certification that source manufacturing facility has been producing ductile iron pipe of specified diameters, dimensions, and standards for a period of not less than 10 years. Testing of pipe required by AWWA C151/A21.51 shall be conducted in testing and laboratory facilities located in the USA and operating under USA laws and regulations. Pipe shall be handled during manufacture and shipped without nesting (without insertion of one pipe inside another).
Pipe	Buried Liquid Service Using Proprietary Restrained Joints: AWWA C111/A21.11, and AWWA C151/A21.51, pressure class conforming to Table 5 and Table 7 for Type 4 trench, 250 psi minimum working pressure. Follower glands shall be ductile iron. Exposed Pipe Using Flange Joints: AWWA C115/A21.15, thickness Class 53 minimum, 250 psi minimum working pressure.
Lining	Cement-mortar: AWWA C104/A21.4.
Fittings	Lined and coated same as pipe. Proprietary Restrained: AWWA C110/A21.10, AWWA C111/A21.11, and AWWA C153/A21.53, ductile iron, 250 psi minimum working pressure. Restraint shall be achieved with removable metal elements fitted between a welded bar on the pipe barrel and the inside of the joint bell or fitting sizes smaller than 16 inches may be mechanical joint, restrained by anchor gland followers, ductile iron anchor type, wedge action, with break-off tightening bolts. Assembled joints shall be rated for deflection in operation at rated pressure. Rated deflection shall be not less than 1-1/2 degrees for 36-inch and smaller pipe. Rated deflection shall be not less than 1/2 degree for 42-inch and larger pipe. Clow Corp., American Cast Iron Pipe Co., U.S. Pipe. Restrained joints relying on metal teeth molded into the gasket to prevent joint separation under pressure will not be accepted. Flange: AWWA C110/A21.10 ductile iron, faced and drilled, Class 125 flat face. Gray cast iron will not be allowed.

SECTION 40 27 00.01 CEMENT-MORTAR-LINED DUCTILE IRON PIPE AND FITTINGS	
Item	**Description**
Joints	Proprietary Restrained: 150 psi minimum working pressure. Clow Corp., Super-Lock; American Cast Iron Pipe Co., Flex-Ring or Lok-Ring; U.S. Pipe, TR Flex. Flange: Dimensions per AWWA C110/A21.10 flat face, ductile iron, threaded conforming to AWWA C115/A21.15. Gray cast iron will not be allowed. Branch connections 3 inches and smaller, shall be made with service saddles as specified in Section 40 27 01, Process Piping Specialties.
Bolting	Type 316 stainless steel, ASTM A320/A320M, Grade B8M heavy hex head or stud bolts; ASTM A194/A194M, Grade 8M heavy hex nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads. Stud bolts are not allowed when bolting to tapped flanges. Torque bolts per gasket manufacturer recommendations.
Gaskets	General: Gaskets in contact with potable water shall be NSF ANSI 61 certified. Proprietary Restrained Joints;: Halogenated butyl or EPDM, Shore A hardness durometer 60, conforming to AWWA C111/A21.11. Flanged,: 1/8-inch-thick, homogeneous black rubber (EPDM), hardness 60-80 (Shore A), rated to 275 degrees F, conforming to ASME B16.21 and ASTM D2000. Full face for flat-faced flanges, flat-ring type for raised-face flanges. Blind flanges shall be epoxy-lined in accordance with the system specified above. Gasket pressure rating to equal or exceed the system hydrostatic test pressure.
Joint Lubricant	Manufacturer’s standard.

END OF SECTION

SECTION 40 27 00.08 STAINLESS STEEL PIPE AND FITTINGS—GENERAL SERVICE		
Item	**Size**	**Description**
Pipe	2-1/2" & smaller	Schedule 40S: ASTM A312/A312M, Type 316 seamless, pickled and passivated.
	3" thru 6"	Schedule 10S: ASTM A312/A312M , Type 316L, pickled and passivated.
	8" & larger	Schedule 5S: ASTM A312/A312M, Type 316L, pickled and passivated.
Joints	1-1/2" & smaller	Threaded or flanged at equipment as required or shown.
	2" & larger	Flanged at valves and equipment.
Fittings	1-1/2" & smaller	Threaded: Forged 1,000 CWP minimum, ASTM A182/A182M, Grade F316 or cast Class 150, ASTM A351/A351M, Grade CF8M/316.
	2" & 2-1/2"	Butt Welded: ASTM A403/A403M, Grade : WP316L conforming to ASME B16.9 and MSS SP 43, annealed, pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows, unless shown otherwise.
	3" & larger	Butt-Welded: ASTM A403/A403M, Type : 316 pickled and passivated; fitting wall thickness to match adjoining pipe; long radius elbows, unless shown otherwise.
Branch Connections	1-1/2" & smaller	Tee or reducing tee in conformance with fittings above.
	2" & larger	Butt-welding tee or reducing tee in accordance with fittings above.
Flanges	All	Forged Stainless Steel: ASTM A182/A182M, Grade F316L, ASME B16.5 Class 150 or Class 300, slip-on weld neck or raised face. Weld slip-on flanges inside and outside.

SECTION 40 27 00.08 STAINLESS STEEL PIPE AND FITTINGS—GENERAL SERVICE		
Item	**Size**	**Description**
Unions	2" & smaller	Threaded Forged: ASTM A182/A182M, Grade F316, 2,000-pound or 3,000-pound WOG, integral ground seats, AAR design meeting the requirements of ASME B16.11, bore to match pipe.
Bolting	All	Flanged Joints in Sumps, Wet Wells, and Submerged and Wetted Installations: Type 316 stainless steel, ASTM A320/A320M, Grade B8M hex head bolts and ASTM A194/A194M, Grade 8M hex nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
Gaskets	All Flanges	1/8 inch thick, homogeneous black rubber (EPDM), hardness 60 (Shore A), rated to 250 degrees F. continuous and conforming to ASME B16.21 and ASTM D1330, Steam Grade. Blind Flanges: Gasketed covering entire inside face with gasket cemented to blind flange.
Thread Lubricant	2" & smaller	General Service: 100 percent virgin PTFE Teflon tape. Fuel Gas Service: Yellow Teflon tape designed for fuel gas service, Air Force A-A-58092, AA Thread Seal Tape, Inc.

END OF SECTION

SECTION 40 27 00.10 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS		
Item	**Size**	**Description**
General	All	Materials in contact with potable water shall conform to NSF 61 acceptance.
Pipe	All	Schedule 80 PVC: Type I, Grade I or Class 12454-B conforming to ASTM D1784 and ASTM D1785. Pipe shall be manufactured with titanium dioxide for ultraviolet protection. Threaded Nipples: Schedule 80 PVC.
Fittings	All	Schedule to Match Pipe Above: ASTM D2466 and ASTM D2467 for socket weld type and Schedule 80 ASTM D2464 for threaded type. Fittings shall be manufactured with titanium dioxide for ultraviolet protection.
Joints	All	Solvent socket weld except where connection to threaded valves and equipment may require future disassembly.
Flanges	All	One-piece, molded hub type PVC flat face flange in accordance with Fittings above, ASME B16.1, Class 125 drilling
Bolting	All	ASTM A193/A193M, Type 316 stainless steel Grade B8M hex head bolts, ASTM A194/A194M Grade 8M hex head nuts and ASTM F436 Type 3 alloy washers at nuts and bolt heads. Achieve 40 percent to 60 percent of bolt minimum yield stress.
Gaskets	All	Flat Face Mating Flange: Full faced 1/8-inch-thick ethylene propylene (EPR) rubber.
Solvent Cement	All	Socket type joints shall be made employing solvent cement that meets or exceeds the requirements of ASTM D2564 and primer that meets or exceeds requirements of ASTM F656, chemically resistant to the fluid service, and as recommended by pipe and fitting manufacturer. Solvent cement and primer shall be listed by NSF 61 for contact with potable water.
Thread Lubricant	All	Teflon Tape.

END OF SECTION

SECTION 40 27 01
PROCESS PIPING SPECIALTIES

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Society of Mechanical Engineers (ASME):
   a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings (Classes 25, 125, and 250).
   b. B16.5, Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
2. American Water Works Association (AWWA):
   a. C110/A21.10, Ductile-Iron and Gray-Iron Fittings.
   b. C153/A21.53, Ductile-Iron Compact Fittings for Water Service.
   c. C210, Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
   d. C213, Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
   e. C219, Bolted, Sleeve-Type Couplings for Plain-End Pipe.
   f. Manual M11, Steel Pipe—A Guide for Design and Installation.
3. ASTM International (ASTM):
   a. A153/A153M, Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
   b. A276, Standard Specification for Stainless Steel Bars and Shapes.
4. National Fire Protection Association (NFPA): 24, Standard for the Installation of Private Fire Service Mains and Their Appurtenances.
5. NSF International (NSF):
   a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
   b. NSF/ANSI 372, Drinking Water System Components - Lead Content.

1.02 SUBMITTALS

A. Action Submittals: Manufacturer’s data on materials, construction, end connections, ratings, overall lengths, and live lengths (as applicable).

PART 2 PRODUCTS

2.01 GENERAL

A. Provide required piping specialty items, whether shown or not shown on Drawings, as required by applicable codes and standard industry practice.

B. Rubber ring joints, mechanical joints, flexible couplings, and proprietary restrained ductile iron pipe joints are considered flexible joints; welded, screwed, and flanged pipe joints are not considered flexible.

2.02 COUPLINGS

A. General:

1. Coupling linings for use in potable water systems shall be in conformance with NSF/ANSI 61.
2. Couplings shall be rated for working pressure not less than indicated in Piping Schedule for the service and not less than 150 psi.
3. Couplings shall be lined and coated with fusion-bonded epoxy in accordance with AWWA C213.
4. Unless thrust restraint is provided by other means, couplings shall be harnessed in accordance with requirements of AWWA Manual M11 or as shown on Drawings.
5. Sleeve type couplings shall conform to AWWA C219 and shall be hydraulically expanded beyond minimum yield for accurate sizing and proofing of tensile strength.

B. Flexible Sleeve Type Coupling:

1. Manufacturers and Products:
   a. Steel Pipe:
      1) Dresser Piping Specialties; Style 38.
      2) Smith-Blair, Inc.; Style 411.
   b. Ductile Iron Pipe:
      1) Dresser Piping Specialties; Style 253.
      2) Smith-Blair, Inc.; Style 441.

C. Restrained Flange Adapter:

1. Pressure Rating:
   a. Minimum Working Pressure Rating: Not less than 150 psi.
   b. Safety Factor: Not less than two times working pressure and shall be supported by manufacturer’s proof testing.
2. Thrust Restraint:
   a. Provide hardened steel wedges that bear against and engage outer pipe surface, and allow articulation of pipe joint after assembly while wedges remain in their original setting position on pipe surface.
   b. Products employing set screws that bear directly on pipe will not be acceptable.
3. Manufacturer and Product: EBAA Iron Sales Co.; Mega-Flange.

D. Restrained Dismantling Joints:

1. Pressure Rating:
   a. Minimum working pressure rating shall not be less than rating of the connecting flange.
   b. Proof testing shall conform to requirements of AWWA C219 for bolted couplings.
2. Manufacturers and Products:
   a. Dresser Piping Specialties; Style 131.
   b. Smith Blair, Inc.; Model 975.

2.03 SERVICE SADDLES

A. Double-Strap Iron:

1. Pressure Rating: Capable of withstanding 150 psi internal pressure without leakage or over stressing.
2. Run Diameter: Compatible with outside diameter of pipe on which saddle is installed.
3. Taps: Iron pipe threads.
4. Materials:
   a. Body: Malleable or ductile iron.
   b. Straps: Galvanized steel.
   c. Hex Nuts and Washers: Steel.
   d. Seal: Rubber.
5. Manufacturers and Products: Smith-Blair; Series 313 or 366.

2.04 SLAB, FLOOR, WALL AND ROOF PENETRATIONS

A. Ductile Iron Wall Pipe:

1. Diameter, Lining, and Ends: Same as connecting ductile iron pipe.
2. Thickness: Equal to or greater than remainder of pipe in line.
3. Fittings: In accordance with applicable Pipe Data Sheet.
4. Thrust Collars:
   a. Rated for thrust load developed at 250 psi.
   b. Safety Factor: 2, minimum.
   c. Material and Construction: Ductile iron or cast iron, cast integral with wall pipe wherever possible, or thrust rated, welded attachment to wall pipe.
5. Manufacturers:
   a. American Cast Iron Pipe Co.
   b. U.S. Pipe and Foundry Co.

PART 3 EXECUTION

3.01 GENERAL

A. Provide accessibility to piping specialties for control and maintenance.

3.02 PIPING FLEXIBILITY PROVISIONS

A. General:

1. Thrust restraint shall be provided as specified in Section 40 27 00, Process Piping—General.
2. Install flexible couplings to facilitate piping installation, in accordance with approved shop drawings.

B. Flexible Joints at Concrete Backfill or Encasement: Install within 18 inches or one-half pipe diameter, whichever is less, from the termination of any concrete backfill or concrete encasement.

C. Flexible Joints at Concrete Structures:

1. Install 18 inches or less from face of structures; joint may be flush with face.
2. Install a second flexible joint, whether or not shown.
   a. Pipe Diameter 18 Inches and Smaller: Within 18 inches of first joint.

3.03 PIPING TRANSITION

A. Applications:

1. Provide complete closure assembly where pipes meet other pipes or structures.
2. Pressure Pipeline Closures: Plain end pieces with double flexible couplings, unless otherwise shown.
3. Restrained Joint Pipe Closures: Install with thrust tie-rod assemblies as shown.

B. Installation:

1. Flexible Transition Couplings: Install in accordance with coupling manufacturer's instructions to connect dissimilar pipe and pipes with a small difference in outside diameter.
2. Concrete Closures:
   a. Locate away from structures so there are at least two flexible joints between closure and pipe entering structure.
   b. Clean pipe surface before placing closure collars.
   c. Wet nonmetallic pipe thoroughly prior to pouring collars.

d. Prevent concrete from entering pipe.
e. Extend collar a minimum of 12 inches on each side of joint with minimum thickness of 6 inches around outside diameter of pipe.
f. Make entire collar in one placement.
g. After concrete has reached initial set, cure by covering with well-moistened earth.

3.04 PIPING EXPANSION

A. Piping Installation: Allow for thermal expansion due to differences between installation and operating temperatures.

3.05 SERVICE SADDLES

A. Ferrous Metal Piping (except stainless steel): Double-strap iron.

3.06 OUTLET/TAPPING SADDLE

A. Install in accordance with manufacturer's written instructions.

3.07 COUPLINGS

A. General:

1. Install in accordance with manufacturer's written instructions.
2. Before coupling, clean pipe holdback area of oil, scale, rust, and dirt.
3. Do not remove pipe coating. If damaged, repair before joint is made.
4. Application:
   a. Metallic Piping Systems: Flexible couplings, transition couplings, and flanged coupling adapters.
   b. Concrete Encased Couplings: Flexible coupling.

3.08 SLAB, FLOOR, WALL AND ROOF PENETRATIONS

A. Applications:

1. Watertight and Below Ground Penetrations:
   a. Wall pipes with thrust collars.
   b. Provide taps for stud bolts in flanges to be set flush with wall face.
2. Nonwatertight Penetrations: Pipe sleeves with seep ring.
3. Existing Walls: Rotary drilled holes.
4. Fire-Rated or Smoke-Rated Walls, Floors or Ceilings: Insulated and encased pipe sleeves.

END OF SECTION

SECTION 40 27 02
PROCESS VALVES AND OPERATORS

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards which may be referenced in this section:

1. American Gas Association (AGA): 3, Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids.
2. American National Standards Institute (ANSI): Z21.15, Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
3. American Society of Mechanical Engineers (ASME):
   a. B16.1, Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
   b. B16.44, Manually Operated Metallic Gas Valves for Use in Above Ground Piping Systems up to 5 psi.
4. American Society of Sanitary Engineers (ASSE): 1011, Performance Requirements for Hose Connection Vacuum Breakers.
5. American Water Works Association (AWWA):
   a. C111/A21.11, Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
   b. C500, Metal-Seated Gate Valves for Water Supply Service.
   c. C504, Rubber-Seated Butterfly Valves, 3 In. (75 mm) Through 72 In. (1,800 mm).
   d. C508, Swing-Check Valves for Waterworks Service, 2-In. Through 24-In. (50-mm Through 600-mm) NPS.
   e. C509, Resilient-Seated Gate Valves for Water Supply Service.
   f. C510, Double Check Valve Backflow Prevention Assembly.
   g. C511, Reduced-Pressure Principle Backflow Prevention Assembly.
   h. C512, Air-Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
   i. C515, Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
   j. C541, Hydraulic and Pneumatic Cylinder and Vane-Type Actuators for Valves and Slide Gates.
   k. C542, Electric Motor Actuators for Valves and Slide Gates.
   l. C550, Protective Interior Coatings for Valves and Hydrants.
   m. C606, Grooved and Shouldered Joints.
   n. C800, Underground Service Line Valves and Fittings.

6. ASTM International (ASTM):
   a. A276, Standard Specification for Stainless Steel Bars and Shapes.
   b. A351/A351M, Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
   c. A380, Standard Practice for Cleaning, Descaling, and Passivation of Stainless Steel Parts, Equipment, and Systems.
   d. A564/A564M, Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless Steel Bars and Shapes.
   e. B61, Standard Specification for Steam or Valve Bronze Castings.
   f. B62, Standard Specification for Composition Bronze or Ounce Metal Castings.
   g. B98/B98M, Standard Specification for Copper-Silicon Alloy Rod, Bar, and Shapes.
   h. B127, Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip.
   i. B139/B139, Standard Specification for Phosphor Bronze Rod, Bar and Shapes.
   j. B164, Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire.
   k. B194, Standard Specification for Copper-Beryllium Alloy Plate, Sheet, Strip, and Rolled Bar.
   l. B584, Standard Specification for Copper Alloy Sand Castings for General Applications.
   m. D429, Standard Test Methods for Rubber Property-Adhesion to Rigid Substrates.
   n. D1784, Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
7. Canadian Standards Association, Inc. (CSA): 9.1, Manually Operated Gas Valves for Appliances, Appliance Connector Valves and Hose End Valves.
8. Chlorine Institute (CI): Pamphlet 6, Piping Systems for Dry Chlorine.
9. FM Global (FM).
10. Food and Drug Administration (FDA).
11. International Association of Plumbing and Mechanical Officials (IAPMO).
12. Manufacturers Standardization Society (MSS):
   a. SP-80, Bronze Gate, Globe, Angle, and Check Valves.
   b. SP-81, Stainless Steel, Bonnetless, Flanged Knife Gate Valves.
   c. SP-85, Gray Iron Globe and Angle Valves, Flanged and Threaded Ends.
   d. SP-88, Diaphragm Valves.
   e. SP-110, Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends.
13. National Electrical Manufacturers Association (NEMA): 250, Enclosures for Electrical Equipment (1000 Volts Maximum).

14. NSF International (NSF):
    a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
    b. NSF/ANSI 372, Drinking Water System Components - Lead Content.
15. Underwriters Laboratories (UL).
16. USC Foundation for Cross-Connection Control and Hydraulic Research.

1.02 SUBMITTALS

A. Action Submittals:

1. Shop Drawings:
    a. Product data sheets for each make and model. Indicate valve Type Number, applicable Tag Number, and facility name/number or service where used.
    b. Complete catalog information, descriptive literature, specifications, and identification of materials of construction.
    c. Power and control wiring diagrams, including terminals and numbers.
    d. For each power actuator provided, manufacturer's standard data sheet, with application specific features and options clearly identified.
    e. Sizing calculations for open-close/throttle and modulating valves.

B. Informational Submittals:

1. Manufacturer's Certificate of Compliance, for:
    a. Electric actuators; full compliance with AWWA C542.
    b. Butterfly valves; full compliance with AWWA C504.
2. Tests and inspection data.
3. Operating and Maintenance Data as specified in Section 01730, Operating and Maintenance Data.
4. Manufacturer's Certificate of Proper Installation.

PART 2 PRODUCTS

2.01 GENERAL

A. Valves to include operator, actuator, handwheel, chain wheel, extension stem, floor stand, operating nut, chain, wrench, and accessories to allow a complete operation from the intended operating level.

B. Valve to be suitable for intended service. Renewable parts not to be of a lower quality than specified.

C. Valve same size as adjoining pipe, unless otherwise called out on Drawings or in Supplements.

D. Valve ends to suit adjacent piping.

E. Resilient seated valves shall have no leakage (drip-tight) in either direction at valve rated design pressure. All other valves shall have no leakage (drip-tight) in either direction at valve rated design pressure, unless otherwise allowed for in this section or in stated valve standard.

F. Size operators and actuators to operate valve for full range of pressures and velocities.

G. Valve to open by turning counterclockwise, unless otherwise specified.

H. Factory mount operator, actuator, and accessories.

I. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 SCHEDULE

A. Additional requirements relative to this section are shown on Electric Motor Actuated Valve Schedule and Self-Regulated Valve Schedule located at the end of this section.

2.03 MATERIALS

A. Bronze and brass valve components and accessories that have surfaces in contact with water to be alloys containing less than 16 percent zinc and 2 percent aluminum.

1. Approved alloys are of the following ASTM designations: B61, B62, B98/B98M (Alloy UNS No. C65100, C65500, or C66100), B139/B139M (Alloy UNS No. C51000), B584 (Alloy UNS No. C90300 or C94700), B164, B194, and B127.
2. Stainless steel Alloy 18-8 may be substituted for bronze.

B. Valve materials in contact with or intended for drinking water service to meet the following requirements:

1. Materials to comply with requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements.
2. Coatings materials to be formulated from materials deemed acceptable to NSF/ANSI 61.

2.04 FACTORY FINISHING

A. General:

1. Interior coatings for valves and hydrants shall be in accordance with AWWA C550, unless otherwise specified.
2. Exterior coating for valves and hydrants shall be in accordance with Section 09 90 04, Painting.
3. Material in contact with potable water shall conform to NSF/ANSI 61.
4. Exposed safety isolation valves and lockout valves with handles, handwheels, or chain wheels shall be “safety yellow.”

B. Where epoxy lining and coating are specified, factory finishing shall be as follows:

1. In accordance with AWWA C550.
2. Either two-part liquid material or heat-activated (fusion) material except only heat-activated material if specified as “fusion” or “fusion bonded” epoxy.
3. Minimum 7-mil dry film thickness except where limited by valve operating tolerances.

2.05 VALVES

A. Gate Valves:

1. Type V134 Resilient Seated Ductile Iron Gate Valve 3 Inches to 36 Inches:
   a. Ductile iron body, resilient seat, bronze stem and stem nut, ASME B16.1 Class 125 flanged ends, outside screw and yoke, in accordance with AWWA C515, minimum design working water pressure 250 psig, full port, fusion epoxy coated inside and outside per AWWA C550.
   b. Manufacturers and Products:
      1) American Flow Control; Series 2500.
      2) M&H; Style 7000 and C515 Large RW Valves.
2. Type V135 Resilient Seated Ductile Iron Gate Valve 3 Inches to 36 Inches:
   a. Ductile iron body, resilient seat, bronze stem and stem nut, mechanical joint ends, nonrising stem, in accordance with AWWA C515, minimum design working water pressure 200 psig, full port, fusion epoxy coated inside and outside per AWWA C550.
   b. Manufacturers and Products:
      1) American Flow Control; Series 2500.
      2) M&H; Style 7000 and C515 Large RW Valves.

B. Ball Valves:

1. Type V306 Stainless Steel Ball Valve 2 Inches and Smaller:
   a. Two-piece, full port, ASTM A276 GR 316 or ASTM A351/A351M GR CF8M stainless steel body and end piece, NPT threaded ends, ASTM A276 Type 316 stainless steel ball, reinforced PTFE seats, seals, and packing, adjustable packing gland, blowout proof stainless steel stem, stainless steel lever operator with vinyl grip, rated 1,000 psig CWP, complies with MSS SP-110.
   b. Manufacturers and Products:
      1) Conbraco Apollo; 76F-100 Series.
      2) Nibco; T-585-S6-R-66-LL.

C. Butterfly Valves:

1. General:
   a. In full compliance with AWWA C504 and following requirements:
      1) Suitable for throttling operations and infrequent operation after periods of inactivity.
      2) Elastomer seats which are bonded or vulcanized to the body shall have adhesive integrity of bond between seat and body assured by testing, with minimum 75-pound pull in accordance with ASTM D429, Method B.
      3) Bubble-tight with rated pressure applied from either side. Test valves with pressure applied in both directions.
      4) No travel stops for disc on interior of body.
      5) Self-adjusting V-type or O-ring shaft seals.
      6) Isolate metal-to-metal thrust bearing surfaces from flowstream.
      7) Provide traveling nut or worm gear actuator with handwheel. Valve actuators to meet the requirements of AWWA C504.
      8) Buried service operators shall withstand 450 foot-pounds of input torque at fully open and fully closed positions.
      9) Provide linings and coatings per AWWA, unless otherwise indicated on Drawings or specified herein.
2. Type V500 Butterfly Valve Water Works Service 3 Inches to 72 Inches:
   a. AWWA C504, Class 150B.
   b. Short body type, flanged ends.
   c. Cast-iron body, cast or ductile iron disc, Type 304 stainless steel shafts, EPDM rubber seat bonded or molded in body only, and stainless steel seating surface.
   d. Provide epoxy lining and coating in compliance with AWWA C550.
   e. Manufacturers and Products:
      1) Pratt; Model 2FII or Triton XR-70.
      2) DeZurik; AWWA Valve.

D. Check and Flap Valves:

1. Type V608 Swing Check Valve 2 Inches to 24 Inches:
   a. AWWA C508, 125-pound flanged ends, cast-iron body, bronze body seat, bronze mounted cast-iron clapper with rubber facing, stainless steel hinge shaft.
   b. Valves, 2 inches through 12 inches rated 175-pound WWP and 14 inches through 24 inches rated 150-pound WWP. Valves to be fitted with adjustable outside lever and weight. Increasing-pattern body valve may be used where increased outlet piping size is shown.
   c. Manufacturers and Products:
      1) M&H Valve; Style 59, 159, or 259.
      2) Mueller Co.; No. A-2600 Series.
2. Type V640 Double Check Valve Backflow Prevention Assembly 3/4 Inch to 10 Inches:
   a. Two resilient seated check valves, two outside screw and yoke resilient-seated isolation valves, test cocks, in accordance with AWWA C510, rated 175 psi maximum working pressure, meets requirements of USC Foundation For Cross-Connection Control and Hydraulic Research.
   b. Manufacturers and Products:
      1) FEBCO; Model 850.
      2) Danfoss Flomatic; Model DCVE/DCV.
      3) Watts; Series 007/709.

E. Self-Regulated Automatic Valves:

1. Type V740 Air and Vacuum Valve 1/2 Inch to 16 Inches:
   a. 1/2-inch through 3-inch NPT inlets and outlets, 4-inch and larger ASME B16.1 Class 125 flanged inlet with plain outlet and protective hood.
   b. Rated 150 psi working pressure, cast-iron or ductile iron body and cover, stainless steel float and trim, built and tested to AWWA C512.
   c. Manufacturers and Products:
      1) APCO Valve and Primer Corp.; Series 140 or 150.
      2) Val-Matic Valve; Series 100.

2.06 OPERATORS AND ACTUATORS

A. Manual Operators:

1. General:
   a. For AWWA valves, operator force not to exceed requirements of applicable valve standard. Provide gear reduction operator when force exceeds requirements.

b. For non-AWWA valves, operator force not to exceed applicable industry standard or 80 pounds, whichever is less, under operating condition, including initial breakaway. Provide gear reduction operator when force exceeds requirements.
c. Operator self-locking type or equipped with self-locking device.
d. Position indicator on quarter-turn valves.
e. Worm and gear operators one-piece design, worm-gears of gear bronze material. Worm of hardened alloy steel with thread ground and polished. Traveling nut type operator's threaded steel reach rod with internally threaded bronze or ductile iron nut.

2. Exposed Operator:
   a. Galvanized and painted handwheel.
   b. Cranks on gear type operator.
   c. Chain wheel operator with tieback, extension stem, floor stand, and other accessories to permit operation from normal operation level.
   d. Valve handles to take a padlock, and wheels a chain and padlock.
3. Buried Operator:
   a. Buried service operators on valves larger than 2-1/2 inches shall have a 2-inch AWWA operating nut. Buried operators on valves 2 inches and smaller shall have cross handle for operation by forked key. Enclose moving parts of valve and operator in housing to prevent contact with the soil.
   b. Buried service operators to be grease packed and gasketed to withstand submersion in water to 20 feet minimum.
   c. Buried valves shall have extension stems, bonnets, and valve boxes.

B. Electric Operators, 480 Volts:

1. General:
   a. Unit shall be low profile to reduce amount of required space and weigh 15 pounds or less.
   b. Size to 1-1/2 times required operating torque. Motor stall torque not to exceed torque capacity of the valve.
   c. Provide operator mounting bracket to mount operator to valve providing minimal torque to piping system when operating.
2. Operator Operation, General:
   a. Suitable for full 90-degree rotation of quarter-turn valves.
   b. Manually override handwheel.
   c. Mechanical valve position indication.
3. Electronic Control:
   a. Torque Limiting Switches: Two single pole, double throw mechanical switches. Switches operate at any point in valve travel.
   b. Jammed-valve detection and protection.
   c. Motor over-temperature detection and protection.
   d. Travel limit switches, single pole double throw.

e. Remote Indication and Control:
   1) Relay contact that closes when valve is capable of being controlled remotely (L-O-R switch in REMOTE) for connection to and monitoring by plant control system.
   2) Limit switch that closes when valve is fully OPENED for connection to and monitoring by plant control system.
   3) Limit switch that closes when valve is fully CLOSED for connection to and monitoring by plant control system.

f. Modulating (M) Service:
   1) Operator rated for continuous duty with servo shall be rated for 100 percent modulating operation.
   2) Operator shall modulate based on an externally applied 4 mA to 20 mA dc signal.
   3) Operator shall be equipped with an electronic servo module for valve modulation.
      a) Module shall provide serial communications with provided cable for setup of valve operation.

g. Local Indication and Control:
   1) Integral mechanical valve POSITION indication, 0 percent to 100 percent OPENED.
   2) Integral OPENED and CLOSED indication lights.
   3) Integral LOCAL-OFF-REMOTE (L-O-R).
   4) Integral OPEN momentary switch which causes valve to stroke towards OPENED, as long as OPEN switch is held, while L-O-R switch is in LOCAL.
   5) Integral CLOSE momentary switch which causes valve to stroke towards CLOSED, as long as CLOSED switch is held, while L-O-R switch is in LOCAL.
   6) Position valve proportionally 0 to 100 percent OPEN with external 4 mA to 20 mA dc signal while in REMOTE.

h. Remote Indication and Control:
   1) Relay contact that closes when valve is capable of being controlled remotely (L-O-R switch in REMOTE) for connection to and monitoring by plant control system.
   2) Limit switch that closes when valve is fully OPENED for connection to and monitoring by plant control system.
   3) Limit switch that closes when valve is fully CLOSED for connection to and monitoring by plant control system.
   4) Current Position Transmitter, 4 mA to 20 mA dc signal in proportion to 0 percent to 100 percent OPENED, with 0.5 percent accuracy and 0.5 percent repeatability, capable of driving a 750-ohm load, for connection to and monitoring by Plant Control System.

4. Control Features: Electric motor actuators with features as noted above, and as modified/supplemented in Electric Actuated Valve Schedule.
5. Manufacturer and Product: Rotork; EIM; or equal.

2.07 ACCESSORIES

A. Tagging: 1-1/2-inch diameter heavy brass or stainless steel tag attached with No. 16 solid brass or stainless steel jack chain for each electric actuated valve operator, bearing valve tag number shown on Electric Actuated Valve Schedule.

B. Limit Switch:

1. Factory installed NEMA 4X limit switch by actuator manufacturer.
2. SPST, rated at 5 amps, 120 volts ac.

C. T-Handled Operating Wrench:

1. One each galvanized operating wrenches, 4 feet long.
2. Manufacturers and Products:
   a. Mueller; No. A-24610.
   b. Clow No.; F-2520.

D. Extension Bonnet for Valve Operator: Complete with enclosed stem, extension, support brackets, and accessories for valve and operator.

E. Cast-Iron Valve Box: Designed for traffic loads, sliding type, with minimum of 5-1/4-inch ID shaft.

1. Box: Cast iron with minimum depth of 9 inches.
2. Lid: Cast iron, minimum depth 3 inches nonlocking type, marked DRAIN.
3. Extensions: Cast iron.
4. Two-piece box and lid for valves 4 inches through 12 inches, three-piece box and lid for valves larger than 12 inches with base sized for valve.
5. Valve extension stem for valves with operating nuts 3 feet or greater below finish grade.
6. Manufacturers and Products:
   a. East Jordan Iron Works; Cast-Iron Valve Boxes.
   b. Bingham & Taylor; Cast-Iron Valve Boxes.

PART 3 EXECUTION

3.01 INSTALLATION

A. Flange Ends:

1. Flanged valve bolt holes shall straddle vertical centerline of pipe.
2. Clean flanged faces, insert gasket and bolts, and tighten nuts progressively and uniformly.

B. Screwed Ends:

1. Clean threads by wire brushing or swabbing.
2. Apply joint compound.

C. Valve Installation and Orientation:

1. General:
   a. Install valves so handles operate from fully open to fully closed without encountering obstructions.
   b. Install valves in location for easy access for routine operation and maintenance.
   c. Install valves per manufacturer's recommendations.
2. Gate, Globe, and Ball Valves:
   a. Install operating stem vertical when valve is installed in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above finished floor, unless otherwise shown.
   b. Install operating stem horizontal in horizontal runs of pipe having centerline elevations greater than 4 feet 6 inches above finish floor, unless otherwise shown.
3. Butterfly Valves:
   a. Unless otherwise restricted or shown on Drawings, install valve a minimum of 8 diameters downstream of a horizontal elbow or branch tee with shaft in horizontal position.
   b. For vertical elbow or branch tee immediately upstream of valve, install valve with shaft in vertical position.
   c. For horizontal elbow or branch tee immediately upstream of valve, install valve with shaft in horizontal position.
   d. When installed immediately downstream of swing check, install valve with shaft perpendicular to swing check shaft.
   e. For free inlet or discharge into basins and tanks, install valve with shaft in vertical position.
4. Check Valves:
   a. Install valve in accordance with manufacturer's instructions and provide required distance from immediate upstream fitting.
   b. Install valve in vertical flow (up) piping only for gas services.
   c. Install swing check valve with shaft in horizontal position.
   d. Install double disc swing check valve to be perpendicular to flow pattern when discs are open.

D. Install line size ball valve and union upstream of each solenoid valve, in-line flow switch, or other in-line electrical device, excluding magnetic flowmeters, for isolation during maintenance.

E. Extension Stem for Operator: Where depth of valve operating nut is 3 feet or greater below finish grade, furnish operating extension stem with 2-inch operating nut to bring operating nut to a point within 6 inches of finish grade.

3.02 TESTS AND INSPECTION

A. Valve may be either tested while testing pipelines, or as a separate step.

B. Test that valves open and close smoothly under operating pressure conditions. Test that two-way valves open and close smoothly under operating pressure conditions from both directions.

C. Inspect air and vacuum valves as pipe is being filled to verify venting and seating is fully functional.

D. Count and record number of turns to open and close valve; account for discrepancies with manufacturer's data.

E. Set, verify, and record set pressures for relief and regulating valves.

F. Automatic valves to be tested in conjunction with control system testing. Set opening and closing speeds, limit switches, as required or recommended by Engineer.

G. Test hydrostatic relief valve seating; record leakage. Adjust and retest to maximum leakage of 0.1 gpm per foot of seat periphery.

3.03 SUPPLEMENTS

A. The supplements listed below, following "End of Section," are part of this Specification.

1. Electric Actuated Valve Schedule.

END OF SECTION

Electric Actuated Valve Schedule									
Tag Number	**Valve Type**	**Actuator Power Supply**	**Valve Size (inches)**	**Process Fluid**	**Maximum Operating Flow (gpm)**	**Maximum ΔP (psi)**	**Service**	**Travel Time (Seconds)**	**Control Feature Modifications/ Supplements**
FCV-614	V500	480 V, 3 Phase	16	RW	4,000	100	M	60	C, D, G, J
FV-616A	V500	480 V, 3 Phase	16	RW	4,000	100	O/C	60	C, D, G
FV-616B	V500	480 V, 3 Phase	12	RW	3,000	100	O/C	60	C, D, G
FCV-621	V500	480 V, 3 Phase	12	RW	3,000	100	M	60	C, D, G, J

Service: O/C = Open-Close, T = Throttling, M = Modulating

Control Feature Modifications/Supplements:

A = Actuator shall open valve upon loss of signal.

B = Actuator shall close valve upon loss of signal.

C = Actuator shall remain in last position upon loss of signal.

D = Local OPEN-CLOSE momentary pushbuttons that must be continuously depressed to initiate/maintain valve travel; travel stops when pushbutton is released or when end of travel limit is reached.

E = Remote OPEN-CLOSE maintained dry contacts; travel stops when remote contact opens, or when end of travel limit is reached.

F = Three 24-volt dc interposing relays for remote OPEN-STOP-CLOSE control. Relays powered externally, thereby permitting valve control from greater distances.

G = Motor and control enclosure(s) NEMA 250, Type 4 with space heaters.

H = Motor and control enclosure(s) NEMA 250, Type 6 (IP 68) with space heaters.

I = Motor and control enclosure(s) NEMA 250, Type 7 with space heaters.

J = Valve position output converter that generates isolated 4 mA to 20 mA dc signal in proportion to valve position, and is capable of driving into loads of up to 500 ohms at 24 volts dc.

K = 120-volt secondary control power transformer.

L = Externally operable power disconnect switch.

SECTION 40 80 01
PROCESS PIPING LEAKAGE TESTING

PART 1 GENERAL

1.01 SUBMITTALS

A. Informational Submittals:

1. Testing Plan:
   a. Submit prior to testing and include at least the information that follows.
      1) Testing dates.
      2) Piping systems and section(s) to be tested.
      3) Test type.
      4) Method of isolation.
      5) Calculation of maximum allowable leakage for piping section(s) to be tested.
2. Certifications of Calibration: Testing equipment.
3. Certified Test Report.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PREPARATION

A. Notify Engineer in writing 5 days in advance of testing. Perform testing in presence of Engineer.

B. Pressure Piping:

1. Install temporary thrust blocking or other restraint as necessary to protect adjacent piping or equipment and make taps in piping prior to testing.
2. Wait 5 days minimum after concrete thrust blocking is installed to perform pressure tests. If high-early strength cement is used for thrust blocking, wait may be reduced to 3 days.
3. Prior to test, remove or suitably isolate appurtenant instruments or devices that could be damaged by pressure testing.
4. New Piping Connected to Existing Piping:
   a. Isolate new piping with grooved-end pipe caps, spectacle blinds, blind flanges, or as acceptable to Engineer.
   b. Test joint between new piping and existing piping by methods that do not place entire existing system under test load, as approved by Engineer.
5. Test Pressure: As indicated on Piping Schedule.

C. Test section may be filled with water and allowed to stand under low pressure prior to testing.

3.02 HYDROSTATIC TEST FOR PRESSURE PIPING

A. Fluid: Clean water of such quality to prevent corrosion of materials in piping system.

B. Exposed Piping:

1. Perform testing on installed piping prior to application of insulation.
2. Maximum Filling Velocity: 0.25 foot per second, applied over full area of pipe.
3. Vent piping during filling. Open vents at high points of piping system or loosen flanges, using at least four bolts, or use equipment vents to purge air pockets.
4. Maintain hydrostatic test pressure continuously for 30 minutes, minimum, and for such additional time as necessary to conduct examinations for leakage.
5. Examine joints and connections for leakage.
6. Correct visible leakage and retest as specified.
7. Leave pipe full of water after repair of leaks.

C. Buried Piping:

1. Test after backfilling has been completed.
2. Expel air from piping system during filling.
3. Apply and maintain specified test pressure with hydraulic force pump. Valve off piping system when test pressure is reached.
4. Maintain hydrostatic test pressure continuously for 2 hours minimum, reopening isolation valve only as necessary to restore test pressure.
5. Determine actual leakage by measuring quantity of water necessary to maintain specified test pressure for duration of test.
6. Maximum Allowable Leakage:

$$L = \frac{SD(P)^{1/2}}{148{,}000}$$

where:

L = Allowable leakage, in gallons per hour.
S = Length of pipe tested, in feet.
D = Nominal diameter of pipe, in inches.
P = Test pressure during leakage test, in pounds per square inch.

7. Correct leakage greater than allowable, and retest as specified.

3.03 FIELD QUALITY CONTROL

A. Test Report Documentation:

1. Test date.
2. Description and identification of piping tested.
3. Test fluid.
4. Test pressure.
5. Remarks, including:
   a. Leaks (type, location).
   b. Repair/replacement performed to remedy excessive leakage.
6. Signed by Contractor and Engineer to represent that test has been satisfactorily completed.

END OF SECTION

SECTION 40 90 00
INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This section gives general requirements for Process Instrumentation and Control (PIC). The following PIC subsections expand on requirements of this section:

1. Section 40 91 00, Instrumentation and Control Components.
2. Section 40 95 80, Fiber Optic Communication System.

B. Major Work Items: Includes but is not limited to engineering, furnishing, installing, calibrating, adjusting, testing, documenting, starting up, and training for complete PIC.

1. Process instrumentation including primary elements, transmitters, control devices, and control panels.
2. PLC components and applications software programming associated with the well panels SP-7 and SP-8.
3. Network connections from the new well panels SP-7 and SP-8 to the existing PLC network.
4. Modifications to the Owner's existing SCADA system HMI graphics to incorporate the new signal interface associated with well panels SP-7 and SP-8.

1.02 REFERENCES

A. The following is a list of standards which may be referenced in this section and other PIC subsections:

1. American National Standards Institute (ANSI).
2. ASTM International (ASTM):
   a. A182/A182M, Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
   b. A276, Standard Specification for Stainless Steel Bars and Shapes.
   c. A312/A312M, Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
   d. B32, Standard Specification for Solder Metal.
   e. B88, Standard Specification for Seamless Copper Water Tube.

3. Deutsche Industrie-Norm (DIN): VDE 0611, Specification for modular terminal blocks for connection of copper conductors up to 1,000V ac and up to 1,200V dc.
4. Institute of Electrical and Electronics Engineers, Inc. (IEEE): C62.41, Recommended Practice on Surge Voltages in Low-Voltage AC Power Circuits.
5. International Society of Automation (ISA):
   a. RP12.06.01, Recommended Practice for Wiring Methods for Hazardous (Classified) Locations Instrumentation Part 1: Intrinsic Safety.
   b. S5.1, Instrumentation Symbols and Identification.
   c. S5.4, Instrument Loop Diagrams.
   d. S50.1, Compatibility of Analog Signals for Electronic Industrial Process Instruments.
   e. TR20.00.01, Specification Forms for Process Measurement and Control Instruments, Part 1: General.
6. International Conference on Energy Conversion and Application (ICECA).
7. National Electrical Code (NEC).
8. National Electrical Manufacturers Association (NEMA):
   a. 250, Enclosures for Electrical Equipment (1,000 Volts Maximum).
   b. ICS 1, Industrial Control and Systems General Requirements.
9. National Fire Protection Association (NFPA): 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities.
10. NSF International (NSF):
    a. NSF/ANSI 61, Drinking Water System Components - Health Effects.
    b. NSF/ANSI 372, Drinking Water System Components - Lead Content.
11. Underwriters Laboratory, Inc. (UL): 508A, Standard for Safety, Industrial Control Panels.

1.03 DEFINITIONS

A. Abbreviations:

1. FDT: Factory Demonstration Test.
2. FOPP: Fiber Optic Patch Panel
3. HMI: Human-Machine Interface.
4. HVAC: Heating, Ventilating, and Air Conditioning.
5. I&C: Instrumentation and Control.
6. I/O: Input and Output.
7. O&M: Operation and Maintenance.
8. P&ID: Process and Instrument Diagram.
9. PAT: Performance Acceptance Test.
10. PC: Personal Computer.
11. PIC: Process Instrumentation and Control.
12. PLC: Programmable Logic Controller.
13. SCADA: Supervisory Control and Data Acquisition.

B. Enclosure: Control panel, console, cabinet, or instrument housing.

C. Instructor Day: Eight hours of actual instruction time.

D. Standard Software: Software packages that are independent of Project on which they are used. Standard software includes system software, supervisory control, and data acquisition (SCADA) software.

1. System Software: Application independent (non-project specific) software developed by digital equipment manufacturers and software companies. Includes, but is not limited to, operating systems; network support, programming languages (C, C++, Visual C++, BASIC, Visual Basic, etc); Office Suites (word processor, spreadsheet, database, etc.); e-mail; security (firewall, antivirus; spam, spyware, etc.) debugging aids; and diagnostics.
2. SCADA Software: Software packages independent of specific process control project on which they are used. Includes, but is not limited to, providing configuring and run-time capability for, data acquisition (I/O driver, OPC servers, etc.), monitoring, alarming, human-machine interface, supervisory control, data collection, data retrieval, trending, report generation, control, and diagnostics.
3. Controller Programming Software: Software packages for the configuring of PLCs, RTUs, DCUs, SLDC, and fieldbus devices.

E. Application Software: Software to provide functions unique to this Project and that are not provided by standard software alone, including but not limited to:

1. Configuring databases, tables, displays, historians, reports, parameter lists, ladder logic, function block, and control strategies required to implement functions unique to this Project.
2. Programming in any programming or scripting language.

F. Rising/Falling: Define action of discrete devices about their setpoint.

1. Rising: Contacts close when an increasing process variable rises through setpoint.
2. Falling: Contacts close when a decreasing process variable falls through setpoint.

G. Signal Types:

1. Analog Signal, Current Type:
   a. 4 to 20 mA dc signals conforming to ISA S50.1.
   b. Unless otherwise indicated for specific PIC subsection components, use the following ISA S50.1 options.
      1) Transmitter Type: Number 2, two-wire.
      2) Transmitter Load Resistance Capacity: Class L.
      3) Fully isolated transmitters and receivers.

2. Analog Signal, Voltage Type: 1 to 5 volts dc within panel where common high precision dropping resistor is used.
3. Discrete signals, two-state logic signals using dc or 120V ac sources as indicated.
4. Pulse Frequency Signals:
   a. Direct-current pulses whose repetition rate is linearly proportional to process variable.
   b. Pulses generated by contact closures or solid state switches.
   c. Power source less than 30V dc.
5. Special Signals: Other types of signals used to transmit analog and digital information between field elements, transmitters, receivers, controllers, and digital devices.

1.04 SYSTEM DESCRIPTION

A. Detailed Wiring Design: Panel wiring diagrams, interconnecting wiring diagrams, and loop wiring diagrams are included in Contract Drawings and designed to completely show control panel wiring, terminations, wire numbers, interfaces with other systems, hardwired functions, interlocks, and wiring of components to be provided.

B. Design Requirements:

1. Complete detailed design of PIC components and PIC drawings.
2. Provide consistent hardware and software functions for PIC. For example, provide functions in control logic, sequence controls, and display layouts in same or similar manner.
3. PIC design as shown and specified includes:
   a. Functional requirements, performance requirements, and component specifications.
   b. P&IDs, block diagrams, and network diagrams.
4. Typical drawings for installation details, control panel layouts, control panel schedules, PLC I/O module wiring, panel power, and control diagrams.

C. Use a qualified PIC System Integrator for at least the following work:

1. For PIC Equipment and Ancillaries:
   a. Completing detail design.
   b. Submittals.
   c. Equipment, enclosures, and ancillaries.
   d. Instructions, details, and recommendations to, and coordination with Contractor for Certificate of Proper Installation.
   e. Verify readiness for operation.

f. Verify correctness of final power and signal connections (lugging and connecting).
g. Adjusting and calibrating.
h. Starting up.
i. Testing and coordination of testing.
j. Training.

2. Verify following Work not by PIC System Integrator is provided:
   a. Correct type, size, and number of signal wires with their raceways.
   b. Correct electrical power circuits and raceways.
   c. Correct size, type, and number of PIC-related pipes, valves, fittings, and tubes.
   d. Correct size, type, materials, and connections of process mechanical piping for in-line primary elements.
3. Non-PIC Equipment Directly Connected to PIC Equipment:
   a. Obtain from Contractor, manufacturers' information on installation, interface, function, and adjustment.
   b. Coordinate with Contractor to allow required interface and operation with PIC.
   c. For operation and control, verify installations, interfacing signal terminations, and adjustments have been completed in accordance with manufacturer's recommendations.
   d. Test to demonstrate required interface and operation with PIC.
   e. Examples of items in this category, but not limited to the following:
      1) Valve operators, position switches, and controls.
      2) Chemical feed pump and feeder speed/stroke controls.
      3) Automatic samplers.
      4) Motor control centers.
      5) Adjustable speed and adjustable frequency drive systems.
   f. Examples of items not in this category:
      1) Internal portions of equipment provided under Division 26, Electrical, that are not directly connected to PIC equipment.
      2) Internal portions of package system instrumentation and controls that are not directly connected to PIC equipment.

1.05 SUBMITTALS

A. General:

1. Submit proposed Submittal breakdown consisting of sequencing and packaging of information in accordance with Project Schedule.
2. Partial Submittals not in accordance with Project Schedule will not be accepted.

3. Submittal Format:
    a. Hard Copy: Required for all submittals.
    b. Electronic Copies: Required, unless otherwise noted for specific items.
        1) Manufacturers' Standard Documents: Adobe Acrobat PDF.
        2) Documents created specifically for Project:
            a) Text and Graphics: Microsoft Word.
            b) Lists: Microsoft Excel, unless otherwise noted for specific items.
            c) Drawings: AutoCAD.
4. Identify proposed items, options, installed spares, and other provisions for future work (for example, reserved panel space; unused components, wiring, and terminals).
5. Legends and Abbreviation Lists:
    a. Definition of symbols and abbreviations used; for example, engineering units, flowstreams, instruments, structures, and other process items used in nameplates, legends, data sheets, point descriptions, HMI displays, alarm/status logs, and reports.
    b. Use identical abbreviations in PIC subsections.
    c. Submit updated versions as they occur.
6. Activity Completion:
    a. Action Submittals: Completed when reviewed and approved.
    b. Informational Submittals: Completed when reviewed and found to meet conditions of the Contract.

B. Action Submittals:

1. Bill of Materials: List of required equipment.
    a. Group equipment items by enclosure and field, and within an enclosure, as follows:
        1) PIC Components: By component identification code.
        2) Other Equipment: By equipment type.
    b. Data Included:
        1) Equipment tag number.
        2) Description.
        3) Manufacturer, complete model number and all options not defined by model number.
        4) Quantity supplied.
        5) Component identification code where applicable.
        6) For panels, include panel reference number and name plate inscription.
    c. Formats: Hard copy and Microsoft Excel.
2. Catalog Cuts: I&C components, electrical devices, and mechanical devices:
    a. Catalog information, marked to identify proposed items and options.
    b. Descriptive literature.

c. External power and signal connections.
d. Scaled drawings showing exterior dimensions and locations of electrical and mechanical interfaces.

3. Instrument List:
   a. Engineer will provide an initial Instrument List in Microsoft Excel. Data from this may be used as starting point for creating final Instrument List and Component Data Sheets.
   b. Applicable fields to be completed include, but are not limited to:

Instrument List Characteristics	
Item	**Initially Completed By**
Tag Number	Engineer
Loop Number	Engineer
Description	Engineer
Manufacturer and complete model number	Contractor
Size and scale range	Engineer
Setpoints	Engineer
Reference P&IDs, Electrical, Mechanical, Interconnection Drawings and Installation Details Drawings	Engineer
Instrument detail number	Engineer

   c. Submit updated version of Instrument List.
   d. Electronic Copies: Microsoft Excel.
4. Component Data Sheets: Data sheets for I&C components.
   a. Format:
      1) Similar to ISA TR20.00.01.
      2) Microsoft Excel, one component per data sheet.
   b. Content: Specific features and configuration data for each component, including but not limited to:
      1) Tag Number.
      2) Component type identification code and description.
      3) Location or service.
      4) Service conditions.
      5) Manufacturer and complete model number.
      6) Size and scale range.
      7) Setpoints.
      8) Materials of construction.
      9) Options included.

10) Power requirements.
11) Signal interfaces.
12) Name, address, and telephone number of manufacturer's local office, representative, distributor, or service facility.

c. Electronic Copies: Microsoft Excel.

5. Sizing and Selection Calculations:
   a. Primary Elements:
      1) Complete calculations plus process data used. Example for Flow Elements:
         a) Minimum and maximum values, permanent head loss, and assumptions made.
   b. Controller, Computing, and Function Generating Modules: Actual scaling factors with units and how they were computed.
   c. Electronic Copies: Microsoft Excel, one file for each group of components with identical sizing calculations.
6. Preliminary Panel Elevation Drawings: Provide prior to submitting Panel Construction Drawings:
   a. Scale Drawings: Show dimensions and location of front of panel devices.
   b. Panel Legend (Bill of Material): List front of panel devices by tag number. Include nameplate inscriptions, service legends, and annunciator inscriptions.
   c. Submit electronic copies of Drawings.
7. Panel Construction Drawings:
   a. Scale Drawings: Show dimensions and locations of panel-mounted devices, doors, louvers, subpanels, internal and external.
   b. Panel Legend (Bill of Material): List front of panel devices by tag numbers, nameplate inscriptions, service legends, and annunciator inscriptions.
   c. Bill of Materials: List devices mounted within panel that are not listed in panel legend. Include tag number, description, manufacturer, and model number.
   d. Construction Details: NEMA rating, materials, material thickness, structural stiffeners and brackets, lifting lugs, mounting brackets and tabs, door hinges and latches, and welding and other connection callouts and details.
   e. Construction Notes: Finishes, wire color schemes, wire ratings, wire, terminal block numbering, and labeling scheme.
   f. Submit electronic copies of Drawings.
8. Detailed Wiring Diagrams:
   a. Refer to Drawings for Detailed Wiring Diagrams including:
      1) Panel Wiring Diagrams for discrete control and power circuits.
      2) Loop Wiring Diagrams showing individual wiring diagram for each analog or pulse frequency loop.

3) Interconnecting Wiring Diagrams showing electrical connections between equipment, consoles, panels, terminal junction boxes, and field-mounted components.

b. Prepare as-built redline markup of detailed wiring diagrams. Show terminal numbers on switch blocks, relays, and internal components.

c. Submit electronic copies of Drawings.

9. Panel Wiring Diagrams:

a. Cover wiring within a panel including, but not limited to, instrumentation, control, power, and communications, and digital networks.

b. Objectives: For use in wiring panels, making panel connections, and future panel trouble shooting.

c. Diagram Type:

1) Ladder diagrams where applicable. Include devices that are mounted in or on the panel that require electrical connections. Show unique rung numbers on left side of each rung.

2) Schematic drawings for wiring of circuits that cannot be well represented by ladder diagrams.

d. Item Identification: Identify each item with attributes listed.

1) Wires: Wire number and color. Cable number if part of multiconductor cable.

2) Terminals: Location (enclosure number, terminal junction box number, or MCC number), terminal strip number, and terminal block number.

3) Components:

a) Tag number, terminal numbers, and location ("FIELD", enclosure number, or MCC number).

b) Switching action (open or close on rising or falling process variable), setpoint value and units, and process variable description (for example, Sump Level High).

4) I/O Points: PLC unit number, I/O tag number, I/O address, terminal numbers, and terminal strip numbers.

5) Relay Coils:

a) Tag number and its function.

b) On right side of run where coil is located, list contact location by ladder number and sheet number. Underline normally closed contacts.

6) Relay Contacts: Coil tag number, function, and coil location (ladder rung number and sheet number).

7) Communications and Networks: Network type, address or node identification, port or channel number, and type of connector.

e. Show each circuit individually. No "typical" diagrams or "typical" wire lists will be allowed.

f. Ground wires, surge protectors, and connections.

g. Wire and Cable Names: Show names and wire color for circuits entering and leaving a panel. Refer to Division 26, Electrical.

10. Loop Wiring Diagrams: Individual, end-to-end wiring diagram for each analog and discrete or equipment loop.
    a. Conform to the minimum requirements of ISA S5.4.
    b. Under Paragraph 5.3 of ISA S5.4, include the information listed under Subparagraphs 2 and 6.
    c. Show loop components within a panel and identify each component, component terminals, and panel terminals.
    d. If a loop connects to panels or devices not provided under this section and its subsections, such as control valves, motor control centers, package system panels, variable speed drives, include the following information:
        1) Show the first component connected to within the panel or device that is not provided under this section and its subsections.
        2) Identify the component by tag and description.
        3) Identify panel and component terminal numbers.
    e. Drawing Size: Individual 11-inch by 17-inch sheet for each loop.
    f. Divide each loop diagram into areas for panel face, back-of-panel, field and PLC.
    g. One Drawing Per Loop: Show each loop individually. No “typical” loop diagrams will be allowed.
    h. Show:
        1) Terminal numbers, location of dc power supply, and location of common dropping resistors.
        2) Switching contacts in analog loops and output contacts of analog devices. Reference specific control diagrams where functions of these contacts are shown.
        3) Tabular summary on each analog loop diagram:
            a) Transmitting Instruments: Output capability.
            b) Receiving Instruments: Input impedance.
            c) Loop Wiring Impedance: Estimate based on wire sizes and lengths shown.
            d) Total loop impedance.
            e) Reserve output capacity.
        4) Circuit and raceway schedule names.
11. Communications and Digital Networks Diagrams:
    a. Scope: Includes connections to telephone system, Ethernet network, remote I/O, and fieldbus (for example, Modbus, Profibus, Foundation Fieldbus, Device Net, etc.).
    b. Format: Network schematic diagrams for each different type of network.
    c. Show:
        1) Interconnected devices, both passive and active.
        2) Device names and numbers.

3) Terminal numbers.
4) Communication Media: Type of cable.
5) Connection Type: Type of connector.
6) Node and device address numbers.
7) Wire and cable numbers and colors.

12. Panel Power Requirements and Heat Dissipation: For control panels tabulate and summarize:
    a. Required voltages, currents, and phases(s).
    b. Maximum heat dissipations Btu per hour.
    c. Calculations.
    d. Steady State Temperature Calculations: For nonventilated panels, provide heat load calculations showing the panel estimated internal steady state temperature for ambient air temperatures of 110 degrees F.
13. Panel Plumbing Diagrams: For each panel containing piping and tubing. Show type and size for:
    a. Pipes and Tubes: Thickness, pressure rating, and materials.
    b. Components: Valves, regulators, and filters.
    c. Connections to panel-mounted devices.
    d. Panel interface connections.
    e. Submit electronic copies of Drawings.
14. Installation Details: Include modifications or further details required and define installation of I&C components.
15. Spares, expendables, and test equipment.
16. Electronic Copies: Microsoft Excel.
17. PLC I/O List: Submit I/O assignment and Rack/Slot/Point.
18. Shop Drawings for Changes Impacting PLC Programming:
    a. Submit details of changes required to PLC monitoring and control resulting from installation of alternative or upgraded process equipment and instrumentation, and other causes.
    b. Submit changes at 30-day intervals.
19. Color schedule for control panels.
20. Applications Software Documentation:
    a. Complete configuration documentation for microprocessor based programmable devices.
    b. For each device, include program listings and function block diagrams, as appropriate, showing:
        1) Functional blocks or modules used.
        2) Configuration, calibration, and tuning parameters.
        3) Descriptive annotations.
    c. Refer to PIC subsections for additional requirements.

C. Informational Submittals:

1. Statements of Qualification:
   a. PIC System Integrator.
   b. PIC System Integrator's site representative.
   c. Resume for each PIC System Integrator's onsite startup and testing team member (engineers, technicians, and software/configuring personnel).
2. Operating and Maintenance Data: In accordance with Section 01730, Operating and Maintenance Data, and in addition the following:
   a. General:
      1) Provide sufficient detail to allow operation, removal, installation, adjustment, calibration, maintenance and purchasing replacements for PIC components.
      2) Submittal Format: Both hard copy and electronic copies for all submittals. Refer to Article Submittals, heading Submittal Format.
   b. Final versions of Legend and Abbreviation Lists.
   c. Process and Instrumentation Diagrams: Marked up copy of revised P&ID to reflect as-built PIC design.
   d. Provide the following items as defined under heading Action Submittals:
      1) Bill of materials.
      2) Catalog cuts.
      3) Instrument list.
      4) Component data sheets.
      5) Detailed Wiring Diagrams:
         a) Panel wiring diagrams.
         b) Loop diagrams.
         c) Interconnecting wiring diagrams.
      6) Panel plumbing diagrams.
      7) Applications software documentation.
   e. Manufacturer's O&M manuals for components, electrical devices, and mechanical devices:
      1) Content for Each O&M Manual:
         a) Table of Contents.
         b) Operations procedures.
         c) Installation requirements and procedures.
         d) Maintenance requirements and procedures.
         e) Troubleshooting procedures.
         f) Calibration procedures.
         g) Internal schematic and wiring diagrams.
         h) Component and I/O Module Calibration Sheets from field quality control calibrations.
      2) Provide PDF file will linked index to all manuals.

f. List of spares, expendables, test equipment and tools provided.
g. List of additional recommended spares, expendables, test equipment, and tools. Include quantities, unit prices, and total costs.

3. Provide Manufacturer's Certificate of Proper Installation where specified.
4. Testing Related Submittals:
   a. Factory Demonstration Test:
      1) Preliminary Test Procedures: Outline of proposed tests, forms, and checklists.
      2) Final Test Procedures:
         a) Proposed test procedures, forms, and checklists.
         b) Capacity, Timing, and Simulation: Describe simulation and monitoring methods used to demonstrate compliance with capacity and timing requirements.
      3) Test Documentation: Copy of signed off test results.
   b. Functional Test:
      1) Preliminary Test Procedures: Outline of proposed tests, forms, and checklists.
      2) Final Test Procedures: Proposed test procedures, forms, and checklists.
      3) Test Documentation:
         a) Copy of signed-off test results.
         b) Completed component calibration sheets.
   c. Performance Test:
      1) Preliminary Test Procedures: Outline of proposed tests, forms, and checklists.
      2) Final Test Procedures: Proposed test procedures, forms, and checklists.
      3) Test Documentation: Copy of signed-off test results.
5. Owner Training Plan: In accordance with Section 01 43 33, Manufacturers' Field Services.
6. Maintenance Service Agreement: Prior to Substantial Completion, submit service agreements signed by Owner and maintenance provider for work required under Article Maintenance Service.

1.06 QUALITY ASSURANCE

A. Qualifications:

1. PIC System Integrator: Minimum of 5 years' experience providing, integrating, installing, and starting up similar systems as required for this Project.
2. PIC System Integrator's Site Representative: Minimum of 5 years' experience installing systems similar to PIC required for this Project.

B. PIC Coordination Meetings:

1. General: Refer to Section 01200, Project Meetings, for PIC coordination meetings.
2. PIC Schedule Coordination Meeting:
   a. Timing: Following Engineer review of PIC Schedule.
   b. Purpose: Discuss Engineer's comments and resolve scheduling issues.
3. Training Coordination Meeting:
   a. Timing: Following Engineer review of preliminary training plan.
   b. Purpose:
      1) Resolve required changes to proposed training plan.
      2) Identify specific Owner personnel to attend training.

1.07 DELIVERY, STORAGE, AND HANDLING

A. In accordance with Section 01620, Storage and Protection.

B. Prior to shipment, include corrosive inhibitive vapor capsules in shipping containers, and related equipment as recommended by capsule manufacturer.

C. Prior to installation, store items in dry indoor locations. Provide heating in storage areas for items subject to corrosion under damp conditions.

D. Cover panels and other elements that are exposed to dusty construction environments.

1.08 SEQUENCING AND SCHEDULING

A. Refer to Section 01 31 13, Project Coordination, for Contractor's scheduling requirements for applications software testing.

B. Prerequisite Activities and Lead Times: Do not start following key Project activities until prerequisite activities and lead times listed below have been completed and satisfied:

1. Shop Drawing Reviews by Engineer:
   a. Prerequisite: Engineer acceptance of Schedule of Values and Progress Schedule.
   b. Schedule: In accordance with completed schedule of Shop Drawing and Sample submittals specified in Section 01300, Submittals.
2. Test Prerequisite: Associated test procedures Submittals completed.
3. Training Prerequisite: Associated training plan Submittal completed.
4. Equipment Delivered to Project Site: Refer to PIC subsections for a definition of this equipment.
   a. Prerequisites: FDT completed.
5. PLC Installation Prerequisite: Equipment received at Site.

6. Functional Test Prerequisite: PLC installation and HMI modifications complete.
7. Performance Test Prerequisite: Functional Test completed.

1.09 MAINTENANCE

A. Maintenance Service Agreement:

1. Duration of 2 years, unless otherwise noted in PIC subsections.
2. Start on date of Substantial Completion.
3. Performed by factory-trained service engineers with experience on PIC systems to be maintained.
4. PIC Systems Covered: PIC components and PLC.
5. Materials and labor for demand maintenance with coverage 8:00 a.m. to 5:00 p.m. Monday through Friday.
6. Response Time: Service engineer shall be onsite within 24 hours of request by Owner.
7. Spare Parts: If not stocked onsite, delivered to Site within 24 hours from time of request.
8. Repair or replace components or software found to be faulty.
9. Replace and restock within 1 month onsite spare parts and expendables used for maintenance. Provide list of items used and replaced.
10. Submit records of inspection, maintenance, calibration, repair, and replacement within 2 weeks after each Site visit.

B. Telephone Support: As specified in PIC subsections.

C. Software Subscription: As specified in PIC subsections.

1.10 EXTRA MATERIALS

A. As specified in PIC subsections.

B. In computing spare parts quantities based on specified percentages, round up to nearest whole number.

C. Spare Parts:

Description	Percent of Each Type and Size Used	No Less Than
dc power supplies	20	2
Fuses	20	5
Indicating light bulb	20	10

Description	Percent of Each Type and Size Used	No Less Than
Relays	20	3
Terminal Blocks	10	10
Hand Switches and Lights	10	5
120V ac Isolation Transformers	10	2
Surge Suppressors	10	2

D. Expendables: For following items provide manufacturer's recommended 2-year supply, unless otherwise noted.

1. Corrosion-inhibiting vapor capsules.

PART 2 PRODUCTS

2.01 GENERAL

A. Provide PIC functions shown on Drawings and required in PIC subsections for each system and loop. Furnish equipment items required in PIC subsections. Furnish materials, equipment, and software whether indicated or not, necessary to effect required system and loop performance.

B. First Named Manufacturer: PIC design is based on first named manufacturers of equipment, materials, and software.

1. If an item is proposed from other than first named manufacturer, obtain approval from Engineer for such changes in accordance with the General Conditions, Article 6.05 Substitutes and "Or-Equals".
2. If proposed item requires, but not limited to, different installation, wiring, raceway, enclosures, intrinsically safe barriers, and accessories, provide such equipment and work.

C. Like Equipment Items:

1. Use products of one manufacturer and of the same series or family of models to achieve standardization for appearance, operation, maintenance, spare parts, and manufacturer's services.
2. Implement same or similar functions in same or similar manner. For example control logic, sequence controls, and display layouts.

D. Components and Materials in Contact with Water for Human Consumption: Comply with the requirements of the Safe Drinking Water Act and other applicable federal, state, and local requirements. Provide certification by manufacturer or an accredited certification organization recognized by the Authority Having Jurisdiction that components and materials comply with the maximum lead content standard in accordance with NSF/ANSI 61 and NSF/ANSI 372.

1. Use or reuse of components and materials without a traceable certification is prohibited.

2.02 I&C COMPONENTS

A. Specifications: Refer to Section 40 91 00, Instrumentation and Control Components, for specifications for I&C components.

B. Components for Each Loop: Major components for each loop are described in the Loop Specifications referenced in Article Supplements. Furnish equipment that is necessary to achieve required loop performance.

C. Control Panels: Reference Control Panel Schedule in Article Supplements.

2.03 PROGRAMMABLE LOGIC CONTROLLERS

A. Reference Section 40 91 00, Instrumentation and Control Components.

2.04 FIELD BUS, NETWORK, AND HMI COMPONENTS

A. Reference PIC subsections.

2.05 SERVICE CONDITIONS

A. Standard Service Conditions: The following defines certain types of environments. PIC subsections refer to these definitions by name to specify the service conditions for individual equipment units. Design equipment for continuous operation in these environments:

1. Outside:
   a. Temperature: 0 degrees F to 110 degrees F.
   b. Relative Humidity: 10 percent to 95 percent noncondensing.
   c. NEC Classification: Nonhazardous.

B. Standard Service Conditions for Panels and Consoles: Unless otherwise noted, in Control Panel Schedule located in Article Supplements at End of Section, design equipment for continuous operation in these environments:

1. Freestanding Panel and Consoles:
   a. Inside, Air Conditioned: NEMA 1.
   b. Inside: NEMA 12.
2. Smaller Panels and Assemblies (that are not freestanding):
   a. Inside, Air Conditioned: NEMA 12.
   b. All Other Locations: NEMA 4X.
3. Field Elements: Outside.

C. Special Environmental Requirements: Design following panels for continuous operation in environments listed.

2.06 NAMEPLATES AND TAGS

A. Panel Nameplates: Enclosure identification located on enclosure face.

1. Location and Inscription: Refer to Control Panel Schedule.
2. Materials: Laminated plastic attached to panel with stainless steel screws.
3. Letters: 1/2-inch-high, white on black background, unless otherwise noted.

B. Component Nameplates, Panel Face: Component identification located on panel face under or near component.

1. Location and Inscription: As shown on panel drawing.
2. Materials: Adhesive-backed, laminated plastic.
3. Letters: 3/16-inch-high, white on black background, unless otherwise noted.

C. Component Nameplates, Back of Panel: Component identification located on or near component inside of enclosure.

1. Inscription: Component tag number.
2. Materials: Adhesive-backed, laminated plastic.
3. Letters: 3/16-inch-high, white on black background, unless otherwise noted.

D. Legend Plates for Panel Mounted Pushbuttons, Lights, and Switches.

1. Inscription:
   a. Refer to table under Paragraph Standard Pushbutton Colors and Inscriptions.
   b. Refer to table under Paragraph Standard Light Colors and Inscriptions.
   c. Refer to P&IDs on Drawings.

2. Materials: Stainless steel, keyed legend plates. Secured to panel by mounting nut for pushbutton, light, or switch.
3. Letters: Black on gray or white background.

E. Service Legends: Component identification nameplate located on face of component.

1. Inscription: As shown on panel drawing.
2. Materials: Adhesive-backed, laminated plastic.
3. Letters: 3/16-inch-high, white on black background, unless otherwise noted.

F. Nametags: Component identification for field devices.

1. Inscription: Component tag number.
2. Materials: 16-gauge, Type 304 stainless steel.
3. Letters: 3/16-inch-high, imposed.
4. Mounting: Affix to component with 16-gauge or 18-gauge stainless steel wire or stainless steel screws.

2.07 MECHANICAL SYSTEM COMPONENTS

A. Reference Section 40 91 00, Instrumentation and Control Components.

2.08 FUNCTIONAL REQUIREMENTS FOR CONTROL LOOPS

A. Shown on Drawings, in panel control diagrams, and Process and Instrumentation Diagrams (P&ID). P&ID format and symbols are in accordance with ISA S5.1, except as specified or shown on Drawings.

B. Supplemented by Loop Specifications that describe requirements not obvious on P&IDs or panel control diagrams.

C. Supplemented by standard functional requirements in PIC subsections.

2.09 LOOP SPECIFICATIONS

A. See Article Supplements located at End of Section.

B. Organization: By unit process and loop number.

C. Loop Subheadings:

1. Hardwired Special Functions: Clarifies functional performance of loop, including abstract of interlocks for hard wired logic, for example in MCCs and control panels.

2. PLC Special Functions: Specifies nonstandard PLC functions. When required for clarification, additional definition is shown by logic diagrams or sequence diagrams on Drawings.
3. HMI Special Functions: Specifies nonstandard HMI functions.

2.10 ELECTRICAL REQUIREMENTS

A. Electrical Raceways: As specified in Section 26 05 33, Raceway and Boxes.

B. Wiring External to PIC Equipment:

1. Special Control and Communications Cable: Provided by PIC System Integrator as noted in Component Specifications and PIC subsections.
2. Other Wiring and Cable: As specified in Section 26 05 05, Conductors.

C. I&C and electrical components, terminals, wires, and enclosures UL recognized or UL listed.

D. Wires within Enclosures:

1. ac Circuits:
   a. Type: 600-volt, Type MTW stranded copper.
   b. Size: For current to be carried, but not less than No. 18 AWG.
2. Analog Signal Circuits:
   a. Type: 600-volt stranded copper, twisted shielded pairs or triad with a 100 percent, aluminum-polyester shield, rated 60 degrees C.
   b. Panels with Circuits Less Than 600 volts: Rated at 600 volts. Belden No. 18 AWG Type 9341, Triad Beldon No. 1121A.
   c. Size: No. 18 AWG, minimum.
3. Other dc Circuits.
   a. Type: 600-volt, Type MTW stranded copper.
   b. Size: For current carried, but not less than No. 18 AWG.
4. Special Signal Circuits: Use manufacturer’s standard cables.
5. Wire Identification: Numbered and tagged at each termination.
   a. Wire Tags: Machine printed, heat shrink.
   b. Manufacturers:
      1) Brady Perma Sleev.
      2) Tyco Electronics.

E. Terminate and identify wires entering or leaving enclosures as follows:

1. Analog and discrete signal, terminate at numbered terminal blocks.
2. Special signals terminated using manufacturer’s standard connectors.
3. Identify wiring in accordance with requirements in Section 26 05 05, Conductors.

F. Terminal Blocks for Enclosures:

1. Quantity:
   a. Accommodate present and spare indicated needs.
   b. Wire spare PLC I/O points to terminal blocks.
   c. One wire per terminal for field wires entering enclosures.
   d. Maximum of two wires per terminal for No. 18 AWG wire for internal enclosure wiring.
   e. Spare Terminals: 20 percent of connected terminals, but not less than **5** per terminal block, unless otherwise shown on Drawings.
2. Terminal Block Types: Reference Section 40 91 00, Instrumentation and Control Components.

G. Grounding of Enclosures:

1. Furnish isolated copper grounding bus for signal and shield ground connections.
2. Ground this ground bus at a common signal ground point in accordance with National Electrical Code requirements.
3. Single Point Ground for Each Analog Loop:
   a. Locate signal ground at dc power supply for loop.
   b. Use to ground wire shields for loop.
4. Ground terminal block rails to ground bus.

H. Analog Signal Isolators:

1. Furnish signal isolation for analog signals that are sent from one enclosure to another.
2. Do not wire in series instruments on different panels, cabinets, or enclosures.

I. Wiring Interface: Terminate and identify wiring entering or leaving enclosures.

1. Analog and Discrete Signal Wires: Terminate at numbered terminal blocks as shown on the wiring diagrams.
2. Wiring for Special Signals: Terminate communications, digital data, and multiplexed signals using manufacturer's standard connectors for the device to which the signals terminate.

J. Electrical Transient Protection:

1. General:
   a. Function: Protect elements of PIC against damage due to electrical transients induced in interconnecting lines by lightning and nearby electrical systems.

b. Surge suppressors are not shown for external analog transmitters. Determine quantity and location, and show in Shop Drawings. Refer to example wiring in installation details in Drawings.
c. Provide, install, coordinate, and inspect grounding of surge suppressors at:
    1) Connection of ac power to PIC equipment including panels, consoles assembles, and field-mounted analog transmitters and receivers.
    2) At the field and panel, console, or assembly connection of signal circuits that have portions of the circuit extending outside of a protective building.

2. Surge Suppressor Types: Reference Section 40 91 00, Instrumentation and Control Components.
3. Installation and Grounding of Suppressors:
    a. As shown. See Surge Suppressor Installation Details.
    b. Grounding equipment, installation of grounding equipment, and terminations for field mounted devices are provided under Division 26, Electrical.

2.11 PANEL FABRICATION

A. General:

1. Nominal Panel Dimensions: Refer to Control Panel Schedule in Article Supplements.
2. Instrument Arrangements: As shown on Drawings Panel Component Schedule: Refer to Control Panel Schedule in Article Supplements which provides a list by local control panel of major panel-mounted components for each panel. In case of a conflict between this list and Instrument List, Instrument List takes precedence. In case of a conflict between Panel Component Schedule and P&IDs, P&IDs take precedence.
3. Panel Construction and Interior Wiring: In accordance with the National Electrical Code (NEC), state and local codes, and applicable sections of NEMA, ANSI, UL, and ICECA.
4. Fabricate panels, install instruments and wire, and plumb at PIC System Integrator's facility. No fabrication other than correction of minor defects or minor transit damage permitted onsite.
5. UL Listing Mark for Enclosures: Mark stating "Listed Enclosed Industrial Control Panel" per UL 508A.
6. Electrical Work: In accordance with the applicable requirements of Division 26, Electrical.

B. Temperature Control:

1. Freestanding Panels:
   a. Nonventilated Panels: Size to adequately dissipate heat from equipment mounted inside panel and on panel.
   b. Ventilated Panels:
      1) Furnish with louvers and forced ventilation as required to prevent temperature buildup from equipment mounted inside panel and on panel.
      2) For panels with backs against wall, furnish louvers on top and bottom of panel sides.
      3) For panels without backs against wall, furnish louvers on top and bottom of panel back.
      4) Louver Construction: Stamped sheet metal.
      5) Ventilation Fans:
         a) Furnish where required to provide adequate cooling.
         b) Create positive internal pressure within panel.
         c) Fan Motor Power: 120V ac, 60-Hz, thermostatically controlled.
      6) Air Filters: Washable aluminum, Hoffman Series A-FLT.
   c. Refrigerated System: Furnish where heat dissipation cannot be adequately accomplished with natural convection or forced ventilation.
2. Smaller Panels (that are not freestanding): Size to adequately dissipate heat from equipment mounted inside panel and on panel face.
3. Space Heaters:
   a. Thermostatically controlled to maintain internal panel temperatures above dewpoint.
   b. Refer to Control Panel Schedule in Article Supplements.

C. Freestanding Panel Construction:

1. Materials:
   a. Sheet steel, unless otherwise noted in Control Panel Schedule in Article Supplements.
   b. Minimum Thickness: 10-gauge, unless otherwise noted.
2. Panel Front:
   a. Fabricated from a single piece of sheet steel, unless otherwise shown on Drawings.
   b. No seams or bolt heads visible when viewed from front.
   c. Panel Cutouts: Smoothly finished with rounded edges.
   d. Stiffeners: Steel angle or plate stiffeners or both on back of panel face to prevent panel deflection under instrument loading or operation.
3. Internal Framework:
   a. Structural steel for instrument support and panel bracing.
   b. Permit panel lifting without racking or distortion.

4. Lifting rings to allow simple, safe rigging and lifting of panel during installation.
5. Adjacent Panels: Securely bolted together so front faces are parallel.
6. Door:
    a. Full height, fully gasketed access door where shown on Drawings.
    b. Latch: Three-point, Southco Type 44.
    c. Handle: "D" ring, foldable type.
    d. Hinges: Full-length, continuous, piano-type, steel hinges with stainless steel pins.
    e. Rear Access: Extend no further than 24 inches beyond panel when opened to 90-degree position.
    f. Front and Side Access Doors: As shown on Drawings.

D. Nonfreestanding Panel Construction:

1. Based on environmental design requirements and referenced in Article Environmental Requirements, provide the following unless otherwise noted in Control Panel Schedule in Article Supplements:
    a. Panels listed as inside, air conditioned:
        1) Enclosure Type: NEMA 12.
        2) Materials: Steel.
    b. Other Panels:
        1) Enclosure Type: NEMA 4X.
        2) Materials: Type 316 stainless steel.
2. Metal Thickness: 14-gauge, minimum.
3. Doors:
    a. Rubber-gasketed with continuous hinge.
    b. Stainless steel lockable quick-release clamps.
4. Manufacturers:
    a. Hoffman Engineering Co.
    b. H. F. Cox.

E. Breather and Drains: Furnish with NEMA 250, Type 4 and 4X panels:

1. Manufacturer and Product: Cooper Crouse-Hinds; ECD Type 4X Drain and Breather; Drain Model ECD1-N4D, Breather Model ECD1-N4B.

F. Control Panel Electrical:

1. Power Distribution within Panels:
    a. Feeder Circuits:
        1) Incoming feed power to panels will be 480V ac, 60-Hz.
            a) Provide physical partitioning within the control panel to segregate 480V power and 120V control power.

b) Provide control power transformer inside the 480V section of the panel. Route 120V transformer output to feed the control power side of the panel.

2) Make provisions for feeder circuit conduit entry.

3) Furnish terminal block for termination of wires.

b. Power Panel: Furnish main circuit breaker and circuit breaker on each individual branch circuit distributed from power panel.

1) Locate to provide clear view of and access to breakers when door is open.

2) Breaker Sizes: Coordinate such that fault in branch circuit will blow only branch breaker, but not trip main breaker.

a) Branch Circuit Breakers: 15 amps at 250V ac.

3) Breaker Manufacturers and Products: Refer to Division 26.

c. Circuit Wiring: P&IDs and Control Diagrams on Drawings show function only. Use following rules for actual circuit wiring:

1) Devices on Single Circuit: 20, maximum.

2) Multiple Units Performing Parallel Operations: To prevent failure of any single branch circuit from shutting down entire operation, do not group all units on same branch circuit.

3) Branch Circuit Loading: 12 amperes continuous, maximum.

4) Panel Lighting and Service Outlets: Put on separate 15 amp, 120V ac branch circuit.

5) Provide 120V ac plugmold for panel components with line cords.

2. Signal Distribution:

a. Signal Wiring: Separate analog signal cables from power and control within a panel and cross at right angles where necessary.

b. Within Panels: 4 to 20 mA dc signals may be distributed as 1V dc to 5V dc.

c. Outside Panels: Isolated 4 to 20 mA dc only.

d. Signal Wiring: Twisted shielded pairs.

3. Signal Switching:

a. Use dry circuit type relays or switches.

b. No interruption of 4 to 20 mA loops during switching.

c. Switching Transients in Associated Signal Circuit:

1) 4 to 20 mA dc Signals: 0.2 mA, maximum.

2) 1V dc to 5V dc Signals: 0.05V, maximum.

4. Relay Types: Reference Section 40 91 00, Instrumentation and Control Components, Part 2, Article Electrical Components.

5. Push-to-Test Circuitry: For each push-to-test indicating light, provide a fused push-to-test circuit.

6. Internal Panel Lights for Freestanding Panels:

a. Type: Switched 100-watt incandescent back-of-panel lights.

b. Quantity: One light for every 4 feet of panel width.

c. Mounting: Inside and in the top of back-of-panel area.
d. Protective metal shield for lights.

7. Service Outlets:
   a. Type: Three-wire, 120-volt, 15-ampere, GFCI duplex receptacles.
   b. Quantity:
      1) Panels 4 Feet Wide and Smaller: One.
      2) Panels Larger than 4 Feet Wide: One for every 4 feet of panel width, two minimum per panel.
   c. Mounting: Evenly spaced along back-of-panel area.
8. Internal Panel Lights and Service Outlets for Smaller Panels:
   a. Internal Panel Light: Switched 100-watt incandescent light.
   b. Service Outlet: Breaker protected 120-volt, 15-amp, GFCI duplex receptacle:
   c. Required for panels. Refer to Control Panel Schedule in Article Supplements.
9. Standard Pushbutton Colors and Inscriptions:
   a. Use following unless otherwise noted in Loop Specifications:

Tag Function	Inscription(s)	Color
OO	ON OFF	Black Black
OC	OPEN CLOSE	Black Black
OCA	OPEN CLOSE AUTO	Black Black Black
OOA	ON OFF AUTO	Black Black Black
MA	MANUAL AUTO	Black Black
SS	START STOP	Black Black
RESET	RESET	Black
EMERGENCY STOP	EMERGENCY STOP	Red

   b. Lettering Color:
      1) Black on white and yellow buttons.
      2) White on black, red, and green buttons.

10. Standard Light Colors and Inscriptions:
    a. Use following color code and inscriptions for service legends and lens colors for indicating lights, unless otherwise noted in Loop Specifications:

Tag Function	Inscription(s)	Color
ON	ON	Red
OFF	OFF	Green
OPEN	OPEN	Red
CLOSED	CLOSED	Green
LOW	LOW	Amber
FAIL	FAIL	Amber
HIGH	HIGH	Amber
AUTO	AUTO	White
MANUAL	MANUAL	Yellow
LOCAL	LOCAL	White
REMOTE	REMOTE	Yellow

    b. Lettering Color:
        1) Black on white and amber lenses.
        2) White on red and green lenses.

G. PIC Enclosure Internal Wiring:

1. Restrain by plastic ties or ducts or metal raceways.
2. Hinge Wiring: Secure at each end so bending or twisting will be around longitudinal axis of wire. Protect bend area with sleeve.
3. Arrange wiring neatly, cut to proper length, and remove surplus wire.
4. Provide abrasion protection for wire bundles that pass through holes or across edges of sheet metal.
5. Connections to Screw Type Terminals:
    a. Locking-fork-tongue or ring-tongue lugs.
    b. Use manufacturer's recommended tool with required sized anvil to make crimp lug terminations.
    c. Wires terminated in a crimp lug, maximum of one.
    d. Lugs installed on a screw terminal, maximum of two.
6. Connections to Compression Clamp Type Terminals:
    a. Strip, prepare, and install wires in accordance with terminal manufacturer's recommendations.
    b. Wires installed in a compression screw and clamp, maximum of one for field wires entering enclosure, otherwise maximum of two.

7. Splicing and tapping of wires, allowed only at device terminals or terminal blocks.
8. Terminate 24V dc and analog signal circuits on separate terminal block from ac circuit terminal blocks.
9. Separate analog and dc circuits by at least 6 inches from ac power and control wiring, except at unavoidable crossover points and at device terminations.
10. Arrange wiring to allow access for testing, removal, and maintenance of circuits and components.
11. Plastic Wire Duct Fill: Do not exceed manufacturer's recommendations.
12. Conductors Carrying Foreign Voltages within a Panel:
    a. Route foreign voltage conductors into panel and land on a circuit blade disconnect type terminal block.
    b. Use wire with pink insulation to identify foreign voltage circuits within panel from terminal block on. Do not use wires with pink insulation for any other purpose.
13. Harness Wiring:
    a. 120V ac: No. 14 AWG, MTW.
    b. 24V dc: No. 16 AWG, MTW where individual conductors are used and Type TC shielded tray cable where shielded wire is used.
14. Panelwork:
    a. No exposed connections.
    b. Allow adjustments to equipment to be made without exposing these terminals.
    c. For power and control wiring operating above 80V ac or dc use covered channels or EMT raceways separate from low voltage signal circuits.
15. Plastic Wire Ducts Color:
    a. 120V ac: White.
    b. 24V dc: Gray.
    c. Communications Cables and Fiber Optic Jumpers: Orange.
16. Provide a communications plastic wire duct for communications cables and fiber optic cables between the communications devices in control panel and communications raceways. Design plastic wire duct design to take into account the minimum bending radius of the communications cable.
17. Make plastic wire ducts the same depth.
18. Provide a minimum of 1-1/2 inches between plastic wire ducts and terminal blocks.

H. Control Relay Arrangement: Install control relays associated with specific loops in same panel section as corresponding terminal blocks or side panels. Provide 20 percent space for future relays. Locate spare space in same sections as spare terminal blocks.

I. Factory Finishing:

1. Furnish materials and equipment with manufacturer's standard finish system in accordance with Section 09 90 04, Painting.
2. Use specific color if indicated. Otherwise use manufacturer's standard finish color, or light gray if manufacturer has no standard color.
3. Stainless Steel and Aluminum: Not painted.
4. Steel Panels:
   a. Sand panel and remove mill scale, rust, grease, and oil.
   b. Fill imperfections and sand smooth.
   c. Paint panel interior and exterior with one coat of epoxy coating metal primer, two finish coats of two-component type epoxy enamel.
   d. Sand surfaces lightly between coats.
   e. Dry Film Thickness: 3 mils, minimum.

2.12 CORROSION PROTECTION

A. Corrosion-Inhibiting Vapor Capsules:

1. Areas Where Required: Refer to Part 3, Article Protection.
2. Manufacturers and Products:
   a. Northern Instruments; Model Zerust VC.
   b. Hoffmann Engineering; Model A-HCI.
   c. Approved equal.

2.13 SOURCE QUALITY CONTROL

A. General:

1. Engineer may actively participate in many of the tests.
2. Engineer reserves right to test or retest specified functions.
3. Engineer's decision will be final regarding acceptability and completeness of testing.
4. Procedures, Forms, and Checklists:
   a. Conduct tests in accordance with, and documented on, Engineer accepted procedures, forms, and checklists.
   b. Describe each test item to be performed.
   c. Have space after each test item description for sign off by appropriate party after satisfactory completion.
5. Required Test Documentation: Test procedures, forms, and checklists signed by Engineer and Contractor.
6. Conducting Tests:
   a. Provide special testing materials and equipment.
   b. Wherever possible, perform tests using actual process variables, equipment, and data.

c. If not practical to test with real process variables, equipment, and data provide suitable means of simulation.
d. Define simulation techniques in test procedures.
e. Test Format: Cause and effect.
    1) Person conducting test initiates an input (cause).
    2) Specific test requirement is satisfied if correct result (effect), occurs.

B. Factory Demonstration Tests (FDT):

1. Notify Engineer of test schedule at least 4 weeks prior to start of test.
2. Scope:
    a. Test entire PIC, with exception of primary elements, final control elements, and certain smaller panels, to demonstrate it is operational.
    b. Refer to Control Panel Schedule in Article Supplements for list of panels for which FDT is required.
3. Location: PIC System Integrator's facility.
4. Correctness of wiring from panel field terminals to PLC system input/output points and to panel components.
    a. Simulate each discrete signal at terminal strip.
    b. Simulate correctness of each analog signal using current source.
5. Loop-Specific Functions: Demonstrate functions shown on P&IDs, control diagrams, and loop specifications:
    a. One of each type function; for example, if there are filter backwash sequence control for several identical filters, demonstrate controls for one filter.
    b. One of each type of function in each panel; for example, but not limited to annunciator operation, controller operation, and recorder operation.
    c. All required and shown functions for 100 percent of loops.
6. Non-Loop-Specific Functions:
    a. Capacity: Demonstrate that PIC systems have required spare capacity for expansion. Include tests for both storage capacity and processing capacity.
    b. Timing: Include tests for timing requirements.
    c. Diagnostics: Demonstrate online and offline diagnostic tests and procedures.
7. Correct deficiencies found and complete prior to shipment to Site.
8. Failed Tests:
    a. Repeat and witnessed by Engineer.
    b. With approval of Engineer, certain tests may be conducted by PIC System Integrator and witnessed by Engineer as part of Functional Test.

9. Make following documentation available to Engineer at test site both before and during FDT:
    a. Drawings, Specifications, Addenda, and Change Orders.
    b. Master copy of FDT procedures.
    c. List of equipment to be tested including make, model, and serial number.
    d. Approved hardware Shop Drawings for equipment being tested.
    e. Approved preliminary software documentation Submittal.
10. Daily Schedule for FDT:
    a. Begin each day with meeting to review day's test schedule.
    b. End each day with each meeting to review or revise next day's test schedule.

PART 3 EXECUTION

3.01 EXAMINATION

A. For equipment not provided by PIC System Integrator, but that directly interfaces with PIC, verify the following conditions:

1. Proper installation.
2. Calibration and adjustment of positioners and I/P transducers.
3. Correct control action.
4. Switch settings and dead bands.
5. Opening and closing speeds and travel stops.
6. Input and output signals.

3.02 INSTALLATION

A. Material and Equipment Installation: Follow manufacturers' installation instructions, unless otherwise indicated or directed by Engineer.

B. Wiring connected to PIC components and assemblies, including power wiring in accordance with requirements in Section 26 05 05, Conductors.

C. Electrical Raceways: As specified in Section 26 05 33, Raceway and Boxes.

D. Mechanical Systems:

1. Copper and Stainless Steel Tubing Support: Continuously supported by aluminum tubing raceway system.
2. Plastic Tubing Support: Except as shown on Drawings, provide continuous support in conduit or by aluminum tubing raceway system.
3. Install conduit for plastic tubing and tubing raceways parallel with, or at right angles to, structural members of buildings. Make vertical runs straight and plumb.

4. Tubing and Conduit Bends:
    a. Tool-formed without flattening, and of same radius.
    b. Bend Radius: Equal to or larger than conduit and tubing manufacturer's recommended minimum bend radius.
    c. Slope instrument connection tubing in accordance with installation details.
    d. Do not run liquid filled instrument tubing immediately over or within a 3-foot plan view clearance of electrical panels, motor starters, or mechanical mounting panel without additional protection. Where tubing must be located in these zones, shield electrical device to prevent water access to electrical equipment.
    e. Straighten coiled tubing by unrolling on flat surface. Do not pull to straighten.
    f. Cut tubing square with sharp tubing cutter. Deburr cuts and remove chips. Do not gouge or scratch surface of tubing.
    g. Blow debris from inside of tubing.
    h. Make up and install fittings in accordance with manufacturer's recommendations. Verify make up of tube fittings with manufacturer's inspection gauge.
    i. Use lubricating compound or TFE tape on stainless steel threads to prevent seizing or galling.
    j. Run tubing to allow but not limited to, clear access to doors, controls and control panels; and to allow for easy removal of equipment.
    k. Provide separate support for components in tubing runs.
    l. Supply expansion loops and use adapters at pipe, valve, or component connections for proper orientation of fitting.
    m. Keep tubing and conduit runs at least 12 inches from hot pipes.
    n. Locate and install tubing raceways in accordance with manufacturer's recommendations. Locate tubing to prevent spillage, overflow, or dirt from above.
    o. Securely attach tubing raceways to building structural members.
5. Enclosure Lifting Rings: Remove rings following installation and plug holes.

3.03 FIELD QUALITY CONTROL

A. General:

1. Coordinate PIC testing with Owner and affected Subcontractors.
2. Notify Engineer of Performance Test schedule at least 4 weeks prior to start of test.
3. Engineer may actively participate in tests.
4. Engineer reserves right to test or retest specified functions.
5. Engineer's decision will be final regarding acceptability and completeness of testing.

B. Onsite Supervision:

1. Require PIC System Integrator to observe PIC equipment installation to extent required in order to provide Certificates of Proper Installation.
2. Require PIC site representative to supervise and coordinate onsite PIC activities.
3. Require PIC site representative to be onsite while onsite work covered by this section and PIC subsystems is in progress.

C. Testing Sequence:

1. Provide Functional Tests and Performance Tests for facilities as required to support staged construction and startup of plant.
2. Refer to article Sequence of Work under Section 01 31 13, Project Coordination, for a definition of project milestones.
3. Refer to Section 01 91 14, Equipment Testing and Facility Startup, for overall testing requirements.
4. Completion: When tests have been completed and required test documentation has been accepted.

D. Testing:

1. Prior to Facility Startup and Performance Evaluation period for each facility, inspect, test, and document that associated PIC equipment is ready for operation**.** Preparation for Testing: Performed by PIC System Integrator to test and document PIC is ready for operation.
    a. Loop/Component Inspections and Tests:
        1) These inspections and tests do not require witnessing.
        2) Check PIC for proper installation, calibration, and adjustment on loop-by-loop and component-by-component basis.
        3) Provide space on forms for signoff by PIC System Integrator.
        4) Use loop status report to organize and track inspection, adjustment, and calibration of each loop and include the following:
            a) Project name.
            b) Loop number.
            c) Tag number for each component.
            d) Checkoffs/Signoffs for Each Component:
                (1) Tag/identification.
                (2) Installation.
                (3) Termination wiring.
                (4) Termination tubing.
                (5) Calibration/adjustment.
            e) Checkoffs/Signoffs for the Loop:
                (1) Panel interface terminations.
                (2) I/O interface terminations with PLCs.

f) I/O Signals for PLCs are Operational: Received/sent, processed, adjusted.
g) Total loop operational.
h) Space for comments.

5) Component calibration sheet for each active I&C component (except simple hand switches, lights, gauges, and similar items) and each PLCs, I/O module and include the following:
a) Project name.
b) Loop number.
c) Component tag number or I/O module number.
d) Component code number for I&C elements.
e) Manufacturer for I&C elements.
f) Model number/serial number for I&C elements.
g) Summary of Functional Requirements; For Example:
(1) Indicators and recorders, scale and chart ranges.
(2) Transmitters/converters, input and output ranges.
(3) Computing elements' function.
(4) Controllers, action (direct/reverse) and control modes (P, I, D).
(5) Switching elements, unit range, differential (fixed/adjustable), reset (auto/manual).
(6) I/O Modules: Input or output.
h) Calibrations, for example, but not limited to:
(1) Analog Devices: Actual inputs and outputs at 0, 10, 50, and 100 percent of span, rising and falling.
(2) Discrete Devices: Actual trip points and reset points.
(3) Controllers: Mode settings (P&ID).
(4) I/O Modules: Actual inputs or outputs of 0, 10, 50, and 100 percent of span, rising and falling.
(5) Space for comments.

b. Maintain loop status reports, valve adjustment sheets, and component calibration sheets at Site, and make them available to Engineer at all times.
c. Engineer reviews loop status sheets and component calibration sheets and spot-check their entries periodically, and upon completion of Preparation for Testing. Correct deficiencies found.
d. FDT-Repeat:
1) Repeat FDT onsite with installed PIC equipment and software.
2) As listed in PIC subsections, certain portions of FDT may not require retesting.
3) Use FDT test procedures as basis for this test.

4) In general, this test shall not require witnessing. However, portions of this test, as identified by Engineer during original FDT shall be witnessed.

e. Forms: See Loop Status Report, Instrument Calibration Sheet, and I&C Valve Adjustment Sheet referenced in Article Supplements.

2. Functional Test:
   a. Scope: Confirm PIC, including applications software, is ready for operation.
   b. Refer to PIC subsections for additional requirements.
   c. Completed when Functional Test has been conducted and Engineer has spot-checked associated test forms and checklists in field.
3. Required Test Documentation: Test procedures, forms, and checklists. Signed by Engineer and Contractor except for Functional Test items signed only by Contractor.

E. Performance Test During and After Facility Startup:

1. Once a facility's Functional Test has been completed and that facility has been started up, perform a witnessed Performance Test on associated PIC equipment to demonstrate that it is operating as required by Contract Documents. Demonstrate each required function on a paragraph-by-paragraph, loop-by-loop, and site-by-site basis.
2. Loop-specific and nonloop-specific tests same as required for FDT except that entire installed PIC tested using actual process variables and functions demonstrated.
3. Perform local and manual tests for each loop before proceeding to remote and automatic modes.
4. Where possible, verify test results using visual confirmation of process equipment and actual process variable. Unless otherwise directed, exercise and observe devices supplied by others, as needed to verify correct signals to and from such devices and to confirm overall system functionality. Test verification by means of disconnecting wires or measuring signal levels is acceptable only where direct operation of plant equipment is not possible.
5. Make updated versions of documentation required for Performance Test available to Engineer at Site, both before and during tests.
6. Make O&M data available to Engineer at Site both before and during testing.
7. Follow daily schedule required for FDT.
8. Determination of Ready for Operation: When Functional Test has been completed.
9. Refer to examples of Performance Test procedures and forms in Article Supplements.

3.04 MANUFACTURER'S SERVICES

A. Manufacturer's Representative: As required by each PIC subsection.

B. See Section 01 43 33, Manufacturers' Field Services and Section 01 91 14, Equipment Testing and Facility Startup.

3.05 TRAINING

A. General:

1. Provide an integrated training program for Owner's personnel.
2. Perform training to meet specific needs of Owner's personnel.
3. Include training sessions, classroom and field, for managers, engineers, operators, and maintenance personnel.
4. Provide instruction on two working shift(s) as needed to accommodate the Owner's personnel schedule.
5. Owner reserves the right to reuse videotapes of training sessions.

B. Operations and Maintenance Training:

1. General:
   a. Refer to specific requirements specified in PIC Subsections.
   b. Include review of O&M data and survey of spares, expendables, and test equipment.
   c. Use equipment similar to that provided.
   d. Unless otherwise specified in PIC subsections, provide training suitable for instrument technicians with at least a 2-year associate engineering or technical degree, or equivalent education and experience in electronics, instrumentation, or digital systems.
2. Operations Training: For Owner's operations personnel on operation of I&C components.
   a. Training Session Duration: One instructor day.
   b. Number of Training Sessions: One.
   c. Location: Project Site.
   d. Course Objective: Develop skills needed to use I&C components and functions to monitor and control the plant on a day-to-day basis.
   e. Content: Conduct training on loop-by-loop basis.
      1) Loop Functions: Understanding of loop functions, including interlocks for each loop.
      2) Loop Operation: For example, adjusting process variable setpoints, AUTO/MANUAL control transfer, AUTO and MANUAL control, annunciator acknowledgement and resetting.
      3) Interfaces with PIC subsystems.

3.06 CLEANING

A. Upon completion of Work, remove materials, scraps, and debris from interior and exterior of equipment.

3.07 PROTECTION

A. Use corrosion-inhibiting vapor capsules in enclosures to protect electrical, instrumentation, and control devices, including spare parts, from corrosion.

B. Periodically replace capsules based on capsule manufacturer's recommendations.

3.08 SUPPLEMENTS

A. Supplements listed below, follows "End of Section," are part of this Specification.

1. Preparation for Testing and Functional Test Forms:
   a. Loop Status Report: Each sheet shows status of instruments on a loop. Also, gives functional description for loop.
   b. Instrument Calibration Sheet: Shows details on each instrument (except simple hand switches, lights, and similar items).
   c. I&C Valve Adjustment Sheet: Shows details for installation, adjustment, and calibration of a given valve.
2. Performance Test Sheet: Describe Performance Test for a given loop.
   a. List requirements of the loop.
   b. Briefly describe test.
   c. Cite expected results.
   d. Provide space for checkoff by witness.
3. Loop Specifications.
4. Instrument List.
5. PLC Input/Output List.
6. Control Panel Schedule.

END OF SECTION

JACOBS **LOOP STATUS REPORT—EXAMPLE FORMAT** **Rev.06.05.92**

Project Name: *Newport News WTP*	Project No. *WDC23456.C1*
FUNCTIONAL REQUIREMENTS:	
1. Measure, locally indicate, and transmit RAS flow to LP-10.	
2. At LP-10 indicate flow and provide flow control by modulation of FCV-10-2.	
3. Provide high RAS flow alarm on LP-10.	

COMPONENT STATUS (Check and initial each item when complete)

Tag Number	Delivered	Tag ID Checked	Installation	Termination Wiring	Termination Tubing	Calibration	
FE/FIT-10-2	*Jan-12-90 DWM*	*Jan-12-90 DWM*	*Feb-7-90 DWM*	*Mar-5-90 DWM*	*N.A.*	*May-6-90 VDA*	
FIC-10-2	*Jan-12-90 DWM*	*Jan-12-90 DWM*	*Mar-5-90 DWM*	*Apr-4-90 DWM*		*May-4-90 VDA*	
FSH-10-2	*Jan-12-90 DWM*	*Jan-12-90 DWM*	*Mar-5-90 DWM*	*Apr-4-90 DWM*		*May-7-90 VDA*	
FAH-10-2	*Jan-12-90 DWM*	*Jan-12-90 DWM*	*Mar-5-90 DWM*	*Apr-4-90 DWM*		*May-7-90 VDA*	
FCV-10-2	*Mar-2-90 DWM*	*Mar-2-90 DWM*	*Apr-20-90 DWM*	*Apr-30-90 DWM*		*May-16-90 VDA*	

REMARKS: None.

Loop Ready for Operation	By: *D.W. Munzer*	Date: *May-18-90*	Loop No.: *10-2*

JACOBS **INSTRUMENT CALIBRATION SHEET—EXAMPLE—ANALYZER/TRANSMITTER** Rev.06.05.92

COMPONENT	MANUFACTURER		PROJECT
Code: *A7*	Name: *Leeds & Northrup*		Number: *WDC30715.B2*
Name: *pH Element & Analyzer/Transmitter*	Model: *12429-3-2-1-7*	Serial #: *11553322*	Name: *UOSA AWT PHASE 3*

FUNCTIONS

	RANGE	VALUE	UNITS	COMPUTING FUNCTIONS? N	CONTROL? N
Indicate? Y Record? N	Chart:			Describe:	Action? direct / reverse Modes? P / I / D
	Scale:	*1-14*	*pH units*		SWITCH? N Unit Range:
Transmit/ Convert? Y	Input:	*1-14*	*pH units*		Differential: fixed/adjustable
	Output:	*4-20*	*mA dc*		Reset? automatic / manual

ANALOG CALIBRATIONS							DISCRETE CALIBRATIONS					Note No.
REQUIRED			AS CALIBRATED				REQUIRED			AS CALIBRATED		
Input	Indicated	Output	Increasing Input		Decreasing Input		Number	Trip Point	Reset Pt.	Trip Point	Reset Pt.	
			Indicated	Output	Indicated	Output		(note rising or falling)		(note rising or falling)		
1.0	*1.0*	*4.0*	*1.0*	*4.0*	*1.0*	*3.9*	*1.*	*N.A.*		*N.A.*		
2.3	*2.3*	*5.6*	*2.2*	*5.5*	*2.3*	*5.6*	2.					*1.*
7.5	*7.5*	*12.0*	*7.5*	*11.9*	*7.5*	*12.0*	3.					
12.7	*12.7*	*18.4*	*12.7*	*18.3*	*12.6*	*18.3*	4.					
14.0	*14.0*	*20.0*	*14.0*	*20.0*	*14.0*	*20.0*	5.					
CONTROL MODE SETTINGS:			P: *N.A.*	I:	D:		6.					

#	NOTES:	Component Calibrated and Ready for Start-up
	1. Need to recheck low pH calibration solutions.	By: *J.D. Sewell*
		Date: *Jun-6-92*
		Tag No.: *AIT-12-6*[pH]

JACOBS **I&C VALVE ADJUSTMENT SHEET—EXAMPLE** Rev.06.05.92

PARTS	Project Name: *SFO SEWPCP*	Project Number: *SFO10145.G2*
Body	Type: *Vee-Ball*	Mfr: *Fisher Controls*
	Size: *4-inch*	Model: *1049763-2*
	Line Connection: *159 # ANSI Flanges*	Serial #: *1003220*
Operator	Type: *Pneumatic Diaphragm*	Mfr: *Fisher Controls*
	Action: *Linear – Modulated*	Model: *4060D*
	Travel: *3-inch*	Serial #: *2007330*
Positioner	Input Signal: *3-15 psi*	Mfr: *Fisher Controls*
	Action: *Direct - air to open*	Model: *20472T*
	Cam: *Equal percentage*	Serial #: *102010*
Pilot	Action:	Mfr:
Solenoid	Rating: *None*	Model: Serial #:
I/P	Input: *4-20 mA dc*	Mfr: *Taylor*
Converter	Output: *3-15 psi*	Model: *10-T-576-3*
	Action: *Direct*	Serial #: *1057-330*
Position	Settings: *Closed / Open 5 deg, rising*	Mfr: *National Switch*
Switch	Contacts: *Close / Close*	Model: *1049-67-3*
		Serial #: *156 &157*
Power	Type: *Pneumatic*	Air Set Mfr: *Air Products*
Supply	Potential: *40 psi*	Model: *3210D*
		Serial #: *1107063*

ADJUSTMENTS	Initial	Date	**VERIFICATION**	Initial	Date
Air Set	*JDS*	*Jun-06-92*	Valve Action	*JDS*	*Jun-03-92*
Positioner	*JDS*	*Jun-06-92*	Installation	*JDS*	*Jun-03-92*
Position Switches	*JDS*	*Jun-06-92*	Wire Connection	*JDS*	*Jun-04-92*
I/P Converter	*JDS*	*Jun-07-92*	Tube Connection	*JDS*	*Jun-04-92*
Actual Speed	*JDS*	*Jun-07-92*			

REMARKS: *Valve was initially installed backwards.*	**Valve Ready for Start-up**
Observed to be correctly installed May-25-92	By: *J.D. Sewell*
	Date: *Jun-07-92*
	Tag No.: *FCV-10-2-1*

JACOBS PERFORMANCE TEST SHEET - EXAMPLE Rev.06.05.92

Project Name: *SFO SEWPCP Plant Expansion*	Project No.: *SFO12345.C1*

Demonstration test(s): For each functional Requirement of the loop:
(a) List and number the requirement. (b) Briefly describe the demonstration test.
(c) Cite the results that will verify the required performance. (d) Provide space for signoff.

1. MEASURE EFFLUENT FLOW

1.a With no flow, water level over weir should be zero and

FIT indicator should read zero. *Jun-20-92 BDG*

2. FLOW INDICATION AND TRANSMISSION TO LP & CCS

With flow, water level and FIT indicator should be related by expression

*Q(MGD) = 429*H**(2/3) (H = height in inches of water over weir).*

Vary H and observe that following.

2.a Reading of FIT indicator. *Jun-6-92 BDG*

2.b Reading is transmitted to FI on LP-521-1 *Jun-6-92 BDG*

2.c Reading is transmitted and displayed to CCS. *Jun-6-92 BDG*

H(measured)	*0*	*5*	*10*	*15*
Q(computed)	*0*	*47.96*	*135.7*	*251.7*
Q(FIT indicator)	*0*	*48.1*	*137*	*253*
Q(LI on LP-521-1)	*0*	*48.2*	*138*	*254*
Q(display by CCS)	*0*	*48.1*	*136.2*	*252.4*

Forms/Sheets Verified	By	Date	**Loop Accepted By Owner**
Loop Status Report	*J.D. Sewell*	*May-18-92*	By: *J.D. Smith*
Instrument Calibration Sheet	*J.D. Sewell*	*May-18-92*	Date: *Jun-6-92*
I&C Valve Calibration Sheet	*N.A.*		
Performance Test	By	Date	
Performed	*J. Blow MPSDC Co.*	*Jun-6-92*	
Witnessed	*B. DeGlanville*	*Jun-6-92*	Loop No.: *30-12*

LOOP DESCRIPTIONS

The Process Instrumentation and Control System (PICS) shall provide the following minimum functions described hereinafter. These descriptions include the functional requirements for the Programmable Logic Controllers (PLCs) and the Human Machine Interface (HMI). The descriptions supplement the information shown on the Drawings and in related Specifications. These Loop Descriptions describe only major loops, unit processes and functions not obvious on the Drawings. The contractor is responsible for configuring all I/O and loops as shown on the Contract Drawings. Use the functional requirement descriptions as guidelines for developing PLC and HMI application programs and logic.

The Contractor shall have the overall responsibility for a complete and functional control system for the injection and monitoring wells included in this project.

Additional modifications to the loop descriptions herein may occur. The PICS contractor shall coordinate with Owner at the beginning of their contract. Initial coordination shall be done during a project workshop. The General Contractor shall coordinate said workshop with the PICS Contractor, Owner, and Engineer.

GENERAL

The general requirements stated herein are applicable to the entire system.

GLOBAL FUNCTIONS

Global functions describe common operations associated with various equipment. Therefore, global functions apply to each object or process loop unless otherwise noted in the Contract Documents.

A. Operating Modes: Control of all process equipment is categorized by the following operating modes.

    a. Local: Equipment is operated by hand in the field without PLC controls.

        For example, an operator toggles a selector switch on the valve actuator to open a valve.

    b. Remote Manual: Equipment is operated via button press or mouse click on an HMI screen. The PLC evaluates the command from the HMI and controls the equipment accordingly.

        For example, an operator at the control room clicks on the button “Open Valve”. The PLC energizes a discrete output that drives the valve open.

c. Remote Auto: The PLC continuously reads process values from instrumentation and determines when to control equipment.

   For example, if the flow transmitter reading is below the setpoint value at any time, the PLC shall calculate a higher speed to a pump Adjustable Frequency Drives (AFDs) and increase the analog output to that AFD.

   All equipment and processes identified in the Loop Descriptions shall follow at least one of the three operating modes, and some equipment shall have the ability to toggle between up to all three operating modes.

   Toggling between operating modes is accomplished via selector switches or HMI buttons. Any changeover between Local and Remote control modes require toggling of a handswitch in the field to prevent unexpected remote starts while personnel are in the field.

   No device shall run if multiple selector switches in the field indicate conflicting positions, i.e. one switch is in Remote while another is in Local. However, there are no restrictions to having multiple handswitches toggled in the same operating mode, i.e. both switches in Local. Operation of equipment with multiple operating mode switches is described in further detail under the Recommended Standard Operating Procedure section detailed herein.

   Toggling between Remote Manual and Remote Automatic is achieved via button presses at the HMI. PLC programming or HMI scripting shall be implemented to prevent conflicting operating modes and provide binary states between operating modes.

B. Alarm Latching

a. Unlatched alarms shall de-energize once the original alarm trip condition returns to a normal state or value. Unlatched alarms shall be logged in the alarm stack and plant historian, but the condition is no longer visible in real-time monitoring once the alarm resets.

b. Latched alarms shall remain in the alarm state until both the original alarm trip condition returns to a normal state and the operator acknowledges the alarm via pushbutton on the HMI. Latched alarms will remain visible in real-time monitoring until it is acknowledged. The alarm shall be logged in the alarm stack and plant historian.

C. Event Recording:

a. All signals interfaced between the facility equipment and PLCs, both analog and discrete, shall be relayed from the PLCs to the facility historian server. Nominal recording frequency shall be determined in coordination between PICS Contractor and Owner.

b. Record all network signals interfaced between the plant Supervisory Control And Data Acquisition (SCADA) system and the network connected field equipment on the facility historian server. Include recording events for loss of network communications between the SCADA system and affected equipment.

c. Record PLC and control panel power faults on the facility historian server.

d. Provide active trending for all analog signals in the project.

D. Graphics, Screens, and Faceplates:

a. Illustrate all equipment monitored or controlled by the PLC as graphic objects on the facility HMI.

i. Analog values shall be displayed in the appropriate engineering units or as specified in the specifications. If the process value is above or below a rising or falling alarm setpoint respectively, then the graphic shall change color and indicate an alarm state.

ii. Discrete values shall be color coded with a succinct label for each possible state of an object including alarm or failure states.

iii. Each object with multiple command and status tags shall be provided with a faceplate. The faceplate is another graphic layer that appears when the object graphic is touched or clicked on the screen. The faceplate shall provide logical grouping of values and controls associated with the object selected.

iv. Provide an alarm stack at the top or bottom on every HMI screen that displays active alarm conditions generated by the facility SCADA system.

E. Access Levels:

a. Provide access levels at the HMI to restrict control of certain equipment as defined in the specifications. Each access level shall have a unique username and password.

b. HMI login credentials shall only be entered on a designated HMI workstation inside the facility.

c. Access levels for the HMI controls shall match the facility standard access level configuration.

d. On every HMI screen, clearly indicate the current access level to the user.

e. For all elevated access levels, revert to "No Access" after 60 minutes of inactivity. Adjustment of the access level timeout may be done at the Administrator Access level only.

f. For any access level login, timestamp and transmit the event to the facility SCADA historian.

F. Recovery After A Power Outage

a. For quick recovery after a power loss, equipment running in Remote Auto shall resume operation. Stagger equipment starts to reduce starting in-rush current.

b. Upon loss of both utility and UPS power at the PLC, revert the operating mode of all equipment in Remote Auto to Remote Manual.

c. Display alarms for control panel power fail and UPS fail on the HMI.

MODULAR FUNCTIONS

Modular functions describe common operations associated with similar equipment in Remote Control. Modular functions shall apply to every instance of a device unless otherwise noted in the Contract Documents.

A. Constant Speed Motors:

a. Available: A motor is tagged as available if all process conditions are met for the equipment to operate. The prerequisite conditions for a motor to be available is described in the loop specifications and vary by process and equipment. The PLC shall determine whether a motor is available or unavailable based on monitoring of the process. If a motor is not available to operate, the equipment shall not be able to start in Remote Manual or Remote Auto, and operator commands will be disabled.

Note that the "Available" status shall not prevent Local operation of the motor.

b. Fail-to-Start: If a motor is commanded to start by the PLC, and the motor running status remains inactive for an operator-adjustable amount of time, generate a latched fail-to-start alarm at the PLC and HMI. PLC shall disengage run command once the alarm is triggered. Restarting the motor is performed as follows:

   i. In Remote Manual, operator must reset the alarm and press the start button on the HMI screen again to re-energize the PLC command to the motor.

   ii. In Remote Auto, the PLC shall automatically restart the motor once the operator clears the alarm on the HMI, unless the motor is unavailable.

c. Fail-to-Stop: If a motor is commanded to stop by the PLC, and the motor running status remains active for an operator-adjustable amount of time, generate a latched fail-to-stop alarm at the PLC and HMI.

d. Motor Runtime: Record and display motor runtime based on the time elapsed while the motor running status is received and the motor is not tagged out of service. Provide a button for operations or maintenance to reset the runtime counter. Runtime shall be displayed independent of operating mode.

e. Number of Starts: Record and display the number of motor starts each time there is positive edge detection of the motor running status. Provide a button for operations or maintenance to reset the start counter. Number of starts shall be displayed independent of operating mode.

f. Out of Service: Provide a button on the HMI for each object faceplate to place an object out of service. Out of service is used for faulty equipment that is unsafe or unreliable to run in Remote. While out of service, remote commands are disabled until the device is place back in service using the same faceplate button. Display that the device is out of service.

   Note that the “Out of Service” status does not prevent Local operation of the motor.

B. Variable Speed Motors:

   a. Provide the same functionality as listed for Constant Speed Motors, in addition to the following:

      i. Speed Control: The speed of the motor may be increased or decreased in Remote by one of the following methods:

         1. Remote Manual: Provide an adjustable field on the variable speed motor faceplate to adjust the speed setpoint in terms of speed percentage (0-100% speed).

2. Remote Auto: PLC shall evaluate the process conditions to determine the speed setpoint to transmit to the AFD.

ii. Record and display current motor speed on the faceplate, independent of the operating mode.

iii. Speed Discrepancy Alarm: If the speed setpoint and measured speed of the motor are offset for a period of time, generate an unlatched speed discrepancy alarm. The motor will continue to run with a speed discrepancy alarm. Provide adjustable setpoints both for the alarm time delay and the allowable discrepancy between the two values.

C. Open/Close Valves and Gates:

a. Fail-to-Open: If a valve or gate is commanded to open by the PLC, and the device open status remains inactive for an operator-adjustable amount of time, generate a latched fail-to-open alarm at the PLC and HMI. PLC shall disengage open command once the alarm is triggered. Reopening the device is performed as follows:

i. In Remote Manual, operator must reset the alarm and press the open button on the HMI screen again to re-energize the PLC command to the device actuator.

ii. In Remote Auto, the PLC shall automatically reopen the device once the operator clears the alarm on the HMI.

b. Fail-to-Close: If a valve or gate is commanded to close by the PLC, and the device closed status remains active for an operator-adjustable amount of time, generate a latched fail-to-close alarm at the PLC and HMI.

c. Position Discrepancy: If the PLC receives both the open and closed limit switches from the device, generate an unlatched limit switch discrepancy alarm.

d. Out of Service: Provide a button on the HMI for each object faceplate to place an object out of service. Out of service is used for faulty equipment that is unsafe or unreliable to run in Remote. While out of service, remote commands are disabled until the device is place back in service using the same faceplate button. Display that the device is out of service.

Note that the “Out of Service” status does not prevent Local operation of the valve or gate.

D. Modulating Valves:

a. Provide the same functionality as listed for Open/Close Valves and Gates, in addition to the following:

i. Position Control: The position of a valve may be set in Remote by one of the following methods:

1. Remote Manual: Provide an adjustable field on the object faceplate to adjust the position in terms of percentage open (0-100% open).

2. Remote Auto: PLC shall evaluate the process conditions to determine the position setpoint to transmit to the valve or gate.

ii. Record and display current valve or gate position on the faceplate, independent of the operating mode.

iii. Position Discrepancy Alarm: If the position setpoint and monitored position gate or valve are offset for a period of time, generate an unlatched position discrepancy alarm. The device will continue to reach the desired position with a position discrepancy alarm. Provide adjustable setpoints both for the alarm time delay and the allowable discrepancy between the two values.

E. Instrument Analog Signals

a. For every instrument with a 4-20mA signal, provide operator adjustable setpoints on the HMI for Low-Low, Low, High, and High-High alarms. Additionally, allow operators to adjust deadband and time delay setpoints on the analog instrument faceplate. Provide an option to mask or disable each of the four setpoints.

b. Additionally, provide a button to enable “Simulate Mode”. Simulate mode allows the user to force a process value to the PLC logic if the instrument is temporarily out of service. Maintenance Access is required to initiate simulate mode and adjust the simulated values. On the same faceplate screen, continuously show the true 4-20mA reading of the device in parallel with the simulated value.

c. For all flowmeters, provide a totalizer for daily and monthly flows as well as averaging calculations. Display the totalizer and average on the same display as the current process value.

d. For all other analyzers, provide a daily average calculation only. Display the average on the same display as the current process value.

NETWORK FUNCTIONS

For Ethernet networks, provide a tag value indicating the heartbeat of the data link. If the link is severed or any communication failure occurs, the heartbeat tag shall de-energize. If the heartbeat signal remains inactive for an operator adjustable setpoint, then generate an alarm on all affected screens indicating a network failure.

UNIT PROCESSES

A. Facility Overview

The facility control system upgrades in this project consists of the following major unit processes:

1. Injection Well IW-1
2. Injection Well IW-2
3. Monitoring Wells DMW-1, DZMW-1, and APMW

The proceeding sections describe the specific interlocks, controls, and displays associated with each process area.

Graphics: Provide an HMI screen showing an overview of the injection well and monitoring well sites. At a minimum, display all instrument readings, run or fault status of all motorized equipment, and all valve positions. Include screen navigation links over each major unit process area to allow the user to access the specific unit process HMI screen from the overview page. Design HMI screen navigation so that any of the major unit process areas described above can be accessed within two button presses.

B. Injection Well IW-1

1. HMI Graphic Requirements:

   Provide an overview graphic display of the IW-1 process, including the well head instrumentation and valve lineup. Display all instrumentation readings in the appropriate engineering units.

2. Control Requirements:

   During automatic operation, provide a flow control loop based on the flow meter reading from FIT-614 while controlling the modulating valve FCV-614 in response. The flow control loop will implement Proportional-Integral-Derivative (PID) control. Provide an interlock to close the modulating valve in automatic mode if the pressure reading from PIT-610 drops below the minimum pressure setpoint. This setpoint shall be operator-adjustable from the control room HMI.

Additionally, provide an automatic flow path selection for the operator to choose routing of the injection well. All automated valves must be set in the Remote Auto operating mode before a valid selection can be made. If at least one valve is in the incorrect operating mode, generate text on the HMI graphics page indicating that the system is not in auto and gray out the flow path selector buttons. When a flow path selector button is pressed by the operator on the HMI, generate a popup screen asking for the operator to confirm the intended flow path and verify all manual valves have been turned to the correct positions. Once the Operator presses the verification button, close the popup and begin the automatic sequence. Operator selection of the automatic lineup shall be performed only if logged into the HMI with the appropriate access credentials.

The valve lineup will be interlocked in automatic so that the flow valves FV-616A and FV-616B are not open at the same time. Once a flow path is selected, the PLC shall verify that the opposite valve is closed before opening the valve in the requested lineup. The lineup will be sequenced so that only one valve actuates at a time. Once a valve reaches the full open or closed limit, the next valve may be called to operate in the lineup. Check valve limit switches ZSC-616A and ZSC-616B are present on both flow paths; if the check valve opens on the line that is not intended for the flow path, generate an alarm indicating that flow is present. Alternatively, if a flow path is selected and the corresponding line check valve remains closed after a period of time, generate a check valve fault alarm.

If a valve fails to turn during the flow path adjustment, generate an alarm indicating a fail-to-open or fail-to-close alarm for the affected valve and abort the line-up sequence. If the automatic system fails, or a valve must be maintained in an operating condition other than Remote Auto, then the lineup will be performed manually by the operator.

Provide an automatic interlock so that the valve FV-616B remains closed unless the IW-1 pump is running. However, the pump is currently designated as a future add-on relative to this Project. Therefore, provide temporary code to disable this interlock until the pump is installed.

C. Injection Well IW-2

1. HMI Graphic Requirements:

Provide an overview graphic display of the IW-2 process, including the well head instrumentation and valve lineup. Display all instrumentation readings in the appropriate engineering units.

2. Control Requirements:

   During automatic operation, provide a PID flow control loop based on the flow meter reading from FIT-621 while controlling the modulating valve FCV-621 in response. Provide an interlock to close the modulating valve in automatic mode if the pressure reading from PIT-620 drops below the minimum pressure setpoint. This setpoint shall be operator-adjustable from the control room HMI.

D. Monitoring Wells DMW-1, DZMW-1, and APMW

1. HMI Graphic Requirements:

   Provide level readings for each monitoring well in appropriate engineering units on the HMI screen.

2. Control Requirements:

   Currently no remote controls are intended for the monitoring wells included in this Project. Operation of the pumps will be done locally by the operator.

Manatee NWRF Injection Wells
INSTRUMENT LIST

Instrument Tag Number	Instrument Component Code	Description	Options/Features	Installation Detail	P&ID
LE/LIT-610	L3	Level Element and Transmitter, Submersible	Range: 0-150 ft Zero Setting: To be determined during field installation.	4091-267CG	DI00-601
PIT-610	P9	Pressure Indicating Transmitter	Range: 0-100 psi	4091-302, 4091-305A	DI00-601
FE/FIT-614	F4	Flow Element and Transmitter, Electromagnetic	Tube Size: 16" Range: 500-4,500 gpm	4091-222BG	DI00-601
PDIT-612	P7	Pressure Differential Indicating Transmitter	Range: 0-30 psi	4091-302, 4091-305A	DI00-601
LE/LIT-620	L3	Level Element and Transmitter, Submersible	Range: 0-150 ft Zero Setting: To be determined during field installation.	4091-267CG	DI00-602
PIT-620	P9	Pressure Indicating Transmitter	Range: 0-100 psi	4091-302, 4091-305A	DI00-602
FE/FIT-621	F4	Flow Element and Transmitter, Electromagnetic	Tube Size: 12" Range: 300- 3,500 gpm	4091-222BG	DI00-601
PDIT-622	P7	Pressure Differential Indicating Transmitter	Range: 0-30 psi	4091-302, 4091-305A	DI00-601
LE/LIT-710	L3	Level Element and Transmitter, Submersible	Range: 0-150 ft Zero Setting: To be determined during field installation.	4091-267CG	DI00-603
LE/LIT-720	L3	Level Element and Transmitter, Submersible	Range: 0-150 ft Zero Setting: To be determined during field installation.	4091-267CG	DI00-603
FI/FQ-710	F55	Flow Indicator and Totalizer	Range: 0-100 gpm		DI00-603
FI/FQ-720	F55	Flow Indicator and Totalizer	Range: 0-100 gpm		DI00-603
PI-710	P4	Pressure Gauge	Range: 0-100 psi	4091-302, 4091-304A, 4091-305A	DI00-603
PI-720	P4	Pressure Gauge	Range: 0-100 psi	4091-302, 4091-304A, 4091-305A	DI00-603
LE/LIT-730	L3	Level Element and Transmitter, Submersible	Range: 0-150 ft Zero Setting: To be determined during field installation.	4091-267CG	DI00-604
LE/LIT-740	L3	Level Element and Transmitter, Submersible	Range: T0-150 ft Zero Setting: To be determined during field installation.	4091-267CG	DI00-604
FI/FQ-730	F55	Flow Indicator and Totalizer	Range: 0-100 gpm		DI00-604
FI/FQ-740	F55	Flow Indicator and Totalizer	Range: 0-100 gpm		DI00-604
PI-730	P4	Pressure Gauge	Range:0-100 psi	4091-302, 4091-304A, 4091-305A	DI00-604
PI-740	P4	Pressure Gauge	Range: 0-100 psi	4091-302, 4091-304A, 4091-305A	DI00-604

Manatee NWRF Injection Wells PLC INPUT/OUTPUT LIST				
Control Panel Tag	**Device Tag**	**Device Description**	**I/O Signal Type**	**P&ID**
SP-7	LIT-610	IW-1 Level	AI	DI00-601
SP-7	PIT-610	IW-1 Pressure	AI	DI00-601
SP-7	FCV-614	IW-1 Flow Modulation Valve In Remote	DI	DI00-601
SP-7	FCV-614	IW-1 Flow Modulation Valve Position Command	AO	DI00-601
SP-7	FCV-614	IW-1 Flow Modulation Valve Position Feedback	AI	DI00-601
SP-7	FIT-614	IW-1 Flow	AI	DI00-601
SP-7	PDIT-612	IW-1 Strainer Differential Pressure	AI	DI00-601
SP-7	FV-616A	IW-1 MCMRCS Valve In Remote	DI	DI00-601
SP-7	FV-616A	IW-1 MCMRCS Valve Open Command	DO	DI00-601
SP-7	FV-616A	IW-1 MCMRCS Valve Close Command	DO	DI00-601
SP-7	FV-616A	IW-1 MCMRCS Valve Open Feedback	DI	DI00-601
SP-7	FV-616A	IW-1 MCMRCS Valve Close Feedback	DI	DI00-601
SP-7	FV-616A	IW-1 RW Valve In Remote	DI	DI00-601
SP-7	FV-616A	IW-1 RW Valve Open Command	DO	DI00-601
SP-7	FV-616A	IW-1 RW Valve Close Command	DO	DI00-601
SP-7	FV-616A	IW-1 RW Valve Open Feedback	DI	DI00-601
SP-7	FV-616A	IW-1 RW Valve Close Feedback	DI	DI00-601
SP-7	ZSC-616A	RW Inlet Line Check Valve Close Feedback	DI	DI00-601
SP-7	ZSC-617A	Reject Line Check Valve Close Feedback	DI	DI00-601
SP-7	LIT-730	DZMW-1 Lower Zone Level	AI	DI00-604
SP-7	LIT-740	DZMW-1 Upper Zone Level	AI	DI00-604
SP-7	SP-7	SP-7 Panel Intrusion Switch	DI	N/A
SP-7	SP-7	SP-7 Panel Loss of Control Feed Power	DI	N/A
SP-7	SP-7	SP-7 Panel UPS On Battery	DI	N/A
SP-7	SP-7	SP-7 Panel UPS Charging	DI	N/A
SP-7	SP-7	SP-7 Panel UPS Low Battery/Fault	DI	N/A
SP-7	FV-617A (Future)	IW-1 Plant Reclaim Feed Valve In Remote	DI	DI00-601
SP-7	FV-617A (Future)	IW-1 Plant Reclaim Feed Valve Open Command	DO	DI00-601
SP-7	FV-617A (Future)	IW-1 Plant Reclaim Feed Valve Close Command	DO	DI00-601
SP-7	FV-617A (Future)	IW-1 Plant Reclaim Feed Valve Open Feedback	DI	DI00-601
SP-7	FV-617A (Future)	IW-1 Plant Reclaim Feed Valve Close Feedback	DI	DI00-601
SP-7	FV-617B (Future)	IW-1 Reject Pond Discharge Valve In Remote	DI	DI00-601
SP-7	FV-617B (Future)	IW-1 Reject Pond Discharge Valve Open Command	DO	DI00-601
SP-7	FV-617B (Future)	IW-1 Reject Pond Discharge Valve Close Command	DO	DI00-601
SP-7	FV-617B (Future)	IW-1 Reject Pond Discharge Valve Open Feedback	DI	DI00-601
SP-7	FV-617B (Future)	IW-1 Reject Pond Discharge Valve Close Feedback	DI	DI00-601

Manatee NWRF Injection Wells PLC INPUT/OUTPUT LIST				
Control Panel Tag	**Device Tag**	**Device Description**	**I/O Signal Type**	**P&ID**
SP-7	FV-618A (Future)	IW-1 East Lake Isolation Valve In Remote	DI	DI00-601
SP-7	FV-618A (Future)	IW-1 East Lake Isolation Valve Open Command	DO	DI00-601
SP-7	FV-618A (Future)	IW-1 East Lake Isolation Valve Close Command	DO	DI00-601
SP-7	FV-618A (Future)	IW-1 East Lake Isolation Valve Open Feedback	DI	DI00-601
SP-7	FV-618A (Future)	IW-1 East Lake Isolation Valve Close Feedback	DI	DI00-601
SP-7	FV-618B (Future)	IW-1 East Lake Recovery Valve In Remote	DI	DI00-601
SP-7	FV-618B (Future)	IW-1 East Lake Recovery Valve Open Command	DO	DI00-601
SP-7	FV-618B (Future)	IW-1 East Lake Recovery Valve Close Command	DO	DI00-601
SP-7	FV-618B (Future)	IW-1 East Lake Recovery Valve Open Feedback	DI	DI00-601
SP-7	FV-618B (Future)	IW-1 East Lake Recovery Valve Close Feedback	DI	DI00-601
SP-7	FV-618C (Future)	IW-1 East Lake Discharge Valve In Remote	DI	DI00-601
SP-7	FV-618C (Future)	IW-1 East Lake Discharge Valve Open Command	DO	DI00-601
SP-7	FV-618C (Future)	IW-1 East Lake Discharge Valve Close Command	DO	DI00-601
SP-7	FV-618C (Future)	IW-1 East Lake Discharge Valve Open Feedback	DI	DI00-601
SP-7	FV-618C (Future)	IW-1 East Lake Discharge Valve Close Feedback	DI	DI00-601
SP-7	(Future)	East Lake Recovery Flow	AI	DI00-601
SP-7	ZSC-610 (Future)	IW-1 Pump Check Valve Close Feedback	DI	DI00-601
SP-8	LIT-620	IW-2 Level	AI	DI00-602
SP-8	PIT-620	IW-2 Pressure	AI	DI00-602
SP-8	FCV-621	IW-2 Flow Modulation Valve In Remote	DI	DI00-602
SP-8	FCV-621	IW-2 Flow Modulation Valve Position Command	AO	DI00-602
SP-8	FCV-621	IW-2 Flow Modulation Valve Position Feedback	AI	DI00-602
SP-8	FIT-621	IW-2 Flow	AI	DI00-602
SP-8	PDIT-622	IW-2 Strainer Differential Pressure	AI	DI00-602
SP-8	LIT-710	DMW-1 Level	AI	DI00-603
SP-8	SP-8	SP-8 Panel Intrusion Switch	DI	N/A
SP-8	SP-8	SP-8 Panel Loss of Control Feed Power	DI	N/A
SP-8	SP-8	SP-8 Panel UPS On Battery	DI	N/A
SP-8	SP-8	SP-8 Panel UPS Charging	DI	N/A
SP-8	SP-8	SP-8 Panel UPS Low Battery/Fault	DI	N/A
SP-3 (Existing)	LIT-720	APMW Level	AI	DI00-603

Manatee NWRF Injection Wells CONTROL PANEL SCHEDULE								
Panel No.	**Service**	**Mounting**	**NEMA Rating**	**Dimensions H x W x D (Maximum)**	**WFDT Required**	**Air Conditioned/ Heated**	**Service Lights, Outlets**	**Environment**
SP-7	Injection Well IW-1 Combined Starter and Control Panel	Rack	4X	48"x60"x18"	Yes	No	Yes	Outside Area
SP-8	Injection Well IW-2 Combined Starter and Control Panel	Rack	4X	48"x60"x18"	Yes	No	Yes	Outside Area

Column Descriptions:

WFDT: Witnessed Factory Demonstation Test
Dimensions: Nominal space available for panel

SECTION 40 91 00
INSTRUMENTATION AND CONTROL COMPONENTS

PART 1 GENERAL

1.01 SUMMARY

A. This section gives general requirements for instrumentation and control components.

PART 2 PRODUCTS

2.01 GENERAL

A. Article Mechanical Systems Components covers requirements of mechanical PIC components that are not specifically referenced by Section 40 90 00, Instrumentation and Control for Process Systems, Instrument Lists, or Data Sheets.

B. Article Electrical Components covers requirements for electrical PIC components that are not specifically referenced by Section 40 90 00, Instrumentation and Control for Process Systems, Instrument Lists or Data Sheets.

C. All other Part 2 articles cover components that are referenced by Instrument Lists or Data Sheets in Section 40 90 00, Instrumentation and Control for Process Systems, or by specific component numbers in other PIC subsections.

2.02 MECHANICAL SYSTEMS COMPONENTS

A. Manifold, Two-Valve Block and Bleed:

1. Type: For block and bleed (or calibration) of static pressure transmitter or gauge.
2. Materials: Type 316 stainless steel.
3. Manufacturers and Products: Swagelok, V Series.

B. Manifold, Three-Valve Equalizing:

1. Type: For isolation and equalization of differential pressure transducers.
2. Materials: Type 316 stainless steel.
3. Manufacturers and Products:
   a. Anderson, Greenwood and Co.; Type M1.
   b. Evans.

C. Pressure Gauge: For other than process variable measurement.

1. Dial Size: Nominal 2-inch dial size.
2. Accuracy: 2 percent of span.
3. Scale Range: Such that normal operating pressure lies between 50 percent and 80 percent of scale range.
4. Connection: 1/4-inch NPT through bottom, unless otherwise noted.
5. Manufacturers and Products:
   a. Ashcroft Utility; Gauge Series 1000.
   b. Marsh; Standard Gauge Series.
   c. Ametek U.S.; Gauge Series P500.
   d. Acculite; Series 2000.

D. Valve, Needle:

1. Materials: Brass, stainless steel, PVC, or CPCV, as recommended by manufacturer for designated service, unless otherwise shown on Drawings.
2. Size: 0.020-inch orifice.
3. Manufacturers and Products:
   a. Whitey; Model 21RF2.
   b. Hoke; 3700 Series.

E. ON/OFF Valves:

1. Type: Ball valve.
2. Materials: Brass, stainless steel, PVC, or CPCV, as recommended by manufacturer for designated service, unless otherwise shown on Drawings.
3. Manufacturers and Products:
   a. Whitey; Series 41 through Series 43.
   b. Hoke; Flomite 7100 Series.

F. Test Tap:

1. Manufacturers and Products:
   a. Imperial-Eastman; quick-disconnect couplings No. 292-P and caps No. 259-P.
   b. Crawford Fitting Co.; Swagelok quick-connects Series QC4 and caps QC4-DC.
   c. Parker; CPI Series precision quick couplings.

2.03 ELECTRICAL COMPONENTS

A. Terminal Blocks for Enclosures:

1. General:
   a. Connection Type: Screw compression clamp.

b. Compression Clamp:
   1) Complies with DIN-VDE 0611.
   2) Hardened steel clamp with transversal grooves that penetrate wire strands providing a vibration-proof connection.
   3) Guides strands of wire into terminal.
c. Screws: Hardened steel, captive, and self-locking.
d. Current Bar: Copper or treated brass.
e. Insulation:
   1) Thermoplastic rated for minus 55 degrees C to plus 110 degrees C.
   2) Two funneled shaped inputs to facilitate wire entry.
f. Mounting:
   1) Standard DIN rail.
   2) Terminal block can be extracted from an assembly without displacing adjacent blocks.
   3) End Stops: Minimum of one at each end of rail.
g. Wire Preparation: Stripping only permitted.
h. Jumpers: Allow jumper installation without loss of space on terminal or rail.
i. Marking System:
   1) Terminal number shown on both sides of terminal block.
   2) Allow use of preprinted and field marked tags.
   3) Terminal strip numbers shown on end stops.
   4) Mark terminal block and terminal strip numbers as shown on panel control diagrams and loop diagrams.
   5) Fuse Marking for Fused Terminal Blocks: Fuse voltage and amperage rating shown on top of terminal block.
j. Test Plugs: Soldered connections for 18 AWG wire.
   1) Pin Diameter: 0.079 inch.
   2) Manufacturer and Product: TE Connectivity, Entrelec; Type FC2, or equal.

2. Terminal Block, General Purpose:
   a. Rated Voltage: 600V ac.
   b. Rated Current: 30 amp.
   c. Wire Size: 24 AWG to 10 AWG.
   d. Rated Wire Size: 10 AWG.
   e. Color: Gray body.
   f. Spacing: 0.25 inch, maximum.
   g. Test Sockets: One screw test socket 0.079-inch diameter.
   h. Manufacturer and Product: TE Connectivity, Entrelec; Type M4/6.T, or equal.
3. Terminal Block, Ground:
   a. Wire Size: 24 AWG to 10 AWG.
   b. Rated Wire Size: 10 AWG.
   c. Color: Green and yellow body.

d. Spacing: 0.25 inch, maximum.
e. Grounding: Electrically grounded to mounting rail.
f. Manufacturer and Product: TE Connectivity, Entrelec; Type M4/6.P, or equal.

4. Terminal Block, Blade Disconnect Switch:
   a. Rated Voltage: 600V ac.
   b. Rated Current: 10 amp.
   c. Wire Size: 22 AWG to 10 AWG.
   d. Rated Wire Size: 10 AWG.
   e. Color: Gray body, orange switch.
   f. Spacing: 0.25 inch, maximum.
   g. Manufacturer and Product: TE Connectivity, Entrelec; Type M4/6.SNT, or equal.
5. Terminal Block Diode:
   a. Rated Voltage: 24V dc.
   b. Rated Current: 30 ma.
   c. Wire Size: 16 AWG.
   d. Manufacturer and Product: Phoenix Contact ST-IN, or equal.
6. Terminal Block, Fused, 24V dc:
   a. Rated Voltage: 600V dc.
   b. Rated Current: 25 amp.
   c. Wire Size: 22 AWG to 10 AWG.
   d. Rated Wire Size: 10 AWG.
   e. Color: Gray body.
   f. Fuse: 0.25 inch by 1.25 inches.
   g. Indication: LED diode 24V dc.
   h. Spacing: 0.512 inch, maximum.
   i. Manufacturer and Product: TE Connectivity, Entrelec; Type ML10/13.SFD, or equal.
7. Terminal Block, Fused, 120V ac:
   a. Rated Voltage: 600V ac.
   b. Rated Current: 25 amp.
   c. Wire Size: 22 AWG to 10 AWG.
   d. Rated Wire Size: 10 AWG.
   e. Color: Gray body.
   f. Fuse: 0.25 inch by 1.25 inches.
   g. Indication: Neon lamp, 110V ac.
   h. Leakage Current: 1.8 mA, maximum.
   i. Spacing: 0.512 inch, maximum.
   j. Manufacturer and Product: TE Connectivity, Entrelec; Type ML10/13.SFL, or equal.

8. Terminal Block, Fused, 120V ac, High Current:
    a. Rated Voltage: 600V ac.
    b. Rated Current: 35 amps.
    c. Wire Size: 18 AWG to 8 AWG.
    d. Rated Wire Size: 8 AWG.
    e. Color: Gray.
    f. Fuse: 13/32 inch by 1.5 inches.
    g. Spacing: 0.95 inch, maximum.
9. Manufacturer and Product: TE Connectivity, Entrelec; Type MB10/24.SF, or equal.

B. Relays:

1. General:
    a. Relay Mounting: Plug-in type socket.
    b. Relay Enclosure: Furnish dust cover.
    c. Socket Type: Screw terminal interface with wiring.
    d. Socket Mounting: Rail.
    e. Provide holddown clips.
2. Signal Switching Relay:
    a. Type: Dry circuit.
    b. Contact Arrangement: 2 Form C contacts.
    c. Contact Rating: 5 amps at 28V dc or 120V ac.
    d. Contact Material: Gold or silver.
    e. Coil Voltage: As noted or shown.
    f. Coil Power: 0.9 watt (dc), 1.2VA (ac).
    g. Expected Mechanical Life: 10,000,000 operations.
    h. Expected Electrical Life at Rated Load: 100,000 operations.
    i. Indication Type: Neon or LED indicator lamp.
    j. Seal Type: Hermetically sealed case.
    k. Manufacturer and Product: Potter and Brumfield; Series KH/KHA, or equal.
3. Control Circuit Switching Relay, Nonlatching:
    a. Type: Compact general purpose plug-in.
    b. Contact Arrangement: 3 Form C contacts.
    c. Contact Rating: 10A at 28V dc or 120V ac, and 6.6A at 240V ac.
    d. Contact Material: Silver cadmium oxide alloy.
    e. Coil Voltage: As noted or shown.
    f. Coil Power: 1.8 watts (dc), 2.7VA (ac).
    g. Expected Mechanical Life: 10,000,000 operations.
    h. Expected Electrical Life at Rated Load: 100,000 operations.
    i. Indication Type: Neon or LED indicator lamp.
    j. Push-to-test button.
    k. Manufacturer and Product: Potter and Brumfield; Series KUP, or equal.

l. 0: 2 Form C contacts.
m. Contact Rating: 10A at 28V dc or 120V ac.
n. Contact Material: Silver cadmium oxide alloy.
o. Coil Voltage: As noted or shown.
p. Coil Power: 2.7 watts (dc), 5.3VA (ac).
q. Expected Mechanical Life: 500,000 operations.
r. Expected Electrical Life at Rated Load: 50,000 operations.
s. Manufacturer and Product: Potter and Brumfield; Series KB/KBP or equal.

4. Control Circuit Switching Relay, Time Delay:
   a. Type: Adjustable time delay relay.
   b. Contact Arrangement: 2 Form C contacts.
   c. Contact Rating: 10A at 30V dc or 277V ac.
   d. Contact Material: Silver cadmium oxide alloy.
   e. Coil Voltage: As noted or shown.
   f. Operating Temperature: Minus 10 degrees C to 55 degrees C.
   g. Repeatability: Plus or minus 2 percent.
   h. Delay Time Range: Select range such that time delay setpoint fall between 20 percent to 80 percent of range.
   i. Time Delay Setpoint: As noted or shown.
   j. Mode of Operation: As noted or shown.
   k. Adjustment Type: Integral potentiometer with knob external to dust cover.
   l. Manufacturer and Products: Potter and Brumfield; Series CB for 0.1-second to 100-minute delay time ranges, Series CK for 0.1-second to 120-second delay time ranges, or equal.

C. Surge Suppressors:

1. General:
   a. Construction: First-stage high-energy metal oxide varistor and second-stage bipolar silicon avalanche device separated by series impedance; includes grounding wire, stud, or terminal.
   b. Response: 5 nanoseconds maximum.
   c. Recovery: Automatic.
   d. Temperature Range: Minus 20 degrees C to plus 85 degrees C.
2. Suppressors on 120V ac Power Supply Connections:
   a. Occurrences: Tested and rated for a minimum of 50 occurrences of IEEE C62.41 Category B test waveform.
   b. First-Stage Clamping Voltage: 350 volts or less.
   c. Second-Stage Clamping Voltage: 210 volts or less.
   d. Continuous Operation: Power supplies for one four-wire transmitter or receiver: 5 amps minimum at 130V ac. All other applications: 30 amps minimum at 130V ac.

3. Suppressors on Analog Signal Lines:
    a. Test Waveform: Linear 8 microsecond rise in current form 0 amps to a peak current value followed by an exponential decay of current reaching one-half the peak value in 20 microseconds.
    b. Surge Rating: Tested and rated for 50 occurrences of 2,000-amp peak test waveform.
        1) dc Clamping Voltage: 20 percent to 40 percent above operating voltage for circuit.
        2) dc Clamping Voltage Tolerance: Less than plus or minus 10 percent.
        3) Maximum Loop Resistance: 18 ohms per conductor.
4. Physical Characteristics:
    a. Mounted in Enclosures: Encapsulated inflame retardant epoxy.
    b. Type SS2: For Analog Signals Lines: EDCO PC-642 series or equal.
    c. Type SS1: For 120V ac Lines: EDCO HSP-121 or equal.
    d. Type SS3: Field Mounted at Two-Wire Instruments: Encapsulated in stainless steel pipe nipples. EDCO SS64 series or equal.
    e. Type SS4: Field Mounted at Four-Wire Instruments: With 120V ac outlet, ac circuit breaker, and 10-ohm resistors on signal lines, all in enclosure.
        1) Enclosure:
            a) NEMA 4X polycarbonate or Type 316 stainless steel with door.
            b) Maximum Size: 12 inches by 12 inches by 8 inches deep.
        2) Manufacturer and Product: EDCO; SLAC series or equal.

D. Intrinsic Safety Relays and Barriers:

1. Provide UL Listed Intrinsically safe relays and barriers as shown on drawings and where required according to the NEC and NFPA 820.
2. Install in accordance with the NEC (NFPA 70).
3. Select intrinsically safe devices using manufacturer's recommendation based on the entity parameters of the associated instrument.
4. Physical Characteristics:
    a. Type IS1: Intrinsically Safe Relays for discrete inputs.
    b. Type IS2: Intrinsically Safe Barriers for analog inputs.
5. Manufacturers:
    a. Eaton.
    b. Stahl.
    c. Or equal.

E. Power Supplies:

1. Furnish as required to power instruments requiring external dc power, including two-wire transmitters and dc relays. Provide dual power supplies with diode auctioneered outputs.
2. Convert 120V ac, 60-Hz power to dc power of appropriate voltage(s) with sufficient voltage regulation and ripple control to assure that instruments being supplied can operate within their required tolerances.
3. Provide output over voltage and over current protective devices to:
   a. Protect instruments from damage due to power supply failure.
   b. Protect power supply from damage due to external failure.
4. Enclosures: NEMA 1.
5. Mount such that dissipated heat does not adversely affect other components.
6. Fuses: For each dc supply line to each individual two-wire transmitter.
   a. Type: Indicating.
   b. Mount so fuses can be easily seen and replaced.
7. Manufacturers:
   a. IDEC; PS5R series.
   b. Phoenix Contact; Quint Series.
   c. ABB; CP series.

2.04 FLOW COMPONENTS

A. F4 Flow Element and Transmitter, Electromagnetic:

1. General:
   a. Function: Measure, indicate, and transmit the flow of a conductive process liquid in a full pipe.
   b. Type:
      1) Electromagnetic flowmeter, with operation based on Faraday's Law, utilizing the pulsed dc type coil excitation principle with high impedance electrodes.
      2) Full bore meter with magnetic field traversing entire flow-tube cross section.
      3) Unacceptable are insert magmeters or multiple single point probes inserted into a spool piece.
   c. Parts: Flow element, transmitter, interconnecting cables, and mounting hardware. Other parts as noted.
2. Service:
   a. Stream Fluid:
      1) Leachate, unless otherwise noted.
      2) Suitable for liquids with a minimum conductivity of 5 microS/cm and for demineralized water with a minimum conductivity of 20 microS/cm.

3. Operating Temperature:
   a. Element:
      1) Ambient: Minus 5 to 140 degrees F, typical, unless otherwise noted.
      2) Process: Minus 5 to 140 degrees F, typical, unless otherwise noted.
   b. Transmitter:
      1) Ambient: Minus 5 to 140 degrees F, typical, unless otherwise noted.
      2) Storage: 15 to 120 degrees F, typical, unless otherwise noted.
4. Performance:
   a. Flow Range: As noted.
   b. Accuracy: Plus or minus 0.5 percent of rate for all flows resulting from pipe velocities of 2 to 30 feet per second.
   c. Turndown Ratio: Minimum of 10 to 1 when flow velocity at minimum flow is at least 1 foot per second.
5. Features:
   a. Zero stability feature to eliminate the need to stop flow to check zero alignment.
   b. No obstructions to flow.
   c. Very low pressure loss.
   d. Measures bi-directional flow.
6. Process Connection:
   a. Meter Size (diameter inches): As noted.
   b. Connection Type: 150-pound ANSI raised-face flanges; AWWA C207, Table 2 Class D; or wafer style depending on meter size, unless otherwise noted.
   c. Flange Material: Carbon steel, unless otherwise noted.
7. Power (Transmitter): 120V ac, 60-Hz, unless otherwise noted.
8. Element:
   a. Meter Tube Material: Type 304 stainless steel, unless otherwise noted.
   b. Liner Material: Hard rubber, unless otherwise noted.
   c. Liner Protectors: Covers (or grounding rings) on each end to protect liner during shipment.
   d. Electrode Type: Flush or bullet nose as recommended by the manufacturer for the noted stream fluid.
   e. Electrode Material: Type 316L stainless steel, unless otherwise noted.
   f. Grounding Ring:
      1) Required, unless otherwise noted.
      2) Quantity: Two, unless otherwise noted.
      3) Material: Type 316L stainless steel, unless otherwise noted.
   g. Enclosure: NEMA 4X, minimum, unless otherwise noted.
   h. Submergence: Temporary.

i. Hazardous Area Certification:
   1) Class 1, Division 2, Groups A, B, C, D: If noted.
   2) Class 1, Division 1, Groups A, B, C, D, and FM approved: If noted.
   3) Class 1, Division 1, Groups C, D, and FM approved: If noted.

9. Transmitter:
   a. Mounting: Surface (wall), unless otherwise noted.
   b. Display: Required, unless otherwise noted.
      1) Digital LCD display, indicating flow rate and total.
      2) Bi-directional Flow Display: Required, unless otherwise noted.
         a) Forward and reverse flow rate.
         b) Forward, reverse and net totalization.
   c. Parameter Adjustments: By keypad or non-intrusive means.
   d. Enclosure: NEMA 4X, minimum, unless otherwise noted.
10. Signal Interface (at Transmitter):
   a. Analog Output: Isolated 4 mA to 20 mA dc for load impedance from 0 ohm to at least 500 ohms minimum for 24V dc supply.
11. Cables:
   a. Types: As recommended by manufacturer.
   b. Lengths: As required to accommodate device locations.
12. Built-in Diagnostic System:
   a. Features:
      1) Field programmable electronics.
      2) Self-diagnostics with troubleshooting codes.
      3) Ability to program electronics with full scale flow, engineering units, meter size, zero flow cutoff, desired signal damping, totalizer unit digit value, etc.
      4) Initial flow tube calibration and subsequent calibration checks.
13. Factory Calibration:
   a. Calibrated in an ISO 9001 and NIST certified factory.
   b. Factory flow calibration system must be certified by volume or weight certified calibration devices.
   c. Factory flow calibration system shall be able to maintain calibration flow rate for at least 5 minutes for repeatability point checks.
14. Manufacturers:
   a. Endress & Hauser, Promag 400W.
   b. McCrometer, UltraMag.
   c. ABB Automation MagMaster (includes Transmitter):
      1) 10D1475 Mini-Mag (size: 1/10 to 4 inches).
      2) MFE (size: 1/2 to 24 inches).
      3) Plus MFF (size: 8 to 84 inches).
   d. Sparling Instruments; Tigermags, Model FM625 or FM655, as applicable;
   e. Foxboro; Series 8000 or Series 2800 flow tube with Model 896 transmitter, as applicable.

B. F55 Flow Element and Totalizer, Propeller

1. General:
   a. Function: Measure flow rate of water.
   b. Type: Flanged tube, propeller meter.
2. Service:
   a. Process Liquid: Water.
   b. Pressure: 150-psi standard, 250 psi when noted.
3. Performance:
   a. Accuracy: Plus or minus 2 percent of flow rate over 10:1 flow range.
   b. Uni-directional flow measurement, unless otherwise noted.
4. Element:
   a. Materials:
      1) Cover Plate: Cast iron.
      2) Propeller: Molded polyethylene.
      3) Gearbox: Brass up to 30 inches; cast iron above 30 inches.
      4) Bearings: Stainless steel or rubber (high speed).
      5) Coating: Epoxy-based paint.
   b. Mounting:
      1) Type: In-line tube.
      2) Materials:
         a) 2-Inch and 3-Inch Size: Cast iron tube lined with stainless steel liner at the metering section.
         b) 4-Inch Through 36-Inch Size: Fabricated steel.
   c. Integral Totalizer
   d. Process Flow Range: As noted.
   e. Process Connections: AWWA Class D flanges.
5. Manufacturer: McCrometer, McPropeller Series

2.05 LEVEL COMPONENTS

A. L3 Level Element/Transmitter, Submersible:

1. General:
   a. Function: Measure and transmit signal proportional to level.
   b. Type: Totally submersible pressure sensor (loop powered).
   c. Parts: Sensor, interconnecting cable, sensor termination enclosure.
2. Service:
   a. Fluid: Raw water.
3. Performance:
   a. Process Range:
      1) As noted.
      2) Provide fixed factory range such that noted process range is between 40 and 80 percent of fixed factory range.
   b. Accuracy: 1 percent of full scale, Total Error Band.
   c. Operating Temperature: Minus 10 to 60 degrees C.

4. Features:
    a. Sensor:
        1) Type 316 stainless steel sensing element.
        2) IP68 (submersible).
        3) Temperature Compensation: Minus 10 to 80 degrees C.
        4) 3/4 -inch NPT installation fitting.
        5) Loop powered, 11-28V dc.
    b. Transmitter:
        1) Remote electronics installation.
        2) Type 316 stainless steel construction.
        3) Loop power transmitter in series with sensor and PLC.
5. Signal Interface: 4 to 20 mA dc output, for load impedance of 0 to 750 ohms, minimum for 24V dc supply without load adjustment.
6. Manufacturers: Delta Controls, Model 592.

2.06 PRESSURE COMPONENTS

A. P4 Pressure Gauge:

1. General:
    a. Function: Pressure indication.
    b. Type:
        1) Direct reading bellows for ranges below 10 psig.
        2) Bourdon tube actuated for ranges 10 psig and above.
2. Performance:
    a. Range: As noted. Compound scale when noted.
    b. Accuracy: Plus or minus 0.5 percent of span.
3. Features:
    a. Mounting: Lower stem, unless otherwise noted.
    b. Dial: 4-1/2 inch diameter, unless otherwise noted.
    c. Case Material: Phenolic plastic, unless otherwise noted.
    d. Element Material: Phosphor-bronze, unless otherwise noted.
    e. Dampening: Pulsation dampener when noted, piston type with multiple choice of piston placement to vary the desired amount of dampening.
    f. Case Type: Solid front design with solid wall between window and element. Rear of case, gasketed pressure relief.
    g. Pointer: Micrometer pointer with self-locking adjustment.
    h. Movement: Stainless steel, rotary geared.
4. Process Connection:
    a. Line Size: 1/2 inch.
    b. Connection Type: Threaded.
5. Manufacturers:
    a. Bellows Type:
        1) Ashcroft General Service Series 1180.
        2) Ametek U.S. Gauge; Model 734.

b. Bourdon Tube Type:
   1) Ashcroft Duragauge Model 1279/1379.
   2) Ametek U.S. Gauge; Solfrunt Model 19XX.

B. P7 Pressure Differential Transmitter

6. General:
   a. Function:
      1) Measure differential pressure.
      2) Transmit signal proportional to either differential pressure or square root of differential pressure, as applicable.
   b. Type:
      1) Electronic variable capacitance or silicon strain gauge.
      2) Two-wire transmitter; "smart electronics".
   c. Parts: Transmitter and accessories.
7. Performance:
   a. Range: As noted.
      1) Select transmitter's factory upper range limit (URL) such that upper boundary of noted range is as close as possible to 80 percent of factory URL, but does not exceed it.
   b. Accuracy: Plus or minus 0.10 percent of span, unless otherwise noted.
   c. Ambient Operating Temperature: Minus 40 degrees F to plus 175 degrees F, with integral meter.
   d. Process Operating Temperature: Minus 40 degrees F to plus 250 degrees F.
   e. Humidity: 0 to 100 percent relative humidity.
   f. Hazardous Location Certifications: If and as noted.
8. Features:
   a. Linear or square-root output, user-configurable.
   b. Factory preconfigure for square root output if transmitter tagged as "FT" or "FIT".
   c. Adjustable damping.
   d. LCD indicator, unless otherwise noted.
      1) Display in either percent or engineering units, field configurable.
   e. Wetted Metallic Parts: Type 316 stainless steel, unless otherwise noted.
      1) Includes drain/vent valves; process flanges and adapters, and process isolating diaphragm.
   f. Wetted O-Rings: Glass-filled TFE, graphite-filled PTFE, or Viton, unless otherwise noted.
   g. Bolts and Nuts (if required): Type 316 stainless steel, unless otherwise noted.
   h. Fill Fluid: Silicone, unless otherwise noted.
9. Process Connections:
   a. Line Size: 1/2 inch.
   b. Connection Type: FNPT.
   c. Direct/remote Diaphragm Seal: If and as noted.

10. Signal Interface:
    a. 4 mA to 20 mA dc output with digital signal based on HART protocol, unless otherwise noted below.
        1) Nominal Maximum Loop Resistance with External 24V dc Power Supply: 550 ohms.
    b. FOUNDATION Fieldbus Protocol: If noted.
    c. Profibus: If noted.
11. Enclosure:
    a. Type: NEMA 4X.
    b. Materials: Coated aluminum, unless otherwise noted.
    c. Mounting bracket, unless otherwise noted.
        1) Bracket and Accessories: Stainless steel; suitable for mounting transmitter to panel or 2-inch pipe.
12. Accessories:
    a. Three-valve manifold, unless otherwise noted.
        1) Includes one equalization and two isolation valves.
        2) Type 316 stainless steel.
13. Manufacturers and Products:
    a. Rosemount; Model 3051 CD.
    b. Foxboro; Model IDP10.
    c. SMAR; LD30XD Series.

C. P9 Pressure Transmitter:

1. General:
    a. Function: Measure pressure and transmit signal proportional to pressure.
    b. Type:
        1) Electronic variable capacitance or silicon strain gauge.
        2) Two-wire transmitter; “smart electronics”.
    c. Parts: Transmitter and accessories.
2. Performance:
    a. Fluid: Air, unless otherwise noted.
    b. Range: As noted.
        1) Select transmitter’s factory upper range limit (URL) such that upper boundary of noted range is as close as possible to 80 percent of factory URL, but does not exceed it.
    c. Accuracy: Plus or minus 0.075 percent of span, unless otherwise noted.
    d. Ambient Operating Temperature: Minus 5 degrees F to plus 140 degrees F, with integral meter.
    e. Process Operating Temperature: 33 degrees F to plus 150 degrees F.
    f. Humidity: 0 to 100 percent relative humidity.
    g. Hazardous Location Certifications: If and as noted.
3. Features:
    a. Type: Gauge pressure, unless otherwise noted.
    b. Adjustable damping.

c. LCD indicator, unless otherwise noted.
   1) Display in either percent or engineering units, field configurable.
d. Wetted Metallic Parts: Type 316 stainless steel, unless otherwise noted.
   1) Includes drain/vent valves; process flanges and adapters, and process isolating diaphragm.
e. Wetted O-Rings: Glass filled TFE, graphite filled PTFE, or Viton, unless otherwise noted.
f. Bolts and Nuts (if required): Type 316 stainless steel, unless otherwise noted.
g. Fill Fluid: Silicone, unless otherwise noted.

4. Process Connections:
   a. Line Size: 1/2 inch.
   b. Connection Type: FNPT.
   c. Direct/remote Diaphragm Seal: If and as noted.
5. Signal Interface:
   a. 4mA to 20 mA dc output with digital signal based on HART protocol, unless otherwise noted below.
      1) Nominal Maximum Loop Resistance with External 24V dc Power Supply: 550 ohms.
   b. FOUNDATION fieldbus protocol: If noted.
6. Enclosure:
   a. Type: NEMA 4X.
   b. Materials: Coated aluminum, unless otherwise noted.
   c. Mounting bracket, unless otherwise noted.
      1) Bracket and Accessories: Stainless steel; suitable for mounting transmitter to panel or 2-inch pipe.
7. Accessories:
   a. Two-valve (isolate and vent) Stainless Steel Manifold: Required unless otherwise noted.
8. Manufacturers and Products:
   a. Gauge Pressure Units:
      1) Rosemount; Model 3051 TG.
      2) Foxboro; Model IGP20.
      3) SMAR; LD30XM Series.

2.07 SYSTEM COMPONENTS

A. Y40 Uninterruptible Power Supply:

1. General:
   a. Function: Provides isolated, regulated uninterrupted ac output power during a complete or partial interruption of incoming line power.
   b. Major Parts: Inverter, battery charger, sealed battery.

2. Performance:
    a. Capacity: As required to meet backup runtime.
    b. Input Power:
        1) 120 V ac single phase, 60-Hz, unless otherwise noted.
        2) Connections: Manufacturer's standard, unless otherwise noted.
    c. Output Power:
        1) 120 V ac single phase, 60-Hz, unless otherwise noted.
        2) Connections: Manufacturer's standard, unless otherwise noted.
    d. On-line Efficiency: 85 percent minimum, unless otherwise noted.
    e. Transfer time: 6 ms nominally.
    f. Backup Runtime:
        1) Full Load: 2 minutes minimum, unless otherwise noted.
    g. Continuous no-break power with no measurable transfer time.
    h. Sine-Wave Output Voltage Total Harmonic Distortion (THD): Plus or minus 6 percent or less.
    i. Input Voltage Range: Plus 10 percent, minus 20 percent.
    j. Output Voltage Regulation: Plus or minus 5 percent nominal.
    k. Operating Temperature: 0 degrees to 50 degrees C
    l. Operating Relative Humidity: 0 percent to 95 percent without condensation.
    m. UL listed: UL 1778 listed meeting UL 508 requirements without derating panel.
3. Features:
    a. Bypass Switches: As noted.
    b. Enclosure: DIN rail mountable, unless otherwise noted.
4. Manufacturers and Products: APC, or Equal.

B. Y55 PLC, Compact Unit

1. General:
    a. Function: Provides both open and closed loop control functions.
    b. Type: Expandable with external expansion modules.
    c. Provide method to backup operator inputted or adjusted set point or variable to automatically restore last entered set point or variable upon restart from power failure.
2. Environmental:
    a. Ambient Operating Temperature:
        1) Horizontal Installation: 0 to 55 degrees C.
        2) Vertical Installation: 0 to 45 degrees C.
    b. Relative Humidity: 5 to 95 percent RH.
3. Processor:
    a. Program Memory: 8 KB, typically 2.6 K statements.
    b. Data Memory: 2.5 K words.
    c. Memory Cartridge: If noted.
    d. Program and Data Backup: Integrated EEPROM.

e. Programming Language: LAD, FBD, and STL.
f. Program Execution:
    1) Free scan cycle.
    2) Interrupt controlled.
    3) Time controlled (1 to 255 ms).
g. Processing Times for Bit Operations: 0.37 ms.
h. Cycle Time Monitoring: 300 ms.
i. Memory bits: 256.
j. Counters: 256.
k. Timers: 256.
l. Communication Interfaces:
    1) Integrated EtherNet I/P.
m. Instruction Set:
    1) Basic Operations: Binary logic, operations, result allocations, save, count, load, transfer, compare, shift, rotate, form complement, call subroutines with parameter passing.
    2) Enhanced Functions: Pulse duration modulation, pulse sequence commands, jump commands, loop commands, code conversions, math functions, integer and floating point arithmetic.
    3) Manufacturer and Product: Allen-Bradley, CompactLogix L33ER processor.

4. I/O Subsystem:
    a. General: Pluggable I/O Terminals.
    b. Digital Inputs:
        1) 24V dc.
        2) Galvanic Isolation: Optocoupler, in groups of 13 and 11.
        3) Input Delay: 0.2 to 12.8 ms (adjustable).
        4) Cable Lengths:
        5) Unshielded: 300 meters max.
        6) Shielded: 500 meters max.
    c. Digital Outputs:
        1) Relay Type:
            a) 2 amps between 5 to 30V dc.
            b) 2 amps between 20 to 250V ac.
        2) Contact Life:
            a) Mechanical: 10 million.
            b) With Rated Load Voltage: 100,000.
        3) Short Circuit Protection: Provide externally.
        4) Cable Lengths:
            a) Unshielded: 150 m.
            b) Shielded: 500 m.

5) Isolation:
   a) Between 24V dc and 24V dc: 500V dc.
   b) Between 24V dc and 230V ac: 1500V ac.

d. Analog Inputs:
   1) 8-channels.
   2) 4-20mA Inputs.

e. Analog Outputs:
   1) 4-channels.
   2) 4-20mA Outputs.

5. Power Supply: Include 120V ac Input, 24V dc Output PLC Power Supply.
6. Manufacturer Model: Allen-Bradley CompactLogix series CPU and I/O modules.

END OF SECTION

SECTION 40 95 80
FIBER OPTIC COMMUNICATION SYSTEM

PART 1 GENERAL

1.01 REFERENCES

A. The following is a list of standards that may be referenced in this section:

1. Electronic Components, Assemblies, and Materials Association (ECA): 310-E, Cabinets, Racks, Panels, and Associated Equipment.
2. Institute of Electrical and Electronic Engineers, Inc. (IEEE): 802.3, Telecommunications and Information Exchange Between Systems—Local and Metropolitan Networks.
3. Insulated Cable Engineers Association (ICEA):
   a. S-83-596, Optical Fiber Premises Distribution Cable.
   b. S-87-640, Optical Fiber Outside Plant Communications Cable.
   c. S-104-696, Indoor-Outdoor Optical Fiber Cable.
4. International Organization for Standardization (ISO): 9001, Quality Management Systems—Requirements.
5. International Telecommunication Union (ITU): T G.652, Characteristics of a Single-mode Optical Fibre and Cable.
6. National Fire Protection Association (NFPA): 70, National Electrical Code (NEC).
7. QuEST Forum (QF): TL 9000, Quality Management Systems.
8. Rural Development Utilities Programs (RDUP):
   a. 7 CFR 1755.902, Minimum Performance Specification for Fiber Optic Cables.
   b. 7 CFR 1755.903, Fiber Optic Service Entrance Cables.
9. Telecommunications Industry Association (TIA):
   a. 526-7, OFSTP-7 Measurement of Optical Power Loss of Installed Single-Mode Fiber Cable Plant.
   b. 526-14, OFSTP-14 Optical Power Loss Measurements of Installed Multimode Fiber Cable Plant.
   c. 568-C.1, Commercial Building Telecommunications Cabling Standards.
   d. 568-C.3, Optical Fiber Cabling Components Standard.
   e. 598, Optical Fiber Cable Color Coding.
   f. 606, Administration Standard for Commercial Telecommunications Infrastructure.
10. Telecommunications Industry Association/Electronics Industry Association (TIA/EIA):
    a. 455-78, FOTP-78 - IEC 60793-1-40 Optical Fibres Part 1-40: Measurement Methods and Text Procedures – Attenuation.

b. 455-133, FOTP-133 IEC-60793-1-22 Optical Fibres Part 1-22: Measurement Methods and Test Procedures Length Measurement.
c. 492AAAA, Detail Specification for 62.5-Micrometer Core Diameter/125-Micrometer Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers.
d. 492AAAB, Detail Specification for 50-Micrometer Core Diameter/125-Micrometer Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers.
e. 492AAAC, Detail Specification for 850-nm Laser-Optimized, 50-um Core Diameter/125-um Cladding Diameter Class Ia Graded-Index Multimode Optical Fibers.
f. 492CAAA, Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers.
g. 492CAAB, Detail Specification for Class IVa Dispersion-Unshifted Single-Mode Optical Fibers with Low Water Peak.
h. 604-2, FOCIS-2 Fiber Optic Connector Intermateability Standard, Type ST.
i. 604-3, FOCIS-3 Fiber Optic Connector Intermateability Standard, Type SC and SC-APC.
j. 604-12, FOCIS-12 Fiber Optic Connector Intermateability Standard, Type MT-RJ.
k. 942, Telecommunications Infrastructure Standard for Data Centers.
l. TSB-140, Additional Guidelines for Field-Testing Length, Loss and Polarity of Optical Fiber Cabling Systems-Contains Color.

11. Underwriter Laboratories (UL): 94, Tests for Flammability of Plastic Materials for Parts in Devices and Appliances.

1.02 DEFINITIONS

A. ATM: Asynchronous Transfer Mode.

B. AUI: Attachment Unit Interface.

C. dB: Decibel.

D. DNI: Desktop Network Interface.

E. EMB: Effective Modal Bandwidth.

F. ETL: Electrical Test Laboratories.

G. FDDI: Fiber Distributed Data Interface.

H. FIM: Facilities Information Management.

I. Flux Budget: Difference between transmitter output power and receiver input power required for signal discrimination when both are expressed in dBm.

J. FOCS: Fiber Optic Communication System.

K. FOIRL: Fiber Optic Inter Repeater Link.

L. Fusion Splice: Connecting ends of two fibers together by aligning fiber ends and applying electric arc to fuse ends together.

M. Hybrid Cable: Cable containing more than one type of fiber.

N. LAN: Local Area Network.

O. LIMS: Laboratory Information Management System.

P. m: Micrometer.

Q. Mbps: Megabits per Second.

R. Mechanical Splice: Connecting ends of two fibers together by means other than fusion.

S. Megahertz (MHz): One million cycles per second.

T. MHz: Megahertz.

U. micro: x 10^{-6}.

V. Micron: Micrometer or one millionth meter.

W. MIS: Management Information System.

X. n, nano: x 10^{-9}.

Y. N: Newton.

Z. nm: Nanometer—unit of measure equal to one billionth meter.

AA. OFL: Over-filled Launch.

BB. OFN: Nonconductive Optical Fiber Cable.

CC. OFNP: Nonconductive Optical Fiber Plenum Cable.

DD. OFNR: Nonconductive Optical Fiber Riser Cable.

EE. OLTS: Optical Loss Test Sets.

FF. OTDR: Optical Time Domain Reflectometer.

GG. OVD: Outside Vapor Deposit.

HH. PIC: Process Instrumentation and Control.

II. Plenum: Air return path of central air handling system, such as open space above suspended ceiling.

JJ. RLM: Restricted Mode Launch.

KK. ROL: Reverse Oscillation Lay.

LL. SPC: Super Physical Contact.

MM. UPC: Ultra Physical Contact.

NN. UPS: Uninterruptible Power Supply.

OO. V ac: Volts Alternating Current.

PP. WAN: Wide Area Network.

1.03 SYSTEM DESCRIPTION

A. Function of FOCS is to transmit digital data between network nodes. Requirements listed identify minimum acceptable system performance.

B. Provide a FOCS based on referenced standards for use in the following local and wide area networks: Fast Ethernet.

C. Network(s) will be used by PIC to distribute data and coordinate Owner's operations.

1.04 SUBMITTALS

A. Action Submittals:

1. Site Layout Diagram Showing:
   a. Access holes, with identification.
   b. Abovegrade cable routings, with pole and cable identification.
   c. Belowgrade conduit routings between access holes and buildings, with conduit counts and identification.
   d. Belowgrade innerduct routings through conduits, with innerduct counts and identification.
   e. Cable routings through innerducts and to patch panels, fiber centers, or network nodes, with cable and node identification.

2. Cable Schedule Showing:
    a. Cable identification.
    b. Fiber counts for each cable and identification of used fiber pairs.
    c. Cable length and attenuation, with two connector pairs and no splice(s), based on TIA 568-C.3, Annex H.
3. Component Data:
    a. Manufacturer and model number.
    b. General data and description.
    c. Engineering specifications and data sheet.
    d. Scaled drawings and mounting arrangements.

B. Informational Submittals:

1. Manufacturer's statement that installer is certified to perform installation Work.
2. Subcontractor Qualifications:
    a. FOCS Subcontractor: Minimum of 5 years' experience providing, integrating, installing, and commissioning of similar systems.
        1) Statement of Experience: List of at least three fiber optic data communications systems comparable to system specified which have been furnished and placed into operation. For each system, provide following information:
            a) Owner's name, address, telephone number, and name of current operations supervisor or other contact.
            b) Description of system hardware configuration, including major equipment items, number of nodes, and communication standards implemented.
            c) System block diagram.
            d) Dates when contract was signed, equipment was delivered, and system was accepted by Owner. Also, include originally scheduled completion date and if different from actual date, explain why.
            e) Approximate value of listed FOCS provided in dollars.
            f) Detailed horizontal and riser routing.
            g) Distribution frame arrangements.
            h) Fiber and termination identification, including spares.
    b. FOCS Subcontractor's Site Representative: Minimum of 5 years' experience installing similar systems.
    c. Qualification of Personnel:
        1) Resumes identifying management and technical qualifications of supervisory, local service representative, and key personnel.
        2) Qualification data of firm and persons to demonstrate capabilities and experience in the following areas:
            a) Fiber optic cable handling and placement techniques.
            b) Fiber optic splicing and installation of connections.
            c) Attenuation testing procedures.

d. Owner acceptance of FOCS Subcontractor does not exempt FOCS Subcontractor or Contractor from meeting Contract Document requirements nor does it give prior acceptance of subsystems, equipment, materials, or services.
e. Sample of Network Test Report, minimum 10 pages, that Contractor generated in a previous project.
f. Testing and acceptance plan, 30 days prior to beginning of testing.
g. Fiber test results. Documentation covering fiber facility testing, not later than 2 days after testing, showing:
    1) Manufacturer's tag of attenuation per fiber as recorded from OTDR reading before shipment.
    2) Attenuation of each fiber upon delivery to Site.
    3) Attenuation of each fiber plus connector after installation as recorded from OTDR with tracing.
    4) Flux Budget calculations with comparison to measured attenuation for each run verifying adequate optical signal strength.
h. For each maintenance organization, identify location of base of service and how required coverage will be achieved.

3. Manufacturer's Certificate of Compliance, in accordance with General Requirements.
4. Manufacturer's suggested installation practice.
5. Operation and Maintenance Data: As specified in Section 00 17 30, Operation and Maintenance Data.

1.05 ENVIRONMENTAL REQUIREMENTS

A. Optical Fiber Cable and Cable Splice Centers:

1. Outside, Underground/Submerged: Minus 20 degrees C to 40 degrees C.
2. Outside, Overhead: Minus 40 degrees C to 80 degrees C.
3. Outside, Aboveground in Conduit: Minus 40 degrees C to 80 degrees C.
4. Inside: 0 degree C to 40 degrees C.

B. Equipment:

1. Outside, Aboveground: Minus 40 degrees C to 80 degrees C.
2. Control Rooms, Equipment Rooms, and Telecommunications Closets: 30 percent to 55 percent relative humidity, 18 degrees C to 24 degrees C.
3. Other Interior Areas: 0 percent to 100 percent relative humidity, 5 degrees C to 35 degrees C.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Cable:
   a. ISO 9001 or QF TL 9000 registered, whichever applies to material.
   b. Minimum of 20 years in manufacturing optical fiber cable in order to demonstrate reliable field performance.
2. Housing: ISO 9001 and QF TL 9000 registered.
3. Connector:
   a. ISO 9001 or QF TL 9000 registered.
   b. Minimum 10-year history of manufacturing and supporting connector technology that does not require epoxy or polishing in field.
4. Jumper Cable: ISO 9001 and QF TL 9000 registered.

B. Installer Qualifications:

1. Individuals with at least 3 years of experience with projects utilizing fiber optic cable in compliance with TIA 568-C.3.
2. Certified by fiber cable manufacturer.

C. Tester Qualifications: Individuals with at least 3 years of experience with projects utilizing fiber optic cable in compliance with TIA 568-C.3.

1. Technician: Successfully attended training program, which includes testing with an OLTS and an OTDR and have obtained a certificate as proof thereof. Certificate may have been issued by the following organizations or an equivalent organization:
   a. Manufacturer of fiber optic cable and fiber optic connectors.
   b. Manufacturer of test equipment used for field certification.
   c. Other independent training organizations acceptable to Owner.

D. Provide connectors/coupling, splicing enclosures, mounting hardware, and miscellaneous accessories for fibers by same manufacturer.

1.07 SPECIAL GUARANTEE

A. Provide manufacturer's extended guarantee or warranty, with Owner named as beneficiary, in writing, as special guarantee. Special guarantee shall provide for correction, or at option of Owner, removal and replacement of Work specified in this specification section found defective during a period of 5 years after date of Substantial Completion. Duties and obligations for correction or removal and replacement of defective Work shall be as specified in General Conditions.

1.08 EXTRA MATERIALS

A. Furnish, tag, and box for shipment and storage the following materials.

Item	Quantity
Jumpers of each length needed	100 %

B. Delivery: In accordance with General Requirements.

PART 2 PRODUCTS

2.01 MULTIMODE FIBER OPTIC CABLE

A. 50/125 and 62.5/125-micron, graded-index for use in backbone and horizontal distribution subsystems, meets or exceeds the requirements of TIA 568-C.3, including the following specifications:

1. Maximum Mean Fiber Loss:
   a. 3.5 dB per km at 850 nm.
   b. 1.5 dB per km at 1,300 nm.
2. Minimum OFL Bandwidth:
   a. OM1-200 MHz•km minimum at 850 nm; TIA 492AAAA.
   b. 500 MHz•km minimum at 1,300 nm.
3. Distance Capacity per IEEE 802.3:
   a. 100Mbit Ethernet: OM1 300m at 850 nm and 2,000m at 1,310 nm.
   b. 1 Gbit Ethernet: OM1 300m at 850 nm and 550 at 1,310 nm.

B. Type 62.5/250 OM1, Backbone for Underground Conduit Installation:

1. Assembly:
   a. Nonmetallic, gel-free, dry water blocked, loose-tube fiber core with dielectric strength member enclosed by nonmetallic cross-ply sheath; requires buffer tubing.
   b. Cable: Comply with ICEA S-87-640.
2. NEC/UL Listing: None; not approved for general use within building except when installed in metallic conduit.
3. Protective Covering: Black, antifungus, UV-resistant, polyethylene jacket with rip-cord.
4. Minimum Short Term Pull Strength: 600 lbf.
5. Manufacturers and Products:
   a. Corning Cabling Systems; ALTOS loose-tube dielectric cable.
   b. Mohawk; Outdoor loose-tube cable.

C. Type 62.5/250 OM1, Backbone for Underground Conduit and Building Riser Installation:

1. Assembly:
   a. Nonmetallic, gel-free, dry water blocked, loose-tube fiber core with dielectric strength member enclosed by nonmetallic cross-ply sheath; requires buffer tubing.
   b. Cable: Comply with ICEA S-104-696.
2. NEC/UL Listing: OFNR.
3. Protective Covering: Black, flame and UV-resistant, thermoplastic jacket with rip-cord.
4. Minimum Short Term Pull Strength: 600 lbf.
5. Manufacturers and Products:
   a. Corning Cabling Systems; FREEDM cable.
   b. Mohawk; RiserLite loose-tube cable.
   c. Approved Equal.

D. Type 62.5/900 OM1, Indoor/Outdoor Cable:

1. Assembly:
   a. Distribution Style with core of individually tight-buffered fibers surrounded by nonmetallic sheath.
   b. Cable: Comply with ICEA S-83-596.
2. Protective Covering: Flame retardant outer jacket with pull string.
3. NEC/UL Listing: OFNR.
4. Manufacturers and Products:
   a. Corning Cabling Systems; (MIC) cable.
   b. Mohawk; Distribution Riser cable.
   c. Approved Equal.

2.02 MULTICELL CONDUIT SYSTEM

A. Innerduct:

1. Function: Installs into conduit system provided by others, to provide smooth, low-friction path through conduit, with only one cable per path to facilitate changing individual cables.
2. Features:
   a. Type: Annular, corrugated innerduct.
   b. Material: HDPE.
   c. Color Code: Orange, blue, green, brown, white, or grey.
   d. Strength: Minimum 600-pound tensile strength, with no more than 5 percent ovalization at 600-pound tension.
   e. Lubrication: Prelubricated.
3. Manufacturers:
   a. Endocor.
   b. Dura-Line.

2.03 ETHERNET FIBER-TO-COPPER TRANSCEIVERS

A. Function: Convert half/full-duplex fiber optic ethernet signal to copper ethernet signal and vice versa.

B. Speed: Auto-negotiating 10/100/1000 Mbps.

C. Features:

1. Support fiber optic type specified.
2. Fiber Optic Connectors: ST.
3. Copper Connector: RJ45.
4. Power:
   a. Powered by signal.
   b. 120V ac.
5. Mounting: Suitable for permanent mounting.

D. Manufacturers:

1. ATI Centre.
2. Hewlett-Packard.
3. Black Box Corporation.

2.04 FIBER CENTERS

A. Function: Provides secure place to terminate fiber optic cables.

B. Features:

1. Compartments: Two; one for fiber optic cable, one for jumpers to individual equipment.
2. Coil Former: Former to wind slack cable around, provides controlled long radius bends.
3. Connectors: Minimum 24 ST connectors for entry and exit.
4. Size: Maximum 450 mm by 300 mm by 100 mm.
5. Construction: 1.5-mm steel with corrosion proof finish.
6. Mountings: Suitable for permanent attachment as shown, or provide separate mountings that do not obscure covers and doors.
7. Doors: Separate doors for cable and jumper terminations and lockable.

C. Manufacturers:

1. Ortronics.
2. AT&T.
3. Siecor.

2.05 CONNECTORS

A. General:

1. Comply with TIA/EIA 604-2, TIA/EIA 604-3, TIA/EIA 604-12, and TIA 568-C.3.
2. Pull Strength: 0.2 N minimum.
3. Durability: Sustain minimum 500 mating cycles without violating other requirements.
   a. Ferrules: Free-floating low loss ceramic.
   b. Polarizing key on duplex connector systems.
4. Attenuation:
   a. In accordance with TIA 568-C.3.
   b. Maximum of 0.75 dB per connector pair.
5. Manufacturer: AMP.

2.06 PATCHCORDS

A. General:

1. In accordance with TIA 568-C.3.
2. Function: Connect fiber centers to network nodes, such as computer workstations.
3. Fiber Characteristics: In accordance with requirements for fiber optic cable.
4. Cable Configuration:
   a. Individual tight-buffer thermoplastic, fibers single or multimode, to match fibers being jumpered on.
   b. Protected with kevlar strength members and enclosed in thermoplastic jacket.
5. Length: Standard, to meet requirements shown, plus minimum 3 meters at workstations.
6. Connectors:
   a. As required by Article Connectors.
   b. On-axial Pull Strength: 33 N.
   c. Normal-to-Axial Pull Strength: 22 N.
7. Cable Rating: OFNR or OFNP.
8. Color: Per standards or as indicated.
9. Measured for insertion loss with the following values for each connector: Typical of 0.3 dB and maximum of 0.5 dB (LC typical of 0.1 dB and maximum of 0.3 dB).

2.07 CONDUIT

A. In accordance with Section 26 05 33, Raceway and Boxes.

2.08 ACCESSORIES

A. Hardware: Provide cable clamps, strain reliefs, blocking and grommet kits, closures, and fan outs for complete installation.

PART 3 EXECUTION

3.01 PREPARATION

A. Conduit:

1. Ensure installed conduit system conforms to fiber optic system requirements, including:
   a. Conduits and Innerducts: Size and number.
   b. Access Holes, Handholes, and Pull Boxes: Location and size, to ensure cables and innerducts may be installed without exceeding manufacturer's limitations.
   c. Outlet Boxes: Size to coordinate with outlet cover plates for adequate volume and bend radius.
2. Spare Conduit:
   a. No cables shall be pulled into spare conduit.
   b. 100 percent spare conduit capacity required for buried conduit only. For example, for every conduit with one or more cables in it, there shall be one spare equal-size conduit with no cables.
   c. Spare conduit need not have innerduct installed.
3. Expansion Plugs: Seal conduit to stop ingress of water and grit with fabricated expansion plugs.
4. Ensure duct bank, conduit, and other confined routing is free and clear of debris before cable placement.

B. Multicell Conduit System:

1. Cabled Innerducts: Seal cables into innerducts to stop ingress of water and grit with fabricated expansion seals that have separate seals for each cable.
2. Empty Innerducts: Seal empty innerducts immediately after installation to stop ingress of water and grit with fabricated expansion plugs. Remove plugs as required to install cables.

C. Innerduct:

1. In accordance with manufacturer's recommendations.
2. In all installed fiber optic conduits.
3. Install no more than one innerduct of each color in single conduit.
4. Terminate innerducts in conduit with fabricated termination kits.
5. Identify innerducts at both ends by methods such as color-coding or waterproof tags wired through innerduct wall.
6. Sealing:
   a. Cabled Innerducts: Seal cables into innerducts to stop ingress of water and grit with fabricated expansion seals that have separate seals for each cable.

b. Innerduct to Conduit: Seal gaps between innerducts and conduit with sealing compound such as 3M Ductseal.
c. Empty Innerducts: After installation, seal with fabricated expansion plugs to stop ingress of water and grit. Remove plugs as required to install cables.

3.02 INSTALLATION

A. Fiber Optic Cable:

1. Specified fiber counts, routing, origination, and terminating points are indicated on Drawings.
2. Installation by manufacturer's certified installer.
3. Install cables in accordance with manufacturer's requirements.
4. Install cable directly from shipping reels. Ensure that cable is:
   a. Not dented, nicked, or kinked.
   b. Not subjected to pull stress greater than manufacturer's specification.
   c. Not bent to a radius below manufacturer's minimum bend radius.
   d. Not subjected to treatment that may damage fiber strands during installation.
5. Cables per Conduit or Innerduct: In accordance with NFPA 70 NEC conduit fill limitations.
6. If calculation indicates cable will attenuate signals more than 8 dB, reroute may be allowed if approved by Engineer.
7. Connector: Insertion loss on multimode connections exceeding 0.5 dB and 0.4 dB on single-mode connections not permitted.
8. Identification:
   a. Identify cable on both ends, in access holes, and pull points.
   b. In accordance with TIA 606.
9. Arrange cable, equipment, and hardware to provide neat appearance and accessibility for servicing.
10. Access Holes:
    a. Provide supports for cables in access and handholes**.**
    b. While maintaining minimum bend radius, lace cables neatly to supports to keep them out of way of personnel.

B. Fiber Center, Fiber Distribution Frame, Housing, Panel, Splice Tray: Install securely in field panels or enclosures as shown on Drawings.

C. Cable Terminations:

1. In accordance with TIA 568-C.3.
2. Fan out fiber cable to allow direct connectorization of connectors.
   a. Sleeve over individual fibers with transparent furcation tubes.
   b. At point of convergence of furcation tubes, provide strain relief with metal or high density plastic fan-out collar.

3. Break-out Kits:
   a. Terminate cables using manufacturer-supplied break-out kits.
   b. Terminate in accordance with manufacturer's recommendations.
4. Slack:
   a. Fiber Centers, Hubs, and Switches: Minimum, 3-meter slack fiber at each end, coiled neatly in cable management equipment.
   b. Communications Management Outlets: Minimum, 1-meter slack fiber, coiled neatly in outlet box.
5. Connectors:
   a. Terminate 100 percent fibers in each cable to specified connector.
   b. Connect into fiber management system.

D. Ethernet Fiber-to-Copper Transceivers:

1. Install transceivers in accordance with manufacturer's instructions.
2. Location: Install transceivers securely in field panels, close to network nodes and fiber centers.
3. Power: Energize each transceiver from its field panel's UPS, if applicable.
4. Connections:
   a. Connect transceiver to fiber optics and network node.
   b. Lace fiber optics neatly in place, routed through wireways.

E. Conduit: Install in accordance with Section 26 05 33, Raceway and Boxes.

3.03 LABELING CONVENTIONS

A. Conform to TIA 606 or to requirements specified by Owner or Owner's representative.

B. Backbone (Riser) Cables:

1. Multiconductor cables connecting main distribution field to an intermediate distribution field, usually a wiring closet or cabinet, and are labeled at each terminating end. Label name identifies each endpoint, cable medium, and number of conductors as follows:
   a. Copper: IDF-MDF-C-PPP-N.
   b. Fiber: IDF-MDF-F-MMM, SSS-N.

Where:

IDF	Is the 3-5 position IDF/wiring closet/building code
MDF	Is the 3-5 position MDF (or IDF) code
F	Fiber
PPP	Is pair count of a copper cable
MMM	Is multimode strand count
SSS	Is single-mode strand count
N	Is a sequential number

C. Horizontal (Station) Cables:

1. Connect jack stations to wiring closets or cabinets and are labeled at each end to identify wiring closet they connect to and sequential jack station number as follows:
   a. Data: IDF-D-NNN-A/B.
   b. Voice: IDF-V-NNN-A/B.

   Where:

IDF	Is the 3-5 position IDF/wiring closet/building code
D	Data cable (green)
V	Voice cable (gray)
NNN	Is the sequence number
A/B	Indicates left or right port in faceplate

3.04 FIELD QUALITY CONTROL

A. General:

1. Advise Engineer at least 72 hours in advance of each test. Engineer shall have option to witness and participate actively in tests.
2. In accordance with Section 01 91 14, Equipment Testing and Facility Startup.
3. Provide equipment, instrumentation, supplies, and skilled staff necessary to perform testing.
4. Outlets, cables, patch panels, and associated components shall be fully assembled and labeled prior to field testing.
5. Testing performed on incomplete systems shall be redone on completion of the Work.
6. Document Test Results: Confirm each cable has at least specified number of fibers that meet standards, in accordance with As-Built Fiber Optic Cable Installation form included as Supplement to this section.
7. Confirm quantities and sizes of conduit and innerduct, in accordance with As-Built Conduit/Innerduct Installation form included as Supplement to this section.

B. Test Equipment:

1. Field test instruments shall have latest software and firmware installed.
2. Optical Fiber Cable Testers:
   a. Field test instrument shall be within calibration period recommended by manufacturer.

b. Optical Loss Test Set (OLTS):
   1) Single-mode Optical Fiber Light Source:
      a) Provide dual laser light sources with central wavelengths of 1,310 nm (plus or minus 20 nm) and 1,550 nm (plus or minus 20 nm).
      b) Output Power: Minus 10 dBm, minimum.
      c) Manufacturer: Fluke Networks.
   2) Multimode Optical Fiber Light Source:
      a) Provide dual LED light sources with central wavelengths of 850 nm (plus or minus 30 nm) and 1,300 nm (plus or minus 20 nm).
      b) Output Power: Minus 20 dBm minimum.
      c) Meet launch requirements of TIA/EIA 455-78. This launch condition can be achieved either within the field test equipment or by use of an external mandrel wrap, as described in Clause 11 of TIA 568-C.3, with Category 1 light source.
      d) Manufacturer: Fluke Networks.
   3) Power Meter:
      a) Provide 850 nm, 1,300/1,310 nm, and 1,550 nm wavelength test capability.
      b) Power Measurement Uncertainty: Plus or minus 0.25 dB.
      c) Store reference power measurement.
      d) Save at least 100 results in internal memory.
      e) PC interface (serial or USB).
      f) Manufacturer: Fluke Networks.
   4) Optional Length Measurement: Capable of measuring optical length of fiber using time-of-flight techniques.

3. Optical Time Domain Reflectometer (OTDR):
   a. Bright, color transmissive LCD display with backlight.
   b. Rechargeable for 8 hours of normal operation.
   c. Weight with battery and module of not more than 4.5 pounds and volume of not more 200 cubic inches.
   d. Internal nonvolatile memory and removable memory device with at least 16 MB capacity for results storage.
   e. Serial and USB ports to transfer data to PC.
   f. Single-mode OTDR:
      1) Wavelengths: 1,310 nm (plus or minus 20 nm) and 1,550 nm (plus or minus 20 nm).
      2) Event Dead Zone: 2 meters maximum at 1,310 nm and 2 meters maximum at 1,550 nm.
      3) Attenuation Dead Zone: 15 meters maximum at 1,310 nm and 15 meters maximum at 1,550 nm.
      4) Distance Range: Minimum 10,000 meters.
      5) Dynamic Range: Minimum 10 dB at 1,310 nm and 1,550 nm.

g. Multimode OTDR:
   1) Wavelengths: 850 nm (plus or minus 20 nm) and 1,300 nm (plus or minus 20 nm).
   2) Event Dead Zone: 1 meter maximum at 850 nm and 2 meters maximum at 1,300 nm.
   3) Attenuation Dead Zone: 6 meters maximum at 850 nm and 15 meters maximum at 1,300 nm.
   4) Distance Range: 2,000 meters minimum.
   5) Dynamic Range: Minimum 10 dB at 850 nm and 1,300 nm.
h. Manufacturer: Fluke Networks.

4. Fiber Microscope:
   a. Magnification: 250X or 400X for end-face inspection.
   b. Manufacturer: Fluke Networks.
5. Integrated OLTS, OTDR, and Fiber Microscope:
   a. Test equipment that combines into one instrument such as OLTS, OTDR, and fiber microscope may be used.
   b. Manufacturer: Fluke Networks.

C. Conduit Test:

1. Test and seal spare conduits.
2. Conduit and Innerduct Testing:
   a. Blow full-diameter mouse through each spare conduit and innerduct to verify they are unrestricted over full length.
   b. If conduit is restricted over full length, advise Engineer.
3. Documentation: Confirm conduit test As-Built Conduit/Innerduct Installation form documentation includes details of innerducts.

D. Cable Testing:

1. Test procedures and field test instruments shall comply with applicable requirements of:
   a. LIA Z136.2.
   b. TIA/EIA 455-78.
   c. TIA/EAI 455-133.
   d. TIA 526-7.
   e. TIA 526-14.
   f. TIA 568-C.1.
   g. TIA 568-C.3.
   h. TIA TSB 140.
2. Test attenuation and polarity of installed cable plant with OLTS and installed condition of cabling system and its components with OTDR.
3. Verify condition of fiber end face.
4. Perform on each cabling link (connector to connector).
5. Perform on each cabling channel (equipment to equipment).

6. Do not include active devices or passive devices within link or channel other than cable, connectors, and splices. For example, link attenuation does not include such devices as optical bypass switches, couplers, repeaters, or optical amplifiers.
7. Document Tests:
   a. OLTS dual wavelength attenuation measurements for single-mode and multimode links and channels.
   b. OTDR traces and event tables for single-mode and multimode links and channels.

E. Fiber Testing Parameters:

1. Each cabling link shall be in compliance with the following test limits:
   a. Optical Loss Testing:
      1) Backbone (single-mode and multimode) Link:
         a) Calculate link attenuation by the formulas specified in TIA 568-C.1.
         b) Values for Attenuation Coefficient (dB/km) are listed in the table below:

Attenuation Coefficient				
Type of Optical Fiber	**Wavelength (nm)**	**Attenuation Coefficient (dB/km)**	**Wavelength (nm)**	**Attenuation Coefficient (dB/km)**
Single-mode (Inside plant)	1310	1.0	1550	1.0
Single-mode (Outside plant)	1310	0.5	1550	0.5
Multimode 62.5/125 µm	850	3.5	1300	1.5
Multimode 50/125 µm	850	3.5	1300	1.5

   b. OTDR Testing:
      1) Reflective Events: Maximum 0.75 dB.
      2) Nonreflective Events: Maximum 0.3 dB.
   c. Magnified Endface Inspection:
      1) Visually inspect fiber connections for end-face quality.
      2) Scratched, pitted, or dirty connectors shall be diagnosed and corrected.

F. Diagnosis and Correction:

1. Installed cabling links and channels shall be field tested and pass test requirements and analysis as described herein.

2. Link or channel that fails these requirements shall be diagnosed and corrected.
3. Document corrective action and follow with new test to prove corrected link or channel meets performance requirements.
4. Provide final and passing result of tests for links and channels.

G. Acceptance: Acceptance of test results shall be given in writing after Project is tested and completed in accordance with Contract Documents and satisfaction of Owner.

H. Test Execution:

1. Optical Fiber Cable Testing:
   a. Tests performed that use laser or LED in test set shall be carried out with safety precautions in accordance with LIA Z136.2.
   b. Link and channel test results from OLTS and OTDR shall be recorded in test instrument upon completion of each test for subsequent uploading to a PC in which administrative documentation may be generated.
      1) Record end-face images in memory of test instrument for subsequent uploading to a PC and reporting.
   c. Perform Testing:
      1) On each cabling segment (connector to connector).
      2) On each cabling channel (equipment to equipment).
      3) Using high-quality test cords of same fiber type as cabling under test.
         a) Test cords for OLTS testing shall be between 1 meter and 5 meters in length.
         b) Test cords for OTDR testing shall be approximately 100 meter for launch cable and at least 25 meters for receive cable.
2. Optical Loss Testing (OLTS):
   a. Backbone Link:
      1) Test single-mode at 1,310 nm and 1,550 nm in accordance with TIA 526-7, Method A.1, One Reference Jumper or equivalent method.
      2) Test multimode at 850 nm and 1,300 nm in accordance with TIA 526-14A, Method B, One Reference Jumper or equivalent method.
      3) Perform tests in both directions.
3. OTDR Testing:
   a. Test backbone, horizontal, and centralized links at appropriate operating wavelengths for anomalies and to ensure uniformity of cable attenuation and connector insertion loss.
      1) Single-mode: 1,310 nm and 1,550 nm.
      2) Multimode: 850 nm and 1,300 nm.

b. Test each fiber link and channel in one direction.
c. Install launch cable between OTDR and first link connection.
d. Install receive cable after last link connection.

4. Length Measurement:
    1) Record length of each fiber.
    2) Measure optical length using OLTS or OTDR.
5. Polarity Testing:
    a. Test paired duplex fibers in multifiber cables to verify polarity in accordance with subclause 10.3 of TIA/EIA 568-C.1.
    b. Verify polarity of paired duplex fibers using OLTS.
6. Test Results Documentation:
    a. Test results saved within field-test instrument shall be transferred into Windows-based database utility that allows for maintenance, inspection, and archiving of test records. These test records shall be uploaded to the PC unaltered. For example, “as saved in the field-test instrument.” The file format, CSV (comma separated value), does not provide adequate protection of these records and shall not be used.
    b. Available for inspection by Owner or Owner’s representative during installation period. Submit within 5 working days of completion of tests on cabling served by a telecommunications room or of backbone cabling.
    c. Database for project, including twisted-pair copper cabling links, if applicable, shall be stored and delivered on CD-ROM prior to Owner acceptance of building. CD-ROM shall include software tools required to view, inspect, and print test reports.
    d. Circuit IDs reported by test instrument shall match specified label identification.
    e. Provide in electronic database for each tested optical fiber with the following information:
        1) Identification of Site.
        2) Name of test limit selected to execute stored test results.
        3) Name of personnel performing test.
        4) Date and time test results were saved in memory of tester.
        5) Manufacturer, model, and serial number of field test instrument.
        6) Version of test software and version of test limit database held within test instrument.
        7) Fiber identification number.
        8) Length for Each Optical Fiber: Optionally the index of refraction used for length calculation when using a length capable OLTS.
        9) Test results to include OLTS attenuation link and channel measurements at appropriate wavelength and margin; difference between measured attenuation and test limit value.
        10) Test results to include OTDR link and channel traces, and event tables at appropriate wavelength.

11) Length for each optical fiber as calculated by the OTDR.
12) Overall pass/fail evaluation of link-under-test for OLTS and OTDR measurements.

I. Drawings:

1. Record Copy: Provide at end of Project on CD-ROM.
   a. CAD format and include notations reflecting as-built conditions of additions and variations from Drawings provided, such as to cable path and termination point.
   b. CAD drawings are to incorporate test data imported from test instruments.
2. As-built Drawings:
   a. Include, but not limited to block diagrams, frame and cable labeling, cable termination points, equipment room layouts, and frame installation details.
   b. Include field changes made up to construction completion:
      1) Field directed changes to pull schedule.
      2) Field directed changes to cross connect and patching schedule.
      3) Horizontal cable routing changes.
      4) Backbone cable routing or location changes.
      5) Associated detail drawings.

3.05 TRAINING

A. Train Owner's staff in the following skills:

1. Connectorizing fibers.
2. Splicing optical fiber cables, including fiber splices.
3. Testing quality of connectors, splices and fibers.

B. Schedule: Provide two 4-hour training sessions on consecutive weekdays, to suit Owner's schedule.

C. Materials: Provide hardware for training, including fibers, connectors, and splice kits.

3.06 SUPPLEMENTS

A. Supplements listed below, following "End of Section," are part of this Specification.

1. As-Built Fiber Optic Cable Installation Form.
2. As-Built Conduit/Innerduct Installation Form.

END OF SECTION

PROJECT: NRWRF INJECTION WELL INFRASTRUCTURE

Contractor:

Signed by:

AS-BUILT FIBER OPTIC CABLE INSTALLATION

Cable Identification:
Routing: From: In:
(Identify field panel, control room, etc. in building)

Through: 1
(Identify access hole, building, gallery, etc.)
Through: 2 Through: 5
Through: 3 Through: 6
Through: 4 Through: 7
To: In:
See As-Built Conduit/Innerduct Installation forms for identification of conduits/innerducts cable is routed through.

Acceptable Attenuation:
Multimode Fibers

		cable length*		
850 nm:	3.5 dB/km x	km + 1.5 dB =		dB
1300 nm:	1.0 dB/km x	km + 1.5 dB =		dB

*Contractor to provide actual length installed, within ±0.1 km.

Fiber ID	Use/Spare	Measured Attenuation (dB)			
		Hub-to-Node		Node-to-Hub	
		850 nm	1,300 nm	850 nm	1,300 nm

Single-mode Fibers

		cable length*	
1310 nm:	1.0 dB/km x	km + 1.5 dB =	dB
1550 nm:	1.0 dB/km x	km + 1.5 dB =	dB

*Contractor to provide actual length installed, within ±0.1 km.

Fiber ID	Use/Spare	Measured Attenuation (dB)			
		Hub-to-Node		Node-to-Hub	
		1,310 nm	1,550 nm	1,310 nm	1,550 nm

PROJECT: NRWRF INJECTION WELL INFRASTRUCTURE

Contractor:

Signed by:

AS-BUILT CONDUIT/INNERDUCT INSTALLATION

From: To:

(Identify building, access hole, field panel, etc.) Sheet 1 of 1

Conduits:
Used: 4 inches; 2 inches
Spare: 4 inches; 2 inches Confirm all spares unrestricted: Yes/No
(Provide number of conduits in each category)

Innerducts:

Conduit ID*	Innerduct ID	Cable ID / Spare

(Continued overleaf delete if not applicable)

*Provide conduit ID if required to identify innerduct uniquely in the access hole, if for example, color-coded innerduct is used in more than one conduit. If innerducts are tagged uniquely, leave this column blank.

END OF SUPPLEMENT

BID ATTACHMENT 3, PLAN SET / DRAWINGS

NOTE - This attachment is uploaded as a separate document on the Procurement page of the County website with the solicitation document and available for download.

BID ATTACHMENT 4, GEOTECHNICAL REPORT

NOTE - This attachment is uploaded as a separate document on the Procurement page of the County website with the solicitation document and available for download.

BID ATTACHMENT 5, PUBLIC WORKS STANDARDS PART 1 UTILITIES STANDARDS MANUAL FEBRUARY 2020

PUBLIC WORKS STANDARDS

PART I. UTILITIES STANDARDS MANUAL

FEBRUARY 2020

Public Works Standards

Part 1. Utilities Standards Manual

February 2020

TABLE OF CONTENTS

Note: Items not addressed by these standards shall provide a similar superior level of quality.

All items and/or materials furnished and installed shall conform to the Manatee County Approved Products List (separate manual). If there is a conflict between this manual and the Approved Products List, the Approved Products List shall take precedence.

MANATEE COUNTY
PUBLIC WORKS STANDARDS MANUAL

PART 1 - UTILITY STANDARDS

SECTION 1.1 SITE DEVELOPMENT STANDARDS

This section 1.1 contains general standards for the construction of infrastructure in Manatee County. Subsequent sections contain more detailed standards. All improvements shall be subject to all the standards contained in this manual, including the Approved Product List (separate manual), and any Technical Bulletins issued.

1.1.1 WATER

A. Individual private water distribution systems supplied by individual wells shall be constructed to facilitate independent connections to a public water distribution facility. All water wells constructed in Manatee County shall conform to Chapter 373 F.S., the requirements of the Southwest Florida Water Management District and the Manatee County Natural Resources Division, including all provisions in the interlocal agreement between Manatee County and the Southwest Florida Water Management District.

B. The coordination and sharing of any water distribution system, excluding individual private well water supply systems, between developments shall be preferred, including installation of oversized facilities to serve a logical area. Such over sizing may be paid for, where appropriate, by the Utilities Department when designed to serve property other than that owned by the developers. All major water distribution lines provided by a developer, together with necessary easements for access and maintenance, shall be dedicated to Manatee County.

C. All distribution water mains that enter private property become private mains and shall have a master meter and a certified backflow prevention assembly (BPA) installed at the right-of-way (property line) in accordance with Chapter 2-31, Article X of the Manatee County Code of Ordinances.

   All distribution reclaimed water mains that enter private property become private mains and shall have a master meter installed at the right-of-way (property line).

D. In the twenty-five (25) year and one hundred (100) year floodplain, all new and replacement water supply systems shall be located and designed to:

   1. Avoid impairment to the floodplain;
   2. Minimize contamination to the floodplain;
   3. Eliminate infiltration of flood waters; and
   4. Prevent contamination of the aquifers.

E. All new construction, additions, including buried storage tanks, must be anchored as necessary to prevent flotation, collapse, or lateral movement of the structure.

1.1.2 SANITARY SEWERAGE

A. General and individual sewerage systems including septic systems where allowed outside the defined EPA 201 service area or exempted by Chapter 2-31 of the Code of Ordinances and Resolution 89-70 shall be approved by the Manatee County Health Department, Environmental Health Services and the Public

Works Department. On-site sewerage systems shall be constructed in accordance with the Manatee County Health Department, Environmental Health Services regulations in such a manner as to facilitate later connection to a public collection facility including design and installation of septic systems so as to provide for eventual connection of this system to a public sewage collection system.

B. The coordination and sharing of any portion of the sewerage system between developments shall be preferred, including installation of oversize facilities to serve a natural tributary area, with such oversizing paid for where appropriate, by the Manatee County Public Works Department when designed to serve property other than that owned by the developer. All major sewer collection lines provided by a developer, together with necessary easements for access and maintenance, shall be dedicated to Manatee County.

C. All new and replacement sewerage and waste disposal systems located within the twenty-five (25) and one hundred (100) year floodplain, shall meet the requirements of Floodplain Management standards contained in this manual, the Stormwater Management Design Manual and the Land Development Code, and shall be located and designed to:

1. Avoid impairment to the floodplain;
2. Minimize contamination to the floodplain;
3. Eliminate infiltration of flood waters; and
4. prevent contamination of the aquifers.

D. Additionally, all new parts of the system, including buried storage tanks, must be anchored as necessary to prevent flotation, collapse, or lateral movement.

E. All industrial or commercial land uses which generate a wastewater load of a character not permitted for disposal in the County's system, shall be pretreated by the property owner and/or facility operator pursuant to Ordinance 88-01. This pretreatment shall occur prior to discharge of wastewater into any public or on-site sewage system.

F. Lift Stations. All lift stations shall be landscaped in accordance with the Landscape & Irrigation requirements for Lift Stations of this Manual.

1.1.3 IRRIGATION.

A. Irrigation shall be from a non-public water source. A suitable water supply is preferred to be reclaimed water, but is not limited to, lakes, ponds, stormwater retention areas, and wells. Design and use of wet stormwater facilities as sources of water for irrigation shall be required, as long as the use for irrigation does not adversely impact normal water levels in such a way that it impairs the viability of the biological treatment system. Suction lines from individual lots shall not be connected to or extend to sewer, stormwater drains, or catch basins to provide irrigation or non-potable water for any lot.

B. The Department Director requires the use of drought resistant species and may specify operational schedules and practices for irrigation for water conservation. No water service shall be furnished to any person by a public or private utility or water well unless such person agrees to accept all the provisions of the Water Shortage Plan, the Water Shortage Emergency, and the Year-Round Water Conservation Measures. The acceptance of water service shall be in itself the acceptance of the above provisions. The use of reclaimed water or other alternative sources shall be required for sites located outside of the Watershed Overlay Districts and located in an area that either has the distribution system for reclaimed water or is programmed to have such system installed. Potable water shall not be used for landscape irrigation.

C. Dual distribution systems for irrigation purposes may be required on all sites within an EPA 201 service area which are identified by the Department Director as being economically feasible for the Public Works Department to provide a connection to a public re-use water system at the periphery of the development. Such systems shall be connected to the approved reuse system when available. The determination of when the dual distribution system will be required will be made at the time the applicant submits the initial development application.

D. Dual distribution systems with supplemental source or irrigation water is required, whenever a development covenant running with the land requires all lots to install irrigation systems.

E. Dual distribution systems serving residential developments shall be installed in accordance with this manual.

F. No private irrigation sprinkler line or sprinkler head shall be installed within the rights-of-way without the written approval of the Public Works Department. Sprinkler heads shall be installed so as not to distribute water onto the sidewalks and travel lanes or effect the safety of pedestrian and motorist's safety.

G. All piping and outlets conveying re-use water shall be adequately and durably identified by a distinctive color coding so that it is readily distinguished from piping carrying potable water. The color coding shall comply with the American National Standards Institute ANSI Z53.1 and identified in accordance with ANSI A13.1.

1.1.4 SOLID WASTE REGULATIONS

A. Purpose and Intent. These regulations are established to provide for the safe, efficient management of solid waste, the minimization of wastes generated, the recovery of recyclable materials and the reduction of wastes disposed of, in accordance with State and County mandates and regulations.

B. Administration. The Utilities Department shall be responsible for the administration and enforcement of these regulations in conjunction with Chapter 2-16 Solid Waste and Recyclable Materials of the County Code of Ordinances and amendments thereto; and in coordination with Federal, State and other County and regulatory agencies.

C. Construction Wastes.

1. *Generation.* The applicant shall consider various waste management and waste minimization procedures to reduce the amount of wastes which will be generated during the construction phase of the proposed project. Waste materials are defined not only as those materials resulting directly from construction, but includes materials generated by construction crews during their occupation at the site.

2. *Storage.* The applicant shall provide for approved temporary waste storage on the site. Any hazardous materials shall be stored and identified in appropriate containers as mandated by law and required by these Standards.

3. *Transport.* The applicant shall remove all wastes from the site in an acceptable manner. Special wastes, including hazardous and biohazardous wastes, shall be delivered to approved processing site(s) for the specific waste involved. Construction and demolition material may be delivered to an approved recycling facility.

D. Occupancy Wastes.

1. *Storage*. The applicant shall make provisions for temporary on-site waste storage including the separate storage of all hazardous and biohazardous wastes in suitable containers on the site.

2. *Transport*. The applicant shall make arrangements with Manatee County Utilities Department to transport all waste generated to be transported to appropriate process and/or disposal sites.

E. Waste Storage Facilities.

1. All enclosures are to provide ample room for recycling containers per House Bill 7243 that became effective July 1, 2012.

2. Shopping centers and strip malls are to provide enclosures for the maximum number of stores and outbuildings the facility can accommodate.

3. Customers are responsible for keeping their dumpsters and enclosures clean.

4. Developers should be aware that additional monthly access fees could apply for certain ancillary services (Resolution 15-56).

5. All enclosures shall not be used for storage purposes. The enclosures shall only contain solid waste and recycling containers.

6. *Solid Waste and Recyclables Enclosure Requirements.* The County requires container storage and access in all new buildings in Manatee County. The Solid Waste and Recyclables enclosure information for a multi-family dwelling, commercial and industrial establishments requiring large containers, including but not limited to “dumpsters”, “compactors”, “roll off containers”, and “can enclosures” shall be specified within engineering drawings and specifications, and other written documentation submitted to the County required for site plan review. The submittal of the required materials shall be concurrent with the building permit application. Further specifications for each applicable large container is indicated in Sections 1.1.4.E.(7)-(10). Proposed future growth and phased development shall be considered in the site design with regard to sizing, location(s), and access of future solid waste and recyclables enclosures. Solid waste and recycling areas necessary for future growth shall be available for development, but need not be developed, nor enclosures constructed, until the future growth occurs.

   Construction of enclosure(s) shall be completed prior to the issuance of a certificate of occupancy. Submittals to the County should include the minimum standards specified in the sections below:

   a. Drawings of solid waste and recyclables enclosure location(s) per scale on a site drawing as described in this section.

      1) Solid waste and recyclables enclosures must be placed in unobtrusive locations accessible by all collection vehicles. Parallel parked cars or other obstacles shall not prevent a collection vehicle from accessing containers.

      2) The siting for solid waste and recyclables enclosures and support pads shall not encroach upon a parking space, pedestrian walkway, landscaped area, fire lane, driveway entrance, public rights-of- way, visibility triangle, or easement. There must be a minimum of 16 feet of lateral clearance (width) in any narrow lane for a sufficient distance where a collection vehicle may drive through without obstruction. The turning radii for the collection vehicle at the solid waste and recyclables enclosure or support pad shall not encroach upon a parking space, pedestrian walkway, landscaped area, fire lane, driveway entrance, public rights-of-way, visibility triangle, or easement. For dumpsters, there needs to be a curb cut if containers are being moved from a sidewalk to the street for collection.

   b. Drawings delineating the ingress/ egress service pathway sufficient for the safe movement and travel of the solid waste and recyclables collection vehicles that will be used at the site. Vehicle

path analysis software showing the collection vehicle pathway specifications is required.

1) Collection vehicles picking up solid waste and recyclables must be able to exit the street or alley by driving forward (collection vehicles cannot back up out of a street or alley).

2) Collection vehicles will require an adequate turning radius to enter the street or alley in order to access containers. A minimum turning radius of 45 feet must be maintained from the vehicular path or road to the collection location.

3) The actual height clearance must allow for the safe and efficient access of the collection vehicle. A minimum 25-foot height clearance must be maintained within 25 feet of the enclosure. This allows overhead lifting of the container for servicing. The length of the unobstructed vehicular path from the gate of the enclosure must maintain a minimum 60-foot clearance.

4) Utility wires and structure overhangs should have a minimum height clearance of 16 feet along the ingress and egress route. No utility wires shall extend over the enclosure approach and service area.

c. Drawings containing enclosure construction specifications as described in this section.

1) Enclosure plans must specify that gates will open outwards a minimum of 130 degrees. A minimum entrance clearance of 10 feet per container is required for the safe and efficient access of collection vehicles. No obstructions within or outside of the gates shall prevent the gates from opening wide enough for clearance.

2) The gate doors must be constructed with a pin stop mechanism that will provide a means of securing the gate doors in both an open and closed position. Locations of pin stops must be marked on drawings.

3) Enclosures shall have two centered 4-inch diameter impact resistant bollards installed 1 ft from the interior walls of the enclosure area and 4 ft apart from each other to prevent damage to the walls. Impact resistant bollards shall have a minimum height of 5 ft not to exceed the height of the back-screen wall of the enclosure.

7. Dumpsters and Compactors, General. All multi-family and non-residential establishments of sufficient size shall require large containers, such as "dumpsters" and "compactors," for storing solid waste between collections. Because these large containers must be properly located and supported, the following minimum criteria shall be adhered to:

a. *Support Pads*. All dumpsters and compactors shall be placed on concrete pads. All support pads shall be designed in accordance with detail US-14A, Compactor and Dumpster Pads.

b. *Siting*.

1) No dumpster or compactor shall be located in the front yard of any lot. Exceptions may be made for corner lots where no reasonable alternative location is available, except that minimum district front yard setbacks shall be maintained.

2) All dumpsters, support pads and associated screening shall be setback a minimum of ten (10) feet from side and rear lot lines. Support pads must be located to provide adequate maneuverability for the lift collection vehicle length of forty-five (45) feet and an additional forty-five (45) feet for backing and turning.

3) Businesses that have canopies must provide direct access to the dumpsters no closer than ten (10) feet to the canopy. All dumpsters and associated screening which consist of

combustible fencing around the support pad shall have a minimum separation from the nearest building or building overhang of ten (10) feet. Large commercial/industrial dumpsters, such as 20 or 40 yard containers may require a larger separation due to Building and Fire Codes. This minimum separation may be reduced or waived if the dumpster is protected by one or more fire sprinkler heads of a fire sprinkler system designed in accordance with sound engineering practices and as approved by the Fire Marshall.

4) All dumpsters and compactors shall be screened from view with a minimum six (6) foot opaque fence. The contractor shall provide an accessible site that does not cause obstruction of or damage to existing County roads or rights-of-way.

8. Dumpsters and Compactors, Food Service. In addition to the foregoing, businesses serving food and utilizing a dumpster or compactor must also meet the following criteria:

   a. *Support Pad Design*. The support pad must be equipped with a hose bib with a backflow prevention assembly in accordance with Chapter 2-31, Article X of the Manatee County Code of Ordinances. Discharge from the support pad shall be directed to the onsite stormwater management system, i.e. catch basins, swales, retention area, etc.

   b. *Aerator*. Clean mist aerators shall be required at owner's expense on food service compactors if odors can be detected at the subject parcel's property line, complaints are received from neighboring residents or businesses, and as required by Manatee County Sewer Use Ordinance and State regulations.

9. Roll Off Containers Placement. Roll off container(s) on-site placement shall be determined on case-by-case basis by the Utilities Department Director or designated staff.

10. Can Enclosure Locations. Enclosures are required where cans are approved for containment of solid waste and recycling generated by any single use requiring a special permit, final site plan, or off- street parking application. Can enclosures must be screened on three sides by an opaque fence a minimum of three (3) feet high. The enclosure must be sized a minimum of 5’ x 8’. If the enclosure is not located so that one side is a building wall, a gate is required as the fourth side to ensure containment.

F. General and Specific Waste Handling.

See Florida Administrative Code for additional specific requirements relative to certain types of trash removal (i.e., Beauty Salons, Doctor Offices, and Veterinarian Clinics).

G. Hazardous and Biohazardous Waste.

Any facility which will generate hazardous and/or biohazardous waste is obligated to handle it in compliance with the Florida Administrative Code Chapter 62-730 and other sections of the Land Development Code. Any application for a Development Permit where the facility or operation in which any hazardous and biohazardous wastes are to be handled; the method of storage, safety features, transport and disposal shall be indicated. A contingency plan must be provided along with a site and building plan indicating the areas in which specific types and amounts of wastes will be stored. The licensed hauler of the wastes and the disposal and/or processing sites must be identified. Evidence of insurance or a bond to cover accidents involving the wastes must be provided as part of the application. This evidence must be resubmitted to and approved by the Building and Development Services Department on a yearly basis as proof of continued coverage.

H. County Ordinance.

Chapter 2-16 Solid Waste and Recyclable Materials of the County Code of Ordinances provides for mandatory

collection and disposal of solid waste within the unincorporated area of Manatee County. Disposal is currently and for the foreseeable future, at the County-owned Lena Road Solid Waste Management Facility. In as much as this ordinance, including definitions, affects the design, construction and use of any development, building or structure, it shall be considered part of this manual and Land Development Code.

I. Enforcement.

The Utilities Department is responsible for the enforcement of this Section and shall investigate violations of this Section and shall process confirmed violations in accordance with the violations section of the Land Development Code or as otherwise allowed by law.

END OF SECTION

SECTION 1.2 MODIFICATIONS TO EXISTING STRUCTURES, PIPING AND EQUIPMENT

1.2.1 DESCRIPTION OF WORK

Modification or conversion of existing structures as required by the construction drawings. Existing piping and equipment removal, dismantling, and disposal, as required.

1.2.2 PRODUCTS

A. Epoxy mortar shall be fiberglass fiber mixed with an epoxy filler.

B. Non-shrink grout shall be a sand-cement, non-metallic formulation, having a 28-day strength of 4,000 psi and 0.0 percent shrinkage per ASTM C1090.

C. Liners to be installed in existing manholes and wet wells shall be spray-applied, monolithic, reinforced urethane resin. Urethane resin-based manhole liner material shall be resistant to hydrogen sulfide gas, and other common contents found in a sanitary sewer environment.

D. Protective liners: Please reference the Approved Product List for acceptable products.

1.2.3 GENERAL MODIFICATION WORK

A. Cut, repair, reuse, excavate, demolish or otherwise remove parts of the existing structures or appurtenances, as indicated on the construction drawings, or as necessary to complete the work as required. Dispose of surplus materials resulting from the above work in an approved manner. The work shall include all necessary cutting and bending of reinforcing steel, structural steel, or miscellaneous metal work found embedded in the existing structures.

B. Dismantle and remove all existing equipment, piping, and other appurtenances required for the completion of the work. Where called for or required, cut existing pipelines for the purpose of making connections thereto.

C. Anchor bolts for equipment and structural steel to be removed shall be cut off one inch below the concrete surface. Surfaces shall then be refinished using non-shrink grout or epoxy mortar or as indicated on the construction drawings. Repairs to the interior surfaces of existing concrete structures in sanitary sewers shall be made with epoxy mortar. Repairs to be made on other existing concrete surfaces using non-shrink grout shall be made using a bonding agent. Remove all dirt, curing compounds, sealers, paint, rust or other foreign material, and etch with muriatic acid solution. Flush with clean water and while still damp, apply a coating of the bonding agent. Place the new grout patch onto the treated area immediately.

D. At the time a new connection is made, the following shall be installed: additional new piping, extending to and including a new valve, shall be installed. Old valves shall be removed and replaced with a new valve on potable and reclaimed water mains. Pipe restraint devices shall also be installed as required. At the time when a new potable or reclaimed water main or service is installed, a pipe locator tracer wire shall be installed and connected to the tracer wire at the main.

E. No existing pipes, structures, equipment, or appurtenances shall be shifted, cut, removed, or otherwise altered except with the express approval of and only to the extent approved by the County. All existing valve boxes, fire hydrants, air release valve cabinets, and manholes shall be relocated or adjusted to meet the new finished grade elevations after construction.

F. When removing materials or portions of existing utility pipelines or structures or when making openings in walls and partitions, take all precautions and use all necessary barriers and other protective devices so as not to damage the structures beyond the limits necessary for the new work, and not to damage the

structures or contents by falling or flying debris. Unless otherwise approved by the County, saw-cutting, rotary core-boring, or line drilling will be required in removing material from existing concrete structures or pipes.

G. Materials and equipment removed in the course of making alterations and additions shall remain the property of the County, except that items not salvageable, as determined by the County, shall be disposed of off the work site.

H. All alterations to existing utility pipes and structures shall be done at such time and in such a manner as to comply with the approved time schedule. Before any part of the work is started, all tools, equipment, and materials shall be assembled and made ready so that the work can be completed without delays.

I. All cutting of existing concrete or other material to provide suitable bonding to new work shall be done in a manner to meet the requirements of the respective section of these Standards covering the new work. When not covered, the work shall be carried on in the manner and to the extent directed by the County or per the construction drawings.

J. Surfaces of seals visible in the completed work shall be made to match as nearly as possible the adjacent surfaces.

K. Non-shrink cementitious grout shall be used for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete and elsewhere as shown on the construction drawings. The surface to which grout is to be applied shall be wetted to facilitate good bonding.

L. Where necessary or required for the purpose of making connections; cut existing pipelines in a manner to provide an approved joint. Where required, use flanges, couplings, or adapters, all as required.

M. Provide flumes, hoses, piping, pumps and well points, and other related items to divert or provide suitable plugs, bulkheads, or other means to hold back the flow of water or other liquids, all as required in the performance of the work.

N. Care shall be taken not to damage any part of existing buildings or foundations or outside structures.

O. Prior to entering confined spaces in sanitary sewer structures, conduct an evaluation of the atmosphere within, in accordance with local, state, and federal regulations. Provide ventilation equipment and other equipment as required to assure safe working conditions.

1.2.4 CONNECTING TO EXISTING PIPING AND EQUIPMENT

Verify exact location, material, alignment, joint, etc. of existing piping and equipment prior to making the connections called out in the construction drawings. The verifications shall be performed with adequate time to correct any potential alignment or other problems prior to the actual time of connection. Asbestos concrete nipples between tees and valves shall be replaced with currently accepted materials. The County Inspector must be present for all tie-ins for a visual inspection.

1.2.5 REMOVAL AND ABANDONMENT OF ASBESTOS CEMENT PIPE AND APPURTENANCES

A. All work associated with the removal or abandonment of existing asbestos cement pipe and appurtenances shall be performed by a licensed asbestos removal contractor registered in the State of Florida.

B. The asbestos contractor shall contact the appropriate regulatory agencies prior to removal or abandonment of any asbestos material and shall obtain all required permits and licenses and issue all

required notices. The cost for all fees associated with permits, licenses and notices to the governing regulatory agencies shall be borne by the asbestos Contractor.

C. All work associated with removal or abandonment of asbestos cement pipe and appurtenances shall be performed in accordance with the standards listed below and all other applicable local, State, or Federal standards.

1. Florida Administrative Code, Chapter 62-257, ASBESTOS PROGRAM
2. Title 40 CFR, Part 61, Subpart M, NATIONAL EMISSION STANDARD FOR ASBESTOS
3. Occupational Safety and Health Act, Title 29 CFR
4. Title 40 CFR, Part 763, ASBESTOS
5. Florida Statute Title XXXII, Chapter 469, ASBESTOS ABATEMENT

D. All asbestos cement pipe sections indicated on the construction drawings to be removed, and all related valves, fittings and appurtenances shall be removed in their entirety and disposed of by the asbestos Contractor in accordance with this Section. After removal of the pipelines, all excavations shall be backfilled in accordance with the applicable provisions of the Trenching and Excavation Section of these Standards. The cost of disposing of the removed materials shall be borne by the asbestos Contractor.

E. The cutting of existing asbestos-cement (A/C, a.k.a. "Transite") pipe shall be by hand tools only. No powered machine cutting is allowed. Removal of all fragments of pipe shall be double bagged prior to shipment. Longer sections of pipe removed may be shipped without double bagging. An asbestos manifest form must accompany each shipment of such pipe or pipe material waste to the Manatee County Lena Road Landfill. Prior to each shipment, a minimum of 24-hour notice to the Landfill field office (telephone (941) 748-5543) is required.

1.2.6 IN-PLACE ABANDONMENT OF EXISTING PIPE

A. Where water and wastewater utility pipes are to be abandoned in place, they shall be filled with a non-shrink, sand-cement grout or cement slurry. When such pipes are made of asbestos-cement materials, the abandonment activities shall be performed by a licensed asbestos Contractor. It is completely the Contractor's responsibility to obtain all regulatory clearances and provide documentation in cases where they have determined that an asbestos-cement pipe abandonment activity by in-place grouting does not require a licensed asbestos Contractor.

B. The ends of the pipe sections to be abandoned shall be capped or plugged with suitable pipe fittings. The material shall be of suitable properties and the pumping pressure shall be such that the pipe sections are filled completely. All above-ground features shall be completely removed: hydrants, meters, valve & meter boxes, pads, vaults, etc. Existing non-mechanical joint fittings (tees, crosses, etc.) and valves to be removed shall be replaced with a spool piece of pipe (match existing). Existing fittings and valves left in service shall be plugged and properly restrained.

C. The County shall be given timely notice so that the County's representative may be present to monitor all pipe abandonment operations. Provide standpipes and/or additional means of visual inspection as required to determine if adequate material has filled the entire pipe sections.

1.2.7 SPRAY-APPLIED LINERS

A. Use a high-pressure water spray to remove all foreign material from the walls and bench of the structure. Loose or protruding masonry materials shall be removed using a hammer and chisel. Fill any voids, holes

or cracks using a hand trowel with epoxy mortar to form a uniform surface. Place covers over all pipe openings to prevent extraneous material from entering the pipes. Block or divert sewer flow from entering the structure. Any infiltration leaks shall be completely stopped by using such methods as approved by the County.

B. Install the coating systems per manufacturer's recommendation and completely protect the structure from corrosion. The liner or coating systems must extend and seal onto manhole ring, onto and around pipe openings and any other protrusions, and completely cover the inverts, bench, and wall areas.

C. The sprayed-on material shall be applied such that the entire structure is lined with a structurally enhanced monolithic liner. The thickness of the wall liner material shall be such that it will withstand the hydraulic load generated by the surrounding groundwater table, using a factor of safety of two, and using the assumption that the groundwater table is at the level of the top of the structure. The invert and bench liner material shall be the same thickness as that required for the base of the wall.

D. Special care shall be used to provide a smooth transition between the intersecting pipelines and the structure inverts such that flow is not impaired. Remove concrete material from the existing structure base channel in depth to the required thickness of the new liner material.

E. No active sewer flow shall be allowed in the newly lined structure, nor shall any vacuum tests be performed, until the liner material has had adequate time to cure, as recommended by the liner material manufacturer.

F. Provide a five (5)-year unlimited warranty on all workmanship and products. The work includes the surface preparation and application of the coating or liner system and shall protect the structure for at least five (5) years from all leaks and from failure due to corrosion from exposure to corrosive gases such as hydrogen sulfide.

1.2.8 CONNECTION TO EXISTING PORTLAND CONCRETE MANHOLES

A. Where required or as indicated on the construction drawings, make connection of new pipelines to existing manhole structures. If pipe stub-outs of the correct size and position are not available, make connections by removing a portion of the manhole wall by mechanical rotary core boring. The connection between pipe and manhole shall be complete with a jack-in resilient seals meeting the requirements of ASTM C923. The external take down clamp and its hardware shall be 316 stainless steel. The internal expansion band and its hardware shall be minimum 304 stainless steel.

B. A new channel shall be formed in the manhole bench by removing and reforming or by providing new concrete to convey the new flow into the existing channel in accordance with the standard requirements for new sewer manhole structures. Flow direction shall not change by more than 90 degrees within the manhole base.

C. Repair internal coating of existing manholes cored during connection of new sewers by applying approved coating material as listed in the Approved Product List in accordance with the manufacturer's recommendations. If an existing manhole has an internal coating other than that listed in the approved material list, completely remove the existing liner from the existing manhole and apply an approved coating in accordance with the manufacturer's recommendations.

D. When connecting a force main to an existing manhole, the force main termination manhole and the next two manholes downstream shall be rehabilitated and lined with an approved liner.

E. For connections to polymer concrete manholes and wet wells, please refer to Section 1.13.13.

1.2.9 ADJUSTING EXISTING PORTLAND CONCRETE MANHOLE FRAME AND COVER

A. Existing manhole covers, which must be adjusted to existing or new pavement surfaces, shall be adjusted by modifying the existing precast portland or polymer concrete adjustment rings to bring the entire existing ring and cover to grade.

B. No manhole cover adjustment rings shall be allowed.

C. For adjustments to polymer concrete manholes and wet wells, please refer to Section 1.13.11.

END OF SECTION

SECTION 1.3 TRENCHING AND EXCAVATION

1.3.1 DESCRIPTION OF WORK

Excavate for utility pipelines, valves and fittings, manholes, utility vaults and lift stations. Dewater underground soils to elevations as required to allow the installation of pipelines, beddings, foundations and structures. Store excavated soil materials that are suitable for use as backfill. Dispose of excavated soil materials that are either unsuitable for use as backfill or will not be required for fill on the project site. Import suitable soil materials or granular rock materials as required to provide suitable backfill, bedding or foundation materials. Place and compact bedding and foundation materials and install utility structures. Place and compact backfill materials to finished grades. Provide other materials and labor as required to complete the utility work as indicated on the construction drawings.

1.3.2 CLEARING AND GRUBBING

Clear and grub the areas within rights-of-way and utility easements where utility structures will be installed. Completely remove and dispose of all buildings, foundations, materials, rubbish, debris, trees, brush, stumps, roots, or any other obstructions on or buried near the surface of the ground. Remove roots and other obstructions to a depth of at least 12 inches below the surface.

1.3.3 DEWATERING

A. The construction of pipelines, structures, foundations, beddings, and the placement of backfill materials shall be in dry or dewatered subsurface soil conditions. Where the existing groundwater piezometric elevation is higher than 18 inches below the bottom of the proposed excavation, use well points, wells, pumps and other approved methods to lower the groundwater level to 18 inches below the elevation of the proposed excavation bottom. Excavation for pipelines and structures shall not proceed unless or until the existing groundwater levels have been lowered to at least 18 inches below the intended lowest elevation of the digging operation.

B. Dewatering operations shall continue while the pit is open and while structure placement and construction is taking place and while backfilling and compaction is accomplished. At all times during the construction operations, the groundwater levels shall be maintained at an elevation 18 inches below the lowest level where structures are being installed.

C. Divert surface water flows as necessary to prevent surface water from entering the open excavations.

D. Discharged flows from dewatering operations shall be disposed of in a manner consistent with US EPA, FDEP, and SWFWMD regulations.

E. All dewatering well-points and kelly wells shall be completely abandoned when no longer in use. Methods for proper well abandonment shall be followed to ensure the well-points and/or kelly wells are completely filled from bottom to top. Contractor shall use a non-shrink hydraulic grout or flowable fill, and any equipment (i.e. tremie, etc.) to ensure complete abandonment.

1.3.4 PROTECTION OF EXISTING STRUCTURES

A. Where excavations are made and underground utility structures are constructed in close proximity to existing structures, take all reasonable precautions and measures to prevent damage to such structures. Existing building foundations and existing utility structures shall be monitored during the construction operations and any movement of these structures shall be reported to the County's authorized

representative. When any movement of existing structures has been detected, immediately take any and all remedial measures required to affect the protection and prevent damage to the structures.

B. Existing structure protection measures shall include, but shall not be limited to, the installation of sheet piling, bell restraints, or other shoring methods or materials as needed, maintenance of the groundwater piezometric elevation, and control of the vibrations from construction operations. Where existing utility pipelines or structures are situated vertically above a line from the base of the excavation pit or trench along an angle of repose of the soil, or where an existing utility crosses a trench transversely, take reasonable measures to protect and support these structures during the construction operations.

1.3.5 EXCAVATION

A. Excavate trenches and pits for structures to the elevations indicated on the construction drawings. Take special care to avoid over-excavating or disturbing the bottom of the trench or pit, so that the soil at the bottom of the hole remains in a naturally compacted condition. Excavate to widths sufficient to provide adequate working room to install the required structures. Do not excavate the final layer of soil to the designed grade until just before placing the bedding, foundation, pipe, structure, or masonry work required. Remove boulders, rocks, logs or any unforeseen obstacles encountered.

B. In case the foundation soil found at the bottom of the trench or pit is soft, predominantly clay or mucky, or does not conform to the soils classification specified as suitable foundation material, over-excavation to a greater depth will be required. Soils not meeting the classification required for foundation material shall be removed to a depth at least four inches below the bottom of the pipe, bedding or structure bottom elevation. Rock, boulders or other hard or lumpy material shall be removed to a depth 12 inches below the bottom of the pipe, bedding or structure bottom elevation. Remove muck, clay or other soft material to a depth as needed to establish a firm foundation.

C. Where possible, the sides of trenches should be vertical up to at least the spring line of the installed pipe.

D. Trench excavation shall be performed in accordance with Florida Statute Title XXXIII, Chapter 553, Part III, Trench Safety Act.

1.3.6 BACKFILL MATERIALS

A. Bedding - shall conform to FDOT Standard Specifications for Road and Bridge Construction, Section 901 Coarse Aggregate, and shall be either coarse aggregate of Size No. 57 or coarse sand of Size No. 9. Washed shell size No.57 may be used as an alternate bedding material.

B. Structural Fill - shall be either soil classification A-1, A-2 or A-3, per AASHTO M-145, and shall be free of organic matter, lumps of clay or marl, muck, compressible materials, and rock exceeding 2.5 inches in diameter. Broken concrete, masonry, rubble or other similar materials shall not be used as backfill.

C. Selected Common Fill - shall have the same material classification and requirements as Structural Fill, as per Paragraph 1.3.6.B, above.

D. Common Fill - shall be either soil classification A-1, A-2, A-3, A-4, A-5 or A-6, per AASHTO M-145, and shall be free of organic matter, lumps of clay or marl, muck, compressible materials and rock exceeding 2.5 inches in diameter. Broken concrete, masonry, rubble or other similar materials shall not be used as backfill.

E. Unsuitable Material - soil classification A-7 and A-8, per AASHTO M-145, shall not be used as backfill material.

1.3.7 BACKFILL

A. Backfill materials shall be placed on solid, firm, naturally compacted or compacted, dry or dewatered in-place soil foundations.

B. Where over-excavation is required due to nonconforming soil classification or rocky, unstable, or otherwise undesirable soil conditions, place Structural Fill or Selected Common Fill in the over-excavated zone up to the base of the bedding material layer. Compact the over-excavated zone to a 98 percent of the maximum dry density as determined by AASHTO T-180.

C. When backfilling in an over-excavated zone where moist or watery conditions exist, backfill shall be coarse No. 9 sand or a mixture of No. 57 coarse aggregate with either No. 9 coarse sand, A-1, or A-3 material.

D. After compaction, backfill material in the over-excavation zone shall form a solid and firm foundation on which to build up successive layers of backfill and structures.

E. Bedding materials shall be placed on solid, firm soil foundations and shall be compacted to a 98 percent of the maximum dry density as determined by AASHTO T-180. When #57 stone is used for bedding, density testing is not required, however, the stone shall be placed in lifts and consolidated using conventional compaction techniques. Visual inspection by County personnel is adequate to indicate when the stone is consolidated and locked into place.

F. Concrete and masonry structures shall be backfilled using Structural Fill. Backfilling and compaction shall be underneath the structure and carried up evenly on all walls of an individual structure simultaneously. The maximum allowable difference in backfill elevations shall be two feet. No backfilling shall be allowed against concrete or masonry walls until the walls and their supporting slabs have been in place at least seven days or until the specified 28-day strength has been attained. Compaction of Structural Fill shall be 98 percent of the maximum dry density of the material as determined by AASHTO T-180. The Structural Fill shall be either dried or shall have water added so that the moisture content of the material is within a range that will allow the required density to be achieved.

G. Trenching backfill for pipe installation shall be Selected Common Fill for the pipe bedding zone. The pipe bedding envelope shall begin at the level four inches, six inches, or nine inches, depending on pipe diameter, below the bottom of the pipe, and shall extend vertically up to a level 12 inches above the top of the pipe. Where the in-place soil material within the four inch, six inch, or nine inch pipe bedding zone beneath the bottom of the pipe meets the soil classification for Selected Common Fill, undercutting of the trench below the bottom of the pipe will not be required. In this case, loosen the soil in the bottom of the trench immediately below the middle third of the pipe diameter, and place the pipe upon it. Where the in-place soil material within the pipe bedding zone does not meet the soil classification for Selected Common Fill, undercutting shall be required, and the bedding zone shall be backfilled with Selected Common Fill. In this case, place the pipe bedding material and leave it in a moderately firm uncompacted condition under the middle third of the pipe diameter, and compact the outer portions of the trench bottom to 98 percent of the maximum dry density. Soils that were over-excavated due to rocky, soft or otherwise unsuitable soil foundation conditions shall also be replaced with Selected Common Fill. Compaction of Selected Common Fill shall be 98 percent of the maximum dry density as determined by AASHTO T-180. Such backfill material shall have an optimized moisture content that will allow the required density to be achieved.

H. Pipe sections for gravity flow systems shall be laid with spigots downstream and bells upstream. Excavate for pipe bells before laying pipe. Lay pipe true to the lines and grades indicated on the construction plans. Place backfill material on both sides of the pipe and compact to 98 percent of the maximum dry density

as determined by AASHTO T-180. Take special care to effectively fill and compact the material in the haunch areas under the sides of the pipe.

I. For pipes that are not installed under roadways or driveways, trenching backfill for pipe installation shall be Common Fill above the pipe envelope zone, and shall be compacted to 95 percent of the maximum dry density of the material as determined by AASHTO T-180, and shall have moisture content optimized to allow the required density. For pipes that are installed under roadways or driveways, trenching backfill for pipe installation shall be Selected Common Fill above the pipe envelope zone, and shall be compacted to 98 percent of the maximum dry density of the material as determined by AASHTO T-180, and shall have moisture content optimized to allow the required density. Selected Common Backfill shall be placed in layers not to exceed 6 inches. Common Backfill shall be placed in layers not to exceed 12 inches.

J. Backfill compaction tests shall be performed every 500 feet for the full depth of bury in pressure and gravity pipe line trenches, at every structure, and performed every 100 feet for gravity pipe line trenches from the bottom of the haunch area up to 2 feet from the top of pipe every lift (12 inch maximum). Test reports shall be presented to the County Inspector.

1.3.8 GRADING AND CLEANING UP

A. Surplus and unsuitable soil materials not used on-site shall be removed and disposed of off-site in a manner that is consistent with state and local regulations. In no case shall surplus or unsuitable material be deposited on-site or on adjacent lands.

B. The surface of backfilled areas shall be graded smooth and true to the lines and grades indicated on the construction plans. No soft spots or uncompacted areas shall be allowed in the work.

C. Upon completion of the work, leave the work areas and all adjacent areas in a neat and presentable condition, clear of all temporary structures, rubbish and surplus materials. Pile any salvageable materials that have been removed in neat piles for pickup by County crews, unless otherwise directed.

END OF SECTION

SECTION 1.4 DUCTILE IRON PIPE AND FITTINGS

1.4.1 DESCRIPTION OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install ductile iron pipe, restrained joint ductile iron pipe and ductile iron fittings, complete, as indicated on the construction drawings.

B. Provide and install complete all fittings and appurtenances not noted specifically on the construction plans as required to complete the utility system in accordance with these Standards.

C. Ductile iron pipe shall not be used in sewer applications, unless where agreed upon by the County based on economic benefit and/or construction feasibility. Approval shall be sought from the County prior to plan submittal.

1.4.2 PRODUCTS

A. Ductile iron pipe shall conform to AWWA C150 and AWWA C151. Pipe shall be Pressure Class 350 for sizes 4" thru 16" and Pressure Class 250 for 18" and larger. All pipe materials used in potable water systems shall comply with NSF Standard 61.

B. All flanged ductile iron pipe used in above ground applications (i.e. aerial crossings, master meter assemblies, backflow assemblies, etc.) shall be Special Thickness Class 53.

C. Ductile iron pipe, 14 inches in diameter, shall not be used.

D. Unrestrained joint pipe shall be supplied in lengths not to exceed 21 ft and shall be either the rubber-ring compression-type push-on joint or standard mechanical joint pipe.

E. All mechanical joint fittings shall be pressure rated for 350 psi for sizes 4-16 inches and 250 psi for sizes 18 inches and larger. All flanged fittings shall be pressure rated for 250 psi for all sizes. All fittings shall meet the requirements of AWWA C110 or AWWA C153.

F. Rubber gaskets shall conform to AWWA C111 for mechanical and push-on type joints and shall be Ethylene Propylene Diene Monomer (EPDM) rubber for potable water and reclaimed water pipelines. "EPDM" shall be embossed and/or etched into the gasket material. Acrylonitrile butadiene (NBR) gaskets shall be used for all ductile iron pressure pipe that are located in soil that is contaminated with low molecular-weight petroleum products or non-chlorinated organic solvents or non-aromatic organic solvents. Fluorocarbon (FKM) gaskets shall be used for all ductile iron pressure mains that are located in soil that is contaminated with aromatic hydrocarbons or chlorinated hydrocarbons. Fluorocarbon (FKM) gaskets shall be used where both classes of contaminates are found.

G. Water Main and Reclaimed Water Main Coatings: All buried ductile iron pipe shall have a standard thickness cement lining on the inside in accordance with AWWA C104 and a standard 1-mil asphaltic exterior coating per AWWA C151 or as defined in the Approved Products List. All above-ground ductile iron pipe shall have a standard thickness cement lining on the inside in accordance with AWWA C104 and have an exterior coating factory-applied epoxy primer.

   All ductile iron fittings shall have double the standard thickness cement linings on the inside per AWWA C104. Buried ductile iron fittings shall have a standard 1-mil asphaltic exterior coating per AWWA C151. Above-ground ductile iron fittings shall have a factory-applied epoxy primer.

H. Wastewater Main Coatings:

   1. Interior: All ductile iron pipe and fittings used in wastewater sewer systems shall have a green, factory applied amine cured novalac ceramic epoxy or a modified polyamine ceramic epoxy

interior lining on the inside, dry film thickness shall be as defined in the Approved Products List. The interior lining application is to be based on the manufacturer's recommendation for long-term exposure to raw sewage. To ensure a holiday-free lining, documentation must be provided, at time of delivery, showing each section of lined pipe has passed holiday testing at the time of production per ASTM G62. The lining shall have a minimum three (3)-year warranty covering failure of the lining and bond failure between liner and pipe.

2. Exterior: All buried ductile iron pipe and fittings used in wastewater systems shall have a standard 1-mil asphaltic coating per AWWA C151 or as defined in the Approved Products List. Above-ground ductile iron pipe and fittings shall have a factory-applied epoxy primer.

I. Lubricant furnished for lubricating the push-on joints in potable water pipes shall be nontoxic, water soluble, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material, and shall not impart color, taste, or odor to the water, and shall be an approved substance per NSF 61.

J. Thrust restraint devices shall be provided at all horizontal and vertical bends and fittings, in casings under roads and railroads and at other locations specifically indicated on the construction drawings. Thrust restraint devices shall be either concrete thrust blocks or restraining glands.

K. Manufacturer's restrained joints for ductile iron pipe where used, shall be installed at bend and fitting locations and at pipe joint locations both upstream and downstream from the bends or fittings at distances as required by these Standards. Restrained joint pipe fittings shall be designed and rated for the following pressures:

350 psi for pipe sizes up to and including 16" diameter

250 psi for pipe sizes 18" diameter and above

L. All gaskets used in water and reclaimed water application shall be EPDM rubber. The word "EPDM" shall be embossed or formed into the gasket. Stamped or stickers shall be prohibited. All gaskets not clearly identified to be EPDM shall be rejected and removed from the job site.

M. All restraining gasket shall have a color inherent with the rubber. Color shall not be attained by surface coating.

1.4.3 IDENTIFICATION

A. Each length of pipe and each fitting shall be marked with the name of the manufacturer, size and class, lining type, and shall be clearly identified as ductile iron pipe. All gaskets shall be marked with the name of the manufacturer, size and proper insertion direction.

B. All ductile iron pipe and/or fittings shall be entirely covered with a polyethylene sleeve; blue for water mains, purple for reclaimed water mains, and green for sewer mains, per AWWA C105.

C. All above ground potable water mains and appurtenances shall be painted Scott Paints safety blue; purple (Pantone purple 522 C) for reclaimed water; or Hunter Green (Rustoleum 7538) for pressure sewer.

END OF SECTION

SECTION 1.5 POLYETHYLENE (HDPE) PIPE AND FITTINGS

1.5.1 DESCRIPTION OF WORK

Furnish all labor, materials, equipment and incidentals required to install high density polyethylene (HDPE) pressure pipe, tubing, fittings and appurtenances as indicated on the construction drawings.

1.5.2 PRODUCTS

A. Polyethylene mains 4" diameter and larger shall be high-density bimodal PE 100/PE4710 polyethylene resin with a minimum cell classification of 445574 per ASTM D3350, Class 200, DR 11, meeting the requirements of AWWA C906. All pipe materials used in potable water systems shall comply with NSF Standard 61. Outside diameters of water, reclaimed water and pressure sewer HDPE pipes shall be ductile-iron sizing system (DIPS).

B. High density polyethylene (HDPE) shall not be placed within the roadways in water and reclaimed applications, unless in a casing.

C. High density polyethylene (HDPE) pipe, 14 inches in diameter, shall not be used.

D. Polyethylene tubing 2 inches in diameter and smaller for potable water and reclaimed water services shall be high-density PE4710 polyethylene resin per ASTM D2737, Pressure Class 200, Copper Tube Size (CTS), DR 9, meeting the requirements of AWWA C901. Butt fusion or CTS brass connections shall be used. All pipe materials used in potable water systems shall comply with NSF Standard 61.

E. Polyethylene pipe 3 inches in diameter (for wastewater grinder lift force mains) shall be high-density PE4710 polyethylene, per ASTM D2737, Pressure Class 200, iron pipe size (IPS) outside diameter, DR 11, meeting the requirements of ASTM D3350 and AWWA C906. 3 inch diameter pipe shall only be used with written authorization from the County.

1.5.3 JOINTS

A. Where PE pipe is joined to PE pipe, it shall be by thermal butt fusion. Thermal fusion shall be accomplished in accordance with the written instructions of the pipe manufacturer and fusion equipment supplier. The installer of the thermal butt fused PE pipe shall have received training in heat fusion pipe joining methods and shall have had experience in performing this type of work.

B. Flanged joints, mechanical joints and molded fittings for 4” and larger pipe shall be in accordance with AWWA C906. Mechanical joints and fittings for 2” and smaller pipe & tubing shall meet the requirements of: AWWA C901, ASTM D 3350 and ASTM D 3140.

1.5.4 IDENTIFICATION

A. Mains and tubing shall bear identification markings in accordance with AWWA C906 or C901.

B. All pressure mains shall have color coded embedded striping on 3 sides (120 degree apart); blue for water, purple for reclaimed water or green for pressure sewer.

C. All pressure service tubing shall be solid color coded pipe; blue for water or purple for reclaimed water.

END OF SECTION

SECTION 1.6 POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

1.6.1 DESCRIPTION OF WORK

A. Furnish all labor, materials, equipment and incidentals required to install the PVC piping, iron fittings and other appurtenances complete and ready for use as indicated on the construction drawings.

B. Provide and install complete all fittings and appurtenances not noted specifically on the construction plans as required to complete the utility system in accordance with these Standards.

1.6.2 PRODUCTS

A. Polyvinyl chloride (PVC) pressure pipe, 4 - 12 inches in diameter, shall be Class 235, DR 18, meeting the requirements of AWWA C900-16 and used for water, reclaimed water, and sewer force mains. Mains shall have cast-iron-pipe-equivalent outside diameters (also known as ductile iron pipe size (DIPS)). Each length of pipe shall be hydrostatically tested to two times its pressure class of the pipe by the manufacturer in accordance with AWWA C900-16. Pipe shall be furnished in standard lengths of approximately 20 feet.

B. Polyvinyl chloride (PVC) pressure pipe shall not be placed within the roadways in water and reclaimed applications, unless in a casing.

C. Polyvinyl chloride (PVC) pressure pipe, 14 inches in diameter, shall not be used.

D. Water and reclaimed water mains greater the 16” are to be ductile iron (or may be HDPE with prior County written approval).

E. Polyvinyl chloride (PVC) pressure pipe C900-16 DR 18, 16 inches thru 36 inches, can be used in force main applications.

F. Polyvinyl chloride (PVC) pressure pipe, 2 inches in diameter, used solely for sewer grinder lift station application only, shall be Pressure Rated 200, SDR21, conforming to ASTM D2241, and shall have Iron Pipe Size (IPS) outside diameters. SDR 21 PVC pipe 2-3 inches in diameter shall not be used for working pressures greater than 125 psi. PVC pipe shall not be used in applications which require pipes that are less than 2 inches in diameter for wastewater force mains. PVC Pipe shall not be used in applications which require pipes that are less than 4 inches in diameter for potable water piping and reclaimed water piping.

G. Standard PVC pressure pipe joints shall be bell and spigot push-on type with elastomeric ring seals. Ring seal gaskets used at push-on joints shall conform to ASTM F 477 and shall be EPDM rubber for potable and reclaimed water pipes. “EPDM” shall be embossed and/or etched into the gasket material.

H. Lubricant furnished for lubricating the push-on joints in potable water pipes shall be nontoxic, water soluble, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material, and shall not impart color, taste, or odor to the water, and shall be an approved substance per NSF 61.

I. Thrust restraint devices shall be provided at all horizontal and vertical bends and fittings, in casings under roads and railroads and at other locations as indicated on the construction drawings. Thrust restraint devices for PVC pipe and fittings shall be restraining glands. Restrained joints, shall be installed at bend and fitting locations and at pipe joint locations both upstream and downstream from bends or fittings at distances as required by these Standards.

J. All fittings for PVC pipe shall be ductile iron with mechanical joints and shall conform to AWWA C153 and to the applicable sections of these Standards for ductile iron.

K. All pipe materials used in potable water systems shall comply with NSF Standard 61.

1.6.3 IDENTIFICATION

A. PVC pipe shall bear identification markings in accordance with AWWA C900-16 or ASTM D2241.

B. PVC pipe shall be color coded blue for water, purple for reclaimed water or green for pressure sewer using a solid pipe color pigment.

END OF SECTION

SECTION 1.7 POLYVINYL CHLORIDE (PVC) GRAVITY SEWER PIPE

1.7.1 DESCRIPTION OF WORK

Furnish all labor, equipment, materials, testing and incidentals required to install the gravity sewers, complete, as indicated on the construction drawings.

1.7.2 PRODUCTS

A. Polyvinyl chloride (PVC) gravity sewer pipe and fittings, 4-15 inches in diameter, shall be SDR 26, meeting the requirements of ASTM D 3034. Joining of pipe sections and fittings shall be by water-tight push-on joints using elastomeric gaskets in accordance with ASTM D 3212.

B. Polyvinyl chloride (PVC) pipe, 16-48 inches in diameter, for gravity sewers, shall be DR 25, with cast-iron (CI) outside diameter (also known as ductile iron pipe size (DIPS)), meeting the requirements of AWWA C900-16.

C. All PVC sewer pipe bell ends shall be field inspected for out-of-roundness and spigot ends shall be field inspected for out-of-roundness and for squareness of the pipe end. Any materials not in conformance with the tolerances of ASTM D 3212 or AWWA C900-16 shall be removed from the work site.

D. All PVC sewer pipe sections shall also be field inspected for excessive cross-section deflection. Any pipe section visually found to have a pipe deflection, before installation, of 2 percent of the Base Inside Diameter or greater shall be removed from the work site.

E. After installation and backfill, pipe deflection shall not be allowed to be 5 percent or greater of the Base Inside Diameter. Any length of pipe found installed having excessive deflection shall be dug up and either reinstalled or removed from the work site.

F. Six inch PVC fittings for sewer laterals shall also be SDR 26, molded in one piece, with elastomeric joints in accordance with ASTM D-3034. Fittings not currently available in molded form may be fabricated in accordance with ASTM D-3034 with manufacturer's standard pipe bells and gaskets.

1.7.3 JOINING PVC GRAVITY SEWER PIPE AND FITTINGS

A. The PVC joints shall be of the push-on type with a single rubber gasket conforming to ASTM F 477.

B. Wyes and riser fittings shall be gasketed connections. Rubber doughnuts are not to be used.

C. Joints between pipes of different materials shall be made using stainless steel shielded couplings or coated mechanical joints connections. Metal piping shall not be threaded into plastic fittings, valves, or couplings, nor shall plastic piping be threaded into metal valves, fittings, or couplings.

1.7.4 IDENTIFICATION

A. PVC gravity sewer pipe shall bear identification markings in accordance with ASTM D 3034 or AWWA C900-16.

B. PVC gravity sewer pipe shall be color coded green using a solid pipe color pigment.

END OF SECTION

SECTION 1.8 INSTALLATION OF PIPELINES

1.8.1 REQUIRED EASEMENTS

A. Master Meter and/or Backflow Prevention Assemblies:

1. All assemblies shall be encompassed by a public utility easement that shall extend from the public right-of-way (or other public access) to 5 feet past the downstream edge of the assembly's concrete pad. The easement shall also extend a minimum of 3 feet from the side edges of the concrete pad;
2. No landscaping and irrigation shall be installed within the easement or protrude into the easement boundaries and trees shall be a minimum of 10 feet from the easement;
3. No structures shall be installed at or within the easement and shall include but not be limited to buildings, foundations, footers, fencing, etc.;
4. All easements shall be coordinated with and recorded through Property Acquisitions.

B. Pipelines:

1. All publicly owned and maintained pipelines that are on private property shall have a minimum 20 or 10-foot wide plus pipe diameter public utility easement, centered on the pipeline;
2. No landscaping and irrigation shall be installed within the easement or protrude into the easement boundaries and trees shall be a minimum of 10 feet from the easement;
3. No structures shall be installed at or within the easement and shall include but not be limited to buildings, foundations, footers, fencing, etc.;
4. All easements shall be coordinated with and recorded through Property Acquisitions.

1.8.2 GENERAL

A. Furnish and install pipe, fittings, valves, fire hydrants, services, and all other appurtenances and incidentals complete and in-place as required by the construction drawings.

B. All pipe crossings of federal or state roads; or local arterials & thoroughfares; or railroads shall be installed in a casing pipe (steel, PVC, or HDPE).

C. Potable and reclaimed water mains shall be ductile iron or protected by a casing pipe in the following instances:

1. mains that are installed under and run parallel with a paved roadway shall be ductile iron only;
2. mains that cross under more than 48 LF of paved roadway (as measured from outer most edge of pavement to outer most edge of pavement of the entire right-of-way cross-section) shall be in a casing; less than 48 LF shall be ductile iron pipe;
3. mains that are installed under paved areas, (i.e. parking lots, etc.) shall be ductile iron only;
4. the above criteria shall be implemented and enforced to replace and/or protect existing mains when the above conditions are created by new development or site improvements.

D. Force mains shall be protected by a casing pipe in the following instances:

1. mains that cross under more than 48 LF of paved roadway (as measured from outer most edge of pavement to outer most edge of pavement of the entire right-of-way cross-section) shall be in a

casing; less than 48 LF shall be determined on a case-by-case basis (i.e. cul-de-sacs, dead-end roads, etc.);

2. the above criteria shall be implemented and enforced to replace and/or protect existing mains when the above conditions are created by new development or site improvements.

E. Force main aerial crossings shall be PVC pipe in a steel casing. Alternate solutions may be considered by the County prior to plan submittal.

F. In situations where mains have been designed, but not limited to, near or between buildings, pass under structures (i.e. walls, fences, etc.), or pass under decorative landscaping (i.e. planters, berms, etc.), the mains shall be placed in a casing with ends that extend well past the edges to allow for excavation during operation and maintenance practices and prevent adverse conditions to the above. The clearance shall be based on the review and approval of the County.

G. When the main(s) is located under any kind of pavement, the water or reclaimed water service line shall be Type "L or K " copper or Schedule 40 stainless steel.

H. Water mains 16-inches and larger shall be ductile iron (or high-density polyethylene with Manatee County Utilities written approval).

I. Ductile iron pipe, with gasket materials as required in these Standards, shall be used in soil that is contaminated with low molecular-weight petroleum products, aromatic hydrocarbons, chlorinated hydrocarbons or organic solvents.

J. Trees shall not be planted or located within 10 feet of any potable water main, reclaimed water main, sanitary force main, gravity sanitary sewer main, sanitary cleanouts, or potable/reclaimed/force main appurtenances such as meters, hydrants, backflow prevention assemblies, etc. that are owned and maintained by Manatee County. An approved root barrier shall be used where trees are planted closer than 10 feet.

K. All distribution waterlines that enter private property become private lines and shall have a backflow prevention assembly installed at the right-of-way in accordance with Chapter 2-31, Article X of the Manatee County Code of Ordinances.

L. No line stops shall be used in potable water or reclaimed water mains.

M. Water mains installed on short cul-de-sacs or permanent dead-ends, where future growth is not feasible (or expected), shall be reduced in diameter to 4-inch and/or 2-inch based on the hydraulic needs of the distribution system. On longer cul-de-sacs, the water main shall be reduced to 4-inch and/or 2-inch after the fire hydrant; also based on the hydraulic needs of the distribution systems. In all cases, dead-end mains shall require a manual blow-off assembly.

Generally, not more than 4, or the equivalent of 4, residences shall be connected to a 2-inch diameter water line, unless the main is looped or otherwise supplied from two connections with mains of adequate capacities. A looped 2-inch main shall serve no more than 40 residences, or the equivalent water demand of 40 residences. A 2-inch diameter main shall not exceed 1,000 feet in length.

The hydraulic calculations and distribution design shall produce a system that limits the need for constant regular flushing of water to ensure water-quality levels are met.

Dead-end public mains, with more than a 4-day water turn-over rate, shall require the installation of a metered blow-off assembly with an auto-flusher.

1.8.3 HANDLING AND STORAGE

A. Prior to installation, all pipe and fittings shall be inspected. Cracked, broken, or otherwise defective materials not in compliance with these standards shall not be used and shall be removed from the project site.

B. The pipeline installer shall take care in the handling, storage and installation of the pipe and fittings to prevent injury to the materials or coatings. Use proper implements, tools and facilities for the safe and proper protection of the work. Lower the pipe and fittings from the truck to the ground and from the ground into the trench in a manner to avoid any physical damages. Under no circumstances shall the pipe or fittings be dropped onto the ground or into the trenches.

C. The pipeline installer shall not distribute material on the job site faster than it can be used to good advantage. Unless otherwise approved by the County, installer shall not distribute more than one week's supply of material in advance of laying. Any materials not to be installed within two weeks of delivery shall be protected from the sunlight, atmosphere and weather by suitable enclosures or protective wrapping until ready for installation. Stored PVC pipe shall be placed on suitable racks with bottom tiers raised above the ground to avoid damage. Storage of pipe on the job site shall be done in accordance with the pipe manufacturer's written instructions.

1.8.4 CLEANING

The interior of pipe, fittings, valves and other appurtenances shall be thoroughly cleaned of all dirt, debris and obstructions before being lowered into the trenches. All pipelines shall be kept clean during and after installation and shall be protected from dirt or foreign matter entering the pipe at all times. All open pipe ends shall be securely plugged or capped water-tight when construction stops during the day, or during lunch, or overnight or during longer periods of inactivity.

1.8.5 INSTALLATION

A. Pipe, fittings, valves and other appurtenances shall be installed in accordance with the manufacturer's written installation instructions and with the provisions of "Recommended Standards for Water Works" report as incorporated by reference in Chapter 62-555, F.A.C., and with the provisions of "Recommended Standards for Wastewater Facilities" report as incorporated by reference in Chapter 62-604, F.A.C.

B. In general, all pressure pipe, (water, reclaimed water and force main sewer), shall be designed with no less than three feet of cover, but not more than six feet of cover from final grade, unless otherwise shown on the plans and approved by Utilities.

C. In all cases, all pipe shall be laid to such lines, gradients and levels as shown on the construction drawings. Gravity sewer pipe shall be laid on grade with bell upgrade and spigot downgrade.

D. It is the Contractor's responsibility to preserve uniform gradients and correct alignment. If it is determined the pipe is incorrect in size, level or grade, then all deficiencies shall be corrected.

E. Where shown on the construction drawings, special bends shall be provided for horizontal or vertical changes of direction. Where such bends are not shown on the construction drawings, changes of direction shall be affected by angling the joints.

F. No joint shall be angled to such an extent as to impair its effectiveness and tightness.

G. When making a joint, pipes should always be in line and if required, deflection made after making the joint. The deflection shall not be greater than the maximum value recommended by the pipe manufacturer.

H. Installation tolerances:

1. Direct Bury:
    a. Vertical Alignment = ±0.5 feet
    b. Horizontal Alignment = ±1.0 feet
2. Horizontal Directional Drill (Trenchless Technologies):
    a. Vertical Alignment:
        1) max. slope shall not exceed 2% (2.0 feet within a length of 100 feet).
        2) No reverse curvature within 200 feet
        3) No vertical deviation greater than ten (10) percent of the proposed depth of cover at that specific station.
    b. Horizontal Alignment:
        1) max. rate of deviation shall not exceed 1.5% (1.5 feet within a length of 100 feet
        2) No reverse curvature
        3) Total deviation not to exceed 2.0 feet

I. The trenches and bedding for the pipe installations shall be prepared according to Section 1.3, Trenching and Excavation, of these standards. Pipe sections shall be laid in full contact with the prepared pipe bedding, with bell holes dug out, to provide a continuous and uniform bearing and support for the pipe barrel between joints. Blocking under the pipe shall not be permitted (except through casing sleeves).

J. While laying pipe in gravity sewer installations, the pipe alignment shall not deviate by more than 1/2 inch for line and 1/4 inch for grade, as measured at the pipe inverts at the manhole, from the design line and grade established on the construction drawings, provided that such variance does not result in a level or a reverse sloping pipe invert. Line and grade of gravity sewer pipelines shall be measured at the pipe invert and shall be controlled during installation by laser beam method. Other methods of controlling line and grade may be approved by the County if the laser beam method is shown to be unworkable. A "Caution - Laser Light" placard shall be displayed in a conspicuous place while laser beam pipe laying equipment is in use. Pipe grade between manholes shall not deviate by more than 1 inch from the design grade line, as measured with the television (TV) camera's depth gauge during the mandatory pre-acceptance TV inspection, provided that such deviation does not result in a level or a reverse sloping pipe invert.

K. Joining of pipe sections shall be done in strict accordance with the pipe manufacturer's written instructions. The joining surfaces of the bell and spigot and the rubber seal ring shall be thoroughly cleaned and lubricated immediately prior to joining the pipe per the written instructions. After the joint has been made, the pipe alignment shall be checked. Place sufficient compacted backfill material around and over the pipe to secure the pipe from movement before installing the next joint to assure proper pipe alignment and joint makeup.

L. When cutting or machining pipe in the field is necessary, the pipe installer shall use only the tools and methods recommended by the manufacturer in the written instructions. Care shall be taken to not damage the pipe coating or linings. Damage to linings shall be cause for rejections of the complete section of pipe, or for the rejection of a fitting or valve. Damage to exterior coatings shall be corrected to the original standard material specification.

M. At connections to manholes or other concrete structures, the pipe joint shall be located a minimum of 18-inches outside of the edge of the structure.

N. At stub-outs from new structures to future pipelines, the pipe stub-out length shall be the same as the standard pipe length being laid. Stub-out pipes shall be closed off with standard restrained plug or cap fittings.

O. Thrust restraint devices shall be either cast-in-place concrete thrust blocks or other approved restrained joint devices. Cast-in-place concrete for thrust blocks shall have a 28-day strength of 3,000 psi. The concrete shall be placed between undisturbed soil and the fittings or appurtenance to be supported. Concrete shall not be placed on or around the pipe, bells, flanges, or other joints.

P. All ductile iron pipe(s) and fitting(s) shall be protected with a polyethylene sleeve(s), thickness as defined by the Approved Products List.

Q. At all fire hydrant laterals, the lateral pipe from tee to fire hydrant shoe shall have all joints restrained. The lateral shall also be restrained from side movement by concrete thrust blocks placed at the fire hydrant shoe and at the lateral tee.

R. Place and secure a black bag over all fire hydrants not yet placed into service to designate them as such and to serve as a warning that the water is not safe to drink.

S. All pressure water, reclaimed water and force main sewer pipelines laid in trenches shall have a continuous, solid copper clad steel wire with a polyethylene insulation rated UF or USE by Underwriter's Laboratories, as defined in the Approved Products List, attached to the pipe. The polyethylene insulation shall be color coded blue (water), purple (reclaimed water) or green (sanitary sewer). The wire shall be placed on top of the pipe and secured in place at every joint and at 5 foot intervals with color coded 6 mil thick PVC marking tape.

T. All mains which are installed by the open-trench method, regardless of piping material, shall also include the installation of a continuous, 6--inch wide, color-coded, electrically detectable path marking tape buried directly over the pipe. The path marking tape shall be placed between 12-inches and 24--inches below finished grade; with 48-inch being the maximum. The top of the tape shall be boldly labeled every eighteen to thirty-two (18-32) inches as follows "CAUTION WATER LINE BURIED BELOW", "CAUTION SEWER LINE BURIED BELOW", OR "CAUTION RECLAIMED WATER LINE BURIED BELOW" and shall be color-coded blue (water), green (sewer), or purple (reclaimed water).

U. Trenching, backfilling and compaction for the newly laid pipelines shall be accomplished in accordance with Section 1.3, Trenching and Excavation.

V. In directional bore applications, one extra high strength copper clad steel tracer wire with a polyethylene insulation rated UF or USE by Underwriter's Laboratories, as defined by the Approved Products List. The wire shall be pulled and secured to the top of the pipe with color coded PVC marking tape or 10-mil thickness polyethylene pressure sensitive tape at every joint and at 24-inch intervals. The tracer wire shall be color coded blue (water), purple (reclaimed water) or green (sanitary sewer).

W. Underground splice connections shall be minimized and shall be rated for direct burial service. Spliced tracer wire connections shall be underground water-proof wire connectors meeting UL 486D test standards. The wire shall terminate at fire hydrants, backflow prevention assemblies, and at each meter box with a underground water-proof terminal connector. The wire shall also terminate at valve boxes for gate valves, plug valves, tapping valves, air release valves and blow-off valves. The tracer wire shall also terminate at gate valve boxes that are not located within 200 feet of a fire hydrant, backflow prevention assembly, meter box, plug valve, air release valve or blow-off valve. Meter boxes shall have at least 12

inches of wire looped into the boxes. The looped termination shall allow for the connection of an electronic locator transmitter.

X. Prior to construction of any pressure main, the Contractor shall propose a flushing/pigging plan to the County Inspector showing on the drawings each location where each pig will be placed in the pipe and each location that the pig will be retrieved. A pig (with a 2 lb/cu-ft density) one diameter larger than the inside diameter for the type of pipe installed, shall be run through the pressure main(s) until clear and free of debris. Inspectors must be notified 48 hours in advance of any pigging and flushing operations. With the County Inspector present, all new pressure mains 4 inches and larger shall be pigged and then flushed. All new pressure mains less than 4 inches shall be flushed to clean all parts of the system and to remove any accumulation of construction debris, rocks, sand, gravel, silt and other foreign material. If necessary, also make use of mechanical rodding or bucketing equipment. Short pipe lengths (i.e. stubs) may be flushed without pigs with prior approval from County. For flushing, a minimum velocity of at least 3.0 ft/sec, preferably 3.5 ft/sec, shall be obtained in the pipe. This velocity shall be maintained long enough to allow three (3) complete pipe volume changes of water for proper flushing action. Successful flushing shall be determined visually by the County Inspector and may be deemed acceptable when the water is clear and free of debris.

Y. During the installation of pipelines using the horizontal directional drilling (HDD) method, the pulling force and downhole mud pressure shall be digitally monitored and recorded. Pulling force shall be limited to the maximum allowed by the pipe manufacturer. A mandrel based on 80% of the inside diameter of the pulled pipe shall be pulled through the final installed pipe by hand to confirm no elongations (necking) have occurred.

Z. As a marker for the Surveyor, a PVC pipe marker or 2" x 4" marker shall be inserted by the Contractor on the top of pipe for potable water mains, reclaimed water mains and sanitary force mains at intervals no greater than 200 feet apart; at all fittings, and at locations where there is a substantial grade change. The pipe markers shall indicate the pipe diameter and/or fitting type with orientation (H or V) and shall be labeled PWM in "safety" blue for potable water mains, RWM in purple for reclaimed water mains, and FM in green for sanitary force mains, respectively. The Contractor is responsible for making the aforementioned markers available to the Surveyor. The Contractor shall field locate (expose) the mains and fittings when markers are not made available to the Surveyor.

AA. A PVC pipe marker or 2" x 4" marker shall be inserted by the Contractor at the beginning and end of each horizontal directional drill (HDD). The HDD Contractor shall provide a certified report and bore log indicating the horizontal and vertical location every 25 linear feet or less along the pipe. The horizontal locations on the bore log shall also indicate the location per the stationing of the construction baseline.

1.8.6 PRESSURE TAPS

A. Pressure taps for connection of new water, reclaimed water or sewer systems to existing County pressure mains shall be made by a County crew for tap sizes up to and including 12 inches diameter. For each pressure tap performed by the County, the pipeline installer shall provide excavation to unearth the existing pipe and provide a dry, safe tapping pit, and shall provide and install the tapping sleeve and tapping valve with an EPDM full-face 1/8-inch rubber gasket. Prior to the tapping of the pipe, the pipeline installer shall pressure test the sleeve and the valve to the satisfaction of the County Tapping Crew or the County Inspector. After the tap has been made, the pipeline installer shall backfill and compact the excavation, and provide all other materials and labor required to complete the work.

B. Pressure taps shall not be used to make pipeline connections in new work except to make a connection to an existing County main, and then only if it is deemed to be inconvenient or unworkable to make the

connection by another method using standard fittings. Where a new phase of the system will be connected to a future phase or future subdivision, standard fittings will be assembled which shall include a line valve and stub-out and cap where the future system will be connected without need for making another pressure tap. All pressure tap installations shall be subject to approval by the County.

C. All pressure taps greater than 12 inches in diameter and all tap sizes on concrete mains, shall be made by a Manatee County approved tapping company.

D. When installations are made under pressure, the flow of water through the existing main shall be maintained at all times. The diameter of the tap shall be at least two inches smaller than the inside diameter of the through main. No same size taps shall be allowed.

E. The Contractor shall confirm the location(s) of the existing main to be tapped by visually inspecting the proposed location(s) of the tapping sleeve(s) and ensure the locations will be satisfactory and no interference will be encountered; such as the occurrence of existing utilities or of a joint or fitting at the location proposed for the connection. No tap will be made closer than 30 inches from a pipe joint or a fitting.

F. Adequate support shall be provided under the sleeve and valve during the tapping operation. Thrust blocks shall be provided underneath the valve and behind all tapping sleeves. Proper tamping of supporting earth around and under the valve and sleeves is mandatory. After completing the tap, the valve shall be flushed to ensure that the valve seat is clean.

1.8.7 FINAL FLUSHING OF WATER MAINS

After disinfection and prior to final acceptance, all new potable water mains shall receive a final flush to clean all parts of the system and to remove all remaining concentrations of heavily chlorinated water.

1.8.8 PIPELINE ALIGNMENTS

A. Water, sewer and reclaimed water pipelines to be installed within new roadway rights-of-way shall be situated along typical uniform alignments that minimize the number of interferences or obstructions between the different utilities. Appendix A has a matrix of separation requirements for most installed utility mains. Water mains shall be designed to cross over sanitary and storm utilities.

B. Potable water pipelines shall typically be located along the southerly and easterly sides of the roadways 5 feet away from the back-of-curb line. Fire hydrants shall be installed on the same side of the roadways as the potable water mains. Potable water mains shall be on the opposite side of the street from sidewalks, sanitary force mains and reclaimed water mains.

C. Force main sewer pipelines shall typically be located on the opposite side of the road from the water mains, generally along the northerly and westerly sides of the roadways and 5 feet away from the back-of-curb line when no reclaimed water pipeline is present; or no closer than 3 feet to the right-of-way line when this side of the road is shared with a reclaimed water main.

D. Reclaimed water pipelines shall be typically located on the same side of the roads as the force mains (on the northernly and westerly sides) and 3 feet away from the back of curb and 3 feet away from the force mains, when force mains are present; when no force main is present, the reclaimed water main shall be located 5 feet away from the back-of-curb. Fire hydrants on reclaimed water mains shall be on the same side of the roadway as the main.

E. Where it is demonstrated that it is not technically feasible or economically practical for the sanitary force mains or the reclaimed water mains to be on the opposite side of the street from the potable water mains;

a minimum horizontal separation from the potable water mains shall be 6 feet for force mains and 3 feet for reclaimed water mains, respectively.

F. Gravity-flow sanitary sewer pipelines shall typically be located under the roadway pavement along the centerline of the right-of-way, and may vary from side to side under curved roadways, but shall be no closer to a potable water main than 6 feet; or no closer to a reclaimed water main than 3 feet; or no closer to a force mains than 3 feet, respectively.

G. Depth of bury for potable water mains, reclaimed water mains and force mains shall typically be no less than 3 feet and no more than 6 feet of cover at final grade.

H. Potable water mains, when crossing sewer, reclaimed water mains, and storm pipe, shall cross over the top of the other mains with a minimum of 12 inches of vertical clearance. See Separation Matrix in Appendix A.

Where approved by the County, potable water, reclaimed water or force mains may be buried less than 3 feet deep to avoid an obstruction or another pipeline, provided the potable water mains or reclaimed water mains are constructed of ductile iron pipe or the potable water mains or reclaimed water mains or force mains are enclosed in ductile iron or steel encasement pipes. Increased thrust restraint shall be provided for pipes with less depth of cover. Prior written approval from the County is required before submitting design construction plans for all mains with less than 3 feet; or more than 6 feet of cover, except where short runs are necessary to avoid existing infrastructure; unnecessarily deep mains shall be prohibited.

I. For preferred horizontal and vertical separation, please refer to the matrix "Manatee County Utility Required Separations" located in the Appendix at the back of this manual.

1. Where it is technically feasible and economically practical, the standard minimum horizontal separations between pipelines shall be practiced.

2. Where it is demonstrated and the County agrees that standard separations are not realistic, the County may approve reductions of the standard separations.

J. Standard force mains are to be 4 inches and larger in diameter and shall be designed to minimize the adverse effects of air pocket entrapment by either the use of air release valves (ARV's) or by designing the overall force main system to exceed the minimum air-scouring fluid velocity within the pipeline.

1. Where ARV's are used, long upward or downward sloping runs of pipeline should be used – rather than laying-to-cover of 3 feet minimum bury, or rather than dipping up and down under other utility structures – and the vertical alignment should be designed such that the number of ARV's required is limited to the minimum.

a. ARV's shall be placed at high points along the pipeline and where air would otherwise become entrapped.

b. For vertical alignments requiring ARV's, such alignments shall be fully defined and depicted on the construction plans with use of elevation notations at each station or with use of elevations given for all vertical points of intersection and slopes given on the pipeline in between all vertical points of intersection from the lift station to the termination of the force main.

c. Any proposed significant deviation from the vertical alignment of the approved construction plans must be resubmitted for checking and re-approval by the Manatee

County Utility Engineering Division representative before such revised vertical alignments may be constructed.

2. Where an air-scouring design is proposed, and air is to be transported downstream along the pipeline by the sufficiently rapid movement of the fluid, no ARV's are required and no strict definition of the alignment by means of elevation and slope notations are required on the plans.

   Air-scouring velocity to move air pockets downstream at various downward slopes shall be as determined by Wheeler in Table B-9 of Pumping Station Design, by Robert L. Sanks, 1998, (see Appendix) or as determined by an equally credible source or calculation.

1.8.9 VALVE AND HYDRANT PLACEMENT

A. In-line potable or reclaimed water valves shall generally be installed at intervals no greater than 1,600 LF on transmission mains, where systems serve widely scattered customers and where future development is not expected; and at intervals of no greater than 800 LF on main distribution loops and feeders, and on all primary branches connected to these lines.

B. In residential, commercial and industrial subdivisions, water valves shall be installed at intervals no greater than 800 feet.

C. Valves shall be located on all sides of tees and crosses, unless there is another in-line valve on that leg within 200 feet. At the discretion of the County, valving may be reduced on dead-end streets, where mains have no possibility of being "looped" or connected to other mains.

D. In-line sewer valves shall be installed at intervals of no greater than 1,200 LF on sewer force mains.

E. In all instances, for both water and pressure sewer pipes, valves shall be placed to maximize the effectiveness of isolation of the pipelines during maintenance and repairs. Valves shall not be placed in curbs or gutters, blow-off valve assemblies shall not be placed in driveways or sidewalks. In-line water and sewer valves shall be installed near each side of a canal crossing, major road crossing, at all jack and bore crossings, and/or railroad crossings.

F. An approved backflow prevention assembly shall be placed on private property at the right-of-way line where a public water distribution system crosses over onto private property and becomes a privately maintained system. All valves shall be noted and depicted on the construction and record drawings.

G. A sewer control valve shall be placed at the property line, where a private sewer force main enters the right-of-way. All valves shall be noted and depicted on the construction and record drawings.

H. Valves that are located in fields or open spaces shall have a 4" PVC pipe marker inserted by the Contractor adjacent to the concrete pad. The markers shall be a 6 foot length of PVC pipe inserted 2 feet into the ground and shall indicate the type of valve. The marker shall be labeled PWM in "safety" blue for potable water mains, RWM in purple for reclaimed water mains, and FM in green for sanitary force mains, respectively.

I. Fire hydrants shall be located no more than 800 feet apart and within 400 feet of the main entrance of all non-residential buildings as measured along normal access routes, on the same side of the roadway as the water main. Hydrants shall be placed no closer than 400 feet from the end of the water main as depicted in UW-20 and located on the side property lot lines, unless within 500 feet of another hydrant. Dead-end water mains shall be installed with a blow-off assembly to help address any possible water quality issues. Hydrants shall not be located within 40 feet of any building, except within a right of way or within one-story single-family residential areas.

1.8.10 MINIMUM PIPE FLOW DESIGN CRITERIA

A. Gravity Sewer Design. A minimum design velocity of 2.0 feet per second and a maximum design velocity of 10.0 feet per second shall be used for the design of gravity-flow pipelines. Maximum design flow depths for peak design flow rates shall not exceed 80 percent of the pipe inside diameter.

B. Minimum slopes required to achieve a velocity of at least 2.0 feet per second are provided below:

Sewer Pipe Diameter in Inches, I.D.	Minimum Slope in Feet per 100 Feet, Manning's *n* = 0.013
8	0.42 **
10	0.28
12	0.22
14	0.17
15	0.15
16	0.14
18	0.12
21	0.10
24	0.08
27	0.067
30	0.058
36	0.046

** All gravity sewer mains shall meet ten state standards including minimum slopes except for 8" gravity sewer mains. Sewer main 8 inch in diameter shall be laid at a minimum slope of 0.42%, except for terminal runs. Terminal runs shall be laid at 0.50% for the equivalent of 4 single family dwelling units or greater. Anything less shall be laid at 1.00%.

C. Sewer Force Main Design. Sewer force main velocities shall not be less than 2 feet per second, with one/smallest pump running (at minimum flow) and not exceed 6 feet per second at peak-hour flow conditions. Hazen-William's roughness coefficient of a maximum of 120 will be used in the calculations.

D. Gravity Sewer, Sewer Force Main, and Lift Station Design. Construction drawings that are submitted to Manatee County for approval shall include engineering calculations, which may include computer hydraulic modeling. Gravity sewer, sewer force main, and lift station design shall be based on peak-hour flow rate. Unless the Engineer of Record provides credible documentation and/or data to support peaking factors used in his or her calculations, peaking factors for peak hour flow rate shall be based on the following equation:

Peak-Hour Flow/Average Daily Flow = $(18 + \sqrt{P})/(4 + \sqrt{P})$

(where $\sqrt{P}$ = square root of the population in thousands)

(Peak hour factor not to exceed 4)

E. Water Distribution Main Design. Water mains shall be designed with velocities no greater than 5 feet per second at peak-hour flow conditions and no greater than 10 feet per second at maximum-day plus required fire flow conditions. Hazen-William's roughness coefficient of a maximum of 130 shall be used in the calculations for plastic pipe and lined ductile iron pipe. Delivered flows for pressure water mains shall meet the required fire flow rate plus a background water demand equivalent to the maximum-day demand with a residual gauge pressure not less than 20 pounds per square inch (psi). A residual gauge pressure not less than 20 psi shall be maintained at the peak-hour water demand. Construction drawings

that are submitted to Manatee County for approval shall include engineering calculations, which may include computer hydraulic modeling. Unless the Engineer of Record provides credible documentation and/or data to support peaking factors used in his or her calculations, peaking factors for peak-hour and maximum-day flow rates in potable water main design shall be based on the following equations:

Q-Peak = 2.2 X Average Daily Flow

Q-Max Day = 1.5 X Average Daily Flow

1.8.11 DETECTION

A. All direct buried mains shall have a continuous 6-inch wide, color-coded, electronically detectable path marking tape buried over the main. The path marking tape shall be placed between 12--inches and 24-inches below finished grade, with a 48-inch maximum depth.

B. All direct buried (excluding gravity sewer) pressure pipe shall have a tracer wire installed along the pipe alignment. The tracer wire to be used shall be a solid, high strength, copper clad steel wire with a polyethylene jacket of appropriate color, as defined in the Approved Products List.

C. All horizontal directional drilled pipe shall have a tracer wire installed along the pipe alignment. The tracer wire to be used shall be a solid, extra high strength, copper clad steel wire with a polyethylene jacket of appropriate color, as defined in the Approved Products List.

D. Prior to acceptance of pressure pipe by the County, the Contractor shall demonstrate that the electrically detectable path marking tape and the locator tracer wire functions properly. During the tracer wire testing, the Contractor shall also demonstrate that the wire is connected to all services at meter boxes, hydrants, backflow prevention assemblies, valves, air release valves, and blow-off valves. The Contractor shall use one of several commercially available utility locating instruments to energize and trace the electrically detectable path marking tape and/or locator wire for continuity. Direct signal locate method shall directly apply the current from the transmitter to the tracer wire and the signal shall be detected and followed with a receiver. Submit to the County Inspector for approval the method and equipment to be used. Testing of the electrically detectable path marking tape and locator wire shall be done prior to or concurrent with the hydrostatic pressure test.

E. A 2” PVC pipe marker with a painted end cap shall be inserted by the Contractor at the ROW line indicating each individual new service location or stub out. The marker shall be a 6 foot length of PVC pipe inserted 2 feet into the ground and shall be painted “safety” blue for potable water, purple for reclaimed water, and green for sewer.

END OF SECTION

SECTION 1.9 TESTING AND INSPECTIONS

1.9.1 DESCRIPTION OF WORK

Timely notice shall be given to the County Inspector of approvals or observations which may be required, and a time and date for a field visit shall be scheduled. Provide all materials, equipment, supplies and labor as required to complete the testing or inspection operations. Should any test fail, the causes of failure shall be corrected, and the work shall be retested until all test requirements have been successfully met.

1.9.2 FIELD VISITS

Field tests or observations which require the presence of a County Inspector shall be scheduled on weekdays during normal working hours. A minimum of two full days' notice, not counting weekends, shall be provided to the inspector in advance of when the test is to be conducted. Any requests for emergency test scheduling must be made in writing, stating why the test should be scheduled ahead of tests for other jobs.

1.9.3 PIPELINE INSPECTIONS

A. During the County Inspector's routine inspections of construction, the County Inspector shall observe that the pipe interior, fittings, valves and other appurtenances are thoroughly cleaned of all dirt, debris and obstructions before being lowered into the trenches; and that the interior of all pipelines are kept clean during and after installation; and that all open pipe ends are securely plugged or capped water-tight when construction stops during the day, or during lunch, or overnight or during long periods of inactivity.

B. All thrust restraint devices on pressure pipelines shall be checked and approved by the County Inspector before backfilling.

C. The County Inspector shall be present during the flushing and pigging operations and verify that final discharges are clear and free of debris.

1.9.4 COMPACTION TESTING

A. Compaction testing shall be performed per Section 1.3 Trenching and Excavation, 1.3.7 - Backfill.

1.9.5 MATERIALS CLASSIFICATION

Soils and soil-aggregate mixtures used as backfill materials shall be identified according to the AASHTO system, designation M-145.

1.9.6 FLOW TESTS

Measurements of static, pitot, and residual pressures and available fire flow, for use in the design of water distribution systems, shall be made using the two-hydrant method (or additional hydrants as required) as described in AWWA Publication M17, "Installation, Field Testing, and Maintenance of Fire Hydrants". Flow tests obtained and utilized as boundary condition for hydraulic modeling must be performed no later than within a year of the initial construction plan submittal.

1.9.7 HYDROSTATIC TESTING OF PRESSURE PIPELINES

A. After the water mains, reclaimed water mains or sewer force mains are installed complete, and the fire hydrants, valves, fittings, blow-offs and restraining devices are permanently installed, and the trenches are backfilled, the new pipelines shall be tested hydrostatically for leakage.

B. The County Inspector shall have been notified and shall be present during hydrostatic testing procedures. The Contractor and an Engineer of Record representative shall also be present during the tests.

C. All excavations for any utility pipes or cables within the rights-of-way or easements must be complete before a hydrostatic test is performed. Any subsequent digging or boring across the water, sewer or reclaimed pipelines after they have been tested shall result in a requirement for the pipelines to be retested.

D. All mains to be tested shall be cleaned as specified in these Standards to remove all dirt, stones, pieces of wood or any other material which may have entered the lines during construction. Any obstructions remaining shall be removed.

E. Pipelines to be tested shall have been allowed to remain in place undisturbed for at least 24 hours to allow time for all joints to develop a complete seal. All potable water services and reclaimed water services are to be installed complete with curb stops, resetters and meter boxes prior to beginning the test. Gate valves on fire hydrant laterals shall be opened so that the test pressure bears against the closed hydrant valve.

F. Discharged flows from cleaning or flushing operations shall be disposed of in a manner consistent with US EPA, FDEP, and SWFWMD regulations.

G. Only one connection to the existing water supply system shall be allowed prior to acceptance of the main. Connection shall be made through an approved backflow prevention assembly. Air shall be expelled completely from the section of pipeline to be tested. If air can not be fully expelled, ARV's shall be required at the high points to ensure proper function of the mains. After the hydrostatic test has been successfully completed, the corporation stops, located at the temporary jumper connection, are to be closed and plugged with brass or PVC stops.

H. The hydrostatic test duration shall be at least two hours. The test pressure at the beginning of the test shall be 180 psi for water mains and reclaimed water mains and shall be 150 psi for sewer force mains. The water supply, and the water supply pump, shall be disconnected during the test. The test pressure shall not vary by more than plus or minus 5 psi during the test. If the pressure drops 5 psi, makeup water shall be pumped into the test pipeline section during the test duration to maintain the pressure to within 5 psi of the test pressure and the amount of leakage measured. The total amount of makeup water added shall be measured and shall be compared to the allowable leakage.

I. The allowable leakage measured during the test duration for DI and PVC pipe shall be as determined by the following formula:

$$L = \frac{SD\sqrt{P}}{148{,}000}$$

where,

L = testing allowance (makeup water), gallons per hour

S = length of pipe tested, feet

D = nominal pipe diameter, inches

P = test pressure, psi (gage)

or, as determined by Table 5A of the Hydrostatic Testing section of AWWA C600.

J. The maximum length of pipe to be hydrostatically tested shall be 2,600 feet. If an exception to this rule is granted by the County's authorized representative, and a length of pipeline greater than 2,600 feet is tested, the allowable leakage will still be figured for a 2,600-foot length of pipeline.

K. Force mains shall be pressurized for testing between the above-ground valve assembly at the lift station and the valve at the termination to the existing force main system or at the termination to the gravity system manhole.

L. Any exposed pipe sections, valves, fittings, hydrants, services and pipe joints shall be carefully observed during the test duration. All visible leaks shall be repaired, regardless of the amount of leakage.

M. Any damaged or defective pipeline components that are discovered after the hydrostatic testing shall be repaired or replaced with standard materials, and the test shall be repeated until a satisfactory test result is achieved. Any modifications to the new pipeline made after a successful hydrostatic test has been performed shall be cause for a new hydrostatic test of the same pipeline to be performed again.

N. No pipeline installation shall be accepted if the amount of make-up water is greater than the allowable leakage. In the event of a failed test result, locate all leaks and make repairs or replacements as required, and retest the pipeline until the leakage is within the allowable limit.

O. When the test has been completed successfully, blow off the pressure from the opposite end of the line from the water supply connection, to demonstrate the limits of the length of pipeline subjected to testing. Also, flush water from all hydrants, services and blow-offs, to demonstrate that they were on-line during the test.

P. The section of pipeline being tested shall be identified on the Charge Sheet Inspection Report. The stationing numbers from the construction survey shall be used to describe the extent of the tested pipelines, if available. The exact lengths and sizes, and the precise extents of the tested pipelines, and the particular valves being tested against, must all be identified clearly on the Charge Sheet. A copy of the Charge Sheet shall be provided to the Engineer of Record's and the Contractor's representative.

Q. A punch list shall be made at the end of all tests.

R. Hydrostatic Testing for HDPE Pipelines:

1. For pressure pipelines laid wholly using HDPE pipe, a modified hydrostatic test is required. In the modified test, the pipeline shall be cleaned, flushed, filled and vented, and otherwise prepared for testing similar to other types of pipeline materials; but, prior to the test, an initial expansion period at test pressure shall be allowed, during which the HDPE pipe shall be allowed to stretch and assume an equilibrium volume against the applied pressure. During the expansion period, make-up water shall be added to the pipeline to maintain the test pressure. If pressure testing dissimilar materials (PVC and HDPE, etc.) the test shall use the PVC standard for allowable leakage. Otherwise test the HDPE individually.

2. After the initial expansion period, the test shall commence, and shall proceed in accordance with the methods presented in Chapter 2, "Inspections, Tests and Safety Considerations" of the Handbook of Polyethylene Pipe, Plastics Pipe Institute, or using information provided by the pipe manufacturer for the material and class of pipe installed and conducted in accordance with ASTM F2164, unless otherwise approved by the County. In the event of a test failure, locate and repair

the cause of the leakage and retest the pipeline. Repair all visible leaks regardless of the amount of leakage.

1.9.8 BACTERIOLOGICAL TESTING

A. After the new potable water pipelines have been hydrostatically tested, or after existing potable water pipelines have been modified or repaired, they shall be cleaned, disinfected and sampled and tested for the presence of coliform organisms in accordance with AWWA C651.

B. See Section 1.10 Cleaning and Disinfecting Water Pipelines.

1.9.9 INSPECTION OF PRECAST CONCRETE STRUCTURES

A. Precast portland or polymer concrete manhole bases, sections and tops, utility vaults, and wet wells shall be subject to inspection and approval by the County.

B. The County Inspector will carefully examine the structures for compliance with ASTM C 478, these Standards, and the manufacturer's shop drawings. All structures will be inspected for dimensions, cracks, voids, blisters, roughness, soundness, scratch strength, and general appearance. After installation, there shall be no visible leaks within the manholes, utility vaults and wet wells.

C. Structures with minor imperfections may be repaired, subject to the approval of the County's Representative, after demonstration by the manufacturer that such repairs will result in strong and permanent restorations. All visible leaks in the manhole structures shall be repaired. Repair leaks by injecting a moisture activated polyurethane type injection resin grout. The County Inspector shall have been notified and shall be present during the repair and retesting. Repairs shall be carefully examined by the County Inspector before final approval by the County.

1.9.10 AIR TESTING OF GRAVITY SEWER MAINS

A. Gravity sewer pipes shall be tested for leakage by performing the low-pressure air test. The County Inspector shall have been notified and shall be present during the pressure test.

B. All excavations for any utilities or cables within the rights-of-way or easements must be complete before a low-pressure air test is performed. Any subsequent digging or boring across the gravity sewer pipes after they have been tested shall result in a requirement for the sewer system to be retested.

C. The sewer pipes to be tested shall be flushed and cleaned prior to the test to remove dirt, debris or obstructions.

D. Each pipe section tested shall be the length of pipe between two manholes. The ends of all branches, laterals, tees, wyes and stub-outs included in a test section, as well as the ends of the pipe section to be tested, shall be plugged to prevent any air leakage, and all plugs shall be secured in place to prevent blowouts due to the internal test pressure.

E. The test pressure shall be no less than 3.5 psi and no more than 9 psi. The specific test pressure shall be determined by the average height of the natural ground water table above the pipe springline. The elevation of the ground water table shall be measured by using a test well, or by digging a test pit, or by other approved methods, or the County Inspector may accept an assumption of the surface of the ground or pavement for the ground water table elevation. The height of the ground water table above the test pipe section shall be the average of the height above the inlet of the pipe and the height above the outlet of the pipe.

F. The test pressure shall be calculated individually for each test section of pipe and shall be as determined by the following formula:

$$P = 3.5 + 0.43H \quad P \leq 9$$

where,

P = test pressure, psi (gage)
H= average height of ground water table above pipe springline, feet

G. Air shall be pumped into the test section of pipe until the pressure inside reaches the test pressure. After the pressure has been stabilized at the test pressure, remove the connection from the pressurized air source and begin the test duration. The test duration shall be as indicated in the following table:

LOW PRESSURE AIR TEST
SPECIFICATION TIME REQUIRED FOR A 1.0 PSIG PRESSURE DROP
FOR SIZE AND LENGTH OF PIPE INDICATED FOR Q = 0.0015

L = length of test section, feet.

1. Pipe Diameter (in.)	2. Minimum Time (min: sec)	3. Length for Minimum Time (ft.)	4. Time for Longer Length (sec)	Specification Time for Length (L) Shown (min: sec)							
				100 ft	150 ft	200 ft	250 ft	300 ft	350 ft	400 ft	450 ft
4	3:46	597	.380 L	3:46	3:46	3:46	3:46	3:46	3:46	3:46	3:46
6	5:40	398	.854 L	5:40	5:40	5:40	5:40	5:40	5:40	5:42	6:24
8	7:34	298	1.520 L	7:34	7:34	7:34	7:34	7:36	8:52	10:08	11:24
10	9:26	239	2.374 L	9:26	9:26	9:26	9:53	11:52	13:51	15:49	17:48
12	11:20	199	3.418 L	11:20	11:20	11:24	14:15	17:05	19:56	22:47	25:38
15	14:10	159	5.342 L	14:10	14:10	17:48	22:15	26:42	31:09	35:36	40:04
18	17:00	133	7.692 L	17:00	19:13	25:38	32:03	38:27	44:52	51:16	57:41
21	19:50	114	10.470 L	19:50	26.10	34:54	43:37	52:21	61:00	69:48	78:31
24	22:40	99	13.674 L	22:47	34:11	45:34	56:58	68:22	79:46	91:10	102:33
27	25:30	88	17.306 L	28:51	43:16	57:41	72:07	86:32	100:57	115:22	129:48
30	28:20	80	21.366 L	35:37	53:25	71:13	89:02	106.50	124:38	142:26	160:15
33	31:10	72	25.852 L	43:05	64:38	86:10	107:43	129.16	150:43	172:21	193:53
36	34:00	66	30.768 L	51:17	76:55	102:34	128.12	153.50	179:29	205:07	230:46

Source: Uni-Bell Handbook of PVC Pipe.

H. No more air shall be added to the test section during the test duration. The allowable drop in pressure during the test duration shall be 1 psi or less. No gravity sewer main installation shall be accepted if the pressure drop during the test duration is greater than 1 psi.

I. In the event of a failed test result, locate all leaks and make repairs or replacements as required, and retest the sewer main until the leakage is within the allowable limit. All visible leaks in sewer pipes or at connections to manholes shall be repaired regardless of the results of the low-pressure air tests.

J. Any damaged or defective sewer main or service lateral components that are discovered after the low-pressure air testing shall be repaired or replaced with standard materials, and the test shall be repeated until a satisfactory test result is achieved. Any modifications to the new sewer collection system made after a successful test has been performed shall be cause for a new low-pressure air test of the same sewer main to be performed again.

1.9.11 DEFLECTION TESTING OF GRAVITY SEWERS (MANDREL TESTING)

A. The Contractor shall perform a pipe ring deflection test on all new gravity sanitary sewer mains. The rigid ball or mandrel used for the ring deflection test shall have a diameter not less than 95 percent of the base inside diameter or average inside diameter of the pipe depending on which is specified in the ASTM C 3034, to which the pipe is manufactured. The test shall be performed without mechanical pulling devices.

B. The allowable ring deflection is 5 percent of the inside pipe diameter. Pipes that have a ring deflection that exceeds this amount shall not be accepted.

1.9.12 TELEVISION INSPECTION OF GRAVITY SEWERS

A. TV inspection of the entire length of the inside of new gravity sewer mains shall be conducted by the Contractor. The County Inspector shall have been notified and shall be present during the TV inspection.

B. The sewer pipelines shall be thoroughly cleaned of all dirt, debris or obstructions before the TV inspection. Water shall be added to the upstream manhole until it is seen flowing from the most downstream point of the system to be inspected.

C. The TV camera shall be a self-propelled, 360-degree pan-head, color type and shall have dual DVD recording capability. The camera shall be equipped with a depth gauge calibrated to 1/4-inch increments to accurately record the depth of the water in the pipeline. A calibration report shall be submitted with each digital video disk (DVD), which shall include a drawing of the depth gauge, indicating the marks on the gauge, and what depth each mark represents.

D. The County Inspector shall be present and will observe the TV monitor along with the camera operator as the camera progresses through the pipe. All pipelines will be inspected with the camera progressing in an upstream direction when possible. The camera operator shall record the manhole numbers and the distance the camera has progressed from the downstream manhole as the inspection proceeds. The operator shall stop the progress of the camera and record the distance at all locations along the pipeline where unusual or defective features are encountered. The operator shall record the distance and depth of the water in the pipe at all locations where the depth is greater than or equal to 3/4 inch. The camera operator shall make records where cracked, dented or deformed pipe is found, or at joints that are not properly installed, or where infiltration is observed, or at any other abnormality or where any other defective feature is encountered.

E. At the end of the inspections, or at the end of the day, one original digital video disk (DVD) of the TV record shall be submitted to the County Inspector along with the written inspection report and depth gauge calibration for evaluation. The County's representative shall be the sole judge of whether any information imparted by the TV test DVD will cause the County to accept or reject the pipe test section.

F. Pipe grade between manholes shall not deviate ("dip") by more than 1 inch from the design grade line, as measured with the television (TV) camera's depth gauge during the TV inspection, provided that such deviation does not result in a level or a reverse slope in the mains or service laterals. Joint deflection and longitudinal pipe deflection between manholes that exceeds 1 inch; or more than two deflections that

exceed 3/4 inch, as measured with the television camera's depth gauge during the TV inspection, shall not be accepted.

	Water Holding Depth (inches)
Pipe Size	Maximum
8 inch – 15 inch	1.00
18 inch – 21 inch	2.00
24 inch and greater	2.50

1.9.13 LIFT STATION INSPECTIONS

A. Prior to placing a sanitary sewer lift station into service, the new facility will be inspected for general compliance with the County's standards and for conformance to the pump performance required by the construction drawings.

B. The County Inspector shall have been notified and shall be present during the pump start-up tests. When calling for inspection, the lift station Contractor shall have ready the approved shop drawings, pump sheet, manufacturer's information and maintenance manuals for the facility and he shall present them to the County at the time of the inspection. The manufacturer's information shall include the model number, serial number, impeller diameter, motor horsepower, voltage, speed and certified performance curve for each pump installed. Provide County's Lift Station Maintenance Section with one copy of the lift station information described above at startup.

C. The total dynamic head for each pump shall be found by direct measurement. The performance of each pump shall be in substantial conformance with the design performance requirement as indicated on the construction drawings. The Contractor shall perform a "draw down" test and a "dead head" test for each pump.

D. Any materials or installation found not in compliance with the County standards shall be reinstalled or removed and replaced with standard materials. Any pumps found to be not conforming to the performance required by the construction drawings shall be removed and replaced with conforming pumps. Replacement pumps shall be retested until a satisfactory result is achieved. Manatee County Public Works Department and Utilities Department representatives shall be the sole judges of the suitability and acceptability of the pumps.

E. Fiberglass Wet wells And Valve Vaults

1. Wet wells and valve vaults for privately owned and maintained grinder lift stations may be fiberglass. The manufacture, dimensions, material and construction methods shall be made available for review by the County and shall be approved by the Engineer of Record in advance of construction.

2. The quality of all materials, the process of manufacture and the finished wet wells and valve vaults shall be subject to inspection and approval by the Engineer of Record and the County Inspector. Such inspection may be made at the place of manufacture, on site, or both locations. The fiberglass wet wells and utility vaults may be inspected prior to unloading from the delivery truck and marked by the inspector showing acceptance or rejection. Discovery of failure at any time to meet the requirements of these Specifications is cause for rejection.

3. Wet wells and valve vaults rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All wet wells and valve vaults which are damaged after delivery as determined by the Engineer of Record or County Inspector shall be rejected and shall be removed and replaced entirely at the Contractor's expense.
4. Fiberglass wet wells and valve vaults shall be fabricated in compliance with ASTM D3753, and constructed in accordance with the manufacturer's shop drawings and the approved construction drawings. Structures shall be inspected for general appearance, correct dimensions, blisters, cracks, holes, roughness, and soundness and must be free of defects.
5. Minor imperfections may be repaired subject to the approval of the Engineer of Record and County Inspector and after demonstration by the manufacturer that repairs will be strong and permanent.
6. There shall be no leaks in the fiberglass structures.

F. Lift stations will not be accepted for County ownership and maintenance until all punch list items are resolved. This includes security fence and driveways, landscaping when required, irrigation, water meter, and an FDEP acceptance letter.

END OF SECTION

SECTION 1.10 CLEANING AND DISINFECTING WATER PIPELINES

1.10.1 DESCRIPTION OF WORK

Furnish all labor, materials, equipment and incidentals required to clean and disinfect portable water pipelines. This work is required to place all potable water pipes into service.

1.10.2 CLEANING WATER MAINS

A. With the County Inspector present, all new potable and reclaimed water mains shall be preliminarily cleaned (pigged or flushed) in accordance with Paragraph 1.8.5.X of this Manual.

B. Fire hydrants may be used to perform flushing. A blowoff connection, if one has been installed, may also be used if diameter is determined to be large enough to flush debris. A velocity of at least 3.0 ft/sec, preferably 3.5 ft/sec, should be obtained in the pipe without causing the County's main pressure to fall below 35 psi. This velocity should be maintained long enough to allow three complete changes of water for proper flushing action and follow the requirements in Sections 1.8.5.X and 1.8.6.

1.10.3 DISINFECTING POTABLE WATER PIPELINES

A. Prior to being placed in service, all potable water pipelines shall be chlorinated in accordance with AWWA C651. The location of the chlorination and sampling points shall be determined by the Engineer of Record, FDEP, and Manatee County's representative. Taps for sampling shall be uncovered and backfilled by the pipeline installer as required.

B. The general procedure for chlorination shall be to flush or pig all dirty or discolored water from the lines, then introduce chlorine at 25 mg/L of free chlorine through a tap at one end while water is being withdrawn at the other end of the line. The chlorine concentration shall be measured at regular intervals to ensure that it is fed at a constant rate of not less than 25 milligrams per liter (mg/L) of free chlorine. The chlorine solution shall remain in the pipeline for 24 hours.

C. At the end of the chlorine contact period, the chlorine residual shall be determined by sampling and testing, and the results shall be reported to the regulatory agencies with the County and State. The pipelines shall then be flushed thoroughly with clean potable water until chlorine measurements show that the concentration is no higher than the chlorine concentration that is acceptable for domestic use.

D. Water for flushing, pigging, filling and disinfecting the new lines must be obtained without contaminating existing pipelines. Water obtained from existing pipelines for this purpose shall pass through an approved backflow prevention assembly. See UW-23, Temporary Jumper Connection Detail.

E. Following the chlorination period, all concentrations of heavily chlorinated water shall be flushed from the lines at their extremities and replaced with water from the distribution system. Bacteriological sampling and analysis of the replacement water shall then be made by an approved laboratory in full accordance with the AWWA Manual C651. The line shall not be placed in service until the requirements of the State are met. Results of the bacteriological tests together with certified record drawings must be submitted to FDEP within 60 days of the tests. Pipelines that are tested and return an unsatisfactory test result shall be reflushed and resampled, or re-disinfected, or otherwise reconditioned, until a satisfactory result is attained.

F. Discharge flows from cleaning or flushing operations, and heavily chlorinated water from disinfecting operations, shall be disposed of in a manner consistent with US EPA, FDEP and SWFWMD regulations. Chapter 62-302 F.A.C. water quality standard for residual chlorine in Class III waters is <0.01 mg/L (ppm).

G. Special disinfecting procedures, when approved by the County, may be used where the method outlined above is not practical.

H. No potable water main shall be placed into service until the results of the bacteriological tests are satisfactory and the FDEP has provided the County with a written letter of acceptance. Potable water services, fire service, and fire hydrant leads that are exempt from a permit from the FDEP but still require bacteriological sampling in accordance with Chapter 62-555, Florida Administrative Code, shall not be placed into service until the results of the bacteriological tests are satisfactory and the Manatee County Public Works Engineering Department has provided written acceptance

END OF SECTION

SECTION 1.11 VALVES AND APPURTENANCES

1.11.1 DESCRIPTION OF WORK

Furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as indicated on the construction drawings and as specified herein.

1.11.2 GENERAL REQUIREMENTS

A. All of the types of valves and appurtenances shall be products of well-established reputable firms who are fully experienced and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these standards as applicable. Valves used in waterworks applications shall comply with Section 8 of NSF Standard 61 for mechanical devices.

B. The brass alloy used for all surfaces coming in contact with potable water shall meet the requirements of UNS/CDA number C89833 as listed in ANSI/AWWA C800 Standard and the products produced with this alloy shall meet the ANSI/NSF Standard 61 and/or ANSI NSF Standard 372 as applicable, complying with the Safe Drinking Water Act. These products shall have the letters “NL” cast into the main body for proper identification.

C. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of potable water, reclaimed water, wastewater, etc., depending on the applications.

D. All valves and appurtenances shall be of the size shown on the drawings and, to the extent possible, all equipment of the same type on the project shall be from a single manufacturer.

E. All valves and appurtenances shall have the name of the manufacturer, year, and the working pressure for which they are designed cast in raised letters upon some visible part of the body.

F. Special tools, if required for the normal operation or maintenance, shall be supplied with the equipment.

G. All valves are to have a 2-inch square cast or ductile iron AWWA operating nut and shall open left (counter-clockwise) and shall be located at the bonnet or actuator. Provide 304 stainless steel extension stems and alignment rings where needed to bring the operating nut to within 4 feet below the valve box lid.

H. All hand actuated buried valves shall have two-piece adjustable valve box.

I. Water and reclaimed water system isolation valves shall be gate valves.

J. Force main system isolation valves shall be plug valves up to 20-inch diameter and gate valves greater than 20-inch diameter. Taps shall only use tapping valves no matter what size.

K. All bonnet bolts, gland bolts, flange connection bolts, nuts, washers, and other trim hardware exposed to the outside environment shall be 316 stainless steel. Above-ground thrust collar tie-rod bolts shall be 316 stainless steel. All underground mechanical joint-type bolts, nuts, washers, tie-rod bolts, etc. shall be high strength low alloy steel per AWWA C111 and shall be certified fluoropolymer coated or shall be 316 stainless steel.

L. All valves shall have a factory applied, fusion bonded epoxy coating on the interior and exterior unless otherwise noted in the plans or the following specification. Valves shall meet AWWA C550 fusion bonded epoxy 8 mils, unless otherwise stated in the Approved Material List. All other painted items exposed to sunlight, including field painted box lids, etc., shall be painted the appropriate color with an epoxy type paint.

M. No valves with a break-away stem shall be allowed.

N. All valves shall have concrete blocking to ensure against settlement. All shall be protected with a double wrap of 8-mil polyethylene film a to allow for disassembly and repair of the fitting or appurtenance.

O. A holiday-free certification letter shall be provided to the County, at time of delivery, stating the internal coating of the valve has passed the Holiday testing in accordance with ASTM G62, Method A (Low Voltage). The Contractor shall take extreme consideration when handling valves to ensure coating does not get damaged during construction activities or installation. County representative shall have the right to deny the installation of the valve, if the coatings are damaged.

1.11.3 DIRECTORY

The following valves and appurtenances are specified herein:

Equipment	Paragraph
Gate Valves	1.11.4
Combination Pressure Reducing and Pressure Sustaining with Check Valve Option	1.11.5
Ball Valves	1.11.6
Plug Valves	1.11.7
Valve Actuators	1.11.8
Air Release Valves	1.11.9
Valve Boxes	1.11.10
Corporation Stops and Saddles	1.11.11
Flanged Adapters and Plain End Couplings	1.11.12
Hose Bibs	1.11.13
Swing Check Valves	1.11.14
Swing-Flex Check Valves (for water & reclaimed only)	1.11.15
Hydrants	1.11.16
Restrained Joints	1.11.17
Tapping Sleeves, Saddles, and Valves	1.11.18
Tracer Wire Boxes	1.11.19

1.11.4 GATE VALVES

A. Where indicated on the drawings or necessary due to locations, size, or inaccessibility, chain wheel operators shall be furnished with the valves. Such operators shall be designed with adequate strength for the valves with which they are supplied and provide for easy operation of the valve. Chains for valve operators shall be galvanized.

B. Gate valves installed underground shall be provided with a box cast in a concrete pad and a box cover. 304 stainless steel valve extension stems shall be provided to place the valve operating nut no more than 4 feet deep. One valve wrench, 6 feet in length, shall be provided for every 15 valves installed.

C. Gate valves 2 inches to 30 inches in diameter shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C515 and shall be UL listed and FM approved where applicable. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

D. Gate valves 16 inches and larger shall be provided with torque limiters.

E. All valves shall be NSF 61 listed.

F. All buried valves shall have a non-rising 304 stainless steel stem. All exterior bolts, nuts and washers on buried valves shall be 304 stainless steel. Aboveground valves at lift stations shall be of the non-rising type with 316 stainless steel stems. Aboveground valves used in potable water and reclaimed water systems shall be OS&Y type with flanged joints and 316 stainless steel stems. All aboveground valves shall have 316 stainless steel exterior bolts, nuts and washers. Manufacturer shall use Never-Seez or equivalent during assembly of bolt and nut sets to prevent galling of similar metals. Stem seals shall be provided and shall be of the O-ring type, two above and one below the thrust collar.

G. The wedge shall be ductile iron fully encapsulated with an EPDM rubber. The Elastomer type shall be permanently indicated on the disc or body of the valve. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

H. The valve body, bonnet, and bonnet cover shall meet or exceed all the requirements of AWWA C515. All valves shall have "DI" cast into the body of the bonnet.

I. Gate valves meeting AWWA C515 requirements shall be rated for an operating pressure of 250 psi and shall be tested in accordance with AWWA C515.

J. The valves shall be covered by a Manufacturer's 10-year warranty on manufacturer's defects and reasonable labor costs for replacement. Warranty shall become effective from the date of purchase by the end user and delivered within 30 days from the receipt of the purchase order. For publicly owned and maintained utilities, the end user is Manatee County Government.

K. Gate valves shall be assembled and tested in a certified ISO 9001:2000 manufacturing facility within the United States and provide their certification of meeting internationally recognized quality control procedures.

1.11.5 COMBINATION PRESSURE REDUCING & PRESSURE SUSTAINING VALVE WITH CHECK VALVE OPTION

A. Pressure sustaining and check valve shall be pilot operated diaphragm actuated valve with cast iron body, bronze trim, and 125-pound flanged ends. The valve shall be hydraulically operated, diaphragm type globe valve. The main valve shall have a single removable seat and a resilient disc, of rectangular cross section, surrounded on three and a half sides. No external packing glands are permitted and there shall be no pistons operating the main valve or any controls. The valve shall be equipped with isolation valves to service the pilot system while permitting flow if necessary. Main valve and all pilot controls shall be manufactured in the United States of America. Valve shall be single chamber type, with stainless steel stem.

B. Valve shall automatically reduce pressure for the downstream distribution network and sustain a minimum pressure in the high pressure main regardless of distribution demand, and as an option, shall also close when a pressure reversal occurs for check valve operations. The pilot system shall consist of two direct acting, adjustable, spring loaded diaphragm valves.

C. Valve shall be ductile iron with main valve trim of brass and bronze. The pilot control valves shall be cast brass with 303 stainless steel trim.

1.11.6 BALL VALVES (SEE ALSO GENERAL REQUIREMENTS)

A. Ball valves for water and reclaimed water, in sizes 3/4-inch through 2-inch, shall be lead-free (NL), 1-piece brass body, stem and ball per ASTM B 62, full port, full flow, 1/4-turn check w/ padlock wings, ball curb valves, rated for 300 psi, with compression, pack joint, flare, threaded or flanged ends as required. These products shall have the letters "NL" cast into the main body for proper identification.

B. Ball valves for wastewater, 2-inch through 3-inch, shall be 316 stainless steel 2-piece body, cap, stem and ball per ASTM A351, full port, full flow, 1/4-turn check, ball valves, steam rated for 150 psi, pressure rating 1,000 psi CWT, with threaded or flanged ends as required

C. All valves shall be mounted in such a position that valve position indicators are plainly visible. Above grade ball valves shall have a vinyl coated lever handle. Lever handle, handle nut, and lever packing gland shall be 304 or 316 stainless steel.

D. Potable plastic service pipe material and compression and pack joint connectors shall not be used in soil that is contaminated with low molecular-weight petroleum products, aromatic hydrocarbons, chlorinated hydrocarbons or organic solvents. Appropriate service tubing (copper "K or L" or min. 304 stainless steel) shall apply.

1.11.7 PLUG VALVES

A. Plug valves shall be eccentric, non-lubricating type with integral plug and shafts and shall be furnished with end connections and with actuating mechanisms as called for on the construction plans or as otherwise required. Valves shall seal bubble-tight or water drop-tight in both directions when tested according to the Leakage Test method of AWWA C517-16 with a hydrostatic pressure of 175 psi for 2"-12" diameter; and 150 psi for larger than 12" diameter.

B. Plug valves shall have a full-port (full-bore), round/circular cross-sectional area of the nominal pipe size area. The internal opening shall have an unobstructed waterway equal to the full circular cross-sectional area of the inside diameter of the pipe it is attached.

C. Plug valves shall also be subjected, at the factory, to the Hydrostatic Testing specified in AWWA C517-16. The shell test shall be performed at a hydrostatic pressure of 1-1/2 times the design pressure of the valve. The seat test shall be at least 2 times the design pressure of the valve. During the test, there shall be no leakage through the metal, or through the end joints or shaft seal, nor shall any part of the valve be deformed.

D. Flanged valve ends shall be faced and drilled according to ANSI B 16.1, Class 125. Mechanical joint valve ends shall conform to AWWA C111. Threaded ends shall conform to the NPT requirements of ANSI B1.20.1.

E. The plug valve body, bonnet and gland shall be cast iron per ASTM A126, Class B or ductile iron grade 65-45-12 per ASTM A526 in accordance with AWWA C517-16. The integral plug and shaft shall be ductile iron grade 65-45-12 per ASTM A526, or 316 stainless steel. The entire plug and stem shall be covered with nitrile (Buna N) rubber. Per AWWA C517-16, the rubber compound shall have been vulcanized to the metal plug/stem and shall have a minimum strength of not less than 250 psi when tested according to ASTM D429, Method A or shall have a peel strength of not less than 75 psi when tested according to ASTM D 429, Method B. Valve seats for sizes 3-inch and larger shall be at least 95 percent pure nickel, welded-in overlay into the cast iron or ductile iron body. The top and bottom shaft bearings shall be sintered, oil impregnated 316 stainless steel.

F. Below grade valves shall have a manufacturer standard heavy-duty worm gear type actuator with 2-inch square operating nut. The gearbox shall be externally adjustable and totally enclosed to prevent water infiltration. Actuators for buried service valves shall be not less the 90% grease packed and totally sealed by means of gaskets or o-rings. Actuators shall be self-locking and designed to transmit twice the required actuator torque without damage to the faces of the gear teeth. Gearboxes shall be certified to meet ISO 9001 standards. The gearbox worm gear shall be hardened steel or ductile iron ASTM A536 Class 65-45-

12. Gearbox shaft shall be manufactured of hardened steel. Gearbox bearings shall be high efficiency, oil impregnated, manufactured of bronze or hardened steel.

G. Plug valves shall be installed side-ways with plug shaft horizontal so that the plug rotates upward when it opens, with the flow entering the seat end of the valve.

H. All plug valves shall be internally and externally coated with a factory applied, two-part high solids epoxy conforming to AWWA C550, dry film thickness as defined in the Approved Products List.

1.11.8 VALVE ACTUATORS AND TORQUE LIMITING DEVICES

Gate, Tapping, and Plug Valve Torque-Limiting Devices:

A. Gate, tapping, and plug buried valves that are furnished with a gearbox shall also require a valve torque-limiting device to prevent valve and actuator damage caused by excessive operating torque.

B. The overtorque protection mechanism enclosed in a hermetically sealed cast iron housing and permanently lubricated with molydisulfide-bearing, water-resistance, high pressure synthetic grease.

C. The housing shall have integrally cast, 2-inch AWWA operating nut and matching socket to operate and to fit over the actuator or extension shaft nut, respectively. The socket shall be provided with a set screw to fit to the device.

D. The torque limiting device shall transmit sufficient torque to free up and operate the valve and shall be factory set to 1.5 times the input torque of the valve provided that the trip limit is at least 100 ft-lb less than the valve breaking torque. For the torque limiting device setting, refer to the Approved Products List.

E. The torque limiting device shall be internally and externally coated with a fusion-bonded epoxy and enamel top-coat conforming to AWWA C-213.

F. All hardware shall be minimum 304 stainless steel.

G. The torque limiting device shall be furnished per the latest edition of the County's Approved Products List.

Manual Actuators:

H. Manual actuators shall be of the traveling nut, self-locking type or of the worm gear type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering.

I. Actuators shall be capable of seating and unseating the disc against the full design pressure and velocity, as specified for each class, into a dry system downstream, and shall transmit a minimum torque to the valve. Actuators shall be rigidly attached to the valve body.

J. Actuators shall be equipped with mechanical stop-limiting locking devices to prevent over travel of the disc in the open and closed positions. They shall turn counter-clockwise to open valves.

K. Valves located above grade shall have handwheel and position indicator, and valves located below grade shall be equipped with a 2-inch square AWWA operating nut located at ground level and cast iron extension type valve box.

L. Manual actuators shall have permanently lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure and velocities.

Motor Actuators (Modulating):

M. The motor actuated valve controller shall include the motor, actuator unit gearing, limit switch gearing, limit switches, position transmitter which shall transmit a 4-20 mA DC signal, control power transformer,

electronic controller which will position the valve based on a remote 4-20 milliamp signal, torque switches, bored and key-wayed drive sleeve for non-rising stem valves, declutch lever and auxiliary handwheel as a self-contained unit.

N. The motor shall be specifically designed for valve actuator service using 480-volt, 60 Hertz, three phase power as shown, on the electrical drawings. The motor shall be sized to provide an output torque and shall be the totally enclosed, non-ventilated type. The power gearing shall consist of helical gears fabricated from heat treated alloy steel forming the first stage of reduction. The second reduction stage shall be a single stage worm gear. The worm shall be of alloy steel with carburized threads hardened and ground for high efficiency. The worm gear shall be of high tensile strength bronze with hobbed teeth. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout. Preference will be given to units having a minimum number of gears and moving parts. Spur gear reduction shall be provided as required.

O. Limit switches and gearing shall be an integral part of the valve control. The limit switch gearing shall be made of bronze and shall be grease lubricated, intermittent type and totally enclosed to prevent dirt and foreign matter from entering the gear train. Limit switches shall be of the adjustable type capable of being adjusted to trip at any point between fully opened valve and fully closed valve.

P. The speed of the actuator shall be the responsibility of the system supplier with regard to hydraulic requirements and response compatibility with other components within the control loop. Each valve controller shall be provided with a minimum of two rotor type gear limit switches, one for opening and one for closing. The rotor type gear limit switch shall have two normally open and two normally closed contacts per rotor. Gear limit switches must be geared to the driving mechanism and in step at all times whether in motor or manual operation. Provision shall be made for two additional rotors as described above, each to have two normally open and two normally closed contacts. Each valve controller shall be equipped with a double torque switch. The torque switch shall be adjustable and will be responsive to load encountered in either direction of travel. It shall operate during the complete cycle without auxiliary relays or devices to protect the valve, should excessive load be met by obstructions in either direction of travel. The torque switch shall be provided with double-pole contacts.

Q. A permanently mounted handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operations, but must be responsive to manual operation at all times except when being electrically operated. The motor shall not rotate during hand operation nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve operator will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. This movement from motor operation to handwheel operation shall be accomplished by a positive declutching lever which will disengage the motor and motor gearing mechanically, but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running. The gear limit switches and torque switches shall be housed in a single easily accessible compartment integral with the power compartment of the valve control. All wiring shall be accessible through this compartment. Stepping motor drives will not be acceptable.

R. The motor with its control module must be capable of continuously modulating over its entire range without interruption by heat protection devices. The system, including the operator and control module must be able to function, without override protection of any kind, down to zero dead zone.

S. All units shall have strip heaters in both the motor and limit switch compartments.

T. The actuator shall be equipped with open-stop-close push buttons, an auto-manual selector switch, and indicating lights, all mounted on the actuator or on a separate locally mounted power control station.

U. The electronics for the electric operator shall be protected against temporary submergence.

V. Actuators shall be Flowserve Limitorque L120 with Mudotronic Control System. Actuator shall contain a position transmitter with a 4-20MA output signal.

Motor Actuators (Open-Close):

W. The electronic motor-driven valve actuator shall include the motor, actuator gearing, limit switch gearing, limit switches, torque switches, fully machined drive sleeve, declutch lever, and auxiliary handwheel as a self-contained unit.

X. The motor shall be specifically designed for valve actuator service and shall be of high torque totally enclosed, nonventilated construction, with motor leads brought into the limit switch compartment without having external piping or conduit box.

Y. The motor shall be of sufficient size to open or close the valve against maximum differential pressure when voltage to motor terminals is 10% above or below nominal voltage.

Z. The motor shall be prelubricated and all bearings shall be of the anti-friction type.

AA. The power gearing shall consist of helical gears fabricated from heat treated steel and worm gearing. The worm shall be carburized and hardened alloy steel with the threads ground after heat treating. The worm gear shall be of alloy bronze accurately cut with a hobbing machine. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout.

BB. Limit switches and gearing shall be an integral part of the valve actuator. The switches shall be of the adjustable rotor type capable of being adjusted to trip at any point between fully opened valve and fully closed valve. Each valve controller shall be provided with a minimum of two rotor type gear limit switches, one for opening and one for closing (influent valves require additional contacts to allow stopping at an intermediate position). The rotor type gear limit switch shall have two normally open and two normally closed contacts per rotor. Additional switches shall be provided if shown on the control and/or instrumentation diagrams. Limit switches shall be geared to the driving mechanism and in step at all times whether in motor or manual operation. Each valve actuator shall be equipped with a double torque switch. The torque switch shall be adjustable and will be responsive to load encountered in either direction of travel. It shall operate during the complete cycle without auxiliary relays or devices to protect the valve should excessive load be met by obstructions in either direction of travel. Travel and thrusts shall be independent of wear in valve disc or seat rings.

CC. A permanently mounted handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operation except when being electrically operated. The motor shall not rotate during hand operation, nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve actuator will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. Movement from motor operation to handwheel operation shall be accomplished by a positive declutching lever which will disengage the motor and motor gearing mechanically, but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running.

DD. Valve actuators shall be equipped with an integral reversing controller and three phase overload relays, Open-Stop-Close push buttons, local-remote-manual selector switch, control circuit transformer, three-phase thermal overload relays and two pilot lights in a NEMA 4X enclosure. In addition to the above, a close coupled air circuit breaker or disconnect switch shall be mounted and wired to the valve input power terminals for the purpose of disconnecting all underground phase conductors.

EE. The valve actuator shall be capable of being controlled locally or remotely via a selector switch integral with the actuator. In addition, an auxiliary dry contact shall be provided for remote position feedback.

FF. Valve A.C. motors shall be designed for operation on a 480 volt, 3-phase service. Valve control circuit shall operate from a fuse protected 120-volt power supply.

GG. Motor operators shall be Flowserve Limitorque L120 with Mudotronic Control System.

1.11.9 AIR RELEASE VALVES

A. Air release valves shall be automatic float operated, with inlet size, working pressure ratings, and with NPT connections as required in the Approved Product List

B. Valve bodies shall be ductile iron per ASTM A 126, Class B. The orifice, float and linkage shall be 316 stainless steel. The seat shall be (Buna N) nitrile elastomer. The external fasteners including bolts, washers, and nuts shall be 316 stainless steel.

C. Air release valves installed over waterways shall have body and cover made of 316 stainless steel, with inlet size, working pressure rating, and NPT connections as required in the Approved Products List. Diaphragm, debris shield, float, debris screen, diaphragm holder, and upper air valve part shall be made of homopolymer (PP) or Delrin (POM). The external fasteners including bolts, washers, and nuts shall be made of 316 stainless steel.

1.11.10 VALVE BOXES

A. Buried valves shall have adjustable cast iron or HDPE valve boxes. Lids shall be cast iron drop type, and shall have “WATER”, “SEWER”, or “RECLAIM”, as applicable, cast into the top. Lids will be painted “safety” blue for potable, purple for reclaimed, and green for sanitary sewer.

B. Valve lids in roadways shall be 24 lbs lids.

C. Cast iron boxes shall be two-piece, or three-piece, as required, screw type, with extensions, as required to make the desired box length. Bottom barrel shall be 5-1/4 inches inside diameter, with a flanged bottom with sufficient bearing area to prevent settling.

D. Reclaimed Valve Boxes shall be square 9-inch x 9-inch load bearing marked “Reclaimed Water” and painted Pantone 522C purple.

E. All valves shall have an operating nut no more than 4 feet below the top of the lid and shall have extension stems with centering guides. Extension stems shall be 304 stainless steel fixed to the valve operating nut with a 304 stainless steel fastener and limited to only one extension per valve.

F. All potable water, sewer, and reclaimed water grade-adjustment risers shall be cast iron material just like the valve box. No plastic adjustment riser rings or asphalt coated steel shall be allowed.

G. A non-load bearing centering device shall be installed under the valve operating nut.

H. Standpipe shall match color code of the system being installed, (blue for potable, purple for reclaimed, and green for sanitary sewer).

1.11.11 CORPORATION STOPS AND SADDLES (SEE ALSO GENERAL REQUIREMENTS)

A. Corporation stops for connections to potable and reclaimed water mains shall be all lead-free (NL), red brass per ASTM B 62, and shall conform to AWWA C800. 1-inch through 2-inch corporation stops shall be ball type, 300 psi working pressure rated, with AWWA MIP threaded inlets and compression, pack joint,

flare, or FIP threaded joint outlets. All joints made to CTS size HDPE tubing shall use min 304 stainless steel insert stiffeners.

B. Potable plastic service pipe material and compression and pack joint connectors shall not be used in soil that is contaminated with low molecular-weight petroleum products, aromatic hydrocarbons, chlorinated hydrocarbons or organic solvents. Appropriate service tubing (copper "K or L" or min. 304 stainless steel) shall apply.

C. Water and reclaimed water service connections shall be made using lead-free (NL), red brass saddles (alloy 85-5-5-5) or 304 S.S. per ASTM B 62. Straps, washers and nuts shall be brass or 304 stainless steel. No ductile iron, cast iron or steel saddles will be allowed. Saddles shall have 304 stainless steel or brass extra wide strap.

D. Connections to sanitary force mains for services up to 2 inches shall be made using 316 stainless steel saddles, straps, and hardware.

E. Service and air release valve (ARV) connections to HDPE water, reclaimed water and sewer mains may be made using an approved tapping saddle. All saddles shall be properly sized per the manufacturer product information and be installed according to the manufacturer's written instructions.

F. All sewer force main saddles shall be 316 stainless steel.

1.11.12 PLAIN END COUPLINGS AND FLANGED ADAPTERS

A. Plain end couplings and adapters shall be fusion-bonded epoxy coated carbon steel with fluoropolymer or 316 stainless steel nuts, bolts, spacers, etc. EPDM rubber gaskets shall be required in potable water and reclaimed water systems. In contaminated soils, refer to Ductile Iron Pipe Section 1.4 for gasket materials.

B. Flange adapters shall have a plain end compression seal, with an ANSI 125 Class flange on the opposite end. 316 stainless steel backup rings shall be used for force mains and lift station discharge that are located in corrosive environments including wet wells and valve vaults.

1.11.13 HOSE BIBS

Hose bibs shall be 3/4-inch or 1-inch brass, polished chromium plated brass, with vacuum breaker as noted on the drawings.

1.11.14 SWING CHECK VALVES

A. Check valves shall be swing type, weighted lever, conforming to AWWA C508. Valves shall be iron-body, bronze-mounted, single disk, 175 psi working pressure for 2- through 12-inch, 150 psi for 14- through 30-inch, with ANSI B16.1 Class 125 flanged ends.

B. When there is no flow through the line, the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.

C. Check valves shall have bronze seat and body rings, extended bronze or 316 stainless steel hinge pins and 316 stainless steel nuts and bolts on bolted covers.

D. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weight. The hinge arm and weight, along with hardware, shall be suitable for use in a corrosive environment.

E. All check valves shall be internally and externally coated with a factory applied, two-part high solids epoxy conforming to AWWA C550, dry film thickness as defined in the Approved Products List.

1.11.15 SWING-FLEX CHECK VALVES (FOR WATER & RECLAIMED ONLY)

A. Certified to NSF/ANSI 61, NSF/ANSI 372 certified lead-free, AWWA C508 certified.

B. Available in 2 inch through 48 inch.

C. Ductile iron construction for 250 psi service, manufactured under a certified ISO 9001 quality system.

D. All check valves shall be internally and externally coated with a factory applied, two-part high solids epoxy conforming to AWWA C550, dry film thickness as defined in the Approved Products List.

E. Dome access cover.

F. 25-Year Disc Warranty

1.11.16 HYDRANTS

A. Hydrants shall be dry barrel, nostalgic style, and shall conform to AWWA C502 and be UL/FM certified, and shall in addition meet the specific requirements and exceptions which follow:

B. Hydrants shall be according to manufacturer's standard pattern or nostalgic style and of standard size, and shall have one 5-inch Storz connection with two 2-½ inch hose nozzles.

C. Hydrant inlet connections shall have mechanical joints for 6-inch pipe.

D. Hydrant valve opening shall have an area at least equal to that area of a 5 1/4-inch minimum diameter circle and be obstructed only by the valve rod. Each hydrant shall be able to deliver 500 gpm minimum through its two 2 1/2 -inch hose nozzles when opened together with a loss of not more than 3 psi in the hydrant per AWWA C502.

E. The upper and lower stem rod shall be 304 stainless steel and shall have a breakable stem-rod coupling of stainless steel, or cast iron or ductile iron with a fusion bonded epoxy coating, with 316 stainless steel pins and clips.

F. Hydrants shall be hydrostatically tested as specified in AWWA C502 and shall be rated at 250 psi minimum.

G. The operating nut shall be 1 ½ -inch pentagon shaped with a protective weather cover, and open counter-clockwise.

H. All nozzle threads shall be American National Standard.

I. Each nozzle cap shall be provided with a Buna N rubber washer.

J. All hydrants shall be traffic break away type and allow for 360-degree rotation to position the Storz connection/nozzle in the desired direction after installation.

K. Hydrants must be capable of being extended without removing any operating parts.

L. Hydrant extensions shall be coated as typical ductile iron pipe with a 304 stainless steel stem. The breakaway coupling can be fusion bonded epoxy coated or 304 stainless steel. Only one hydrant extension is allowed per hydrant.

M. Weepholes shall be excluded from fire hydrants.

N. Hydrant main valve closure shall be of the compression type opening against the pressure and closing with the pressure. The main valve shall be faced or covered with EPDM elastomer, which shall seat on a bronze ring.

O. Exterior nuts, bolts and washers shall be 316 stainless steel. Bronze nuts may be used below grade.

P. All internal operating parts shall be removable without requiring excavation.

Q. Hydrant bonnets, weather cover, nozzle section, caps and shoe shall be cast iron or ductile iron. Hydrant shoe shall be fusion bonded epoxy coated inside and outside. Hydrant standpipe shall have interior and exterior coatings as required by Section 1.4.2.G or be factory-applied fusion bonded epoxy. Hydrant bonnets, weather cover, nozzle section, caps shall have interior and exterior epoxy primer. Above-ground parts shall have a UV-resistant external top coat of minimum 4-mil DFT; color Safety Yellow for fire hydrants that are connected to the public potable water system or Pantone 522C purple for fire hydrants that are connected to the public reclaimed water system. Private potable fire hydrants shall have a top coat of acrylic polyurethane; color red.

1.11.17 RESTRAINED JOINTS

A. Pipe joints shall be restrained by poured-in-place concrete thrust blocks or by other mechanical methods. Flanged joints may be used above ground.

B. For thrust blocks, the concrete shall be placed between undisturbed soil and the fittings or appurtenance to be supported. Concrete shall not be placed on or around the pipe, bells, flanges, or other joints. If contact with concrete is unavoidable, these areas shall be protected with a double wrap of 8-mil polyethylene film to allow for disassembly and repair of the fitting or appurtenance.

C. Approved color-coded restraining gaskets are acceptable for use. The gasket color shall be consistent throughout the entire cross section of the gasket. The colors shall not be attained by surface coating: the color shall be inherent within the rubber.

D. All below ground restraints; T-bolts, bolts, nuts, washers, and all thread rods shall be high strength low alloy steel conforming to AWWA C111 / ANSI A21.11-17 or ASTM A242 and all shall be coated with a certified fluoropolymer coating. Alternatively, all hardware can be 316 stainless steel.

E. All above ground restraints; T-bolts, bolts, nuts, washers, and all thread rods shall be 316 stainless steel. The use of rebar with welded thread is prohibited.

1.11.18 TAPPING SLEEVES AND VALVES

A. Tapping sleeves and straps shall be made of 316 stainless steel, shall seal to the pipe by the use of a confined "O" ring gasket, and shall be able to withstand a pressure test of 180 psi for water lines or 150 psi for sewer force mains for one hour with no leakage in accordance with AWWA C110. A 316 stainless steel 3/4-inch NPT test plug shall be provided for pressure testing. All hardware joining the two halves shall be 316 stainless steel and shall be included with the sleeve.

B. The entire area of the flange surface shall be covered by a 1/8-inch minimal thick full-face, rubber gasket. EPDM rubber gaskets shall be required in potable water and reclaimed water systems. In contaminated soils, refer to Ductile Iron Pipe Section 1.4 for gasket materials.

C. Tapping valves shall meet the requirements of AWWA C515 with ductile iron body and shall be rated for a pressure of 250 psi. The valves shall be flanged with alignment ring by mechanical joint with a non-rising 304 stainless steel stem. All bolts, nuts and washers shall be 304 stainless steel. Manufacturer shall use Never-Seez or equivalent during assembly of bolt and nut sets to prevent galling of similar metals. Stem

seals shall be provided and shall be of the O-ring type, two above and one below the valve's thrust collar. Valve shall be designed for vertical burial and shall open counterclockwise. Operating nut shall be AWWA standard 2-inch square for valves 2 inches and up. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve to accommodate full size shell cutter. The wedge shall be ductile iron fully encapsulated with EPDM rubber. All bolts, nuts and washers between the sleeve and valve shall be 316 stainless steel. Torque limiter on 16-inch diameter gate valves are required.

1.11.19 TRACER WIRE BOXES

A. Tracer wire test station boxes shall be provided at plug valves, blowoff valves, gate valves, fire hydrants and backflow prevention assemblies as indicated in these Standards. Tracer wire test station boxes for yard service shall be 2-1/2 inch diameter, 15 inch length, ABS plastic with a cast iron rim and lid. Where test boxes will be in streets or subject to vehicular traffic, 5-1/4 inch diameter or equal, centered in a separate concrete pad similar to a valve box pad.

B. Where possible, locate the tracer wire testing station outside of travel lanes, in medians, or in grassy areas adjacent to the travel lanes. All tracer wire(s) shall be attached to the lid, allowing testing to be performed without removing the lid.

1.11.20 INSERTION VALVE

A. Insertion valves shall be resilient wedge gate valves, manufactured to meet or exceed the requirements AWWA C515 and shall be UL listed and FM approved where applicable. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

B. Buried gate valves shall have a non-rising min. 304 stainless steel stem. Buried gate valve bolts, nuts and washers shall be min. 304 stainless steel. Manufacturer shall use anti-seize lubricant during assembly of bolt and nut sets to prevent corrosion and galling of metals. Stem seals shall be provided and shall be of the O-ring type, two above and one below the thrust collar.

C. The wedge shall be ductile iron that is fully encapsulated with an EPDM rubber. The Elastomer type shall be permanently embossed or formed on the valve body or wedge. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

D. The valve body and bonnet shall be ductile iron meeting or exceeding all the requirements of AWWA C515.

E. Valves shall be rated for an operating pressure of 250 psi and shall be tested in accordance with AWWA C515.

F. The valves are to have 2-inch cast or ductile iron AWWA operating nuts and shall open left or counterclockwise. The wedge nut shall be bronze.

G. The valves shall be covered by a Manufacturer's 10-year warranty on manufacturer's defects and reasonable labor costs for replacement. Warranty shall become effective from the date of purchase by the end user and delivered within 30 days from the receipt of the purchase order. For publicly owned and maintained utilities, the end user is Manatee County Government.

H. Gate valves shall be assembled and tested in a certified ISO 9001 manufacturing facility within the United States and provide their certification of meeting internationally recognized quality control procedures.

I. Contractor shall be qualified to perform the installation and shall provide written certification by valve manufacturer guaranteeing the Contractor is qualified to perform the Work.

J. Sizes 12” and smaller must be capable of working on ductile iron pipe, PVC IPS and C900-16, Asbestos Clay without having to change either the top or bottom portion of split valve body.

K. Valve shall have a factory applied fusion bonded epoxy on the interior and exterior, thickness as defined in the Approved Products List.

END OF SECTION

SECTION 1.12 PRECAST PORTLAND CONCRETE MANHOLES AND WET WELLS

1.12.1 DESCRIPTION OF WORK

A. Furnish all materials, labor and equipment to construct manholes and wet wells consisting of precast concrete sections as indicated on the construction drawings.

B. Precast portland concrete manholes are only to be used in non-turbulent flow conditions and shall not be used in turbulent flow conditions, outside drop manholes, manholes with opposing flow, manholes upstream of a lift station (see US-17A), manholes with 12-inch and greater gravity sewer pipes, manholes receiving force main flow and the next two downstream manholes.

1.12.2 PRECAST CONCRETE SECTIONS

A. Precast concrete manhole grade rings, flat slab tops, conical tops, risers and base sections shall be fabricated in accordance with the material and design standards of ASTM C478, except as modified herein.

B. Portland cement shall conform to ASTM C150, Type II, and concrete shall have a minimum compressive 28-day strength of 4,000 psi.

C. The manufacturer shall make a minimum of four standard test cylinders for each 100 cubic yards of concrete (or part thereof) that is cast each day. These test cylinders, along with sections cast that day, shall be marked in such a way that the test results can be matched with the appropriate castings. Two cylinders shall be cured with the product until the forms are stripped. At this time, one cylinder shall be broken to ascertain that a minimum strength of 2,000 psi has been reached prior to moving the product from the forming location. The remaining two cylinders shall be cured and tested in accordance with ASTM C192 and C39. The average compressive strength for each day's production shall be greater than 4,000 psi with no more than 10% of the tested cylinders falling below 4,000 psi. In no case shall any cylinder strength fall below 3,500 psi. All cylinder strengths shall be certified by a Florida Licensed Professional Engineer. Failure to meet these requirements for any day's production is cause for rejection of all sections cast that day.

D. Minimum wall thickness for manholes shall be 8 inches or 1/12 the inside diameter of the manhole, whichever is greater. The minimum thickness for the bottom of the base section shall be 8 inches.

E. Reinforcing steel shall be as specified in ASTM C478.

F. Precast manhole structures shall be free of cracks, holes, voids, blisters or rough surfaces. Manholes shall be water-tight and shall be generally sound and free of defects of any sort. Lift holes shall not penetrate through the wall of any manhole tops, risers or base sections. Holes passing part-way through the manhole section walls for lifting devices shall be filled with cement or epoxy grout after the manhole has been set in place.

G. All sections shall meet the manufacturing tolerance requirements of ASTM C478 or the following casting tolerances, whichever are more severe:

Wall Thickness	+/- 3/8 inches
Inside Diameter	+/- 3/8 inches
Outside Diameter	+/- 1/2 inches
Height or Length	+/- 3/8 inches

H. Pipe openings shall meet the recommended tolerances of the individual manufactured pipe to manhole connectors; however, the horizontal location shall be within +/- 2 degrees of arc of that detailed on the shop drawings.

1.12.3 MANHOLE INVERTS

A. Benched inverts shall be provided and shall be monolithically cast or shall be a secondary casting in a cured base section as per ASTM C478.

B. The width of the invert channel shall be the same as the inside diameter of the connected sewer pipes and shall have a "U" - shaped cross-section with the bottom of the channel shaped to correspond with the lower half of the pipe. The depth of the channel shall be a minimum of half the inside diameter of the connected pipes.

C. The channel shall be formed smooth and streamlined, and, where the flow changes directions, shall have true curves of the largest radius possible within the manhole base. The maximum change of direction of flow within a manhole shall be 90 degrees.

D. The channel invert slope shall be uniform through the manhole and shall have a minimum vertical drop of 1 inch from the inlet(s) to the outlet.

1.12.4 RESILIENT PIPE CONNECTORS

A. Connections of manholes to pipes shall be made using resilient boot or seal connectors manufactured in accordance with ASTM C923 and shall maintain a resilient, hydrostatic seal between the pipe and the connector and between the connector and the manhole structure. All external hardware and connector bands shall be 316 stainless steel.

B. Connectors shall be installed in strict accordance with the written installation instructions of the manufacturer. Non-shrink grout shall be placed in the gap between the boot or seal and the manhole invert channel, to make a smooth transition, unless otherwise directed by the manufacturer's instructions.

1.12.5 MANHOLE AND WET WELL JOINTS

A. Joints between manhole sections and wet well sections shall be modified tongue and groove, or modified bell and spigot, with a continuous elastomeric ring gasket joint conforming to the requirements of ASTM C443. In addition to the ring gasket, an additional sealing device shall be provided as follows:

1. A minimum of 12-inches wide elastomeric based plastic joint wrap shall be centered over the joint, on the outside of the manhole, or
2. A minimum of ½-inch x ¾-inch bead of hydrophilic urethane paste applied to the joint just before manhole section assembly.

B. Fill the joint at the inside face with non-shrink grout and strike the joint smooth and uniform with the manhole interior walls.

C. For manholes with concrete grade-adjustment rings, joints between the top section and the grade ring, and between grade rings, and between the grade ring and the cast-iron ring frame shall be made with butyl rubber sealant strips and non-shrink cement mortar.

1.12.6 MANHOLE RINGS AND COVERS

Rings and covers shall be gray iron castings, conforming to ASTM A48, Class 30B, with the words "MANATEE COUNTY", "SANITARY SEWER", and "(YEAR)" cast into them. Frame and cover castings shall be dense and even grained, and shall be free of blowholes, warping, or any other defects not true to pattern. Seating surfaces of covers and frames shall be machined true to prevent rocking. Castings shall be designed and tested to bear an AASHTO H-20 wheel loading with and added 30 percent impact factor and shall be Class Heavy Duty traffic bearing.

1.12.7 MANHOLE INSERTS

Watertight manhole inserts are required for all sanitary sewer manholes installed. Neoprene gaskets shall be installed under the insert lip to ensure a leak-proof seal.

1.12.8 PRECAST CONCRETE MANHOLE INSTALLATION

A. Manholes shall be installed at the end of each main run; at all changes in grade, size, or alignment; at all intersections; at distances not greater than 400 feet for sewers 15 inches or less and 500 feet for sewers 18 inches or larger, and at a distance no greater than 50 feet from a lift station wet well. Cleanouts may be used only for special conditions with prior written approval by the County and shall not be substituted for manholes.

B. Invert drops less than 24 inches shall have an elevated U-channel to prevent solids disposition. Where sewers enter a manhole at an elevation 24 inches or more above the lowest invert, then an outside drop polymer concrete manholes shall be provided. The entire outside drop connection shall be encased in portland concrete.

C. Precast concrete sections shall be set vertical and in true alignment as indicated by the construction plans. Excavation, bedding foundation and backfill shall be done in accordance with the Trenching and Excavation section of these Standards. All manholes shall meet the following installation tolerances:

   1. The finished manholes shall not be out of plumb by more than 3/8 inch per 10 feet of height.
   2. Any jog or offset of the inside wall surface at a joint shall not exceed 1/2 inch.
   3. Variation in the joint width around the circumference of the manhole shall not exceed 1/4 inch.

1.12.9 SETTING MANHOLE RING AND COVERS

Manhole rings and covers shall be set to conform accurately to the finished ground or pavement grade as indicated on the construction drawings or as directed by the County. Rings on manholes shall be set concentric with the precast concrete adjusting rings and sealed with butyl rubber strips; 3" wide x 1/2" thick so that the space between the top of the adjustment rings and the bottom flanges of the rings will be made watertight. A ring of mortar shall be placed around the outside of the bottom flange at least one inch thick and pitched to shed water away from the frame. Mortar shall be extended to the outer edge of the masonry and finished smooth and flush with the top of the flange.

1.12.10 ADJUSTING MANHOLE COVER

A. Existing manhole covers, which must be adjusted to existing or new pavement surfaces, shall be adjusted by modifying the existing precast concrete adjustment rings to bring the entire ring and cover to grade.

B. No manhole cover adjustment rings shall be allowed.

1.12.11 SPRAY-APPLIED MANHOLE LINERS

Existing concrete or brick and mortar manhole structures that are to be modified or rehabilitated by adding a manhole liner shall have an approved spray-applied liner installed.

1.12.12 PROTECTION FROM FLOODWATER INFLOW

A. Wastewater sewer systems shall be designed to prevent flood or surface waters from entering the collection system. Manhole rims and clean-out tops shall be elevated 4 inches above the 100-year flood level, or 8 inches above the 25-year flood level, or 4 inches above the surrounding unpaved ground surface within a 20-foot radius, whichever is highest, or the manhole covers and clean-out lids shall be designed and installed with factory-made watertight, tamper proof, sealing devices.

B. Manholes with rims less than the above required elevations shall have a water-tight, bolt-down lid to prevent water infiltration.

C. Cleanouts not at or above the required elevations shall have the clean-out adapter solvent welded watertight to the clean-out riser. Plugs are to be recessed square key with Teflon plumber's tape wrapped on threads to make a watertight seal.

END OF SECTION

SECTION 1.13 PRECAST POLYMER CONCRETE MANHOLES AND WET WELLS

1.13.1 DESCRIPTION OF WORK

A. Furnish all materials, labor and equipment to construct water-tight manholes and wet wells consisting of precast polymer concrete sections as indicated on the construction drawings.

B. Precast polymer concrete manholes shall be used in turbulent flow conditions, outside drop manholes, manholes with opposing flow, manholes upstream of a lift station (see US-17A), manholes with 12-inch and greater gravity sewer pipes, manholes receiving force main flow and the next two downstream manholes.

C. Precast polymer concrete shall be used in the construction of all wet wells. Traditional lined portland concrete wet wells may be accepted, when the required diameter exceeds the diameters available by the authorized manufacturers of the polymer concrete wet well.

D. On sanitary sewer systems that are to be publicly owned and maintained, as a basis of acceptance, the manufacturer shall provide an independent certification consisting of a copy of the manufacturer's test reports along with a copy of the test results certifying that representative manhole samples have been tested, and inspected in accordance with the provisions of this Specification and meet all requirements of same, to include but not limited to the load and strength requirements of ASTM C478 and ASTM C857.

1.13.2 PRECAST CONCRETE SECTIONS

A. Polymer concrete manholes and wet wells shall be manufactured from chemical-resistant polymer concrete with fiber-reinforced polymer (FRP) or steel reinforcement bars. Manholes and wet wells shall be manufactured by an established national manufacturer producing polymer concrete sanitary manholes and wet wells.

B. Marking and Identification - Each manhole and/or wet well shall be marked on the inside and outside with the following information:

1. Manufacturer's name or trademark.
2. Manufacturer's factory location.
3. Manufacturer's serial number.
4. Total length.
5. Production Date.

C. Precast polymer concrete manhole grade rings, flat slab tops, conical tops, risers and base sections shall be designed by the manufacturer to meet loading requirements of ASTM C478, ASTM C857, and ACI 350-06 as modified for polymer concrete manhole and wet well design as follows:

1. Polymer Concrete Mix Design shall consist of thermosetting resin, sand, and aggregate. No Portland cement shall be allowed as part of the mix design matrix. All sand and aggregate shall be inert in an acidic environment.
2. Reinforcement – Shall use acid resistant reinforcement (FRP Bar) in accordance with ACI 440.1R-06 or steel in accordance with ASTM C478 as applicable for polymer concrete design.
3. The wall thickness of polymer concrete structures shall not be less than that prescribed by the manufacturer’s design by less than 95% of stated design thickness.

4. Thermosetting Resin - The resin shall have a minimum deflection temperature of 158° F when tested at 264 psi (1.820 mPa) following Test Method D648. The resin content shall not be less than 7% of the weight of the sample as determined by test method D2584. Resin selection shall be suitable for applications in the corrosive conditions to which the polymer concrete manhole structures will be exposed.
5. AASHTO HS-20 or HL-93 design or as required loading applied to manhole cover and transition and base slabs.
6. Polymer manholes shall be designed based upon live and dead load criteria in ASTM C857 and ACI 350-06.
7. Unit soil weight of 130 pcf located above portions of manhole, including base slab projections.
8. Internal liquid pressure based on unit weight of 63 pcf.
9. Dead load of manhole sections fully supported by transition and base slab.

D. ASTM C478 and ASTM C857 material and manufacturing is allowed compositional and dimensional differences required by a polymer concrete product.

E. Polymer concrete shall have a minimum unconfined compressive strength of 9,000 psi at 28-days when measured in accordance with ASTM C497.

F. Minimum Wall Thickness for Manholes and Wet Wells:

1. Shall be designed to resist hydrostatic pressures with a minimum safety factor of 2.0 for full depth conditions from grade to invert.
2. The wall thickness of risers and conical tops shall not be less than that prescribed by the manufacturer's design by more than 5%. A wall greater than the prescribed design shall not be cause for rejection.
3. Wall thickness shall be as required by structural design performed by the manufacturer. Wall thickness design calculations shall be provided, signed and sealed by a licensed Professional Engineer in the State of Florida.
4. Manhole riser walls shall have a minimum thickness of 2-inches and the cone walls shall have a minimum thickness of 5-inches. Wet well section walls shall have a minimum thickness of 4--inches.

G. Precast structures shall be free of all defects, including indentations, cracks, holes, voids, blisters or rough surfaces, foreign inclusions and resin starved areas that, due to their nature and degree or extent, detrimentally affect the strength and serviceability of the component part.

H. The nominal internal diameter of the structure shall not vary more than 1%.

I. Variations in height of two opposite sides of risers and cones shall not be more than 5/8 inch. The under run in height of a riser or cone shall not be more than 1/4 in/ft of height with a maximum of 1/2 inch in any one section.

J. Structures shall have engineered and rated lifting devices that shall not penetrate through the wall of any tops, risers or base sections. Holes passing part-way through the section walls for lifting devices shall be filled with polyester mortar compound or non-shrink epoxy grout after the structure has been set in place.

K. All sections shall meet the manufacturing tolerance requirements of ASTM C478 or the following casting tolerances, whichever are more severe:

Wall Thickness	+/- 3/8 inches
Inside Diameter	+/- 3/8 inches
Outside Diameter	+/- 1/2 inches
Height or Length	+/- 3/8 inches

L. Provide riser sections joined with tongue and groove / bell and spigot design seamed with butyl mastic and joint lubricated rubber gaskets, so that on assembly, the base, riser and top section make a water-tight continuous and uniform structure.

M. Construct riser sections for polymer concrete structures from standard polymer concrete sections of the diameter indicated on drawings. Use various lengths of polymer concrete sections in combination to provide correct height with the fewest practical joints.

N. Pipe openings shall meet the recommended tolerances of the individual manufactured pipe to structure connectors; however, the horizontal location shall be within +/- 2 degrees of arc of that detailed on the shop drawings.

O. Minimum clear distance between two wall penetrations shall be a minimum of 6" on 48" to 72" diameter manholes and a minimum of 8" on larger diameter manholes. A clearance of 3" is required between wall penetration and joint.

P. All structure penetrations shall be made in the factory, unless otherwise specified in the plans.

1.13.3 MANHOLE INVERTS

A. Polymer bench and channels are to be factory constructed with all resin aggregate material. All precast base sections to be cast monolithically. Extended ballast slab requirements for buoyancy concerns can be addressed with exterior cementitious concrete material.

B. The width of the invert channel shall be the same as the inside diameter of the connected sewer pipes and shall have a "U" - shaped cross-section with the bottom of the channel shaped to correspond with the lower half of the pipe. The depth of the channel shall be a minimum of half the inside diameter of the connected pipes.

C. The channel shall be formed smooth and streamlined, and, where the flow changes directions, shall have true curves of the largest radius possible within the manhole base. The maximum change of direction of flow within a manhole shall be 90 degrees.

D. The channel invert slope shall be uniform through the manhole and shall have a minimum vertical drop of 1 inch from the inlet(s) to the outlet.

1.13.4 RESILIENT PIPE CONNECTORS

A. Connections of structures to pipes shall be made using a cast-in resilient connectors manufactured in accordance with ASTM C923 and shall maintain a resilient, hydrostatic water-tight seal between the pipe and the connector and between the connector and the manhole structure. All external hardware and connector bands shall be 316 stainless steel.

B. Connectors shall be installed in strict accordance with the written installation instructions of the manufacturer. Non-shrink grout shall be placed in the gap between the boot or seal and the manhole invert channel, to make a smooth transition, unless otherwise directed by the manufacturer's instructions.

C. Cold joint pipe stub grouting shall not be allowed.

1.13.5 GROUTING

All materials needed for grouting and patching shall be a polyester mortar compound or non-shrink epoxy grout provided by the manufacturer. All holes in sections used for handling and annular spaces, around influent and effluent pipes, shall be filled using the materials listed above.

1.13.6 MANHOLE AND WET WELL JOINTS

A. Joints between sections shall be modified tongue and groove, or modified bell and spigot, with a continuous joint lubricated elastomeric ring gasket conforming to the requirements of ASTM C443. Joint sealing surfaces shall be free of dents, gouges and other surface irregularities that would affect joint integrity.

B. In addition to the ring gasket, an additional sealing device shall be provided as follows:

1. An internal joint sealant:

a. butyl rubber sealant shall be applied to the interior of the tongue and groove / bell and spigot joints per manufacturer's recommendations and joint lubricated rubber gaskets.

2. An external joint wrap:

a. If the structure joint design has the risers' outer walls offset from each other, an 18-inch wide heat shrinkable joint wrap shall be centered over all these joints including the chimney to frame section per the manufacturer's recommendations

b. If the structure joint design has the risers' outer walls flush with each other, a 12-inch non-shrink elastomeric plastic joint wrap shall be centered over all these joints including chimney to frame section per the manufacturer's recommendations

C. Fill the joint at the inside face with non-shrink epoxy grout and strike the joint smooth and uniform with the structure interior walls.

1.13.7 MANHOLE RINGS AND COVERS

A. Rings and covers shall be heavy duty composite with a gasket seal and a minimum three (3) 316 stainless steel locking bolts; (camlock or quarter-turn locking mechanisms are prohibited). All frames and covers shall be water-tight, designed to withstand an HS-20 wheel loading as defined by AASHTO specifications with the words "MANATEE COUNTY", "SANITARY SEWER", and "(YEAR)" cast into them. Frame and cover molding shall be free of blowholes, warping, or any other defects not true to pattern. Seating surfaces of covers and frames shall be properly faced to prevent rocking. Rings and covers shall be designed and tested to bear an AASHTO H-20 wheel loading with and added 30 percent impact factor and shall be Class Heavy Duty traffic bearing.

B. Manhole composite frames shall be adjusted to grade with polymer concrete corrosion proof grade rings set on top of the manhole slabs and polymer concrete manhole cones to provide grade adjustment in setting manhole frames. Contractor shall use manufacturer recommended sealant between rings. Contractor shall ensure a watertight seal by removing debris, stones, and dirt between rings.

1.13.8 SETTING MANHOLE RING AND COVERS

Manhole rings and covers shall be set to conform accurately to the finished ground or pavement grade as indicated on the construction drawings or as directed by the County. Rings on manholes shall be set concentric with the precast polymer concrete adjusting rings and sealed with butyl rubber sealant strips;

3" wide x 1/2" thick, so that the space between the top of the adjustment rings and the bottom flanges of the rings will be made watertight. A ring of mortar shall be placed around the outside of the bottom flange at least one inch thick and pitched to shed water away from the frame. Mortar shall be extended to the outer edge of the masonry and finished smooth and flush with the top of the flange.

1.13.9 MANHOLE INSERTS

Watertight manhole inserts are required for all sanitary sewer manholes installed. Neoprene gaskets shall be installed under the insert lip to ensure a leak-proof seal.

1.13.10 POLYMER CONCRETE STRUCTURE INSTALLATION

A. Precast concrete sections shall be set vertical and in true alignment as indicated by the construction plans. Excavation, bedding foundation and backfill shall be done in accordance with the Trenching and Excavation section of these Standards. All structures shall meet the following installation tolerances:
    1. The finished structures shall not be out of plumb by more than 3/8 inch per 10 feet of height.
    2. Any jog or offset of the inside wall surface at a joint shall not exceed 1/2 inch.
    3. Variation in the joint width around the circumference of the structure shall not exceed 1/4 inch.
B. Invert drops less than 24 inches shall have an elevated U-channel to prevent solids disposition. Where sewers enter a manhole at an elevation 24 inches or more above the lowest invert, then an outside drop polymer concrete manholes shall be provided. The entire outside drop connection shall be encased in portland concrete.

1.13.11 ADJUSTING MANHOLE COVER

A. Existing manhole covers, which must be adjusted to existing or new pavement surfaces, shall be adjusted by modifying the existing precast polymer concrete adjustment rings to bring the entire existing ring and cover to grade.
B. No manhole cover adjustment rings shall be allowed.

1.13.12 BACKFILL PROCEDURES

A. Excavation, dewater, and backfilling shall be in accordance with Section 1.3.
B. Backfill shall be placed in such a manner as to prevent any wedging action against the manhole structure.

1.13.13 CONNECTIONS TO EXISTING POLYMER CONCRETE MANHOLES AND WET WELLS

A. All penetrations shall be mechanically rotary core-bore.
B. All piping entering existing manholes shall have a jack-in resilient pipe to manhole seals per ASTM C923.
C. The external take down clamp and its hardware shall be 316 stainless steel. The internal expansion band and its hardware shall be minimum 304 stainless steel.
D. Bench shall be modified with a new U-channel and finished with polymer concrete/grout per the manufacturer's recommendations.

END OF SECTION

SECTION 1.14 LIFT STATIONS

1.14.1 DESCRIPTION OF WORK

Furnish all labor, materials, equipment and incidentals required to install complete automatic, underground lift stations with all required equipment installed in a polymer concrete wet well, adjacent above-ground valve assembly (and above-ground meter, as determined by County). The principal items of equipment shall include, at a minimum, two submersible motor-driven sewage pumps, valves, internal piping, automatic pumping level controls, complete control panel and telemetry (most current model). All materials shall be new, without defects and of the best quality. All materials furnished and all work done shall be in strict accordance with the National Electrical Code and all local requirements and codes.

All lift stations that re-pump sewage from four (4) other upstream lift stations or has a discharge flow 500 gpm or greater shall have an on-site back-up diesel pump equipped with a transducer level controls, and backup float switches. The sub-base type fuel tank shall not exceed 540 gallons.

Re-pump station may require an in-line submersible magnetic flow meter (as determined by County), and a force main pressure transducer.

Alternatively, at the sole-discretion of the County, an electric generator equipped with an automatic power transfer switch may be installed in lieu of the back-up diesel pump.

1.14.2 STRUCTURES AND EQUIPMENT

A. Lift Station Wet Well. All wet wells 6 feet diameter and larger, and all lift stations that are owned and maintained by Manatee County, shall be precast polymer concrete (or portland concrete and lined, if the polymer concrete wet well diameter is not available), in accordance with section 1.13, designed to accommodate the peak hour development flow from all contributing areas. The wet well shall have a minimum of 4 feet from the lowest invert to the wet well bottom. In no cases shall the lowest influent pipe invert of the wet well be deeper than 25 feet, nor shall the bottom of the wet well be deeper than 32 feet

B. The lift station wet well size shall be determined using the following formula to determine the minimum volume between the off-level elevation and the influent invert elevation:

MIN. VOLUME (GALS.) = PUMP CAPACITY (G.P.M.) X 4

Wet well diameters shall be 6 feet or larger. 4-foot and 5-foot diameter wet wells shall be used only for special grinder pump applications as approved by the County on a case by case basis.

Polymer Concrete wet wells shall have a minimum wall thickness per Section 1.13.2.F.

Portland Concrete wet wells shall have a minimum wall thickness as follows:

DIAMETER	WALL THICKNESS	DIAMETER	WALL THICKNESS
4' - 0"	8"	8' - 0"	8"
5' - 0"	8"	10' - 0"	10"
6' - 0"	8"	12' - 0"	12"

The lift station wet well size and control equipment shall be designed to limit the pumping cycles of each pump to a maximum of 5 starts per hour for duplex stations and 3 starts per hour for triplex stations. Lift stations discharging through pipes 12 inches or larger shall have more than two variable speed pumps. The pump cycle off level shall be no lower than the top of the sewage pumps. The lead pump on level

shall be no higher than 18 inches below the invert elevation of the influent pipe for duplex stations, and no higher than 24 inches below the invert for triplex stations.

All lift stations shall have a single gravity-flow influent pipe discharging into the wet well. Multiple gravity pipelines and force mains upstream shall all terminate at a separate polymer concrete manhole before flowing into the lift station wet well. This separate polymer concrete manhole shall be located no further than 50 feet from the wet well. The influent gravity sewer shall be aligned, so that the inflowing stream drops into the front side of the wet well, opposite from the riser pipes.

C. Above–ground Valve Assembly. An above-ground valve assembly and 3,000 psi concrete pad with three gate valves, two weighted lever swing check valves, and a pump-out connection shall be constructed adjacent to the wet well. Tri-plex stations have four gate valves and three check valves. The pump-out connection shall be equipped with a gate valve and a male aluminum quick-coupler w/ cap; 4-inch for 4 inch or smaller valve assemblies; 6-inch for all others, unless otherwise specified on the plans. All valves shall have factory applied, fusion bonded epoxy coating on the interior and exterior. All fittings shall have a factory applied epoxy coating inside and outside. All bolt, nuts & washers in or on the wet well or valve assembly shall be 316 stainless steel.

   The valve assembly shall be supported by 316 stainless steel adjustable, flange-type, pipe supports anchored to the structure/valve pad. 6-#5 rebar shall be epoxy doweled into the wet well 3-4 inches and cast into the valve assembly slab 3-4 feet.

D. Entrance Hatches**.** The lift station wet well shall be equipped with an aluminum access cover of adequate size to permit easy removal and installation of sewage pumps and equipment. The wet well access cover shall be a minimum 36" x 48" single (preferred) or double door. The dimensions of the hatch will vary depending on the internal discharge pipe size and internal configuration, the actual required dimensions of the hatch shall be confirmed with the pump manufacturer prior to ordering. The access covers shall be constructed of aluminum with a minimum load rating of 300 lbs/sq. ft. and equipped with 316 stainless steel hinges, a recessed lifting handle which lies flush with the door surface, and a 316 stainless steel staple which may be used to secure the door with a padlock when closed. The doors shall have a raised diamond thread pattern to provide a skid-resistant surface and shall open to 90 degrees and lock automatically in that position, with a handle to release the doors for closing.

E. Sewage Pump Assemblies. Each lift station shall have a minimum of two identical, totally submersible sewage pump assemblies which are rated and suitable for continuous duty, underwater operation. These units and their associated power and signal cables shall have watertight integrity to a depth of 65 feet. The pump, pump motor and associated components shall all be the products of the same manufacturer. Pump assemblies shall be painted after assembly with an approved air dry enamel which will adequately protect the exterior housings from the corrosive environment in the wastewater sewer system. Coating thickness shall be a minimum of 4 mils.

   Pumps shall be selected to operate within 10 percent of the Best Efficiency Point (BEP). The overall lift station system shall be designed to allow for the selected pumps to operate within 10 percent of their BEP.

   Factory testing of the pump assemblies shall be required and as a minimum, shall include:

   1. All tests recommended by the manufacturer.
   2. Verify the integrity of assembly and connections (no leaks, tightness of hardware, proper alignment, assembly, etc.) and that the nameplate and specified pump and pump motor (HP, Voltage, Phase and HZ) correspond.

3. The motor windings and seal housing chambers shall be hi-potted to test for insulation defects and moisture content. Check the resistance of the stator windings with a bridge to verify that the readings of all three phases are basically equal and within tolerance.
4. Energize pump motor, verify direction of rotation and that it corresponds to the nameplate.
5. Provide a written report of all testing with the shipped pump.

All pump assemblies shall be warranted against defects in workmanship and materials for whichever is the greater of: a 5 year pro-rated warranty from the date of purchase or as provided in the Defect Security Agreement with the County.

Month 0 –18 = 100% Month 19-31 = 75% Month 32-45 = 50% Month 46-60 = 25%

Pump motors shall have the following electrical characteristics: 230 -volt for 20 HP and lower or 460 -volt for greater than 20 HP, 3 phase, 60 hertz, minimum service factor of 1.15, continuous duty, maximum NEMA LRA/HP code of J, and NEMA Design B. Pump motors shall be non-overloading throughout the entire range of operation. The pump motors are to be induction motors which are built with moisture resistant Class F insulation. Each motor shall be capable of a minimum of 10 starts per hour without degradation of the windings. The pump motor shaft shall be made from a single, solid, forging of 303 (or better grade) stainless steel, tapered, keyed, and supported by a minimum of one heavy duty upper radial ball bearing and a minimum of one heavy duty lower thrust bearing. The bearings shall have a minimum B-10 life rating of 60,000 hours. The shaft and shaft extension shall be of minimum length and maximum diameter to reduce shaft deflection and prolong bearing life. The pump motor shall be designed for pumping at a maximum sump ambient of 40 degrees C (104 degrees F). The stator of the pump motor shall be copper wound (aluminum stator windings are not permitted) and equipped with at least two heat sensors (klixons installed in the stator end turns) which will shut the motor off in case of excessive heat built up. The heat sensors shall be connected in series with the motor starter coil, so the starter is tripped if the heat sensor opens. The pump motor housing shall be oil or air-filled type for cooling purposes. Oil filled motors shall use pure dielectric insulating oil. The pump motor shall be capable of operating at +/- 10% of rated voltage and +/- 5% of rated frequency without excessive heating. The pump motor shall not exceed a rise by resistance of 90 degrees C at full load over the entire performance curve. It shall be able to operate intermittently a full load while unsubmerged without damage. Power cables and signal cables shall be continuous (without splices from the pump motor to the power supply). Power cables shall be sized for operation at the rated service factor. The power cable shall be a single, multi-conductor, STW-A type that is epoxy potted and compression fitted for watertight sealing into the pump cable entry. As a minimum, the nameplate for the pump motor shall include: MODEL/SERIAL NUMBER, HORSEPOWER, VOLTAGE, FULL LOAD AMPS, FULL LOAD RPM, PHASES, FREQUENCY, NEMA LRA CODE, NEMA DESIGN, INSULATION CLASS, AMBIENT TEMPERATURE, LEAD CONNECTIONS FOR DIRECTION OF ROTATION, TYPE OF DUTY, TYPE OF BEARINGS, and PUMP IMPELLER SIZE. All electrical components used in or in conjunction with the sewage pump assembly shall be UL approved when UL approval is available for that type component.

The pumps shall be capable of pumping raw, unscreened sewage and able to pass a minimum 3-inch solid. Each pump shall have an enclosed cast iron or ductile iron impeller and shall be equipped with a bronze wear ring. The pump lifting cover, stator housing, and volute casing shall be gray cast iron, ASTM A48, Class 30. Castings shall have smooth surfaces that are devoid of blow holes or other casting defects. The pump lifting bail shall have a minimum of 4-inch diameter clear opening and shall be cast as part of the motor cover or fabricated from 316 stainless steel. All fasteners exposed to raw sewage shall be series 316 stainless steel. The backside of the impeller shall have pump-out vanes to keep contaminates out of the seal area. The impeller shall be dynamically balanced, and shall be single - or multi-vaned, with an

enclosed or recessed, non-clogging design. There shall be a maximum clearance of .125 inches between the seal housing and the top of the impeller. The pump shall have a minimum of two mechanical seals mounted in tandem with an oil chamber between the two seals. The oil chamber of each pump shall be equipped with an electric seal fail sensor which shall be connected to an indicating light at the control panel to annunciate a seal failure and a set of relay contacts for purposes of remote notification via the County RTU system. The unit shall be designed so that when the outer seal fails, the contaminates that enter shall not enter the bearing housing and cause damage to the bearings. The inner seal shall be replaceable without disassembly of the motor housing and without the need for special tools. As a minimum, the rotating seal faces shall be carbon and the stationary seal faces shall be ceramic.

All pumps shall be center-line discharge type constructed so that the discharge flange supports the full weight of the pump. Pump assemblies shall be complete with ductile iron BPIU discharge base elbows that are bolted directly to a base plate which is bolted directly to the wet well floor, guide flange adapter and guide rails. The discharge elbow shall have an automatic coupling end facing the pump and an ANSI Class 125 flanged end ready for connection to the flange of the riser pipe. The design of the pump assembly installation shall be such that the pump will be automatically connected to the discharge piping when lowered into place along the guide rails and shall seal leak-tight to the discharge base elbow by the weight of the pump assembly resting in the installed position. The pump base elbow shall be mounted on an ASTM A588 (COR-TEN) steel mounting plate that is level and is bolted to the wet well floor using 3/4-inch 316 stainless steel threaded rods with Hilti HVA anchors or approved equal anchors and shall have base ell mounting bolts of 3/4-inch 316 stainless steel that are mounted in place and welded to the plate. The pump guide rails for each pump shall be constructed of two separate whole length sections of 2-inch Schedule 40, 316 stainless steel pipes, set 4 inches on center.

The pump assemblies shall be easily removed for inspections or service, requiring no fasteners to be removed or disconnected, and no need for personnel to enter the confined space of the wet well, by simply hauling up on the lift chains. The lifting chains shall be type 316 stainless steel, and shall be 1/4-inch for pumps less than 25 HP and 3/8-inch for pumps 25 HP and greater, or as required by the pump assembly weight. Chains shall be attached to the pump lifting bails using 316 stainless steel shackles and shall extend to the inside top of the wet well. All rails and mounting hardware shall be 316 stainless steel.

F. Riser and Fittings. All force main piping and fittings within the wet well from the pump base elbow to the check valve, shall be DR-11 HDPE; only molded HDPE fittings shall be used upstream of the check valves. The HDPE discharge piping from the pump base ells (in the wet well) and to the valve assembly check valves shall be connected using HDPE flange adapters with 316 stainless steel backup rings. No ductile iron bodied fittings shall be located between the pump base elbow and the check valves. A HDPE eccentric reducer shall be used when increasing pipe diameter from the base elbow to the discharge piping. All HDPE connections shall be thermal fused. All piping downstream of the tee/cross in the valve assembly to the first underground fitting shall be ductile iron pipe, after which PVC DR-18 shall be used.

All flanged fittings shall use 316 stainless steel bolts, nuts and washers. All threads shall be treated with Bostik Never-Seez anti-seizing compound or approved equal. All bolts on the flange connection at the pump base ells shall have two nuts with a lock washer between them or a nylon lock nut.

All stainless steel fasteners shall be treated with Never-Seez prior to assembly and torque according to the fitting manufacturer's recommendation.

The riser pipes shall be attached to riser pipe brackets by cushioned 316 stainless steel U-bolt clamps. The cushion design shall distribute the total load allowing the U-bolt to become a full contact hanger. The U-bolts shall be tightened to secure the riser pipe as to grip the pipe without deforming the pipe when bolted to the brackets. The riser pipe brackets shall be constructed of 316 stainless steel 2 inch tubing (or

2 inch 316 stainless steel angle) with 6”x6”x1/4” 316 stainless steel plates welded to each end and attached to the wet well walls by two (min) 316 stainless steel anchors.

G. Hardware. A multi hook stainless steel hanger shall be installed inside the wet well access opening for supporting the float switches and pump electric cables. The multi hook hanger shall be constructed from 1/4-inch x 2-inch type 316 stainless steel flat stock with individual hooks constructed of 1/4” type 316 stainless steel rod stock. Individual hangers shall be installed on each side of the upper guide rail bracket for each pump to support the pump lifting chain and power cable. The lifting chain hook shall be constructed from 3/8-inch type 316 stainless steel rod stock. The pump power cable hook shall be constructed from 1/4-inch x 1-inch type 316 stainless steel flat stock.

H. Painting and Coating. All paint and other coatings shall be applied in accordance with the product manufacturer's specifications for the surfaces being coated. All ductile iron body valves shall have a factory applied fusion bonded epoxy coating inside and outside. A holiday free factory certification per ASTM G62, Method A, (Low Voltage) shall be provided for the interior coating at the time of delivery. No field-applied paintings or coatings shall be applied to the valves.

All ductile iron pipe and fittings shall have an approved interior green, factory applied amine cured novalac ceramic epoxy or a modified polyamine ceramic epoxy interior lining, dry film thickness shall be as defined in the Approved Products List. All buried ductile iron pipe and fittings shall have a standard 1-mil asphaltic exterior coating per AWWA C151, or as defined in the Approved Products List. All above-ground ductile iron pipe and fittings shall have a factory-applied epoxy primer. All above-ground pipe and fittings shall be painted Hunter Green (Rustoleum 7538).

I. Stilling Well. The stilling well shall be a 6” PVC stilling well mounted such that the top is available to an open hatch cover. The bottom of the stilling well shall have two 316 stainless steel bolt all the way through both sides, passing through the center of the pipe, approximately 4” from the base of the pipe. It shall have 1/2” diameter holes drilled around the circumference at a rate of one hole per inch of length for at least the full wetted height. All mounting hardware shall be 316 stainless steel.

J. Magnetic Flow Meter (where required). A flow meter may be required, and if so, shall be rated for continuous submergence, 0.05% accuracy with a polyurethane liner, flush electrodes, FM Class 1, Division 2, Groups A, B, C & D and shall be constructed for a flanged mount. Meter shall be supplied with a like size spool piece. The exterior control module/transmitter shall be mounted either inside or adjacent to the lift station control panel on the same support structure per the Lift Station Supervisor.

1.14.3 ELECTRICAL

A. Service and Metering. The Contractor shall be responsible and shall pay for any permits, fees, and inspections required by the local power company for service installations. Three phase power shall be used unless otherwise approved by the County. Service for pump motors of 20 horsepower or smaller shall be 230 volts. For motors greater than 20 horsepower, the service voltage shall be 460. No phase converters will be accepted. All lift stations shall be equipped with a knife-type fused safety switch in a NEMA 4X 316 stainless steel enclosure, lockable in the ON and OFF position, between the service meter and the control panel to permit servicing of the main breaker without removing the service meter. All meter bases shall be aluminum. Minimum service size shall be 100 amp. Conduit connections to the disconnect shall be sealed using Myers conduit hub connectors (disconnect side).

B. Conductors. All power conductors shall be single conductor, 600-volt, type THW or THHN stranded copper. Minimum conductor size shall be #12 AWG. ALUMINUM WIRE IS NOT PERMITTED. All control wiring shall be single conductor #14 AWG, 600-volt, type THHN stranded copper. All terminations and interconnections of control wiring shall be by means of compression-type lugs of the nylon self insulated

type with an inner bronze insulation grip sleeve on identified terminal strips. All control wiring shall be color coded as indicated on the standard details.

C. Conduit. All power conductors from the utility source to the service meter shall be enclosed in PVC Schedule 80 conduit below ground and aboveground. All lift stations shall be equipped with one conduit to the wet well for each pump power cables and a separate conduit to the wet well for the control (floatball) and signal cables. In lift stations with large horsepower pumps and pumps equipped with sensor cables, the conduit size and quantity shall be determined by the County. All conduit to the lift station wet well shall be minimum 2" Schedule 80 PVC and shall be run by the shortest route possible. All terminations shall be made inside the electrical control panel. All flexible conduit shall be non-metallic.

D. Control Panel. All lift stations shall have one automatic control panel, one telemetry control unit enclosure with specified TCU (most current model) with assigned radio frequency and one junction control box for motor control, floats, seal fail and transducer. The control panel will be ordered through Barney's Pump of Lakeland, FL. The telemetry control cabinet will be ordered through Data Flow Systems (DFS), part# RJ1816HPL. Specify if 480V 3 phase is needed. Enclosure must be ordered with 'NO" tower mounting brackets.

All cabinets shall be white in color unless specified otherwise. The 304 S.S. control cabinet and junction box shall be powder coated white.

The Order Numbers and specification are listed below.

Barney's Pumps approved panels by Manatee County

Part#	STD. FLA	MCB/ECB	PCB	Starter	Size	Note:
ManCoCP240_1_3_VFD	11A Max	100	40	FRN003E1S-7U	N/A	11A Max Pump FLA (VFD)
ManCoCP240_1_5_VFD	19A Max	125	70	FRN010E1S-2U	N/A	19A Max Pump FLA (VFD)
ManCoCP240_3_2_FVNR	8.3	100	15	14DUC32AF	1	
ManCoCP240_3_3_FVNR	9.5	100	15	14DUD32AF	1	
ManCoCP240_3_5_FVNR	15.3	100	25	14DUE32AF	1	
ManCoCP240_3_7.5_FVNR	25.2	100	40	14DUE32AF	1	
ManCoCP240_3_10_FVNR	29.5	100	50	14EUE32AF	1.75	
ManCoCP240_3_15_FVNR	44.2	125	70	14FUF32AF	2	
ManCoCP240_3_20_FVNR	54.4	175	90	14HUG32AF	3	
ManCoCP240_3_25_FVNR	68	200	100	14HUG32AF	3	
ManCoCP480_3_2_FVNR	4.1	100	15	14DUC32AF	1	
ManCoCP480_3_3_FVNR	4.8	100	15	14DUC32AF	1	
ManCoCP480_3_5_FVNR	7.8	100	15	14DUC32AF	1	
ManCoCP480_3_7.5_FVNR	12.6	100	20	14DUD32AF	1	
ManCoCP480_3_10_FVNR	14.7	100	25	14DUD32AF	1	
ManCoCP480_3_15_FVNR	22.1	100	40	14EUE32AF	1.75	
ManCoCP480_3_20_FVNR	27.2	100	50	14FUF32AF	2	

ManCoCP480_3_25_FVNR	34	100	60	14FUF32AF	2	
ManCoCP480_3_30_FVNR	40.1	110	60	14HUG32AF	3	
ManCoCP480_3_40_FVNR	52.2	125	80	14HUG32AF	3	
ManCoCP480_3_50_FVNR	70.5	175	110	14HUG32AF	3	
ManCoCP480_3_75_FVNR	99.4	250/200	150	14IUH32AF	4	

All part numbers include junction box
Fuji Inverters/VFD's only
Part number for cabinets that are single phase does not include inverters - sold separately.

The control panel, telemetry control cabinet, and motor cable junction box along with the safety switch box and electric utility power meter, shall be attached to horizontal support channels with stainless steel fastening systems designed for use with the support channel. The horizontal channels shall be 1-5/8 inch, 12 gage (or thicker) solid stainless steel channels attached (flat side out) with 3/8-inch 316 stainless steel all thread rod with 316 stainless steel flat washers and nuts to two vertical 3 inch diameter 316 stainless steel, schedule 40 posts. The horizontal channel ends shall be covered with plastic caps to prevent injury to personnel. The 3-inch vertical posts shall have plastic end caps or 316 stainless steel end caps at the top and shall be anchored in concrete adjacent to the lift station wet well. See County Standard, “Sewage Lift Station Meter & Electrical Details”. No fittings shall enter from the top or back of the control panel. All fittings shall enter the side or bottom of the control panel and shall penetrate the control panel with Myers Hubs.

The overall control panel shall be a minimum of 30"x 36"x 12" deep and of adequate size to completely cover (without crowding) all wiring and components mounted inside it. It shall have provisions for the mounting of all basic and optional controls and instrumentation. Install engraved nameplates defining door mounted hardware. The electrical control panel shall have a complete wiring schematic which is laminated in plastic and attached to the inside of the outer control panel door.

All components shall be installed per the most current NEMA and NEC regulations and standards. The components shall be industrial NEMA rated (I.E.C. is not acceptable) and UL approved when UL approval is available for that particular type component. The components of the panel shall be held in place with stainless steel, slotted, plan head machine screws with star type washers. The panel shall be tapped to accept the mounting screws of the components and no self-tapping type screws shall be used. The control panel shall have the following items installed on the back plane or on aluminum “high hats” attached to the back plane, so the body of the component is flush with the dead front door to allow operation and reset of the components without opening the dead front door: main power breaker, emergency power circuit breaker, individual pump circuit breakers, control circuit breaker and G.F.I. duplex receptacle circuit breaker. The control panel shall have the following items installed directly to the back plane: individual motor starters, power distribution blocks, neutral bar assembly, grounding bar/lugs, terminal strips, 2-inch PVC panduit for control and telemetry wiring and fuses, and surge suppressor. The control panel shall have one G.F.I. duplex receptacle installed on the dead front door. The exterior of the control panel shall have one emergency generator receptacle and one flashing red light. The individual placement of all the components of the control panel shall be installed as indicated in the standard details.

E. Ratings. The controls shall be rated for the supply voltage (230- or 460-volts), 3 phase, 60-hertz. In the event that three phase power is not available at the location of the control panel, the cabinet shall be either ManCOCP240 1 3 VFD (3 hp) or ManCoCP240 1 5 VFD (5 hp) inverters. All control voltage to the wet well shall not exceed 24 volts DC.

F. Wiring Method. All power conductors from the main circuit breaker to all other circuit breakers shall be connected via a Square D model LBA363206, Marathon #1333555, or equal power distribution block. All electrical panel components shall have individual neutral wires. All neutral wiring shall be connected via a Square D model SN12-125 neutral assembly. Wiring is to be continuous with no splices between connections. Provide a Square D model PK9GTA grounding bar at the bottom of the backplate. This grounding bar will be the central connection point of all ground wires for the system with the exception of the pump power cords and surge arresters. The pump power cords and surge arresters shall be grounded via individual ground lugs that are to be attached to the control panel back plane. Provide two 12 terminal, Ideal Model 89-208 terminal strips to make electrical connections in the control panel. One terminal strip shall be used exclusively for 24-volt connections (TB-1) and the other shall be used exclusively for 120-volt connections (TB-2). The power distribution block, neutral assembly, grounding bar and terminal strips shall be located as indicated in the standard details. Use 316 stainless steel screws and fasteners for all wiring connections.

G. Circuit Breakers. The panels shall be equipped with main and emergency circuit breakers for a minimum size of service of 100 amps. The main and emergency circuit breakers shall be interlocked so that when one is in the open position, the other circuit breaker must be in the closed position. There shall also be an individual circuit breaker for each pump, a control circuit breaker, a 20 amp circuit breaker for site lighting, a 20 amp circuit breaker for the flow meter (re-pump stations only) and a minimum 20 amp circuit breaker for the 120 volt GFI protected convenience outlet that is mounted on the inner control panel door. All circuit breakers shall be mounted in the control panel per the standard details. The circuit breakers shall be of the heavy duty thermal magnetic trip variety. For circuit breakers up to 100 amps, use Square D series QOU or County approved equal. For circuit breakers greater than 100 amps, use Square D "Mag Guard" series with adjustable trip for the pumps, main and emergency breakers shall be Square D QBL, HGL, or JGL.

H. Motor Starters. Pump motors shall each have a NEMA-rated, magnetic starter sized as called for on the construction plans. No starter smaller than NEMA size 1 shall be used. Starters shall be full voltage, non-reversing type. These starters shall be Siemens series ESP-100 or County approved equal with special phase loss protection and a special factory coating of the circuit boards which prevents hydrogen sulfide damage. The starters shall be equipped with under voltage release and overload protection on all three phases. The motor starter contacts (if used) shall be constructed so that they may be easily replaced without removing the starter unit from its mounted position. The overload reset device shall be operable without having to open the inner swing panel.

I. Lightning Arresters. There shall be a Ditek DTK Series lightning arrester/surge suppressor installed on the incoming power source. It shall be mounted on the bottom exterior or placed inside of the safety switch enclosure and connected to the LOAD SIDE of the safety switch and overload reset.

The main circuit breaker and the RTU circuit breaker shall also each have a Ditek CM+Series lightning arrester/surge suppressor connected to the load side of the breaker wiring. These lightning arresters/surge suppressors shall be mounted with the supplied adhesive strip on the back of the "high hat" supporting the breakers. The exact model lightning arresters/surge suppressors shall be based on the voltage and number of phases of the protected circuits.

J. Liquid Level Switches and Sensors. A minimum of four float switches are to be installed in the wet well to monitor and control liquid level height. The switches shall be an approved single pole mechanical type switch. They shall be designed to actuate when the longitudinal axis of the float is horizontal, and deactuate when the liquid level falls one inch below the actuation elevation. The switching arrangement shall be normally open when deactivated. The output leads shall be connected in the control panel as shown in the standard details. The control voltage to the level switches shall be 24 volts DC and the

switches shall be sized to operate at that voltage. In addition to the above, lift stations that re-pump sewage flows (directly or indirectly) from other lift stations shall have a pressure transducer mounted inside a stilling well as the primary level sensor.

The wiring connecting the cable junction box to the wet well floats shall be a continuous length (no splices) of flexible rate 600-volt, minimum diameter of #18, type S.O. cable. The float switches shall have all connections made inside the junction box using crimp on spade terminals that are landed to the terminal strip. The wiring shall be installed so there is a minimum of four feet, and a maximum of 6 feet, of excess cable in the wet well for relocation of the float switches.

K. Alarms. Each lift station shall have one flashing red light to signal high level conditions. A flasher unit shall be installed and mounted in the control panel enclosure to operate the led flashing light attached to the unistrut.

L. Generator Receptacle. A generator receptacle to permit the installation of a portable emergency generator as the power source when the local utility power company power supply is lost shall be installed on the outside of the control panel as indicated on the standard details. It shall be directly connected to the emergency circuit breaker inside the control panel. The emergency and main circuit breakers shall have a mechanical interlink between them which shall allow only one source to supply power to the control panel at any given period of time. The generator receptacles shall be:

Power Supply	Required Receptacle
0-100 Amp, 230 Volt	Russell Stoll JRSB1044FR
100-200 Amp, 230 Volt	Russell Stoll JRSB2044FR
0-200 Amp, 460 Volt	Russell Stoll JRSB2034HR

M. Seal Leak Moisture Detector. Provide for each pump a moisture sensing sensor which will detect when moisture has penetrated the seal chamber. The moisture seal detector shall be connected to the County RTU system to notify lift station maintenance personnel when a seal has allowed moisture to enter the oil chamber of the pump. An indicating lamp is to be mounted in the control panel as illustrated in the standard details to also signal the seal failure.

N. Telemetry Control Unit. The remote terminal/pump control unit shall be a complete TAC Pack TCU system (most current model) as manufactured by Data Flow Systems, Inc. The unit is to be a fully programmable, dual function device. It shall be used to monitor and control SCADA equipment and it shall have all the necessary hardware and software to control three pump motor starters. Its operation is based on level inputs from a minimum of four float ball switches in the wet well. It shall have the ability to control pump alternation, activate and deactivate remote and local alarms, and communicate with the HT3 SCADA System. It shall be equipped with RTU surge protection and a transient filter shield. The unit shall have an uninterruptible power source and contain all the components and be electrically connected as indicated in the standard details. It shall be equipped with an antenna tower with supporting mast and coaxial cable that is required by the manufacturer for that particular system. The battery backup will be contained with the TCU in its own enclosure. The installation shall include the required FCC licensing. The antenna and mast shall be rated for 150 MPH winds. Tower heights above 20 feet shall be as defined by the Approved Product List.

Lift stations that re-pump sewage flows (directly or indirectly) from other lift stations with 3-pumps or less will require a Telemetry Control Unit (TCU) to receive input from the force main pressure transducer and flow meter. Lift station with 4-pumps will require a Remote Telemetry Unit (RTU) with a Programmable Logic Controller (PLC) that needs an Analog Monitor Module (AMM).

Telemetry control and remote terminal/pump control units are not required for privately owned and maintained lift stations.

O. Grounding. Install a 5/8" x 10' copper-clad ground rod for each electrical service. Connect to the ground rod a #6 bare copper wire to connect with the electrical panel grounding bar. Provide another, separate ground rod, tower clamp, and #6 bare copper wire to connect directly to the antenna tower, control cabinet/TCU cabinet, polyphaser, and ground. The ground rods and #6 bare copper wires shall be connected by an exothermic weld (cad weld).

P. Site Lighting. A minimum 6000 lumens LED shall be mounted on the system tower for illumination of the lift station area. The manually operated light shall be mounted on 3/4-inch aluminum rigid conduit connected to the RTU tower using 90-degree korns clamps.

1.14.4 GRINDER LIFT STATIONS

A. Grinder pumps shall be used where the required discharge rate is low and the discharge pipe is required to be smaller than 4-inch diameter. Grinder lift stations shall be constructed essentially to the same standards as the larger standard lift stations, with full plastic liners, dual pumps with guide rails, control panels, RTUs, antennas and masts, etc., but sized smaller to accommodate the lesser capacity. Wet well diameters may be smaller than 6 feet, but shall be no smaller than 4 feet. Riser pipes shall be no smaller than 1.25 inches diameter, and force mains shall be no smaller than 2 inches diameter. Ball check valves shall not be used.

B. Grinder pumps will not be required to pass a 3-inch solid, but shall rather be capable of grinding all materials normally found in domestic raw wastewater into a pumpable slurry. The grinder cutters shall be made of 440C stainless steel hardened to Rockwell 60C. Motors shall be 230-volt, 3 phase, 60 hertz, 3450 or 1750 RPM speed, and shall otherwise meet the same requirements as for the larger standard sewage pump motors. Minimum hatch cover sizes for grinder lift station wet wells shall be 30 x 36 inches.

C. There shall be an approved shut-off valve (tapping gate valve) installed at the connection of a grinder lift station pipeline to a County force main, and where the grinder lift station is maintained by a private entity, there shall be another approved shut-off valve (plug valve) installed at the point where the grinder pump pipeline enters the public right-of-way or public utility easement. The force main shall be at least 18 inches below the top slab within the valve vault. A 90-degree bend, which is turned down, shall be installed 18 inches outside of the valve vault to lower the force main to obtain a minimum 3 feet of cover.

Wet wells and valve vaults for grinder lift stations may be fiberglass or HDPE plastic. If fiberglass, the resins used shall be a commercial grade unsaturated polyester or vinyl ester resin. The reinforcing materials shall be commercial Grade "E" type glass in the form of continuous roving and chop roving, and shall have a coupling agent that will provide a suitable bond between the glass reinforcement and the resin. The inner surface exposed to the chemical environment shall be a resin-rich layer of 0.010 to 0.020 inches thick. The inner surface layer exposed to the corrosive environment shall be followed with a minimum of two passes of chopped roving of minimum length 0.5 inch (13 mm) to maximum length of 2.0 inches (50.8 mm) and shall be applied uniformly to an equivalent weight of 3 oz/ft^2. Each pass of chopped roving shall be well-rolled prior to the application of additional reinforcement. The combined thickness of the inner surface and interior layer shall not be less than 0.10 inch (2.5 mm). The interior surface shall be free of crazing, delamination, blisters larger than 0.5-inch in diameter and wrinkles of 0.125-inch or greater in depth. Surface pits may be permitted if they are less than 0.75-inch in diameter and less than 0.0625-inch deep. Voids that may not be broken with finger pressure and that are entirely below the resin surface shall be permitted if they are less than 0.5-inch in diameter and less than 0.0625-inch thick. After inner layer has been applied, the wet well and valve vault wall shall be constructed with

chop and continuous strand filament wound manufacturing process which insures continuous reinforcement and uniform strength and composition. Wet well and valve vaults may require resin fiber-reinforced bottoms.

Wet well bottom shall have a minimum 3-inch anti-flotation ring. Wet well and valve vault bottom shall be designed to resist all pressures induced by water, soil and wheel loads with a maximum deflection of 1/4-inch.

No hardware shall penetrate the wet well walls. The wet well wall shall include built / molded in channel supports for every 8 feet of vertical discharge piping for mounting pipe support braces and for mounting both guide rails and hooks to hang float balls, pump lifting chains, etc. at the top of the wet well. All pipe openings shall have resilient pipe to wet well seals.

The 1:1 bottom fillet may be molded or formed fiberglass or plastic or concrete. Concrete also may be used on the top of anti-flotation ring and as required to resist buoyancy. The wet well and valve vault shall resist flotation with ground water level assumed to be at finished grade. The Engineer of Record shall submit flotation calculations to Manatee County when submitting Construction Drawing approval.

All fiberglass and plastic wet wells and valve vaults located such that a vehicle may run over it shall have a minimum dynamic-load rating of 16,000 lbs. when tested in accordance with ASTM D3753. To establish this rating, the complete wet well and valve vault shall not leak, crack, or suffer other damage when load tested to 40,000 lbs. and shall not deflect vertically downward more than 0.25 in. at the point of load application when loaded to 24,000 lbs. Thickness of fiberglass and plastic wet wells and valve vaults shall be determined by calculations submitted when submitting construction drawings for approval. The Engineer of Record shall perform the calculations or shall submit a certification that he or she reviewed calculations prepared by others and that the aforementioned requirements have been met.

The wet well cylinder shall have the minimum pipe-stiffness values shown in table below when tested in accordance with ASTM D3753 Table 1.

WET WELL LENGTH (FT.)	PIPE-STIFFNESS F/AY, [PSI (k Pa)]
3 - 6.5	0.72 (4.96)
7 - 12.5	1.26 (8.69)
13 - 20.5	2.01 (13.86)
21 - 25.5	3.02 (20.82)
26 - 35	5.24 (36.13)

The exterior surface shall be relatively smooth with no sharp projections, free of blisters larger than 0.5-inch in diameter, delamination or fiber show.

Each wet well and valve vault shall be designed and built to meet all required ASTM D3753 designations for dimensional requirements, hardness, chemical resistance, and workmanship. Test records shall be provided to the Owner/Engineer of Record and to the County Inspector.

The Contractor shall set sections vertical and in true alignment. The finished wet well and valve vault shall not be out of plumb by more than 3/8-inch per 10 feet of height.

Each wet well and valve vault shall be marked on the inside and outside with the following information: Manufacturer's name or trademark, factory location, serial or model number and total length.

1.14.5 FLOODING

Wastewater lift station structures and electrical and mechanical equipment shall be fully protected from physical damage from flood water intrusion by the 100-year flood. Wastewater lift stations shall remain fully operational and accessible during the 25-year flood. Regulations of state and federal agencies regarding obstructions of the lift station site by flood waters shall be observed during the design of the development.

1.14.6 ENTRANCE HATCH ELEVATIONS

The wet well entrance hatch and valve assembly slab shall be set at least 4 inches above the 100-year flood plain elevation, or 8 inches above the 25-year flood plain elevation, or 4 inches above the surrounding grade, or 12 inches above the adjacent roadway crown elevation, whichever is highest. Where this is not practical, deviation from the above must be approved by the County on a case-by-case basis.

1.14.7 WATER SERVICE

All lift stations shall be equipped with a 1-inch water service. Each water service shall be equipped with a minimum 5/8-inch water meter, a 3/4-inch reduced-pressure principle backflow prevention assembly (Wilkins 975XL2 or Apollo RPLF4A), and a 3/4-inch brass hose bib. The water meter and backflow prevention assembly shall be located within two feet of the lift station easement (or property) line. All water meters shall be obtained from the Manatee County Water Meter Department.

Reclaimed water shall not be used.

1.14.8 SHOP DRAWINGS AND INSPECTIONS

When calling for inspection, the Contractor shall have the approved shop drawings available on-site for review by the inspectors. The Contractor shall also deliver to the Lift Station Section inspector, the pump manufacturer's technical manual with the model number, serial number, and certified pump curve, for each pump prior to acceptance by Manatee County for maintenance.

1.14.9 REQUIRED EASEMENTS

An easement for ingress and egress to the lift station and an easement for the lift station must be granted and recorded before the lift station can be accepted by Manatee County for operation and maintenance.

1.14.10 SITING

A. The siting of all lift station facilities shall be subject to review and approval by Manatee County. All lift stations shall be located on a separate parcel of land or within a utility easement in common open space. The station shall be properly sited with due consideration of the neighborhood, surrounding site features, landscaping, aesthetics, safety and security. The station and associated landscaping shall not be sited on a right-of-way, private road, median, front yard of a residence, or within a visibility triangle. The lift station wet well, valve assembly, control panel, and telemetry antenna shall not be sited within 20 feet of overhead power lines.

B. Each lift station site shall have a vehicular access drive paved with a concrete surface course over a base course. The drive shall be designed to allow a service truck to park off of the right-of-way or roadway easement and to also allow the service truck to back up to the wet well such that the wet well is directly to the rear of the truck or adjacent to the side of the truck. The lift station control panel, telemetry

antenna and hose bib shall not be located between the vehicular access driveway and the wet well, valve assembly, and/or valve vault.

C. There shall be at least a 20-foot easement in all directions from the lift station site equipment. There shall be no obstructions within the easement such as buildings, walls, fences, etc., other than those that are part of the lift station and identified in these standards. A minimum setback of 5 ft shall be provided between lift station structures/equipment and the security fence. Lift station easement shall extend a minimum of 15 ft beyond all four sides of the security fence. If the lift station is adjacent to the street's right-of way, the lift station easement shall extend to the ROW line. The lift station site shall be made accessible with a minimum 30 ft wide corridor/easement.

D. Surface stormwater flow shall be directed around the lift station site. The site shall be graded to provide sheet flow of site runoff away from the equipment and direct it to a suitable swale or drainage outfall. The construction drawings shall include a lift station site plan with a grading and drainage plan, along with a landscaping plan.

1.14.11 LANDSCAPING AND IRRIGATION

A. **Landscape trees and shrubs.** The lift station site shall have shrubs planted around the perimeter of the lift station security fence in a hedge-like placement. Shrubs shall have a minimum spacing of 3 feet between the centers of the shrub's base stem. For private lift stations that are located in non-residential areas, shrubs are optional for the sides that are not adjacent to thoroughfare roads, non-thoroughfare roads, and residential areas. For lift stations that are located adjacent to thoroughfare roads and non-thoroughfare roads, a minimum of two small understory trees or palm trees shall be planted between the lift station security fence and the right of way line. For lift stations within residential areas or located adjacent to residential areas, a minimum of two additional understory trees or palm trees; for a total of at least four understory trees or palm trees shall be planted around the lift station (these landscaping requirements are not applicable to lift stations that only serve one single family residence.) A minimum setback of 5 feet shall be provided between the shrub's base stem and the security fence to provide an access way for service personnel. A minimum setback of 10 feet shall be provided between the trunk of understory trees/palm trees and the security fence.

Understory trees shall not have a mature height exceeding 30 feet. Small understory trees, palm trees and shrubs shall not have evasive roots. The minimum height of understory trees shall be six (6') feet at time of placement. The minimum height of palm trees shall be fifteen (15') feet at time of placement. The minimum height of shrubs shall be two (2') feet at time of placement. Shrubs shall have three gallon root balls. Shrub growth habits shall be upright, globose, or columnar. Shrub growth habits shall not be spreading or broad spreading. The understory trees and palm trees shall be planted to accent the shrub placement. Tops of root balls of plants shall be set at or slightly above existing grade. All plant material to be Florida Grade #1 or better, as defined in "Grades and Standards for Nursery Plants," State of Florida Dept. of Agriculture. Plants shall be sound, healthy, vigorous, and free from plant diseases, insects, pests, or their eggs and shall have healthy normal root systems. Plants shall be nursery grown stock, freshly dug. No heeled in, cold storage, or collected stock shall be accepted. Ground covers shall have sturdy fibrous root systems. Staking and bracing shall be done on all trees using Arbor tape and the Duckbill anchor system, in accordance with sound nursery practices.

The shrubs, understory trees and palm trees shall be of the drought tolerant, low maintenance varieties. Plant selection shall be based on soil water retention as well as soil pH.

Examples of acceptable vegetation are as follows:

	SOIL CONDITIONS WHERE PLANT WILL GROW		pH RANGE	
PLANT NAME	**Damp to poorly drained soils w/ low percolation**	**Well drained sands w/ high percolation**	**Plant tolerates acidic & alkaline soils**	**Plant tolerates acidic soils only**
UNDERSTORY TREES (Mature height not exceeding 30 feet)				
Little Gem Magnolia (Magnolia grandiflora)	X			X
Southern Wax Myrtle (Myrica cerifera)	X	X	X	
Peregrina (Jatropha intergerrima)		X	X	
Bottle Brush Tree (Callistemon citrinus)		X		X
Crape Myrtle Tree (Lagerstroemia Indica)		X		X
Feijoa (Feijoa sellowiana)		X	X	
PALMS				
Cabbage Palms (Sabal palmetto)	X	X	X	
Pindo Palms (Butia capitata)		X	X	
Dwarf Royal (aka Christmas) Palm (Veitchia merrillii)		X	X	
SHRUBS & BUSHES				
Cocoplum (Chrysobalanus icaco)		X	X	
Pipestem (Agarista Populafollia)	X	X	X	
Sweet Viburnum (Viburnum odoratisimum)		X	X	
Yew podocarpus (Podocarpus macrophyllus)		X	X	

The following plant species shall not be planted at the lift station site:

Melaleuca quinquenervia (commonly known as Punk tree, Malaleuca); Schinus terebinthefolius (commonly known as Brazilian Pepper); Casuarina species (commonly known as Australian Pine); Rhodomyrtus tomentosa (commonly known as Downy Rose Myrtle); Mimosa pigra (commonly known as the Catclaw Mimosa); Dalbergia sissoo (commonly known as the Indian Rosewood); and Cupaniopsis anacardioides (commonly known as the Carrotwood).

B. Ground cover. There shall be no vegetation within the lift station fencing. Site shall include a polypropylene weed barrier fabric that is covered with a minimum of 2-inches of washed shell, or rock within lift station fencing. Landscaping stones shall be inert and nonleaching. Crushed lime rock shall not be acceptable. Site shall include a polypropylene weed barrier fabric that is covered with 3 to 4-inches of shredded wood-type mulch that is located under the shrubs and up to the outside of the security fence. Polypropylene weed barrier fabric that is covered with 3 to 4-inches of shredded wood-type mulch shall be located under the trees for a minimum distance of 3 feet from the tree. Bahia, St. Augustine or Floritam sod or shredded wood-type mulch with a polypropylene weed barrier fabric shall be extended from the shrubs to the lift station easement line.

C. Irrigation. An irrigation system shall be connected to a non-potable water source. A weather-tight time clock with built-in transformer, minimum of four zones (Rainbird ESP-4M, Toro CC-M-9, or equal) and a rain sensor (Mini-Clik, or equal) shall be furnished and installed. The irrigation controller shall be in a lockable control panel and attached with 316 stainless steel two piece pipe clamps or 316 stainless steel U-bolts to two vertical 3 inch diameter 316 stainless steel, schedule 40 pipes. The pipe clamp or U-bolt ends shall be covered with plastic caps to prevent injury to personnel. The 3-inch vertical pipe shall have 316 stainless steel at the top and shall be anchored in concrete. The irrigation system control panel recommended location is outside of the fence and behind the shrubs. The Contractor shall furnish the County a padlock with a set of two keys for the irrigation control panel. The number of zones shall be based on the proposed site, planting configuration, watering distribution, irrigation system demand, and type of vegetation to be irrigated.

   The irrigation system shall be installed to irrigate the trees, shrubs and grassed areas; and designed to provide three-fourths (3/4") to one (1") inch of water per week and be in conformance with irrigation restrictions established by the Southwest Florida Water Management District (not restricted if using reclaimed water). The irrigation system shall adhere to the requirements of the Manatee County Land Development Code and to the "Standards and Specifications for Turf and Landscape Irrigation Systems", latest edition, as published by the Florida Irrigation Society, Inc. A permanent sprinkler system with distribution lines underground with mist and/or bubbler nozzles, as appropriate, above the ground are acceptable. A micro-irrigation system located within the planting beds of shrubs and trees is acceptable for that type of installation. In each accent, isolated or separate tree planting bed, a tree bubbler (Toro 514-20 or equal), shall be installed at each tree. In addition, a four (4') foot section of flexible PVC shall be provided for the tree bubbler at each tree. Drip line hoses shall have built-in emitters (Toro DL2000 or equal).

D. Radio signal interference. Landscape buffer plantings are to be field adjusted in coordination with the siting of the lift station's radio antenna to eliminate signal interference. The antenna for the existing or proposed radio telemetry unit at the lift station requires direct line-of-sight signaling capability to the Utilities Department office that will receive the signal. There shall be an unobstructed horizontal angle of fifteen (15°) degrees from the antenna mast (7 1/2 degrees on both sides of the direct line-of-sight azimuth). No tree shall be planted within the designated unobstructed angle for a twenty (20') foot horizontal distance measured from the mast.

1.14.12 ACCESSIBILITY AND SECURITY

The lift station shall be readily accessible by maintenance vehicles during all weather conditions. A fully functional paved travelway shall be provided to the lift station driveway. The facility shall be located off the traffic way of streets and alleys. All hatches, electrical panel and irrigation panel doors shall be provided with lockable hasps or staples. Security fences with lockable gates shall be provided for all lift stations that are owned and maintained by Manatee County. Lift stations shall have a 6-foot high vinyl

coated chain link security fence with privacy decorative slats (color matched). Chain link security fencing shall be #9 gauge core, galvanized with vinyl coating, with 1 5/8 inch top rails, 2 3/8 inch Schedule 40 line posts, 2 ½ inch Schedule 40 corner posts and 3 ½ inch Schedule 40 gate posts for swing gates. Gate posts and track line posts shall be 4-inch Schedule 40 for cantilever slide gates. Maximum line posts spacing shall be equally spaced, not to exceed 8 feet. For private lift stations, the Engineer of Record shall evaluate the location of the proposed lift station and determine whether a security fence is necessary.

1.14.13 FORCE MAIN FLOW METER

Lift stations that re-pump sewage flows (directly or indirectly) from other lift stations shall be equipped with a submersible electromagnetic flow meter. The flow meter shall be mounted on an above-ground force main. The meters, gauges and all connections and wiring shall be rated fully submersible. The flow meter shall transmit 4-20 mA signals to the telemetry system via the Analog Monitor Module mounted inside the control panel. The signal cables and ground wire shall be installed through two separate 1-inch PVC conduits (signal cables in one; ground in the other) from the meter to the control panel and both conduits shall be sealed with a liquid-tight cord connector at the meter. The meter display unit shall be weather-proof and mounted on top of the meter for above ground installations; for belowground meter installations, the meter display shall be mounted on an aluminum stand adjacent to the meter vault or as directed by the County.

1.14.14 AUXILIARY BACKUP PUMP SET

A. Equipment shall be new, factory and field tested, installed, and ready for operation. The pump set shall diesel powered and shall be provided by an approved manufacturer.

B. Pump is to be built with the following characteristics/conditions:

1. The pump should come on automatically when the wet well reaches a high-level condition.
2. Primary level control shall be a level transmitter.
3. Secondary level control shall be with backup floats (“high level” & “off”).
4. Programmable controller that allows both scheduled & manual exercising.
5. Pump and controls to have contacts for the telemetry system.
6. Pump should have the capability to pass a 3” spherical solid.
7. Pump has compressor assisted automatic priming.
8. Pump to have a sound attenuated enclosure.

C. The complete package, engine, pump, fuel tank, controller and other auxiliary components specified in this section shall be provided from a single supplier. The supplier shall be the manufacturer’s authorized distributor who shall maintain a service center capable of emergency maintenance and repairs with a maximum of four hours response time. The supplier shall have 24 hour/365 days per year service availability and factory trained service technicians authorized and capable to perform warranty service on all warrantable products.

D. The supplier shall have satisfactorily provided and installed similar size / design pumping systems for at least 2 other municipalities.

1.14.15 PUMP

A. Each pump shall be:

1. Used for raw wastewater.
2. Able to pass a 3" spherical solid.
3. Be compressor-assisted self priming
4. Initially start at primary rpm/capacity, with the ability to automatically ramp up to maximum capacity of double the primary capacity to keep up with flow, as required.

B. The complete intake and discharge piping, fittings, and layout shall be sized and designed by the pump supplier to ensure the most efficient design and operation as possible. Site constraints shall be taken into account and coordinated with County personnel, as necessary.

1.14.16 INSTRUMENTATION AND CONTROL

A. Each pump is to be capable of being started and shutdown through an automatic level control or manually. Level sensing shall be by two installation contractor installed systems: transducer as the primary indicator, and float balls as the secondary indicator.

B. The controller shall start the pump automatically when the wet well reaches a high level condition. The controller shall be able to automatically ramp up the pump speed incrementally to the maximum pump capacity of double the primary capacity, if the wet well level continues to rise.

C. The controller shall be programmable to exercise the pump automatically, and have the program adjusted by County personnel, if needed.

D. An emergency stop button will also be installed to shut the system down. This button should be a minimum of two inches in diameter, painted red, labeled "STOP" and installed in a conspicuous location on the pump set. It shall be reusable and resettable.

E. The control shall shut down and lock out upon: failing to start (overcrank), overspeed, low engine oil pressure, high engine coolant temperature, or operation of a remote manual stop station. A panel mounted switch shall reset the engine monitor and test all the lamps. Lamp indications on the control panel shall include as a minimum:

1. Overcrank Shutdown - Red
2. Overspeed Shutdown - Red
3. High Coolant Temperature - Red
4. Low Engine Oil Pressure - Red
5. High Engine Coolant Temperature Prealarm - Yellow
6. Low Engine Oil Pressure Prealarm - Yellow
7. Low Fuel - Yellow
8. Run - Green

F. Each pump set is to be set up by the manufacturer to indicate to a remote location through the County's telemetry system:

1. When pump set is in operation.

2. When pump fails (fails to start).
3. When the fuel tank is low on fuel.

G. The contractor shall install four wires from the pump control panel to the RTU control panel; wire type shall be 16 AWG, 16 strand flexing type MTW or TFFN 600 volt. The County's RTU system uses discrete- type signals with N/O type contacts. County shall make the actual connections to the RTU system.

H. The wire coloring scheme shall be:
1. Brown - pump run
2. Red - pump fail
3. Yellow - low fuel
4. Orange - common to alarms and connected to control panel power either 24 volt DC or AC.

I. All penetrations in any enclosure shall be properly sealed from the weather.

J. All wiring shall be installed in Schedule 80 PVC conduit sized according to the National Electrical Code for the number and size of conductors contained within. All trenches for underground installation of conduit shall be hand dug. Any electrical wiring that is installed between the lift station's structures shall be installed in a carrier pipe that is strapped to a structure.

K. Install the electrical components per Manatee County Standards (see typical wiring layouts in the latest Manatee County Public Works Utility Standards).

1.14.17 ENCLOSURE

A. The pump set and all the equipment supplied in this contract, shall be operated in a stationary outdoor environment. At each site, it shall:

1. Require weather protected enclosures. These enclosures shall protect the unit and all equipment and devices from the elements of the weather to include rain and winds.
2. The enclosure shall meet all federal, state, and local regulations.
3. All enclosures, boxes, trays, etc. shall have weep holes for condensation or water intrusion drainage. Any oil containment / catchment areas shall have provision to completely drain off water. The enclosure shall provide adequate ventilation for cooling and operation under full load conditions.
4. The enclosure shall be constructed of aluminum with a minimum thickness of 14 gauge. The enclosure shall have an electrostatically applied, baked on, powder coated enamel or polyester finish a minimum of 2.5 mil thick. The color of the powder coating shall be similar to "Buff" or Pantone Green 5545 C, as noted on the drawings, and must be approved by Manatee County prior to installation of the product.
5. The housing shall have hinged side access doors and a rear control door that are easy to remove. The side panels shall be easy to remove to allow access to all areas of the generator. All doors shall be provided with padlock hasps so that the County can install a standard padlock(s).
6. All exterior assembly hardware, bolts and/or screws, handles, hinges, and hasps shall be 316 stainless steel. All exterior bolts and/or screws shall be tamper-proof. All tamper-proof screws

shall utilize the 6 lobe pin TX or Torx® pin-head security fasteners. A neoprene washer shall be installed between all bolts/nuts/washers and the enclosure's exterior finish.

7. The housing shall be factory assembled to the pump set skid base. The skid base shall be firmly fastened to a concrete foundation pad which is to be provided and installed as part of this contract. The connections shall be adequate to avoid movement from both wind and vibration loading. The skid base / framing surface protection coating shall be per the fuel tank coating requirements. All metal surfaces coming in contact with concrete or grout shall be coated with coal tar epoxy equal to Koppers 300M or a 1/32-inch neoprene gasket between the metal surface(s) and the concrete or masonry may also be used. The neoprene gasket shall be installed along the entire perimeter, not just at the fastening hardware.
8. The engine and pump shall be removable from the base for maintenance purposes.
9. The skid is to have adequate strength and rigidity to maintain alignment of mounted components without depending on the concrete foundation. Lifting attachments shall be arranged to facilitate lifting with slings without damaging any components.
10. The base shall incorporate a battery tray with battery hold down clamps within the rails. Provisions for stub up of electrical conduits shall be within the footprint of the set. Vibration isolation shall be integral between the pump set and base.
11. The enclosure shall be a low noise or sound attenuated enclosure. The noise level at any load operating condition, in any direction from the enclosure, shall not exceed 75 dBA at a distance of five (5) meters from the enclosure unless noted otherwise on the plans.

1.14.18 ENGINE

A. The engine shall be a 4-cycle, direct injection diesel with forged steel crankshaft and connecting rods suitable for continuous operation. It shall be designed for stationary applications and shall be complete with all necessary auxiliaries needed for operation of the pump. The engine block shall be cast iron construction.

B. The engine shall have an electronic governor which shall provide isochronous frequency regulation.

C. The engine shall have an electric starter and battery(ies). See the Starting System section for further details.

D. The engine shall have a mechanical, positive displacement, engine driven, lubrication oil pump. Provide full flow lubrication oil filters with replacement spin-on canister elements. Provide a dipstick for oil level indication and an easily accessible fill location.

E. Supply a replaceable dry element air cleaner with restriction indicator.

F. Provide an engine mounted thermostatically controlled water jacket heater. The heater(s) wattage size shall be determined by the manufacturer. The heater voltage shall be single phase, 120V, 60HZ.

1.14.19 STARTING SYSTEM - ENGINE

A. The battery(ies) used for cranking the engine shall be the lead acid type, 12- or 24-volt, sized as recommended by the engine manufacturer. The battery(ies) shall have sufficient capacity to crank the engine for at least three cycles of 15 seconds on - 15 seconds off, for a total of 75 seconds. They shall be provided as new with the entire manufacturer's warranty.

B. The battery(ies) shall be fastened securely in its(their) own tray within the footprint of the skid. The tray shall be acid resistant.

C. Include all interconnecting conductors and connection accessories.

D. A battery charger of appropriate rating which is voltage regulated, shall be provided for the engine. It shall be sized for the proper current, input AC voltage and output DC voltage. The charger shall be equipped with float, taper and equalize charge settings.

E. A meter on the charger shall provide a visual output reading of the charger.

F. On the engine, provide a factory mounted alternator with solid state voltage regulation and 35 Amp minimum continuous rating.

1.14.20 FUEL SUPPLY SYSTEM - DIESEL ENGINE

A. Provide a sub-base type, double walled fuel tank, made of heavy gauge construction that is designed for full weather exposure. There is to be visual tank to foundation clearance. The tank is to have the following features:

1. Tank shall be UL 142 listed.
2. The capacity of the fuel tank shall be sufficient to run the generator continuously for 24 hours, but not to exceed a maximum of 540 gallons.
3. Equipped with a mechanical fuel gage and low fuel level alarm that may be monitored from a remote location by a RTU which uses N/O type contacts.
4. Two inch NPT fuel opening with spill protection and a lockable lid that is easily accessible.
5. Emergency pressure relief vent opening on the inner and outer tanks.
6. Inner tank leak alarm kit and low fuel alarm that may be monitored in some remote location by an RTU.
7. Basin drain.
8. Overfill protection / containment.
9. Provide an integral fuel pump of sufficient capacity to sufficiently charge the fuel lines under any start or run condition.

B. The overall fuel system is to comply with all applicable NFPA regulations as well as those required by the Florida Department of Environmental Regulation. This includes NFPA compliant labels for the fuel shut-off location and application of Diesel HAZMAT symbol stickers.

C. Provide an anti-siphon valve in the fuel line at the output of the tank.

D. A fuel filter shall be installed between the fuel tank and fuel inlet to the engine. It shall have a fuel water separator. The filter element shall be disposable and be easily removed and installed for maintenance purposes.

E. Provide supply and return fuel lines of sufficient diameter for all load requirements, flexibility for maximum resistance to fatigue due to component operation and made of material which has maximum resistance to corrosion due to environment and fuel supply.

F. The skid base for the fuel tank shall be firmly fastened to a concrete foundation which is to be provided and installed as part of this contract. The fuel tank & skid assembly shall be removable from the base.

Lifting points shall be provided for the tank skid. All metal surfaces coming in contact with concrete or grout shall be coated with coal tar epoxy equal to Koppers 300M or provide a 1/32-inch neoprene gasket between the metal surface(s) and the concrete or masonry may also be used. The neoprene gasket shall be installed along the entire perimeter, not just at the fastening hardware.

G. The exterior coating of the fuel tank and skid base shall be Sherwin Williams SherGlass FF glass flake reinforced amine epoxy (formulated for immersion service) or equal. Color shall be haze grey, two coats of 12-15 mils on top of a stripe coat over all welds, crevices, edges and sharp angles, per manufacturer's recommendations.

H. The fuel tank shall be full and topped off by the contractor when it is accepted by the County.

1.14.21 COOLING SYSTEM- ENGINE

A. The engine shall be cooled by a unit mounted closed loop radiator system rated for full load operation in 50^{o} C ambient condition with the ambient temperature as measured at the air inlet to the radiator. Radiator shall be provided with a duct adapter flange. The cooling system shall use a 50/50 (Prestone, Xerex or equivalent coolant and water) mixture provided by the supplier.

B. Provide drain cocks or plugs in the engine block and radiator for easy changing and flushing of the coolant. Provide coolant drain extensions where necessary for easy access to the drainage device.

C. Protection from rotating parts (fan, fan belt) shall be provided.

D. Install a self contained thermostat module to automatically regulate coolant flow to maintain optimum constant coolant temperature as recommended by the engine manufacturer.

E. Provide a coolant heater which is thermostatically controlled in the jacket of the engine.

1.14.22 EXHAUST SYSTEM- ENGINE

A. The muffler for the engine shall be the critical grade made from aluminized steel of thickness and design as recommended by the manufacturer. The muffler shall be housed within the enclosure.

B. All exhaust piping shall be stainless steel. Vertical discharge exhaust shall be equipped with a rain cap, appropriate condensation drains in the piping, and the outlet, and shall be designed so no external rain or moisture may enter the engine from the outside even if the rain cap fails.

C. Rain Skirt - At the point where the exhaust pipe tubing penetrates the roof or side of the enclosure, a suitable "rain skirt" and collar shall be provided by the MANUFACTURER. It shall be designed to prevent the entrance of rain and allow for expansion and vibration of the exhaust piping without chafing or stress to the exhaust system. This detail must appear on the drawings submitted for approval. Care must be exercised so there is no recirculation of exhaust gases into the intake system.

D. The connection of the engine to the exhaust system shall be a flexible section of corrugated stainless steel pipe. The connection of the exhaust pipe to the muffler shall be a stainless steel expansion joint with liners. The connection of the muffler to the end of the system shall be stainless steel pipe.

E. The exhaust emissions shall fall within the guidelines of the EPA and other state and governmental agencies.

1.14.23 HOUSE KEEPING SLAB FOUNDATION

A. The reinforced concrete slab for the pump and fuel tank is to be suitable to fully support the complete load under all load conditions with a reasonable safety factor, min. 8" thick. The top of the slab shall be

a minimum of two inches above the surrounding grade and extend a minimum of six inches past the footprint of the generator set.

B. The Manatee County Building Department will require the contractor to submit a plan for the poured-in-place concrete slab being installed. The Building Department will accept a slab designed by the manufacturer for their respective pump set, provided the back-up information accompanies each plan. If the manufacturer does not provide a slab design, then the contractor shall submit a slab design that is signed and sealed by a Professional Engineer and meets the Florida Building Code.

1.14.24 FIELD QUALITY CONTROL

A. Upon completion of installation, a factory authorized service representative of the product supplied, is to inspect all field assembled and installed components and make any necessary corrections to insure proper equipment operation. Any cost associated with this procedure shall be borne by the contractor.

1.14.25 TRAINING AND DEMONSTRATION

A. A factory representative of the product is to provide the County's maintenance personnel with a thorough period of instruction and hands-on session regarding the operation, trouble shooting and maintenance of all components of the product. Typical training period: one hour for each site.

1.14.26 NOTICE OF DELIVERY, TESTING, TRAINING AND DEMONSTRATION

A. At least seven business days of notice is to be given by the contractor to the County for delivery, installation, testing, training and demonstration of the product.

1.14.27 RECORD DRAWING REQUIREMENTS

Prior to the County's acceptance of the emergency backup pump system(s), the Contractor shall submit the following for each site(s):

1. Field test results showing compliance with the specifications.
2. A single O&M manual shall be provided that covers all parts of the generator system and controls for all installations contained in this contract. It shall be tabbed for each different size or type of equipment. The cover page shall indicate the manufacturer, date and contract number as well as listing all pump station sites it applies to.
3. Signed and sealed final RECORD DRAWING prepared from the site plan by a Professional Surveyor registered in the State of Florida showing all existing and new above ground facilities / improvements, new underground conduit locations, and/or property corners. A CAD file of the project survey can be requested from the County, if available.

The following information shall be provided on the record drawing site plans:

Location X, Y, & Z	Back-up Pump concrete slab, all new underground conduit pipes and conduits, control panel, & control panel bottom elevation.
Location in Z (elevations)	top of fuel tank and bottom of engine.
Call outs	Back-up pump details information, conduit size, fuel tank size in gallons

END OF SECTION

SECTION 1.15 RECORD DRAWINGS – OFFICE/RETAIL/INDUSTRIAL SINGLE BUILDING & LOT

1.15.1 GENERAL REQUIREMENTS

This section applies to all record drawings for a single business on a single lot with a single building with the following designations: Warehouse (not Warehouse, Mini); Retail Sales, General; Retail Sales, Neighborhood Convenience; Office; Office, Medical and Dental; Industrial, Light; Office, Professional; Restaurant; Restaurant, Drive-Through.

1.15.2 GENERAL

When construction is complete, record drawings, indicating the locations and elevations of the improvements that have been built, shall be provided to Manatee County Public Works Department. The record drawings shall be a special revision of the approved construction drawings and shall reflect all of the below requirements in content.

1.15.3 REQUIREMENTS AS TO FORM

A. Every set of record drawings shall have a cover sheet with a vicinity map, which shows where the project is located, and the address of the property.

B. Each sheet of the record drawings shall have the title "RECORD DRAWING" printed on it in large, bold lettering, near the title block. Each sheet shall also have the words "COUNTY MAINTAINED - WATER", "- SEWER" and/or "- RECLAIMED", or "PRIVATELY MAINTAINED - WATER", "- SEWER", and/or "- RECLAIMED" in large, bold lettering near the title block, and shall clearly define the separation between Public and Private via a text box with a leader arrow.

   The Cover Sheet shall include a list of all contractors/subcontractors that performed work to complete the project and their specific role(s).

C. Record information notes shall be positioned individually on the drawings near the depictions of the item to which each note corresponds.

D. Record information notes shall be bold, italics, or boxed ([X]) to identify them as record information.

E. Record drawings shall have a revision note such as "Record Drawing" in the revision block and a date corresponding to the date the record drawing was issued.

F. Record information shall be presented in a clear and comprehensible form.

G. The drawing scales used in the record drawings shall be the same as were used in the construction drawings, and the sheet number of each record drawing sheet shall be the same as the sheet numbers that were used on the construction drawings from which the record drawings originate. If additional sheets need to be added shall be numbered with a letter following the preceding sheet number: a sheet added between sheet 4 and 5 would be labeled 4a.

H. All plan, profile, and detail sheets that were used to depict locations and elevations of utility structures in the construction drawings shall be included in the record drawing set.

I. Record drawings shall accurately depict all existing improvements within the immediate vicinity of the constructed utilities. Existing improvements shall include, but not be limited to:

   1. Sidewalks, walls, fences, road surfaces, buildings, and other utilities,

   2. Areas within utility easements and areas within rights of way,

3. Areas within 15 feet of potable water mains, reclaimed water mains, sanitary force mains, and gravity sewer mains,

4. Areas within 10 feet of potable water meters, reclaimed water meters, backflow prevention assemblies, and fire hydrants.

J. Rights of way, easements, and property corners shall be shown and shall be of sufficient detail as to determine if the constructed utilities are within the easements or rights of way. A reference to the recording document (O.R. Book or Plat Book and Page) shall be included with any depiction of a right-of-way or easement. O.R. Book or Plat Book and Page are not required to be shown on the record drawings of a project for proposed rights of way or proposed easements that will be identified on the proposed final plat for the said project.

K. Each roadway depicted on the drawings shall have the correct roadway name noted on it.

L. Horizontal locations required for valves, fittings, services, and other utility structures shall be to the center of each installation.

1. Horizontal locations of all features shall be reported to the nearest 0.1 feet.

M. Vertical elevations of required valves, fittings, services, and other utility structures shall be reported as follows:

1. Top of ground or pavement elevations required along pipelines shall be reported to the nearest 0.1 feet.

2. Top of pipe elevations shall be to the nearest 0.1 feet.

3. Elevations of manhole rims and manhole pipe inverts shall be reported to the nearest 0.01 feet.

N. Computer drawing files submitted shall be AutoCAD 2016 or later release date versions. All CAD files and referenced CAD files, fonts, plot styles, etc. used to create the signed and sealed record drawings shall be provided and are required to be included in the submitted digital files. Computer drawing files' format submitted shall be compatible with the County's current version of AutoCAD, shall be in a .DWG format only, and shall be Windows 10 compatible. (*Tip: Use the e-transmit function of the AutoCad program.)*

1.15.4 MONUMENTATION

A. Record information within the right-of-way shall be referenced by State Plane coordinates and swing-ties.

B. A minimum of one on-site benchmark shall be described including datum. All benchmarks shall be based upon NAVD88. All record drawings shall be in NAVD88.

C. All locations and elevations shall be field located by or under the direct supervision of a Florida Licensed Surveyor and Mapper.

1.15.5 CERTIFICATIONS

A. Record Drawings shall be certified by a Florida Licensed Surveyor and Mapper. The certification shall state that the Record Locations and Elevations depicted on the Record Drawing are true and correct and were collected in the field by the Surveyor and Mapper or by a representative under the direct supervision of the Surveyor and Mapper.

B. Record Drawings shall be certified by the Engineer-of-Record. The certification must state that the improvements have been constructed in substantial conformance with the approved plans.

C. All visible record features, including sewer inverts, must be measured and located by the Surveyor or by personnel under his or her direct supervision. The certifying Surveyor shall be fully responsible for the accuracy of the record locations and elevations shown on the record drawings. However, the Surveyor may include statements on the record drawings indicating the following:

1. With the exception of the beginning, ending and the surface locations of the Horizontal Directional Drilling (HDD) log readings, the Horizontal Directional Drilling (HDD) locations and elevations provided by the HDD Contractor have not been field verified.
2. State Plane coordinates and offset of pipe fittings are based on PVC pipe markers or 2" x 4" markers inserted by the Contractor on the top of pipe fittings.
3. State Plane coordinates and elevation of potable water mains, reclaimed water mains, and sanitary force mains are based on PVC pipe markers or 2" x 4" markers inserted by the Contractor on the top of pipe.

1.15.6 RECORD INFORMATION WITHIN THE RIGHT-OF-WAY OR UTILITY EASEMENTS

A. Water distribution utility systems, reclaimed water (or irrigation) utility systems, and sanitary sewer collection utility systems shall be located and the locations shall be depicted and noted on the record drawings by Northing and Easting (NAD83 Florida State Planes, West Zone, US Foot), and by Swing-ties, with Elevations relative to established benchmarks. For "single point" installations, swing ties rather than station and offset may be allowed.

1. Elements of the utility systems that shall be located and noted by State Plane Northing and Easting and Swing-ties:
    a. water services (center of meter or meter box),
    b. reclaimed water (or irrigation) services (center of meter or meter box),
    c. backflow prevention assembly (directly beneath the assembly),
    d. other miscellaneous utility structures with features at or above the surface of the ground.
2. Elements of the utility systems that shall be located and noted by State Plane Northing and Easting, Swing-ties, and Elevation:
    a. center of valve cover lids,
    b. top of nut elevation,
    c. center of sanitary sewer manhole covers (top of rim for elevations),
    d. center of lift stations along with quadrant points of round tops / corners of rectangular tops (top of slab for elevations),
    e. center of above-ground valve assembly slab, along with corners of slab (top of slab for elevation),
    f. bottom center elevation of the lowest control panel cabinet,
    g. all fittings, including water and reclaimed water service saddles (other than sanitary sewer service wyes),
    h. center of sanitary sewer service clean-out cover (invert of 45° wye that is located directly below the clean-out cover for elevation),

i. center of fire hydrants, (center of 5-inch Storz connection nozzle for elevation).

3. At locations where a top-of-pipe elevation is required for pipeline, a top-of-ground or top-of-pavement elevation shall also be measured and noted on the drawings.

4. Elements of the utility systems that shall be located and noted by elevation only: sanitary sewer manhole inverts of individual sewer pipes where they enter and exit the manhole.

B. On record drawings, the actual positions of the pipelines or structures shall be measured, and they shall be depicted in their actual installed positions on the record drawings in all plan and profile views.

C. Record information shall include:

1. A thorough description of the pipes and all appurtenances that have been installed, including type of material or casing, size, class, diameter ratio, and other basic information, i.e., 45° Bend DI, or 6" PVC (DR18), etc.).

2. The recalculated slopes of gravity sewer mains, based on the record survey of manhole inverts and lengths of pipes. Rounding up shall not be allowed.

3. A bold notation shall be placed on each sheet, near the title block, indicating the status of the electrically detectable path marking tape and/or tracer wire installations. "Electrically detectable path marking tape and tracer wire were installed and successfully tested"; and/or "No electrically detectable path marking tape was required"; and/or "No tracer wire was required." The notation shall also include the date of the successful test"

D. For new valves, the manufacture type (as in gate, plug, etc.), size (pipe nominal diameter) and make (manufacturer) of each valve shall be noted on the record drawings.

E. Lift station control and equipment elevations that were shown on the original construction drawing lift station detail sheet shall be measured and the record survey elevations shall be shown on the record drawing revision of the detail sheet. Record pump information, including pump make, model, year of manufacture, serial number, impeller diameter, voltage, horsepower and speed, shall be shown on the record drawing revision of the lift station detail sheet.

F. Also included shall be the "Lift Station Start-up Information Sheet" provided by the pump manufacturer shall be included in the record drawings.

G. Horizontal Directional Drilling (HDD) and Jack-and-Bore locations and elevations shall be shown on the Record Drawing. The Surveyor shall locate the beginning, ending and the surface tracking locations of the driller's log readings, and these locations shall be indicated on the record drawings. The HDD Contractor shall provide a certified report and bore log indicating the horizontal and vertical location at least every 25 lineal feet along the pipe. The horizontal locations on the bore log shall also indicate the location per the stationing of the construction baseline. The information provided by the HDD Contractor shall be depicted on the Record Drawing and identified as having been provided by the HDD Contractor.

H. Abandoned infrastructure shall also be depicted as record information and noted as "abandoned".

I. See Section 1.14.27 for additional record drawing requirements for the auxiliary backup pump set, as applicable.

1.15.7 RECORD INFORMATION OUTSIDE OF RIGHT-OF-WAY OR UTILITY EASEMENTS

A. Water distribution utility systems, reclaimed water (or irrigation) utility systems, and sanitary sewer collection utility systems shall be located and the locations shall be depicted and noted on the record drawings with the following information:

1. utility pipes shall have all bends and fittings labeled with size and type.
2. utility pipes shall have labels showing length, size, and type
3. lift stations along with quadrant points of round tops / corners of rectangular tops (top of slab for elevations) shall be shown at approximate locations on plans,
4. approximate depths shall be shown for all pipes and cleanouts, valves, and lift station,
5. approximate location of fire hydrants, (center of 5-inch Storz connection nozzle for elevation).

B. On record drawings, the actual positions of the pipelines or structures shall be measured, and they shall be depicted in their actual installed positions on the record drawings in all plan and profile views.

C. Record information shall include:

1. A thorough description of the pipes and all appurtenances that have been installed, including type of material or casing, size, class, diameter ratio, and other basic information, i.e., 45° Bend DI, or 6" PVC (DR18), etc.).
2. The recalculated slopes of gravity sewer mains, based on the record survey of manhole inverts and lengths of pipes. Rounding up shall not be allowed.

D. Lift station control and equipment elevations that were shown on the original construction drawing lift station detail sheet shall be measured and the record survey elevations shall be shown on the record drawing revision of the detail sheet. Record pump information, including pump make, model, year of manufacture, serial number, impeller diameter, voltage, horsepower and speed, shall be shown on the record drawing revision of the lift station detail sheet.

E. Also included shall be the "Lift Station Start-up Information Sheet" provided by the pump manufacturer shall be included in the record drawings.

F. Abandoned infrastructure shall also be depicted as record information and noted as "abandoned".

1.15.8 SUBMITTALS

A. Record drawing submittal materials shall be attached to a transmittal letter, which shall list the following information:

1. Submittal date.
2. Project Title.
3. Planning Department Final Site Plan number (if applicable).
4. Title and sheet number of each record drawing sheet submitted.

B. The following materials shall be submitted for review:

1. Transmittal letter,
2. Signed and sealed Record Drawing Checklist,
3. Two signed, dated and sealed sets of the record drawings,

4. Final plats and/or easements when applicable,
5. Final breakdown of construction quantities and final costs when applicable,
6. Performance bond, defect security bond, warranties and associated cost estimates when applicable,
7. A copy of the bacteriological test results,
8. A copy of all the infrastructure inspection reports (i.e. pressure tests, electrically detectable path marking tape tests, tracer wire tests, etc.);
9. A copy of all horizontal directional drill bore logs;
10. Up to three copies each of the water and wastewater Completion of Construction forms, fully signed, sealed and dated by the owner and engineer, of which one of each will be retained for the County's records.

C. Once the submitted documents have been accepted, notification will be given to the engineer to submit the official record drawing package, which shall consist of the following materials:

1. Transmittal letter,
2. One set original Mylar record drawings,
3. One paper copy of the record drawings, signed, dated and sealed by the Engineer of Record and the Surveyor,
4. One electronic copy of the record drawings in CAD (.dwg file) and PDF on a DVD or CD. The DVD or CD file shall have all images, x-refs, and/or data shortcut files linked to the record drawings. Preferably, the record drawing CAD file shall be zipped via the e-Transmit function of AutoCAD, if applicable.
5. One electronic copy of the complete record drawing points PNEZD comma delineated CSV file on the DVD or CD.
6. Additional information such as SUE locations and findings, if previously done and readily available.

END OF SECTION

SECTION 1.16 RECORD DRAWINGS – ALL OTHERS

1.16.1 GENERAL

When construction is complete, record drawings, indicating the locations and elevations of the improvements that have been built, shall be provided to Manatee County Public Works Department. The record drawings shall be a special revision of the approved construction drawings and shall reflect all of the below requirements in content.

1.16.2 REQUIREMENTS AS TO FORM

A. Every set of record drawings shall have a cover sheet with a vicinity map, which shows where the project is located, and a key map, which shows where each sheet in the record drawing set is located inside the project boundaries.

B. Each sheet of the record drawings shall have the title "RECORD DRAWING" printed on it in large, bold lettering, near the title block. Each sheet shall also have the words "COUNTY MAINTAINED - WATER", "- SEWER" or "- WATER AND SEWER", or "PRIVATELY MAINTAINED - WATER", "- SEWER", or "- WATER AND SEWER" in large, bold lettering, near the title block, depending on which entity will be responsible for maintaining the utilities. If the project includes a new reclaimed water system, each sheet shall also have the words "COUNTY MAINTAINED - RECLAIMED WATER", or "PRIVATELY MAINTAINED - RECLAIMED WATER", in large, bold lettering, near the title block, depending on which entity will be responsible for maintaining the utilities.

   The Cover Sheet shall include a list of all contractors/subcontractors that performed work to complete the project and their specific role(s).

C. Record information notes shall be positioned individually on the drawings near the depictions of the item to which each note corresponds. Record drawing information submitted in tabular form shall not be accepted.

D. Record information notes shall be bold, italics, or boxed ([X]) to identify them as record information.

E. Record drawings shall have a revision note such as "Record Drawing" in the revision block and a date corresponding to the date the record drawing was issued.

F. Record information shall be presented in a clear and comprehensible form.

G. The drawing scales used in the record drawings shall be the same as were used in the construction drawings, and the sheet number of each record drawing sheet shall be the same as the sheet numbers that were used on the construction drawings from which the record drawings originate. If additional sheets need to be added shall be numbered with a letter following the preceding sheet number: a sheet added between sheet 4 and 5 would be labeled 4a.

H. All plan, profile, and detail sheets that were used to depict locations and elevations of utility structures in the construction drawings shall be included in the record drawing set.

I. Record drawings shall accurately depict all existing improvements within the immediate vicinity of the constructed utilities. Existing improvements shall include, but not be limited to:

   1. Sidewalks, walls, fences, road surfaces, buildings, and other utilities,

   2. Areas within utility easements and areas within rights of way,

3. Areas within 15 feet of potable water mains, reclaimed water mains, sanitary force mains, and gravity sewer mains,

4. Areas within 10 feet of potable water meters, reclaimed water meters, backflow prevention assemblies, and fire hydrants.

J. Private irrigation mains that are located within ten (10') feet of the right-of-way shall also be located on the record drawings.

K. Rights of way, easements, and property corners shall be shown and shall be of sufficient detail as to determine if the constructed utilities are within the easements or rights of way. A reference to the recording document (O.R. Book or Plat Book and Page) shall be included with any depiction of a right-of-way or easement. O.R. Book or Plat Book and Page are not required to be shown on the record drawings of a project for proposed rights of way or proposed easements that will be identified on the proposed final plat for the said project.

L. Each roadway depicted on the drawings shall have the correct roadway name noted on it. Provisional roadway names, such as "Street A", shall not be allowed on the record drawings. Each new lot of a new subdivision shall have its street address number noted on the record drawings.

M. Horizontal locations required for valves, fittings, services, and other utility structures shall be to the center of each installation.

1. Horizontal locations of all features shall be reported to the nearest 0.1 feet.

N. Vertical elevations of required valves, fittings, services, and other utility structures shall be reported as follows:

1. Top of ground or pavement elevations required along pipelines shall be reported to the nearest 0.1 feet.

2. Top of pipe elevations shall be to the nearest 0.1 feet.

3. Elevations of manhole rims and manhole pipe inverts shall be reported to the nearest 0.01 feet.

O. Computer drawing files submitted shall be AutoCAD 2016 or later release date versions. All CAD files and referenced CAD files, fonts, plot styles, etc. used to create the signed and sealed record drawings shall be provided and are required to be included in the submitted digital files. Computer drawing files' format submitted shall be compatible with the County's current version of AutoCAD, shall be in a .DWG format only, and shall be Windows 10 compatible. (*Tip: Use the e-transmit function of the AutoCad program.)*

1.16.3 MONUMENTATION

A. Record information shall be referenced by station and offset to a monumented baseline.

B. The monumentation for the baseline shall be shown or described on the record drawing (i.e. iron rod & cap, nail & disk or other durable and identifiable monument).

C. For each baseline, there shall be at least two monuments described and referenced. State Plane Coordinates for the monuments shall be shown in NAD 83 (99 adjustment) in feet. Developments not within existing or proposed subdivisions and not within 1.5 miles from existing Manatee County Primary Control Points or platted State Plane Coordinates may be exempted from the requirement for monuments to be based on State Plane Coordinates.

D. The alignment of the baseline shall be along the centerline or edge of one of the following: an existing paved road, recorded right-of-way, recorded easement, face of an existing building, existing sidewalk or

other existing, identifiable reference line. Offsets from the baseline shall not exceed 150 feet. All elevations shown on record drawings shall be referenced to a minimum of two described benchmarks. A minimum of two on-site benchmarks shall be described including datum. All benchmarks shall be based upon NAVD88. All record drawings shall be in NAVD88.

E. All locations and elevations shall be field located by or under the direct supervision of a Florida Licensed Surveyor and Mapper.

1.16.4 CERTIFICATIONS

A. Record Drawings shall be certified by a Florida Licensed Surveyor and Mapper. The certification shall state that the Record Locations and Elevations depicted on the Record Drawing are true and correct and were collected in the field by the Surveyor and Mapper or by a representative under the direct supervision of the Surveyor and Mapper.

B. Record Drawings shall be certified by the Engineer-of-Record. The certification must state that the improvements have been constructed in substantial conformance with the approved plans.

C. All visible record features, including sewer inverts, must be measured and located by the Surveyor or by personnel under his or her direct supervision. The certifying Surveyor shall be fully responsible for the accuracy of the record locations and elevations shown on the record drawings. However, the Surveyor may include statements on the record drawings indicating the following:

1. With the exception of the beginning, ending and the surface locations of the Horizontal Directional Drilling (HDD) log readings, the Horizontal Directional Drilling (HDD) locations and elevations provided by the HDD Contractor have not been field verified.
2. Station and offset of pipe fittings are based on PVC pipe markers or 2” x 4” markers inserted by the Contractor on the top of pipe fittings.
3. Station, offset, and elevation of potable water mains, reclaimed water mains, and sanitary force mains are based on PVC pipe markers or 2” x 4” markers inserted by the Contractor on the top of pipe.

1.16.5 RECORD INFORMATION

A. Water distribution utility systems, reclaimed water (or irrigation) utility systems, and sanitary sewer collection utility systems shall be located and the locations shall be depicted and noted on the record drawings by Northing and Easting (NAD83 Florida State Planes, West Zone, US Foot), and by Station and Offset from an established baseline, with Elevations relative to established benchmarks. For “single point” installations, swing ties rather than station and offset may be allowed.

1. Elements of the utility systems that shall be located and noted by Northing and Easting and Station and Offset:
    a. water services (center of meter or meter box),
    b. reclaimed water (or irrigation) services (center of meter or meter box),
    c. backflow prevention assembly (directly beneath the assembly),
    d. other miscellaneous utility structures with features at or above the surface of the ground.
2. Elements of the utility systems that shall be located and noted by Northing and Easting, Station, Offset and Elevation:

a. center of valve cover lids,

b. top of nut elevation,

c. center of sanitary sewer manhole covers (top of rim for elevations),

d. center of lift stations along with quadrant points of round tops / corners of rectangular tops (top of slab for elevations),

e. center of above-ground valve assembly slab, along with corners of slab (top of slab for elevation),

f. bottom center elevation of the lowest control panel cabinet,

g. top of pipe on potable water mains, reclaimed water mains and sanitary force mains at intervals no greater than 200 feet apart for open cut, no greater than 25 feet apart for HDD, the beginning and ending of all jack-and-bores, and at locations where there is a substantial grade change,

h. all fittings, including water and reclaimed water service saddles (other than sanitary sewer service wyes),

i. center of sanitary sewer service clean-out cover (invert of 45° wye that is located directly below the clean-out cover for elevation),

j. center of fire hydrants, (center of 5-inch Storz connection nozzle for elevation).

3. At locations where a top-of-pipe elevation is required for pipeline, a top-of-ground or top-of-pavement elevation shall also be measured and noted on the drawings.

4. Elements of the utility systems that shall be located and noted by elevation only: sanitary sewer manhole inverts of individual sewer pipes where they enter and exit the manhole.

B. On record drawings, the actual positions of the pipelines or structures shall be measured, and they shall be depicted in their actual installed positions on the record drawings in all plan and profile views.

C. Record information shall include:

1. A thorough description of the pipes and all appurtenances that have been installed, including type of material or casing, size, class, diameter ratio, and other basic information, i.e., 45° Bend DI, or 6” PVC (DR18), etc.).

2. The recalculated slopes of gravity sewer mains, based on the record survey of manhole inverts and lengths of pipes. Rounding up shall not be allowed.

3. A bold notation shall be placed on each sheet, near the title block, indicating the status of the electrically detectable path marking tape and/or tracer wire installations. “Electrically detectable path marking tape and tracer wire were installed and successfully tested”; and/or “No electrically detectable path marking tape was required”; and/or “No tracer wire was required.” The notation shall also include the date of the successful test”

D. For new valves, the manufacture type (as in gate, plug, etc.), size (pipe nominal diameter) and make (manufacturer) of each valve shall be noted on the record drawings.

E. Lift station control and equipment elevations that were shown on the original construction drawing lift station detail sheet shall be measured and the record survey elevations shall be shown on the record drawing revision of the detail sheet. Record pump information, including pump make, model, year of

manufacture, serial number, impeller diameter, voltage, horsepower and speed, shall be shown on the record drawing revision of the lift station detail sheet.

F. Also included shall be the "Lift Station Start-up Information Sheet" provided by the pump manufacturer shall be included in the record drawings.

G. Horizontal Directional Drilling (HDD) and Jack-and-Bore locations and elevations shall be shown on the Record Drawing. The Surveyor shall locate the beginning, ending and the surface tracking locations of the driller's log readings, and these locations shall be indicated on the record drawings. The HDD Contractor shall provide a certified report and bore log indicating the horizontal and vertical location at least every 25 lineal feet along the pipe. The horizontal locations on the bore log shall also indicate the location per the stationing of the construction baseline. The information provided by the HDD Contractor shall be depicted on the Record Drawing and identified as having been provided by the HDD Contractor.

H. Abandoned infrastructure shall also be depicted as record information and noted as "abandoned".

I. See Section 1.14.27 for additional record drawing requirements for the auxiliary backup pump set, as applicable.

1.16.6 SUBMITTALS

A. Record drawing submittal materials shall be attached to a transmittal letter, which shall list the following information:

1. Submittal date.
2. Project Title.
3. Planning Department Final Site Plan number (if applicable).
4. Title and sheet number of each record drawing sheet submitted.

B. The following materials shall be submitted for review:

1. Transmittal letter,
2. Signed and sealed Record Drawing Checklist,
3. Two signed, dated and sealed sets of the record drawings,
4. Final plats and/or easements when applicable,
5. Final breakdown of construction quantities and final costs when applicable,
6. Performance bond, defect security bond, warranties and associated cost estimates when applicable,
7. A copy of the bacteriological test results,
8. A copy of all the infrastructure inspection reports (i.e. pressure tests, electrically detectable path marking tape tests, tracer wire tests, etc.);
9. A copy of all horizontal directional drill bore logs;
10. Up to three copies each of the water and wastewater Completion of Construction forms, fully signed, sealed and dated by the owner and engineer, of which one of each will be retained for the County's records.

C. Once the submitted documents have been accepted, notification will be given to the engineer to submit the official record drawing package, which shall consist of the following materials:

1. Transmittal letter,
2. One set original Mylar record drawings,
3. One paper copy of the record drawings, signed, dated and sealed by the Engineer of Record and the Surveyor,
4. One electronic copy of the record drawings in CAD (.dwg file) and PDF on a DVD or CD. The DVD or CD file shall have all images, x-refs, and/or data shortcut files linked to the record drawings. Preferably, the record drawing CAD file shall be zipped via the e-Transmit function of AutoCAD, if applicable.
5. One electronic copy of the complete record drawing points PNEZD comma delineated CSV file on the DVD or CD.
6. Additional information such as SUE locations and findings, if previously done and readily available.

END OF SECTION

SECTION 1.17 APPENDIX

MANATEE COUNTY UTILITY REQUIRED SEPARATIONS	WATER (POTABLE) (water mains shall cross above all conflicts)	SANITARY SEWER (GRAVITY)	FORCE MAIN (SANITARY)	RECLAIMED (pipelines regulated under Part III of Chpt 62-610, F.A.C.)	STORM
WATER (POTABLE) (water mains shall cross above all conflicts)	–	std. horizontal: 6-ft (preferably 10-ft) - std. vertical: 6-in above (preferably 12-in); or 12-in below	std. horizontal: 6-ft (preferably 10-ft) - std. vertical: 12-in	std. horizontal: 3-ft[++] - std. vertical: 12-in	std. horizontal: 3-ft & gaskets shall be NBR or FKM *5-ft min from roadside underdrains - std. vertical: 6-in above (preferably 12-in); or 12-in below gaskets shall be NBR or FKM
SANITARY SEWER (GRAVITY)	std. horizontal: 6-ft (preferably 10-ft) - std. vertical: 6-in above (preferably 12-in); or 12-in below	–	std. horizontal: 3-ft - std. vertical: 12-in	std. horizontal: 3-ft - std. vertical: 12-in (reclaimed preferably above)	std. horizontal: 6-ft (preferably 10-ft) *5-ft min from roadside underdrains - std. vertical: 12-in
FORCE MAIN (SANITARY)	std. horizontal: 6-ft (preferably 10-ft) - std. vertical: 12-in	std. horizontal: 3-ft - std. vertical: 12-in	–	std. horizontal: 3-ft - std. vertical: 12-in (reclaimed preferably above)	std. horizontal: 3-ft *5-ft min from roadside underdrains - std. vertical: 12-in
RECLAIMED (pipelines regulated under Part III of Chpt 62-610, F.A.C.)	std. horizontal: 3-ft[++] - std. vertical: 12-in	std. horizontal: 3-ft - std. vertical: 12-in (reclaimed preferably above)	std. horizontal: 3-ft - std. vertical: 12-in (reclaimed preferably above)	–	std. horizontal: 3-ft *5-ft min from roadside underdrains - std. vertical: 12-in (reclaimed preferred above)
STORM	std. horizontal: 3-ft & gaskets shall be NBR or FKM *5-ft min from roadside underdrains - std. vertical: 6-in above (preferably 12-in); or 12-in below gaskets shall be NBR or FKM	std. horizontal: 6-ft (preferably 10-ft) *5-ft min from roadside underdrains - std. vertical: 12-in	std. horizontal: 3-ft *5-ft min from roadside underdrains - std. vertical: 12-in	std. horizontal: 3-ft *5-ft min from roadside underdrains - std. vertical: 12-in (reclaimed preferred above)	–

1. All dimensions are from outside edge of pipe to outside edge of pipe

2. All new construction shall adhere to the standard horizontal and vertical required separations; non-standard separations may be considered when avoiding existing utilities.

3. All mains shall be a minimum of 3 feet from sewer and storm structures. A minimum of one (1) full standard length of pipe shall be centered on the structure. Conflict box may be considered for water main passing through storm structures only with prior written approval from the County & FDEP. Refer to 62-555 for exception, in regards to storm sewer manholes or inlet structures.

4. One (1) standard full length of pipe shall be centered above or below the other pipeline so the pipe joints will be as far as possible from the other pipeline. Alternatively, at such crossings, the pipes shall be arranged so that all water main joints are at least 3 ft from all joints in a vacuum-type sanitary sewers, storm sewers, stormwater force mains, or pipelines conveying reclaimed water regulated under Part III or Chapter 62-610, and at least 6 ft from all joints in gravity- or pressure-type sanitary sewers, wastewater force mains, or pipelines conveying reclaimed water not regulated under Part III of Ch 62-610 FAC.

[++]Horizontal distance of at least six feet, and preferably ten feet, between the outside of the water main and the outside of any existing or proposed pipeline conveying reclaimed water **not** regulated under Part III of Chapter 62-610, F.A.C.

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MANATEE COUNTY UTILITY REQUIRED SEPARATIONS	WATER (POTABLE) (water mains shall cross above all conflicts)	SANITARY SEWER (GRAVITY)	FORCE MAIN (SANITARY)	RECLAIMED (pipelines regulated under Part III of Chpt 62-610, F.A.C.)	STORM
WATER (POTABLE) (water mains shall cross above all conflicts)	-	min. horz. separation: <6- ft (3-ft min) - min. vert. separation: <12-in (6-in min)-water is DI	min. horz. separation: <6-ft (3-ft min) - min. vert. separation: 6-in (FM is below)	min. horz. separation: <3-ft - min. vert. separation: <12-in (6-in min); reclaimed is below	horz. separation: <3-ft min.; gaskets shall be NBR or FKM *5-ft min from roadside underdrains - min. vert. separation: <12-in (6-in min)-water is DI & gaskets shall be NBR or FKM
SANITARY SEWER (GRAVITY)	min. horz. separation: <6- ft (3-ft min) - min. vert. separation: <12-in (6-in min)-water is DI	-	min. vert.: 6-in (12-in preferred)	min. horz. separation: <3-ft - min. vert. separation: <12" (6" min) (reclaimed preferably above)	min. horz. separation: <6-ft (3-ft min*)-sewer in watertight casing pipe *5-ft min from roadside underdrains
FORCE MAIN (SANITARY)	min. horz. separation: <6-ft (3-ft min) - min. vert. separation: 6-in (FM is below)	min. vert.: 6-in (12-in preferred)	-	min. horz. separation: <3-ft - min. vert. separation: <12-in (6-in min); force is below	min. vert. separation: <12-in (force is above)
RECLAIMED (pipelines regulated under Part III of Chpt 62-610, F.A.C.)	min. horz. separation: <3-ft - min. vert. separation: <12-in (6-in min); reclaimed is below	min. horz. separation: <3-ft - min. vert. separation: <12" (6" min) (reclaimed preferably above)	min. horz. separation: <3-ft - min. vert. separation: <12-in (6-in min); force is below	-	min. horz. separation: <3-ft min *5-ft min from roadside underdrains - min. vert. separation: <12-in (6-in min)-reclaimed is DI (reclaimed preferred above)
STORM	horz. separation: <3-ft min.; gaskets shall be NBR or FKM *5-ft min from roadside underdrains - min. vert. separation: <12-in (6-in min)-water is DI & gaskets shall be NBR or FKM	min. horz. separation: <6-ft (3-ft min*)-sewer in watertight casing pipe *5-ft min from roadside underdrains	min. vert. separation: <12-in (force is above)	min. horz. separation: <3-ft min *5-ft min from roadside underdrains - min. vert. separation: <12-in (6-in min)-reclaimed is DI (reclaimed preferred above)	-

1 All dimensions are from outside edge of pipe to outside edge of pipe

2. All new construction shall adhere to the standard horizontal and vertical required separations; non-standard separations may be considered when avoiding existing utilities.

3. All mains shall be a minimum of 3 feet from sewer and storm structures. A minimum of one (1) full standard length of pipe shall be centered on the structure. Conflict box may be considered for water main passing through storm structures only with prior written approval from the County & FDEP. Refer to 62-555 for exception, in regards to storm sewer manholes or inlet structures.

4. One (1) standard full length of pipe shall be centered above or below the other pipeline so the pipe joints will be as far as possible from the other pipeline. Alternatively, at such crossings, the pipes shall be arranged so that all water main joints are at least 3 ft from all joints in a vacuum-type sanitary sewers, storm sewers, stormwater force mains, or pipelines conveying reclaimed water regulated under Part III or Chapter 62-610, and at least 6 ft from all joints in gravity- or pressure-type sanitary sewers, wastewater force mains, or pipelines conveying reclaimed water not regulated under Part III of Ch 62-610 FAC.

5. Where an underground water main is being laid less than the required minimum horizontal distance from another pipeline and where an underground water main is crossing another pipeline and joints in the water main are being located less than the required minimum distance from joints in the other pipeline:
a. Use of pressure-rated pipe conforming to the American Water Works Association standards incorporated into Rule 62-555.330, F.A.C., for the other pipeline if it is a gravity- or vacuum-type pipeline,
b. Use of welded, fused, or otherwise restrained joints for either the water main or the other pipeline, or
c. Use of watertight casing pipe or concrete encasement at least four inches thick for either the water main or the other pipeline.

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Table B-9. Velocities Required[a] to Scour Air Pockets from Pipelines. Values computed by Wheeler [4] using Equation B-1 developed by Wisner, Mohsen, and Kouwen [5].

Pipe diameter, mm	Velocities, m/s					Velocities, ft/s					Pipe diameter, in.
	Slope					Slope					
	0%	5%	25%	45°	90°	0%	5%	25%	45°	90°	
25	0.4	0.4	0.5	0.5	0.5	1.4	1.4	1.6	1.7	1.8	1
50	0.6	0.6	0.7	0.7	0.8	1.9	2.0	2.2	2.4	2.5	2
75	0.7	0.8	0.8	0.9	0.9	2.3	2.5	2.7	2.9	3.1	3
100	0.8	0.9	0.9	1.0	1.1	2.7	2.9	3.1	3.4	3.5	4
150	1.0	1.1	1.2	1.3	1.3	3.3	3.5	3.8	4.2	4.3	6
200	1.2	1.2	1.3	1.5	1.5	3.8	4.1	4.4	4.8	5.0	8
250	1.3	1.4	1.5	1.6	1.7	4.3	4.6	4.9	5.4	5.6	10
300	1.4	1.5	1.6	1.8	1.9	4.7	5.0	5.4	5.9	6.1	12
350	1.6	1.6	1.8	1.9	2.0	5.1	5.4	5.8	6.3	6.6	14
375	1.6	1.7	1.8	2.0	2.1	5.2	5.6	6.0	6.6	6.8	15
400	1.6	1.8	1.9	2.1	2.1	5.4	5.8	6.2	6.8	7.0	16
450	1.7	1.9	2.0	2.2	2.3	5.7	6.1	6.6	7.2	7.5	18
500	1.8	2.0	2.1	2.3	2.4	6.0	6.5	6.9	7.6	7.9	20
525	1.9	2.0	2.2	2.4	2.5	6.2	6.6	7.1	7.8	8.1	21
600	2.0	2.2	2.3	2.5	2.6	6.6	7.1	7.6	8.3	8.6	24
675	2.1	2.3	2.5	2.7	2.8	7.0	7.5	8.1	8.8	9.2	27
750	2.3	2.4	2.6	2.8	2.9	7.4	7.9	8.5	9.3	9.6	30
825	2.4	2.5	2.7	3.0	3.1	7.8	8.3	8.9	9.7	10.1	33
900	2.5	2.7	2.8	3.1	3.2	8.1	8.7	9.3	10.2	10.6	36
1050	2.7	2.9	3.1	3.4	3.5	8.8	9.4	10.1	11.0	11.4	42
1200	2.9	3.0	3.3	3.6	3.7	9.4	10.0	10.8	11.8	12.2	48
1500	3.2	3.4	3.7	4.0	4.1	10.5	11.2	12.0	13.1	13.6	60
1800	3.5	3.7	4.0	4.4	4.5	11.5	12.2	13.2	14.4	14.9	72

[a]See first page of Appendix B.

Practical considerations:

- Air problems do not occur where the pipe gradient is positive in the direction of flow [5].
- Avoid excessive headloss by using smaller diameter pipe (to obtain higher velocities) only where gradient is flat or slopes downward.
- For air scouring to be effective, the tabular velocities must occur frequently (e.g., daily or more often).
- Air release valves in small pipes may be of little or no value.
- Blowback from clearing air in large pipes may cause surges that cannot be estimated. See Wisner, Mohsen, and Kouwen [5].

Before designing piping systems for air scouring, it is advisable to read "Air binding in pipes" by Edmunds [6], the chapter on closed conduit flow in Falvey [14], and, for wastewater, "Hydraulics of corrosive gas pockets in force mains" by Walski *et al.* [13] .

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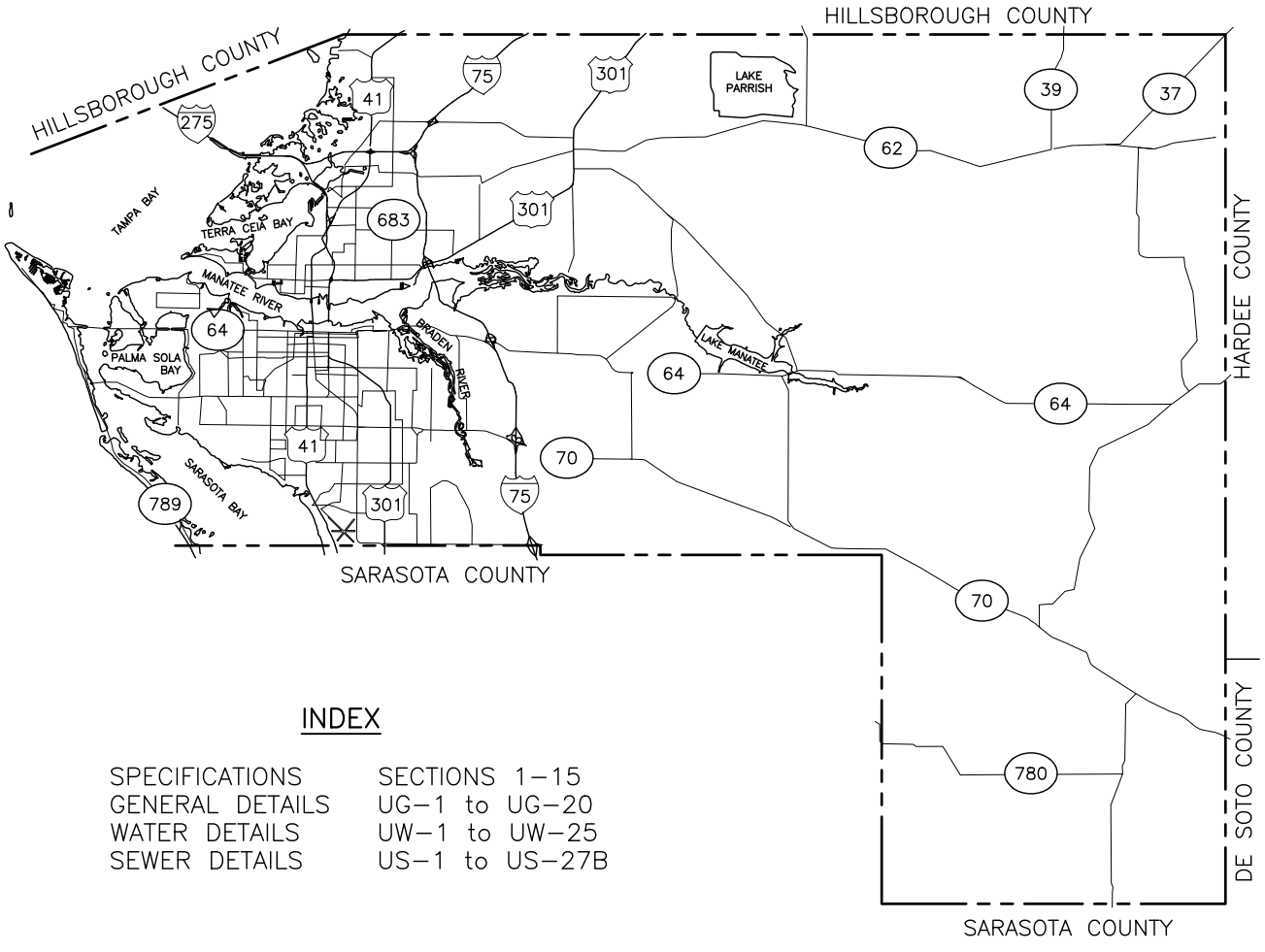
MANATEE COUNTY
PUBLIC WORKS
UTILITY STANDARDS

FEBRUARY 2020



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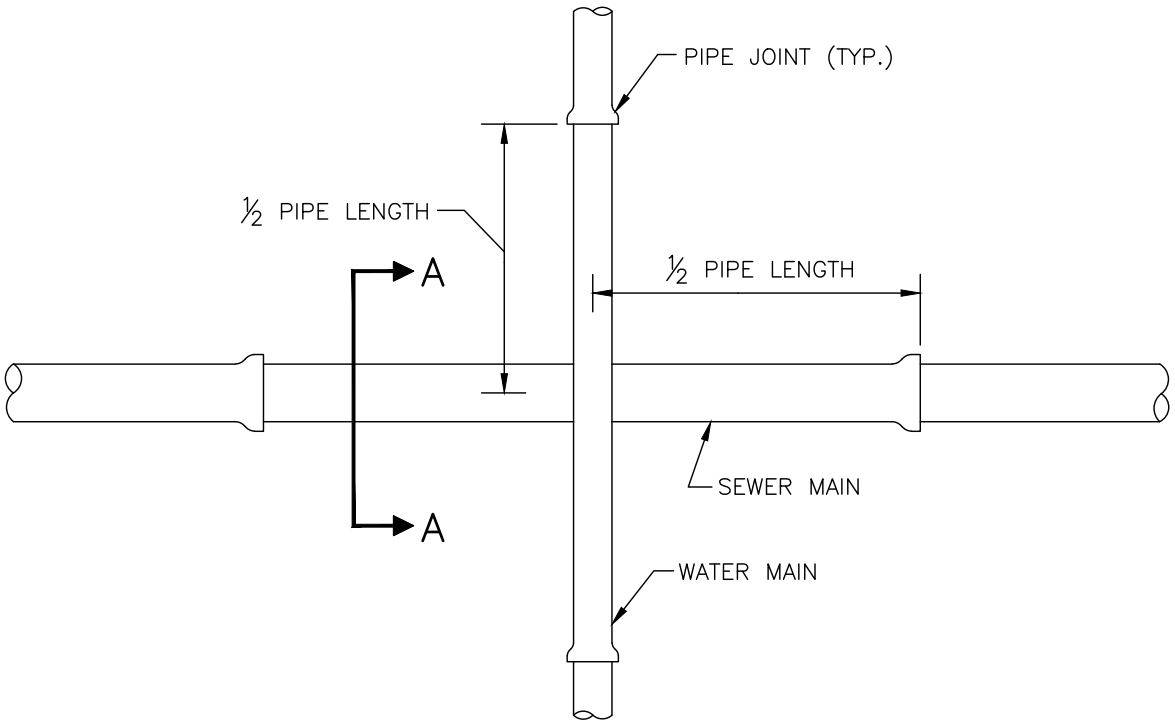
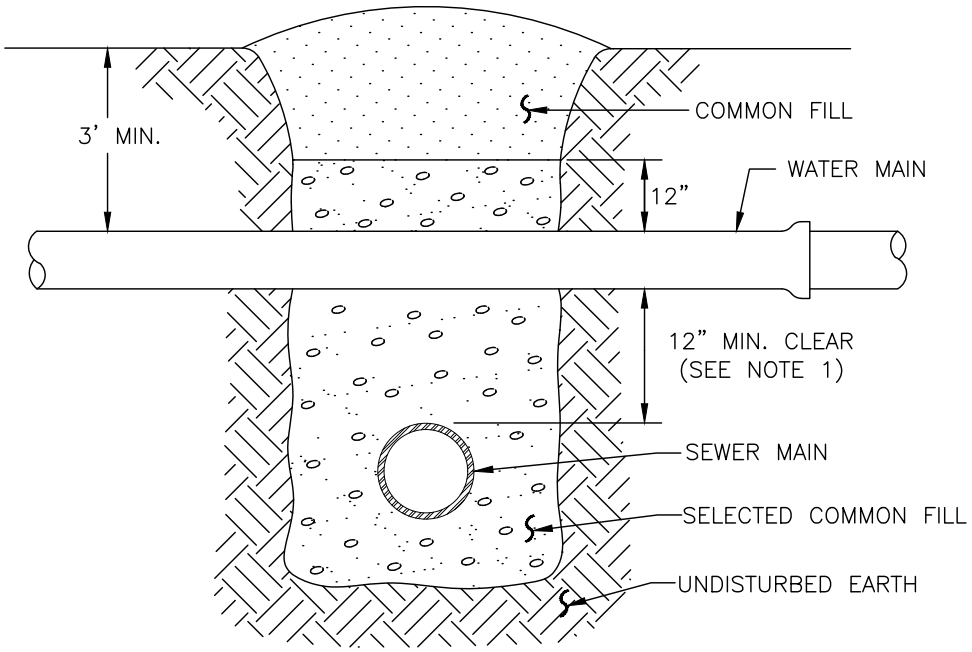


PLAN VIEW

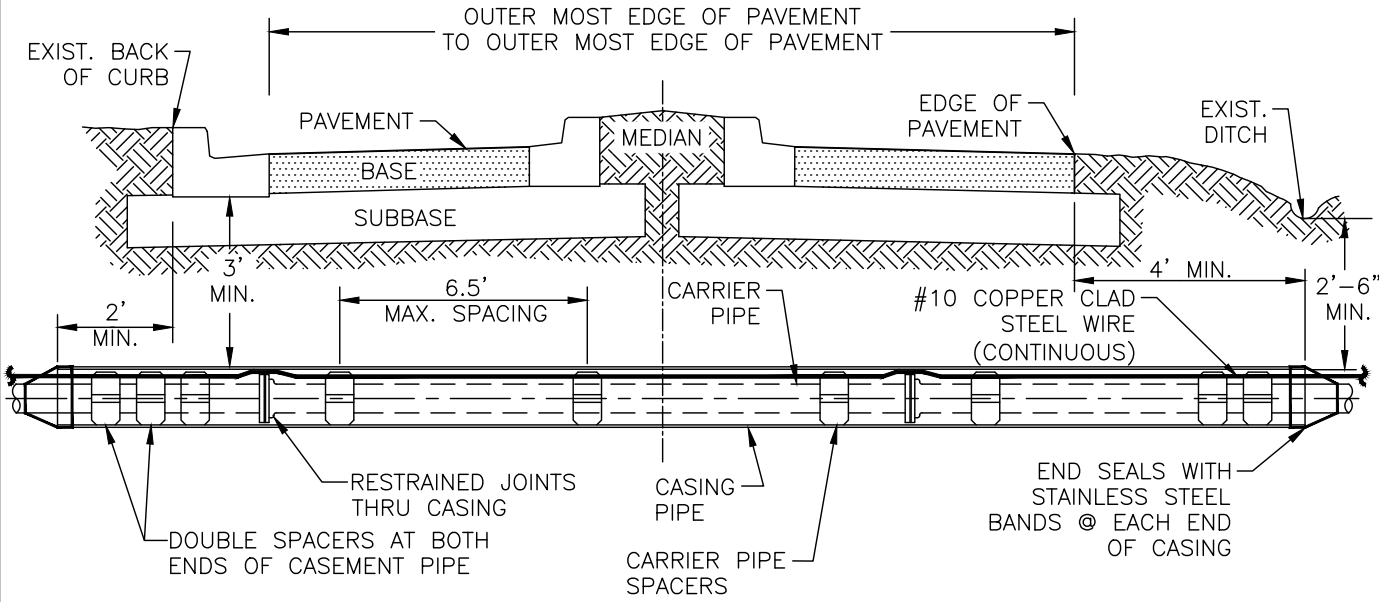


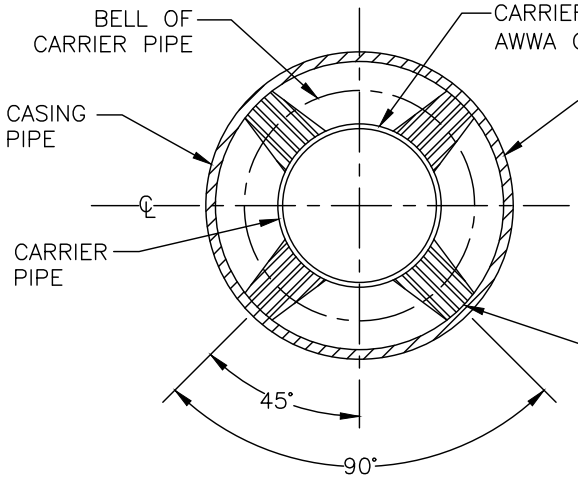
SECTION A–A

NOTES:

1. CLEARANCE MAY BE REDUCED TO 6" FOR GRAVITY SEWER WHERE WATER MAIN IS DUCTILE IRON.
2. PIPE SECTIONS SHALL BE FULL–LENGTH AND SHALL BE ADJUSTED HORIZONTALLY, SO THAT THE CROSSING IS AT EACH PIPE SECTION'S MIDPOINT REGARDLESS OF THE VERTICAL CLEARANCE.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT				
REV.BY	DATE		TYPICAL NEW WATER & SEWER LINE CROSSING	UG–2
		DATE OF APPROVAL		





CARRIER PIPE TO BE DUCTILE IRON CLASS 350 OR AWWA C-900 PVC CLASS 235 (DR-18) AS REQUIRED.

STEEL CASING PIPE JOINTS SHALL BE MADE BY USING A FULL CIRCUMFERENCE COMPLETE PENETRATION GROOVE WELD. STEEL MATERIAL SHALL MEET OR EXCEED ASTM A139 GRADE B. PIPE SHALL BE STRAIGHT SEAM PIPE OR SEAMLESS PIPE.

CARRIER PIPE SPACERS: 304 STAINLESS STEEL BAND CASING INSULATORS OR PLASTIC (HDPE) SPACERS

CARRIER SIZE & MINIMUM CASING SIZE									
CARRIER	4"	6"	8"	10"	12"		16"	18"	20"
CASING	12"	14"	18"	20"	24"		30"	36"	36"
CASING / WALL THICKNESS	0.188	0.188	0.250	0.250	0.344		0.406	0.406	0.406

STEEL CASING SIZES

CARRIER SIZE & MINIMUM CASING SIZE									
CARRIER	4"	6"	8"	10"	12"		16"	18"	20"
CASING	8"	12"	16"	20"	24"		30"	36"	36"

PVC/HDPE CASING SIZES

NOTES:

1. THE ENGINEER OF RECORD MAY SELECT A LARGER CASING DIAMETERS, INCREASE WALL THICKNESS, AND/OR INCREASE DEPTH OF BURY DUE TO EXTERNAL LOADS WITH COUNTY APPROVAL PRIOR TO PERFORMING THE WORK.
2. ALL PIPES CROSSINGS OF FEDERAL OR STATE ROADS; OR RAILROADS SHALL BE INSTALLED IN A CASING PIPE.
3. ALL PIPES CROSSINGS OF COUNTY LOCAL ARTERIAL AND THOROUGHFARE ROADWAYS SHALL BE IN A CASING PIPE.
4. SPLIT-STEEL CASINGS MAY BE USED ON EXISTING COUNTY MAINS ONLY.
5. FOR JACK & BORE SPECIFICATIONS UNDER STATE ROADS AND RAILROADS, REFER TO THE F.D.O.T. UTILITY ACCOMMODATION MANUAL, LATEST EDITION.
6. HDPE CASING SHALL HAVE ALL WELD BEADS REMOVED FROM THE INSIDE SURFACE SUCH THAT THE JOINT SURFACES SHALL BE SMOOTH.
7. *14-INCH DIAMETER MAINS ARE NOT TO BE INSTALLED.

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

CASING CROSSING

UG-3

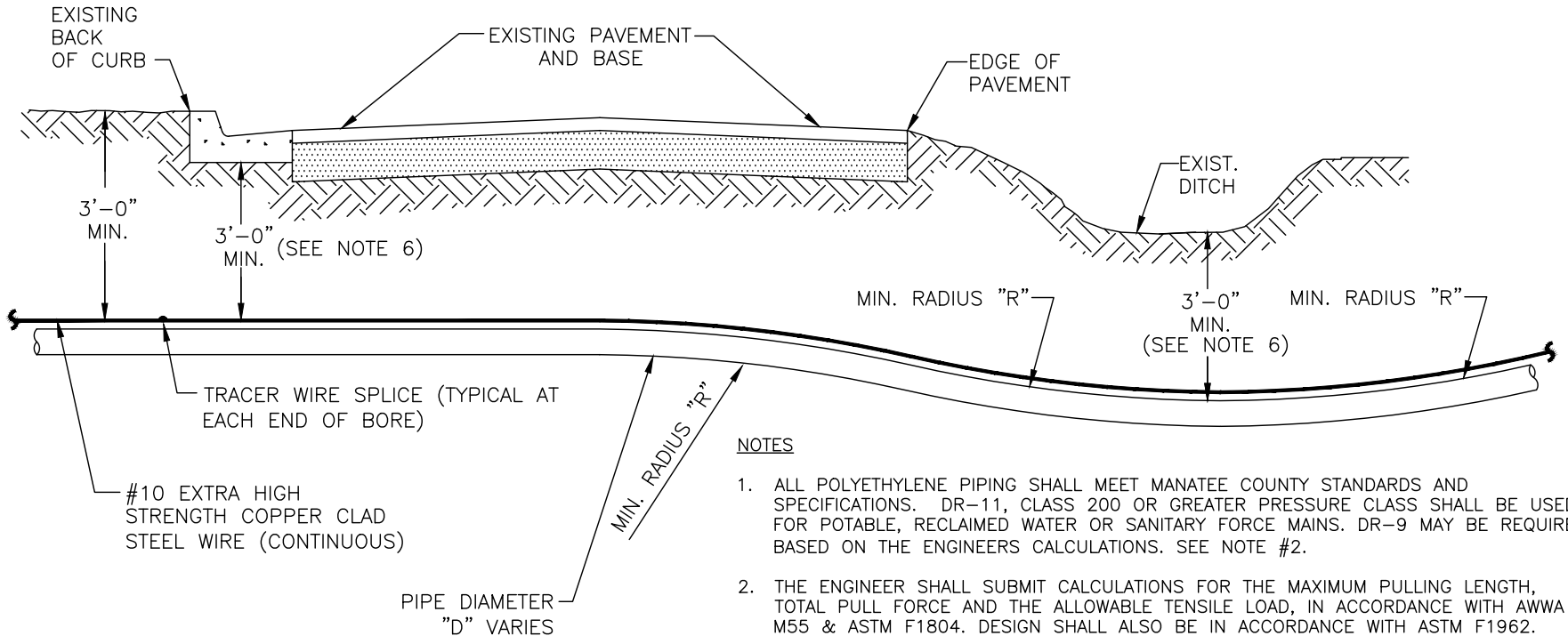
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

DIRECTIONAL BORE ROADWAY CROSSING

UG-4



	MIN. RADIUS FOR PE PIPE IN FEET	
PIPE DIAMETER "D" IN INCHES	MIN. RADIUS "R" FOR DR-11	MIN. RADIUS "R" FOR DR-9
2	4	5.5
3	6	8.3
4	8	11.0
6	12	16.5
8	16	22.0
10	20	27.5
12	24	33.0
16	32	44.0
18	36	49.5
20	40	55.0

NOTES

1. ALL POLYETHYLENE PIPING SHALL MEET MANATEE COUNTY STANDARDS AND SPECIFICATIONS. DR-11, CLASS 200 OR GREATER PRESSURE CLASS SHALL BE USED FOR POTABLE, RECLAIMED WATER OR SANITARY FORCE MAINS. DR-9 MAY BE REQUIRED BASED ON THE ENGINEERS CALCULATIONS. SEE NOTE #2.
2. THE ENGINEER SHALL SUBMIT CALCULATIONS FOR THE MAXIMUM PULLING LENGTH, TOTAL PULL FORCE AND THE ALLOWABLE TENSILE LOAD, IN ACCORDANCE WITH AWWA M55 & ASTM F1804. DESIGN SHALL ALSO BE IN ACCORDANCE WITH ASTM F1962.
3. A MANDREL BASED ON 80% OF THE INSIDE DIAMETER OF THE PULLED PIPE SHALL BE HAND-PULLED THROUGH THE FINAL INSTALLED PIPE WITH A COUNTY INSPECTOR PRESENT, TO CONFIRM NO ELONGATION(S) (NECKING) HAS OCCURRED.
4. ONE #10 GAUGE EXTRA HIGH STRENGTH COPPER CLAD STEEL TRACER WIRE SHALL BE SECURED TO THE PIPE FOR ALL TYPES OF PIPELINE INSTALLATIONS. TRACER WIRES SHALL HAVE A MINIMUM 45-MILS OF POLYETHYLENE INSULATION.
5. TRACER WIRE TO BE COLOR CODED: BLUE FOR POTABLE WATER MAINS; PURPLE FOR RECLAIMED WATER MAINS; AND GREEN FOR SANITARY FORCE MAINS.
6. PIPE DEPTHS MAY NEED TO BE DEEPER TO AVOID FRACKOUTS. PIPE ALIGNMENT SHALL BE AS SHOWN ON THE CONSTRUCTION DRAWINGS. THE ENGINEER SHALL BE NOTIFIED PRIOR TO ANY DEVIATIONS.
7. PIPES CROSSING FEDERAL OR STATE ROADS; OR RAILROADS SHALL BE INSTALLED IN A CASING PIPE.
8. FOR COUNTY LOCAL ARTERIAL OR THOROUGHFARE ROADWAYS; AND ON A CASE BY CASE BASIS, STEEL, PVC, OR HDPE CASING PIPE MAY BE ALLOWED. HDPE CASING PIPE SHALL BE INSTALLED FIRST, TESTED, AND THEN THE CARRIER PIPE MAY BE PULLED THRU THE CASING PIPE AS A SEPARATE OPERATION.
9. MANATEE COUNTY DIRECTIONAL DRILL CRITERIA SHALL BE MET FOR PIPES UNDER LOCAL ARTERIALS & THOROUGHFARES.
10. FDOT DIRECTIONAL DRILL CRITERIA SHALL BE MET FOR PIPES UNDER STATE, & FEDERAL ROADS.

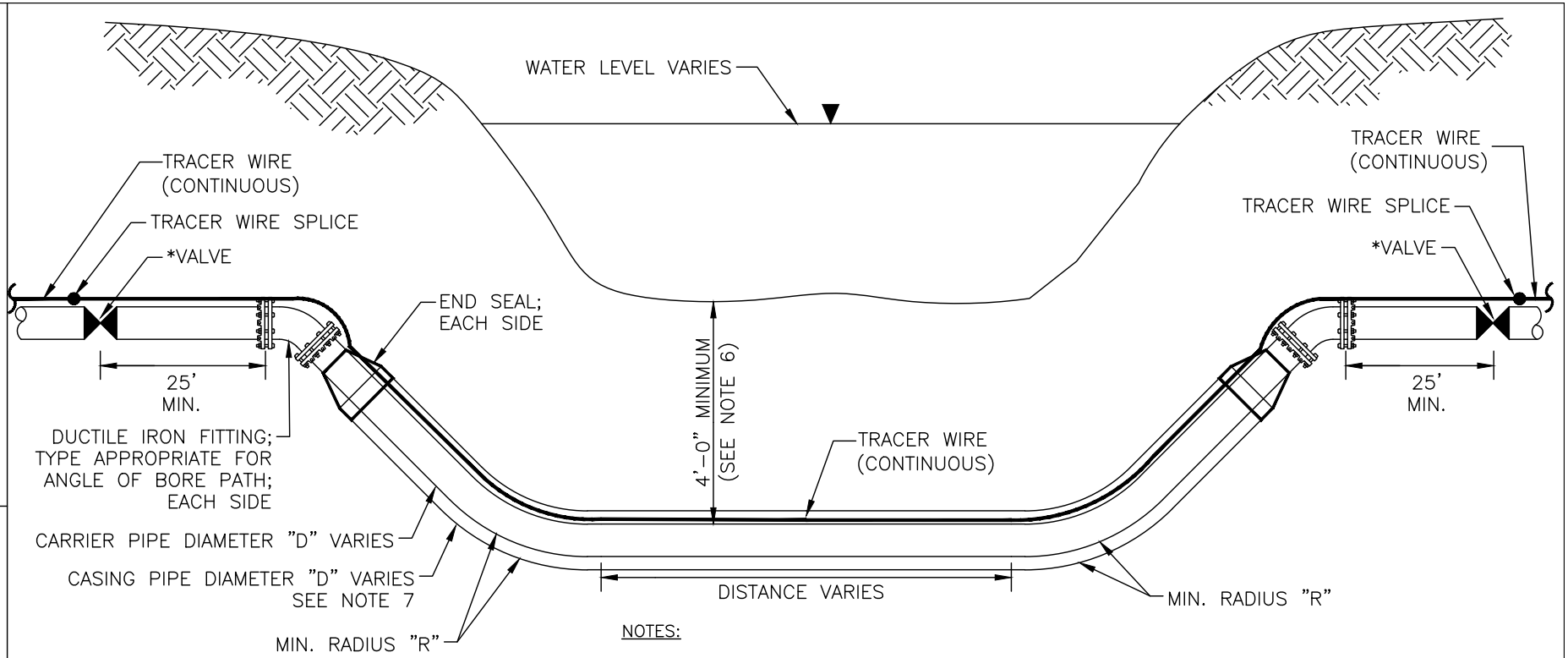
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

DIRECTIONAL BORE SUBAQUEOUS CROSSING

UG-5



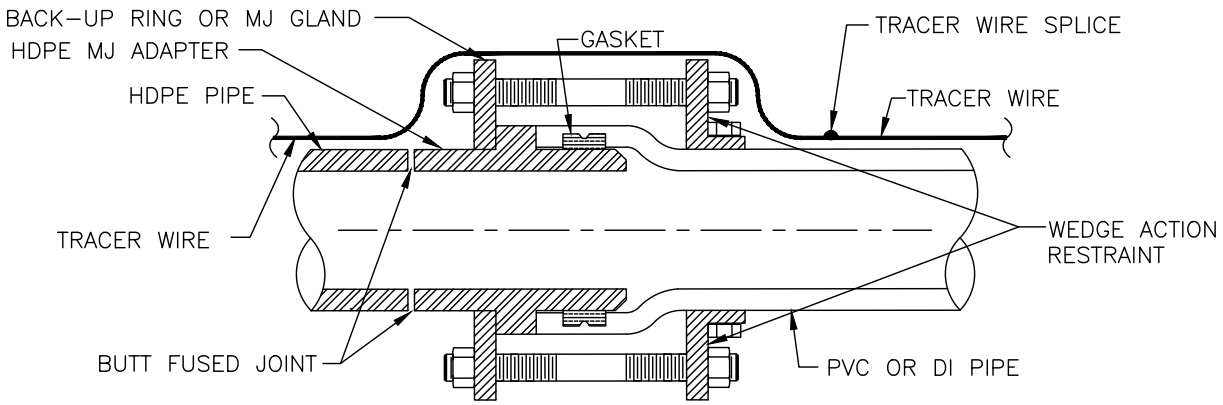
*NOTES:

1. FOR SANITARY FORCE MAIN USE PLUG VALVE.
2. FOR POTABLE AND RECLAIMED WATER USE GATE VALVE.

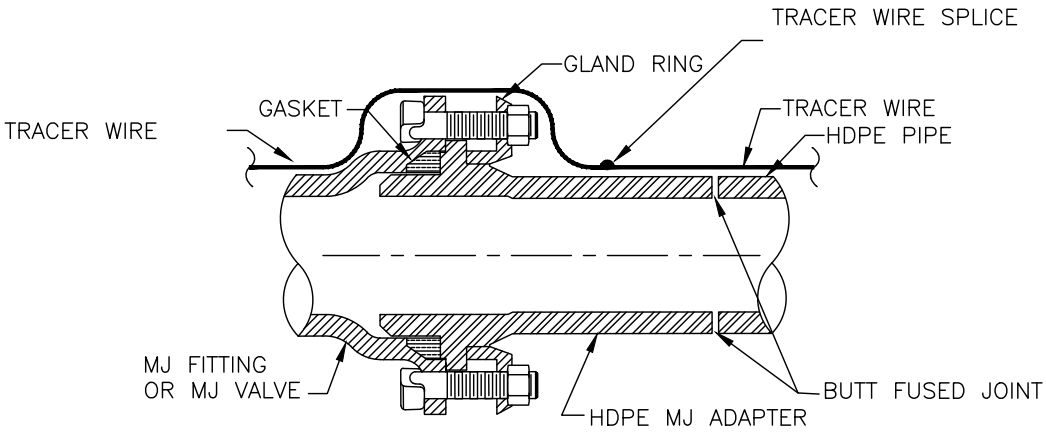
	MIN. RADIUS FOR PE PIPE IN FEET	
PIPE DIAMETER "D" IN INCHES	MIN. RADIUS "R" FOR DR-11	MIN. RADIUS "R" FOR DR-9
2	4	5.5
3	6	8.3
4	8	11.0
6	12	16.5
8	16	22.0
10	20	27.5
12	24	33.0
16	32	44.0
18	36	49.5
20	40	55.0

NOTES:

1. ALL POLYETHYLENE PIPING SHALL MEET MANATEE COUNTY STANDARDS AND SPECIFICATIONS. DR-11, CLASS 200 OR GREATER PRESSURE CLASS SHALL BE USED FOR POTABLE, RECLAIMED WATER OR SANITARY FORCE MAINS. DR-9 MAY BE REQUIRED BASED ON THE ENGINEERS CALCULATIONS. SEE NOTE #2.
2. THE ENGINEER SHALL SUBMIT CALCULATIONS FOR THE MAXIMUM PULLING LENGTH, TOTAL PULL FORCE AND THE ALLOWABLE TENSILE LOAD, IN ACCORDANCE WITH AWWA M55 & ASTM F1804. DESIGN SHALL ALSO BE IN ACCORDANCE WITH ASTM F1962.
3. A MANDREL BASED ON 80% OF THE INSIDE DIAMETER OF THE PULLED PIPE SHALL BE HAND-PULLED THROUGH THE FINAL INSTALLED PIPE WITH A COUNTY INSPECTOR PRESENT, TO CONFIRM NO ELONGATION(S) (NECKING) HAS OCCURRED.
4. ONE #10 GAUGE EXTRA HIGH STRENGTH COPPER CLAD STEEL TRACER WIRE SHALL BE SECURED TO THE PIPE FOR ALL TYPES OF PIPELINE INSTALLATIONS. TRACER WIRES SHALL HAVE A MINIMUM 45-MILS OF POLYETHYLENE INSULATION.
5. TRACER WIRE TO BE COLOR CODED: BLUE FOR POTABLE WATER MAINS; PURPLE FOR RECLAIMED WATER MAINS; AND GREEN FOR SANITARY FORCE MAINS.
6. PIPE DEPTHS MAY NEED TO BE DEEPER TO AVOID FRACKOUTS.
7. ALL SUBAQUEOUS; WETLAND; PRESERVE; OR CONSERVATION AREA PIPE CROSSINGS SHALL BE INSTALLED IN A CASING PIPE. PVC AND HDPE CASINGS MAY BE ALLOWED PROVIDED THE CASING PIPE IS INSTALLED FIRST AND THEN THE CARRIER PIPE IS PULLED THRU THE CASING PIPE AS A SEPARATE OPERATION. HDPE CASINGS SHALL HAVE THE INTERNAL BEAD REMOVED.
8. REFER TO 1.8.5, IF THE CASING IS INSTALLED USING HORIZONTAL DIRECTIONAL DRILLING METHOD.

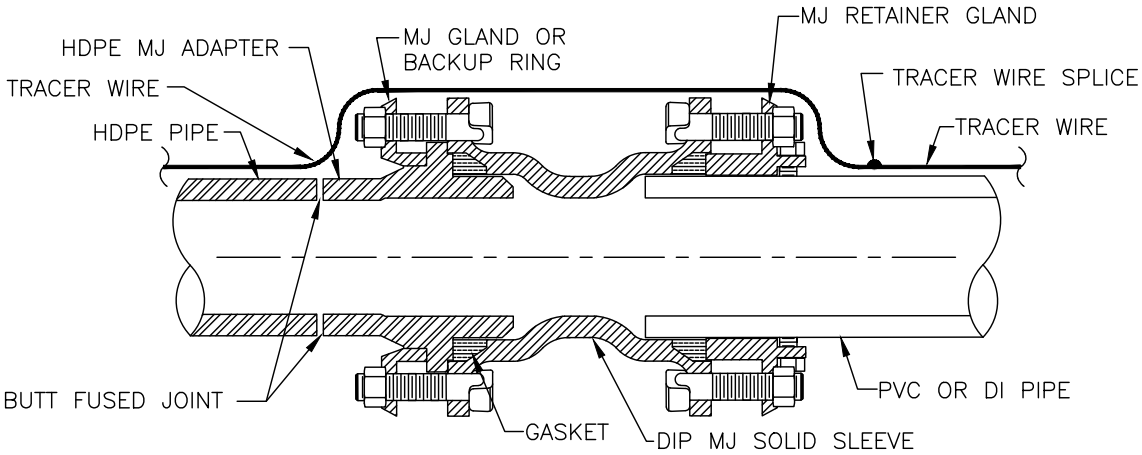


HDPE PIPE TO PVC PIPE / SPIGOT TO BELL CONNECTION



NOTE: SCHEMATIC SHOWN FOR STANDARD MJ FITTINGS AND GATE VALVES.

HDPE PIPE TO MJ FITTING TRANSITION

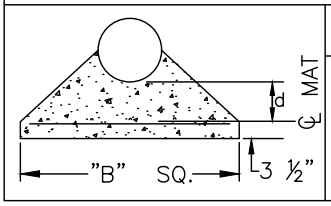


HDPE PIPE TO PVC PIPE SPIGOT TO SPIGOT CONNECTION

1. ONE TRACER WIRE SHALL BE SECURED TO THE PIPE FOR ALL TYPES OF PIPELINE INSTALLATIONS.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			HDPE TO PVC OR DI PIPE ADAPTER	UG–6
REV.BY	DATE			
		DATE OF APPROVAL		

THRUST BLOCK DIMENSIONS B ft. x d inches												
PIPE SIZE	90°BEND		45°BEND		22.5°BEND		11.25°BEND		DEAD END & TEE		45° WYE	
(IN.)	B	d	B	d	B	d	B	d	B	d	B	d
4	1.5	3 ½	1.1	3 ½	0.8	3 ½	0.6	3 ½	1.3	3 ½	1.1	3 ½
6	2.2	5 ¼	1.6	3 ¾	1.2	3 ½	0.8	3 ½	1.9	4 ½	1.6	3 ¾
8	2.9	7	2.1	5	1.5	3 ½	1.1	3 ½	2.4	5 ¾	2.0	4 ¾
10	3.5	8 ½	2.6	6 ¼	1.9	4 ½	1.3	3 ½	3.0	7 ¼	2.5	6
12	4.2	10	3.1	7 ½	2.2	5 ¼	1.6	3 ¾	3.5	8 ¼	3.0	7 ¼
14	4.9	11 ¾	3.6	8 ¾	2.6	6 ¼	1.8	4 ¼	4.1	9 ¾	3.4	8 ¼
16	5.5	13 ¼	4.1	9 ¾	2.9	7	2.1	5	4.7	11 ¼	3.9	9 ¼
18	6.2	15	4.6	11	3.3	8	2.3	5 ½	5.2	12 ½	4.4	10 ½
20	6.9	16 ½	5.0	12	3.6	8 ¾	2.6	6 ¼	5.8	14	4.9	11 ¾
24	8.2	19 ¾	6.0	14 ½	4.3	10 ¼	3.1	7 ½	6.9	16 ½	5.8	14
30	10.1	24 ¼	7.5	18	5.3	12 ¾	3.8	9	8.5	20 ½	7.2	17 ¼
36	12.1	29	8.9	21 ¼	6.4	15 ¼	4.5	10 ¾	10.2	24 ½	8.6	20 ¾



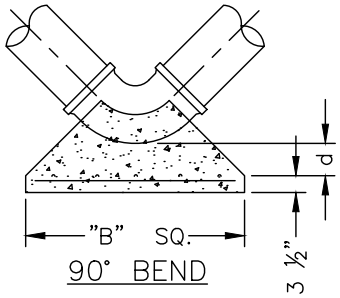
REINFORCEMENT MAT SCHEDULE

FOR DIM. "B" BETWEEN 5.75' & 12.5' USE #4 @ 8" EACH WAY

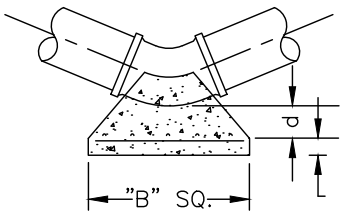
FOR DIM. "B" LESS THAN 5.75' USE #3 @ 8" EACH WAY

NOTES:

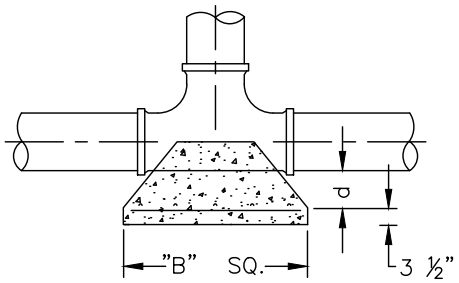
1. ALL THRUST BLOCKS SHALL BE CAST IN PLACE. FITTINGS ADJACENT TO THRUST BLOCKS SHALL BE WRAPPED IN POLYETHYLENE.
2. THIS TABLE IS BASED ON WATER PRESSURE=180 PSI WITH AN ALLOWABLE SOIL BEARING PRESSURE=2000 PSF, CONCRETE STRENGTH f_c =3000 PSI, REINFORCEMENT f_y =60.0 KSI. THRUST BLOCK SHALL BE CAST AGAINST FIRM UNDISTURBED SOIL.
3. FOR LARGER "B" DIMENSIONS IT IS NECESSARY TO CHECK THAT PIPE IS SUFFICIENTLY DEEP TO ALLOW 15" MIN. SOIL COVER OVER TOP EDGE OF THRUST BLOCK.
4. RESTRAINED JOINTS MAY BE USED IN LIEU OF THRUST BLOCKS TO SAVE SPACE. HOWEVER, WHERE THRUST BLOCKS AND RESTRAINED JOINTS ARE CALLED OUT/ILLUSTRATED IN THE DETAILS, BOTH SHALL BE INSTALLED.



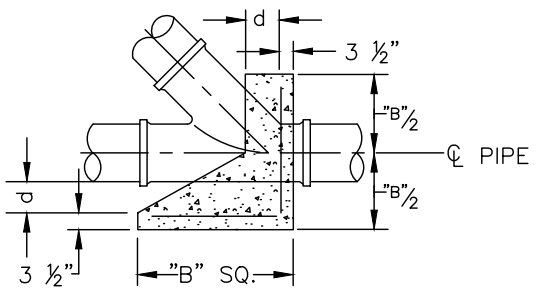
90° BEND



45°, 22.5° OR 11.25° BEND



TEE OR DEAD END



45° WYE

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			CONCRETE THRUST BLOCKS	UG–7
REV.BY	DATE			
		DATE OF APPROVAL		

REQUIRED LENGTH OF RESTRAINED JOINT PIPE FOR C900-16 PVC PIPE (DR-18)

MAIN PIPE SIZE	HORIZ. BENDS			TEES					REDUCERS			PLUGS & VALVES
	90°	45°	22.5°	SIZE / LENGTH					SIZE / LENGTH			
24	90	38	18	X24 / 169	X20 / 132	X16 / 90	X12 / 38	X10 / 6	X20 / 64	X16 / 117	X12 / 158	214
20	78	32	16	X20 / 141	X16 / 101	X12 / 53	X10 / 24	X8 / 1	X16 / 65	X12 / 115	X10 / 149	184
16	66	27	13	X16 / 111	X12 / 67	X10 / 41	X8 / 12		X12 / 64	X10 / 107	X8 / 111	151
12	52	22	10	X12 / 80	X10 / 56	X8 / 31	X6 / 1		X10 / 58	X8 / 62	X6 / 86	118
10	44	18	9	X10 / 63	X8 / 40	X6 / 7			X8 / 33	X6 / 61	X4 / 81	100
8	37	15	7	X8 / 49	X6 / 18	X4 / 1			X6 / 35	X4 / 60		83
6	29	12	6	X6 / 29	X4 / 1				X4 / 33			63
4	21	8	4	X4 / 12								45

NOTES:

1. RESTRAIN 11.25° BENDS 50% OF LENGTH FOR 22.5° BENDS.
2. ALL VALVES AND FITTINGS SHALL BE RESTRAINED TO THE CONNECTING SECTIONS OF PIPE.
3. ALL ISOLATION VALVES MUST BE PROPERLY ANCHORED OR RESTRAINED TO RESIST A 180 PSI TEST PRESSURE IN EITHER DIRECTION.
4. PIPE SIZES ARE GIVEN IN INCHES.
5. RESTRAINED PIPE LENGTHS ARE GIVEN IN FEET.
6. LENGTHS SHOWN ARE FOR A TEST PRESSURE OF 180 PSI.
7. THE RESTRAINED LENGTHS SHOWN IN THESE TABLES ARE BASED ON SOIL CLASSIFICATION SP WITH AWWA TYPE 3 TRENCH CONDITIONS, 180 PSI TEST PRESSURE, 3 FEET OF COVER AND 1.5 FACTOR OF SAFETY. ACTUAL BURY CONDITIONS MUST BE DETERMINED BY THE ENGINEER OF RECORD AND THE RESTRAINED LENGTHS MODIFIED ACCORDINGLY.
8. RESTRAINED LENGTHS TO BE APPLIED TO PIPELINES PER DETAIL UG–10 RESTRAINED LENGTHS FOR PIPE.
9. ALL RESTRAINED JOINT HARDWARE SHALL CONFORM TO 1.11.17 OF THE PUBLIC WORKS UTILITIES STANDARDS MANUAL.
10. ALL THREE "LEGS" OF TEES SHALL BE RESTRAINED PER THE STATED LENGTH IN THE TABLE.

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

RESTRAINED LENGTHS FOR PVC PIPE

UG–8

REQUIRED LENGTH OF RESTRAINED JOINT PIPE FOR DIP (POLY-WRAPPED)

MAIN PIPE SIZE	HORIZ. BENDS			TEES						REDUCERS				PLUGS & VALVES
	90°	45°	22.5°	SIZE / LENGTH						SIZE / LENGTH				
36	142	59	28	x36 / 393	x30 / 318	x24 / 232	x20 / 165	x16 / 84	x12 / 1	X30 / 137	X24 / 247	X20 / 309	X16 / 359	453
30	124	51	25	X30 / 333	X24 / 252	X20 / 189	X16 / 115	X12 / 23	x10 / 1	X24 / 137	X20 / 213	X16 / 276		391
24	106	44	21	X24 / 270	X20 / 211	X16 / 143	X12 / 61	X10 / 10	x8 / 1	X20 / 98	X16 / 178	X12 / 241		327
20	92	38	18	X20 / 225	X16 / 161	X12 / 85	X10 / 39	x8 / 1		X16 / 98	X12 / 176	X10 / 227		280
16	77	32	15	X16 / 177	X12 / 107	X10 / 65	X8 / 19	x6 / 1		X12 / 98	X10 / 163	X8 / 169		231
12	61	25	12	X12 / 127	X10 / 89	X8 / 50	x6 / 1			X10 / 88	X8 / 96	X6 / 131		181
10	52	22	10	X10 / 101	X8 / 64	x6 / 11				X8 / 51	X6 / 94	X4 / 125		153
8	44	18	9	X8 / 78	X6 / 30	x4 / 1				X6 / 54	X4 / 92			128
6	34	14	7	X6 / 46	x4 / 1					X4 / 50				98
4	24	10	5	x4 / 19										69

NOTE:

1. SEE UG–8, RESTRAINED LENGTHS FOR PVC PIPE DETAIL FOR NOTES 1 THROUGH 9 THAT ARE ALSO APPLICABLE TO RESTRAINED LENGTHS FOR DIP.

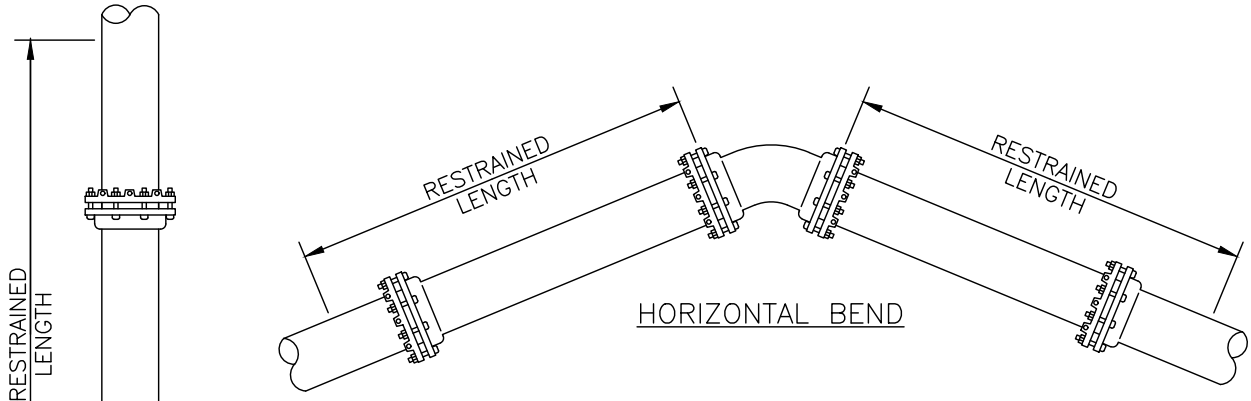
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

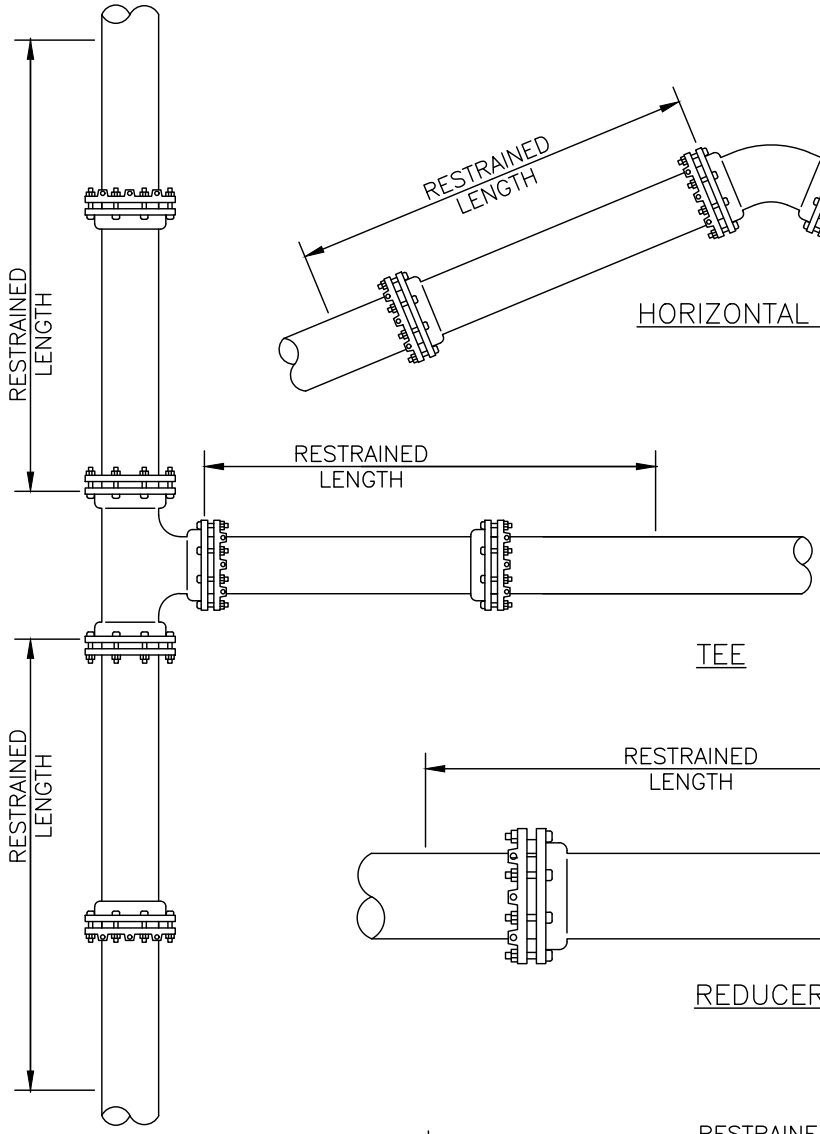
DATE OF APPROVAL

RESTRAINED LENGTHS FOR DIP

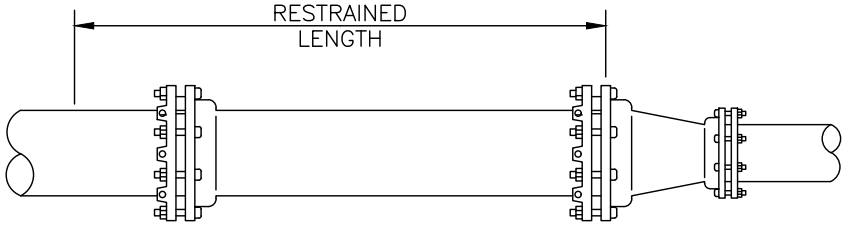
UG–9



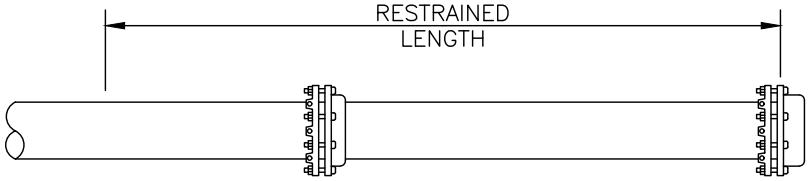
HORIZONTAL BEND



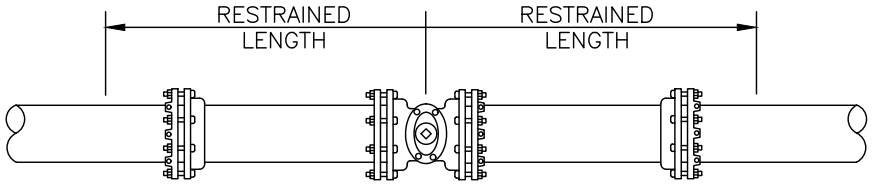
TEE



REDUCER



CAP OR PLUG



ISOLATION VALVE

NOTE:

1. SEE DETAIL UG–8 RESTRAINED LENGTHS FOR PVC PIPE FOR NOTES 1 THROUGH 9 THAT ARE ALSO APPLICABLE TO RESTRAINED LENGTHS FOR PIPE.

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

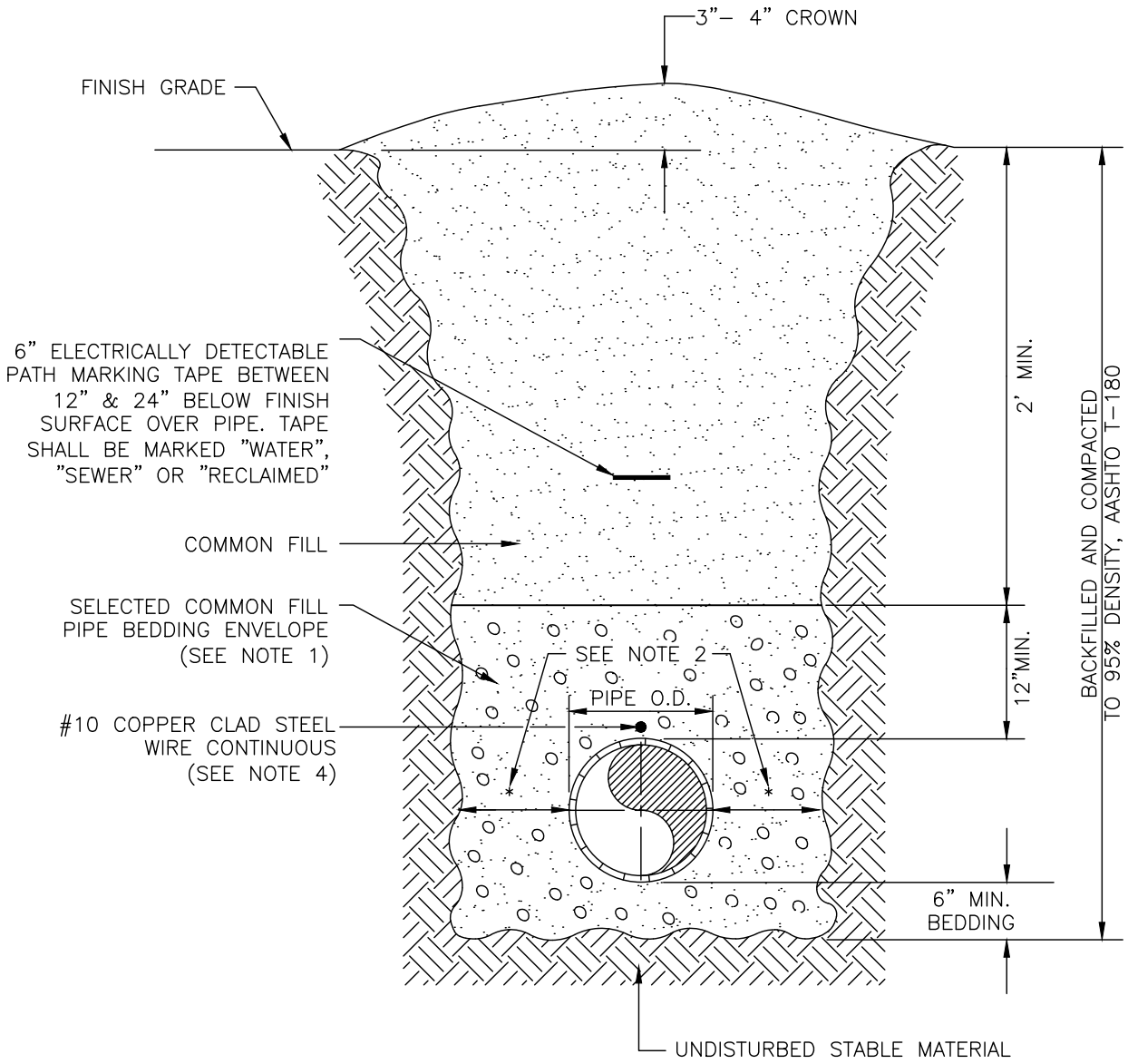
DATE OF APPROVAL

RESTRAINED LENGTHS FOR PIPE

UG–10

NOTES:

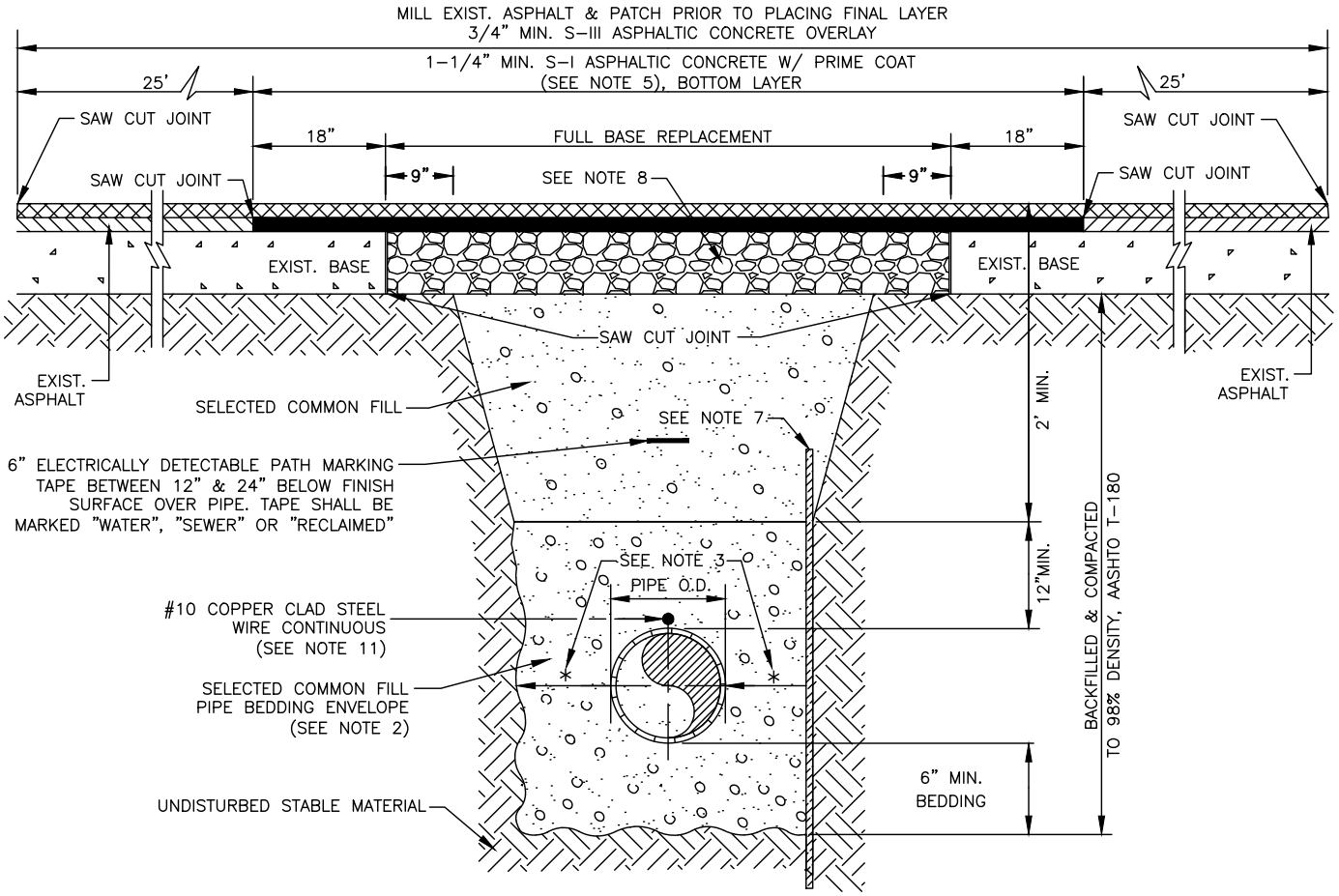
1. USE OF TYPE A–2 AND A–3 PIPE BEDDING TO BE DETERMINED IN THE FIELD BY THE ENGINEER.
2. PROVIDE ADEQUATE CLEARANCE TO PLACE AND COMPACT STAGE 1 BEDDING MATERIAL IN TRENCH AREA BELOW PIPE SPRINGLINE. PIPE EMBEDMENT MUST BE COMPACTED OUT TO THE TRENCH WALL OR 2.5 TIMES THE PIPE OD, WHICHEVER IS LESS.
3. PIPE INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.
4. TRACER WIRE NOT REQUIRED FOR GRAVITY SEWERS.



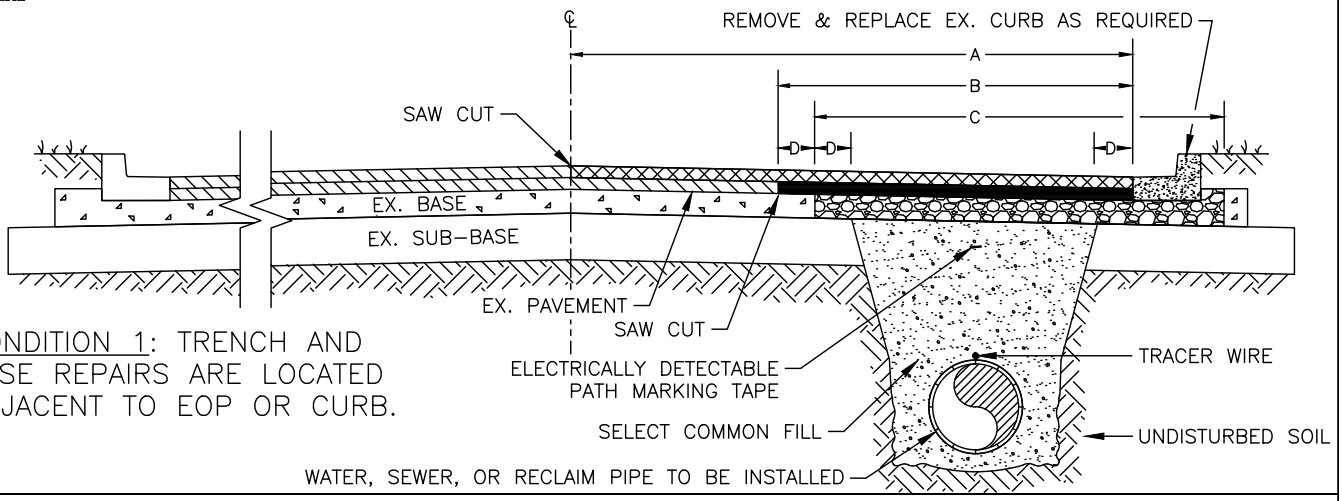
MANATEE COUNTY PUBLIC WORKS DEPARTMENT			TRENCH WITH UNIMPROVED SURFACE TYPE A–1 PIPE BEDDING	UG–11
REV.BY	DATE			
		DATE OF APPROVAL		

NOTES:

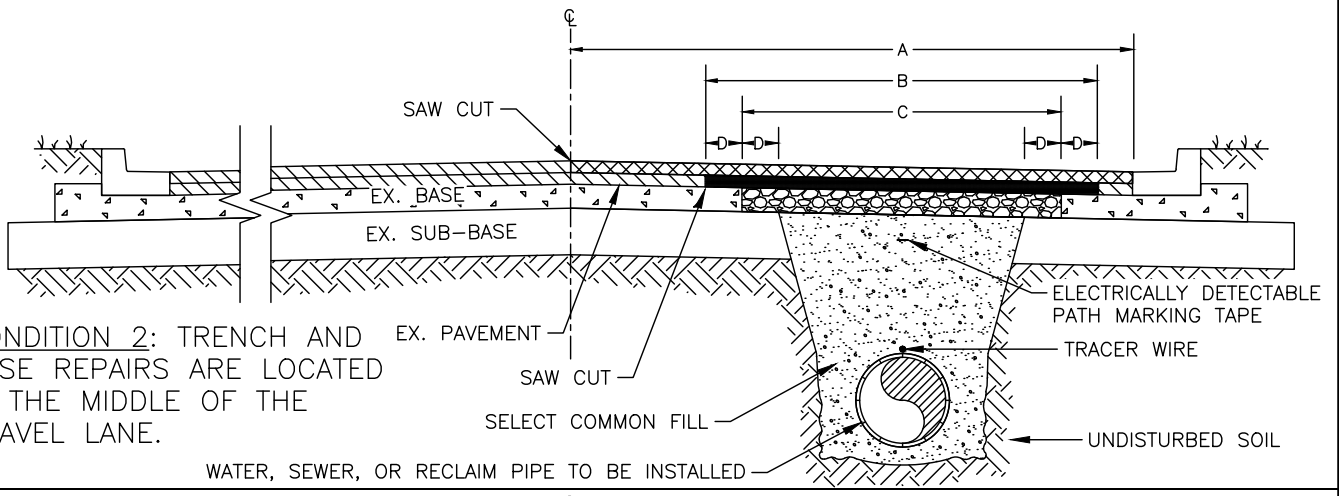
1. BITUMINOUS PAVEMENT SHALL BE REMOVED IN CLEAN STRAIGHT LINES BY SAW CUTTING. WHERE BITUMINOUS PAVEMENT ADJOINS A TRENCH, THE EDGES ADJACENT TO THE TRENCH SHALL BE TRIMMED TO A NEAT STRAIGHT LINES BEFORE RESURFACING TO ENSURE THAT ALL AREAS TO BE RESURFACED ARE ACCESSIBLE TO ROLLERS OR TAMPERS USED TO COMPACT THE SUB-GRADE OR PAVING MATERIALS.
2. USE OF TYPE A-2 AND A-3 PIPE BEDDING TO BE DETERMINED IN THE FIELD BY THE ENGINEER.
3. PROVIDE ADEQUATE CLEARANCE TO PLACE AND COMPACT STAGE 1 BEDDING MATERIAL IN TRENCH AREA BELOW PIPE SPRINGLINE. PIPE EMBEDMENT MUST BE COMPACTED OUT TO THE TRENCH WALL OR 2.5 TIMES THE PIPE OD, WHICHEVER IS LESS.
4. PIPE INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.
5. ASPHALTIC CONCRETE STRUCTURE COURSE WITH PRIME COAT SHALL BE THE SAME DEPTH AND TYPE AS EXISTING OR A MINIMUM OF 1-1/4 INCH S-I, WHICHEVER IS GREATER.
6. MILL 25' BACK FROM TRENCH CROSSING SAW CUTS. ADJUST MILLING PER INDIVIDUAL SITE TO NOT IMPACT BASE. BUTT JOINT TO EXIST ASPHALT. FINAL OVERLAY TO MATCH EXISTING WITH NO DISCERNABLE "BUMP" AT JOINT. MILLING LIMITS THAT IMPACT INTERSECTION SHALL BE ADDRESSED ON A CASE BY CASE BASIS AND APPROVED BY MANATEE COUNTY.
7. SHEETING ORDERED LEFT IN PLACE TO BE CUT OFF 24" BELOW FINISHED GRADE OR 12" BELOW SUBGRADE.
8. NEW BASE SHALL MATCH EXISTING; OR BE CRUSHED CONCRETE, 8" MIN. THICKNESS, LBR ≥150, WHICHEVER IS GREATER.
9. TEMPORARY PATCHES WILL BE INSTALLED TO PROVIDE A SMOOTH ALL WEATHER SURFACE AT ALL TIMES. PERMANENT REPLACEMENT TO BE MADE AS SOON AS POSSIBLE.
10. RESTORE SIGNAGE & MARKING WITH THERMOPLASTIC PER FDOT STANDARDS, LATEST EDITION.
11. TRACER WIRE NOT REQUIRED FOR GRAVITY SEWERS.
12. NOTES 5. THRU 10. ARE MINIMUM REQUIREMENTS FOR A TRENCH IN A LOCAL ROAD. REFER TO LATEST EDITION OF MANATEE COUNTY HIGHWAY AND TRAFFIC STANDARDS FOR ADDITIONAL REQUIREMENTS.



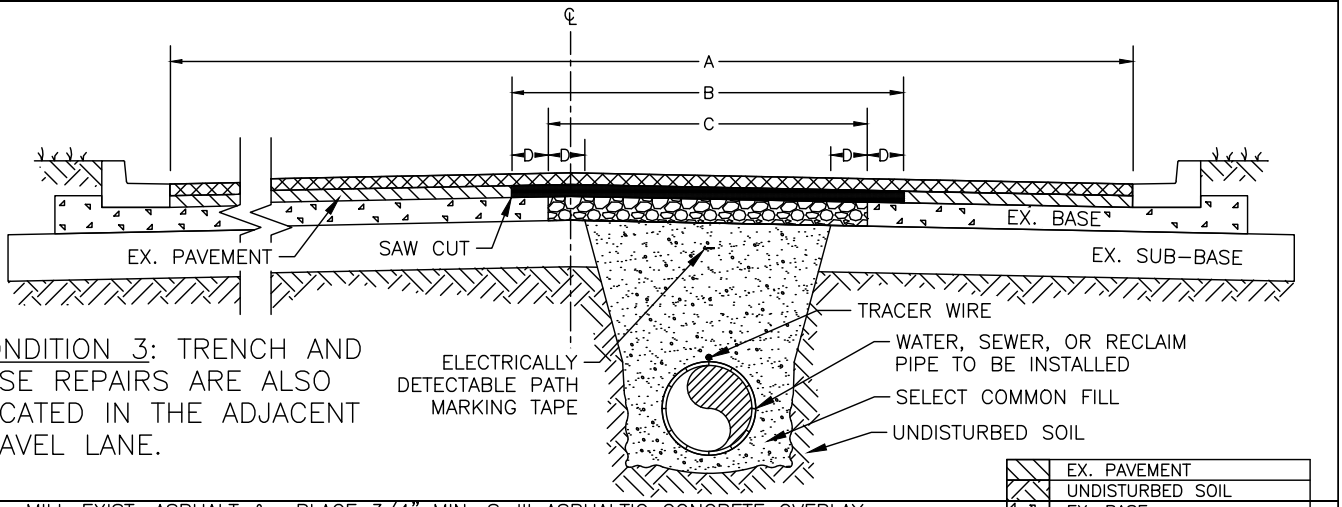
MANATEE COUNTY PUBLIC WORKS DEPARTMENT			TRENCH WITH ASPHALT PAVEMENT SURFACE TYPE A-1 PIPE BEDDING (CROSSING)	UG-12
REV.BY	DATE			
		DATE OF APPROVAL		



CONDITION 1: TRENCH AND BASE REPAIRS ARE LOCATED ADJACENT TO EOP OR CURB.



CONDITION 2: TRENCH AND BASE REPAIRS ARE LOCATED IN THE MIDDLE OF THE TRAVEL LANE.



CONDITION 3: TRENCH AND BASE REPAIRS ARE ALSO LOCATED IN THE ADJACENT TRAVEL LANE.

	EX. PAVEMENT
	UNDISTURBED SOIL
	EX. BASE
	SELECT COMMON FILL
	BASE REPLACEMENT
	S–I
	S–III
	NEW CURB

A = MILL EXIST. ASPHALT & PLACE 3/4" MIN. S–III ASPHALTIC CONCRETE OVERLAY.
B = 1–1/4" MIN. S–I ASPHALTIC CONCRETE W/ PRIME COAT.
C = FULL BASE REPLACEMENT.
D = 9 INCHES

NOTE:

1. THIS DETAIL IS BASED ON A TWO–LANE ROADWAY AND SHALL BE FOLLOWED WHEN A PIPE IS INSTALLED WITHIN THE LIMITS OF A ROADWAY AND RUNS PARALLEL WITH THE EDGE OF PAVEMENT. THIS DETAIL CAN ALSO BE UTILIZED FOR RESTORATION NEEDS OF ROADWAYS WITH ADDITIONAL LANES. CONDITION 3 ONLY EXTENDS TO NEXT ADJACENT LANE ON MULTI–LANE ROADS.
2. THE MILL AND OVERLAY SHALL BE FIELD ADJUSTED TO MEET THE NEEDS FOR PAVEMENT RESTORATION DUE TO CONSTRUCTION ACTIVITIES AND SHALL BE COORDINATED WITH THE COUNTY.
3. SEE TRENCH WITH ASPHALT PAVEMENT TYPE A–1 PIPE BEDDING (CROSSING) DETAIL FOR NOTES 1 TO 12 THAT ARE ALSO APPLICABLE TO ASPHALT PAVEMENT RESTORATION.

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

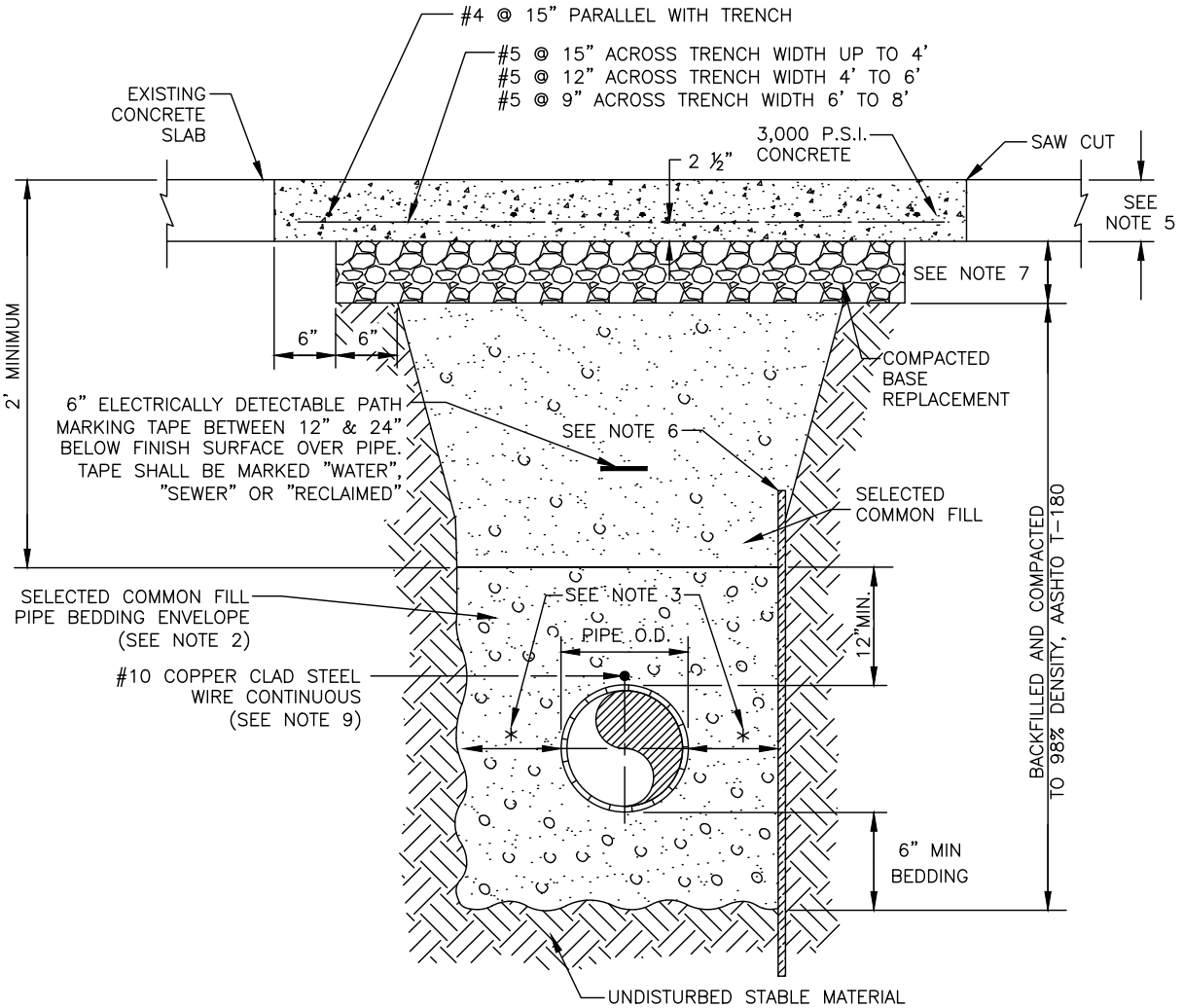
DATE OF APPROVAL

TRENCH WITH ASPHALT PAVEMENT SURFACE TYPE A–1 PIPE BEDDING (LONGITUDINAL)

UG–12B

NOTES:

1. CONCRETE PAVEMENT SHALL BE REMOVED WITH SAWED EDGES AND CUT AT A MINIMUM DEPTH OF ONE AND ONE–HALF (1–1/2"). IF A SAW CUT IN CONCRETE PAVEMENT FALLS WITHIN THREE FEET (3') OF A CONTRACTION JOINT, COLD JOINT, EXPANSION JOINT OR EDGE, THE CONCRETE SHALL BE REMOVED TO THE JOINT OR EDGE. THE EDGES OF EXISTING CONCRETE PAVEMENT ADJACENT TO TRENCHES, WHICH HAD BEEN DAMAGED SUBSEQUENT TO SAW CUTTING OF PAVEMENT, SHALL BE SAW CUT TO NEAT STRAIGHT LINES FOR THE PURPOSE OF REMOVING THE DAMAGED PAVEMENT AREAS.
2. USE OF TYPE A–2 AND A–3 PIPE BEDDING TO BE DETERMINED IN THE FIELD BY THE ENGINEER.
3. PROVIDE ADEQUATE CLEARANCE TO PLACE AND COMPACT STAGE 1 BEDDING MATERIAL IN TRENCH AREA BELOW PIPE SPRINGLINE. PIPE EMBEDMENT MUST BE COMPACTED OUT TO THE TRENCH WALL OR 2.5 TIMES THE PIPE OD, WHICHEVER IS LESS.
4. PIPE INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.
5. THICKNESS TO MATCH EXISTING OR BE 8" MINIMUM, WHICHEVER IS GREATER.
6. SHEETING ORDERED LEFT IN PLACE TO BE CUT OFF 24" BELOW FINISHED GRADE OR 12" BELOW SUBGRADE.
7. BASE SHALL BE CRUSHED CONCRETE, 8" MIN. THICKNESS, LBR ≥150.
8. TEMPORARY PATCHES WILL BE INSTALLED TO PROVIDE A SMOOTH ALL WEATHER SURFACE AT ALL TIMES. PERMANENT REPLACEMENT TO BE MADE AS SOON AS POSSIBLE.
9. TRACER WIRE NOT REQUIRED FOR GRAVITY SEWERS.
10. NOTES 5 THRU 8 ARE MINIMUM REQUIREMENTS. REFER TO MANATEE COUNTY HIGHWAY AND TRAFFIC STANDARDS FOR ADDITIONAL REQUIREMENTS.



MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

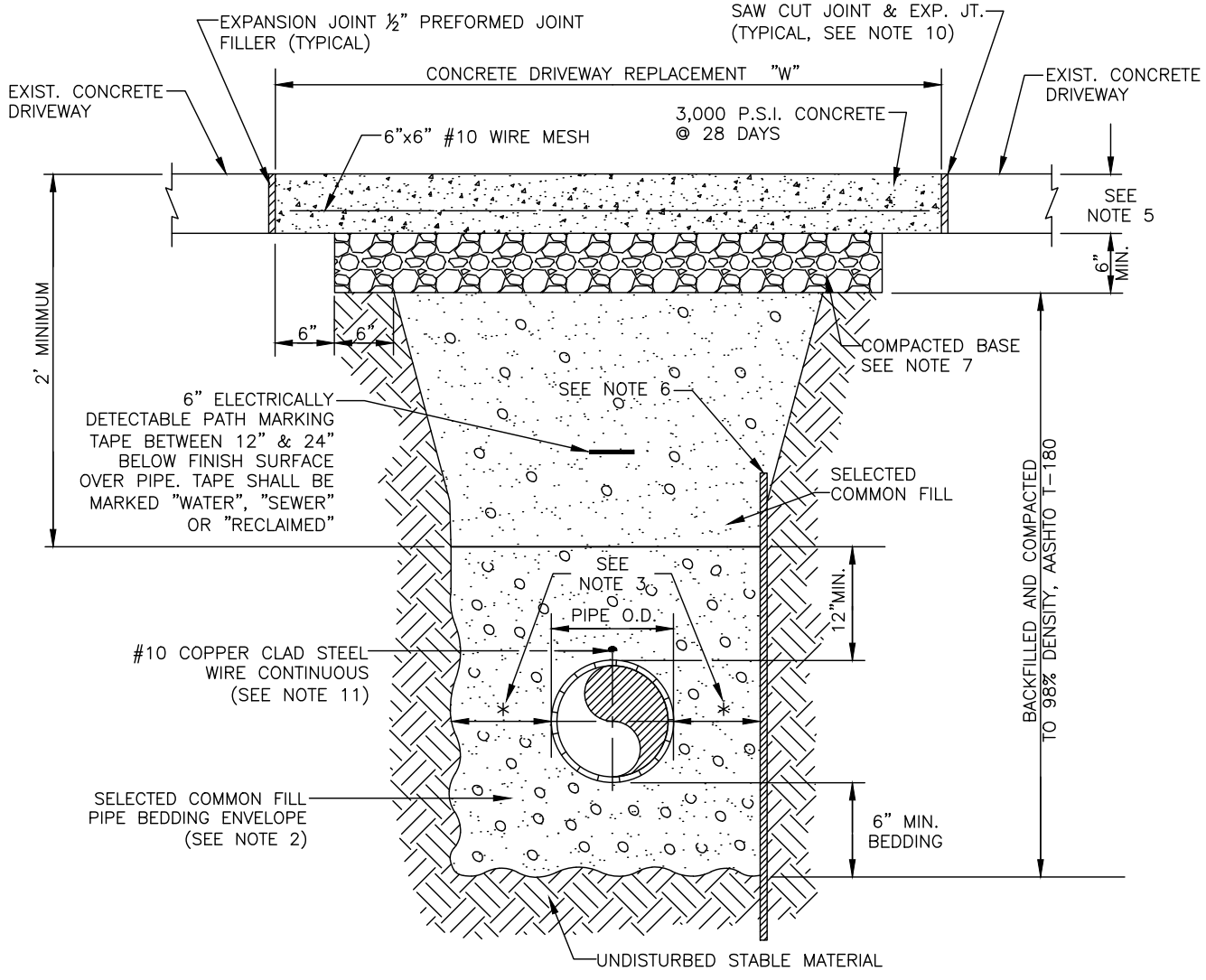
DATE OF APPROVAL

TRENCH WITH CONCRETE PAVEMENT SURFACE TYPE A–1 PIPE BEDDING

UG–13

NOTES:

1. CONCRETE PAVEMENT SHALL BE REMOVED WITH SAWED EDGES AND CUT AT A MINIMUM DEPTH OF ONE AND ONE–HALF (1–1/2"). IF A SAW CUT IN CONCRETE PAVEMENT FALLS WITHIN THREE FEET (3') OF A CONTRACTION JOINT, COLD JOINT, EXPANSION JOINT OR EDGE, THE CONCRETE SHALL BE REMOVED TO THE JOINT OR EDGE. THE EDGES OF EXISTING CONCRETE PAVEMENT ADJACENT TO TRENCHES, WHICH HAD BEEN DAMAGED SUBSEQUENT TO SAW CUTTING OF PAVEMENT, SHALL BE SAW CUT TO NEAT STRAIGHT LINES FOR THE PURPOSE OF REMOVING THE DAMAGED PAVEMENT AREAS.
2. USE OF TYPE A–2 AND A–3 PIPE BEDDING TO BE DETERMINED IN THE FIELD BY THE ENGINEER.
3. PROVIDE ADEQUATE CLEARANCE TO PLACE AND COMPACT STAGE 1 BEDDING MATERIAL IN TRENCH AREA BELOW PIPE SPRINGLINE. PIPE EMBEDMENT MUST BE COMPACTED OUT TO THE TRENCH WALL OR 2.5 TIMES THE PIPE OD, WHICHEVER IS LESS.
4. PIPE INSTALLATION SHALL BE IN ACCORDANCE WITH THE MANUFACTURER'S WRITTEN INSTRUCTIONS.
5. THICKNESS TO MATCH EXISTING OR BE 6" MINIMUM, WHICHEVER IS GREATER.
6. SHEETING ORDERED LEFT IN PLACE TO BE CUT OFF 24" BELOW FINISH GRADE OR 12" BELOW SUBGRADE.
7. BASE SHALL BE COMPACTED 6" MINIMUM THICKNESS OF APPROVED MATERIAL.
8. DRIVEWAYS SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE LATEST ADOPTED CONSTRUCTION STANDARDS OF THE MANATEE COUNTY TRANSPORTATION DEPARTMENT.
9. IF THE DRIVEWAY IS 12' OR WIDER, SAWCUT AN EXPANSION JOINT ALONG THE CENTER OF THE DRIVEWAY (3/16" WIDE AND 1½" DEEP) AFTER THE CONCRETE HAS SET.
10. IF THERE IS AN EXISTING EXPANSION JOINT WITHIN 3' OF THE PROPOSED JOINT, EXTEND DRIVEWAY REPLACEMENT TO THE EXISTING JOINT.
11. TRACER WIRE NOT REQUIRED FOR GRAVITY SEWERS.



MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

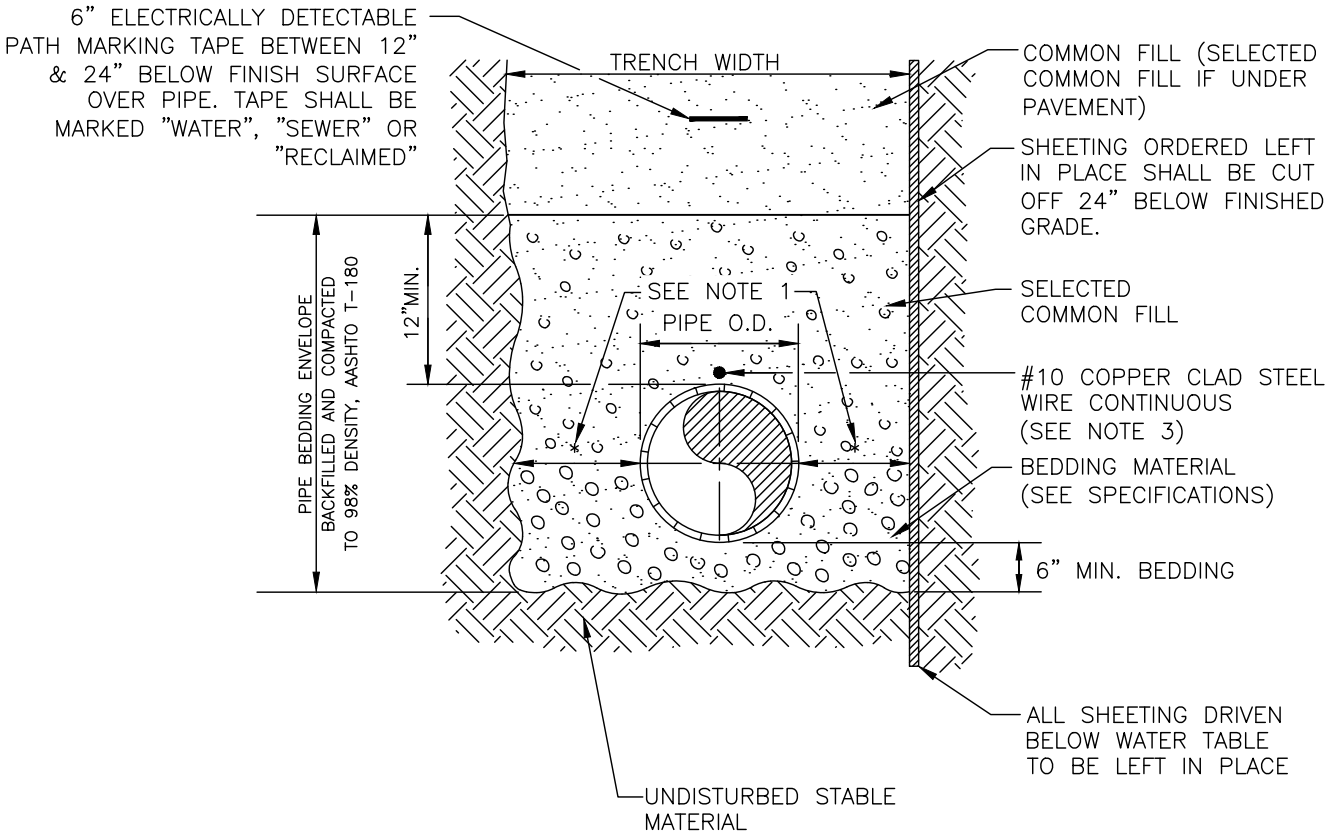
DATE OF APPROVAL

TRENCH WITH CONCRETE DRIVEWAY SURFACE TYPE A–1 PIPE BEDDING

UG–14

NOTES:

1. PROVIDE ADEQUATE CLEARANCE TO PLACE AND COMPACT STAGE 1 BEDDING MATERIAL IN TRENCH AREA BELOW PIPE SPRINGLINE. PIPE EMBEDMENT MUST BE COMPACTED OUT TO THE TRENCH WALL OR 2.5 TIMES THE PIPE OD, WHICHEVER IS LESS.
2. PIPE INSTALLATION SHALL BE IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS.
3. TRACER WIRE NOT REQUIRED FOR GRAVITY SEWERS.



MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

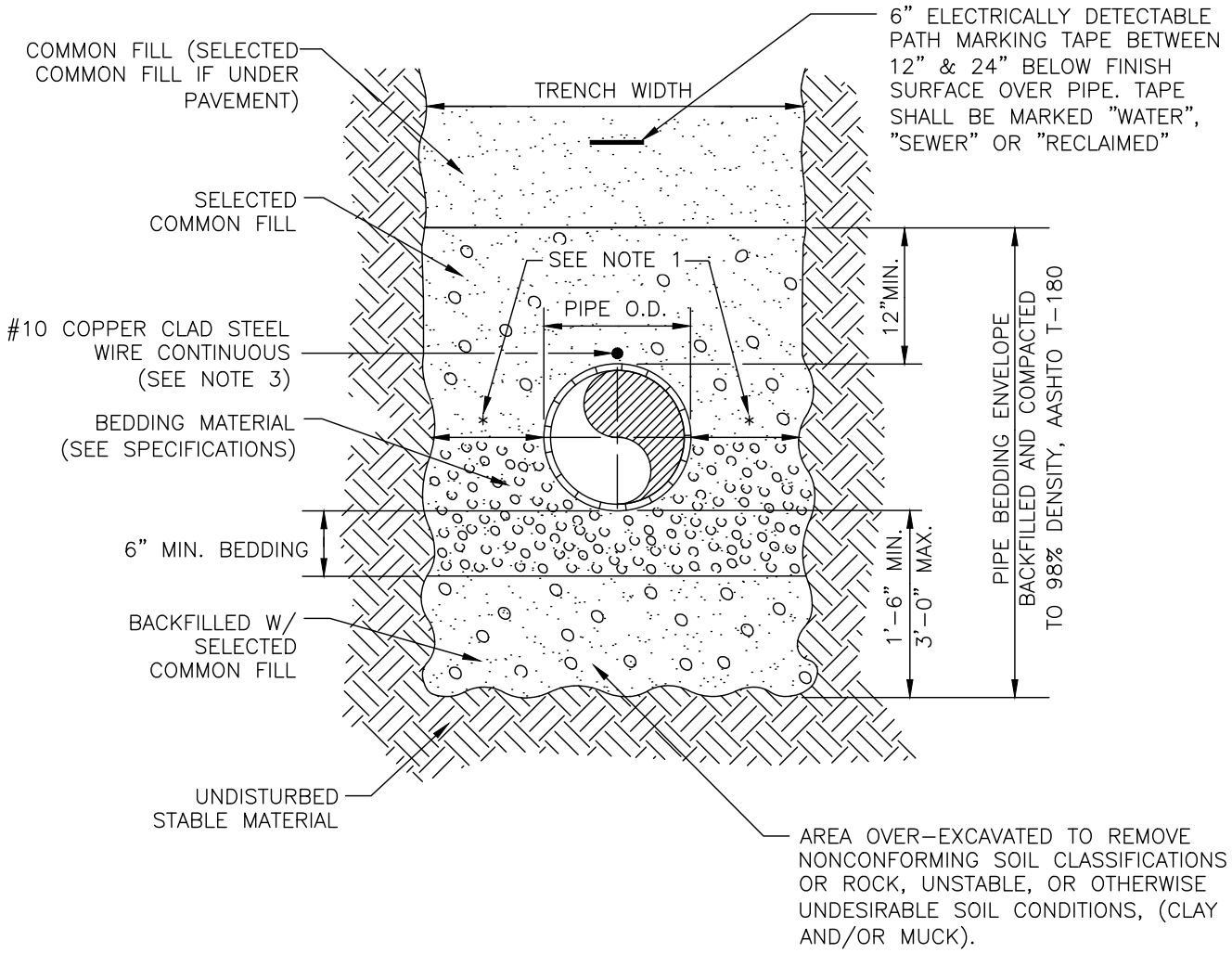
DATE OF APPROVAL

TRENCH WITH TYPE A-2 PIPE BEDDING

UG-15

NOTES:

1. PROVIDE ADEQUATE CLEARANCE TO PLACE AND COMPACT STAGE 1 BEDDING MATERIAL IN TRENCH AREA BELOW PIPE SPRINGLINE. PIPE EMBEDMENT MUST BE COMPACTED OUT TO THE TRENCH WALL OR 2.5 TIMES THE PIPE OD, WHICHEVER IS LESS.
2. PIPE INSTALLATION SHALL BE IN ACCORDANCE WITH MANUFACTURER'S WRITTEN INSTRUCTIONS.
3. TRACER WIRE NOT REQUIRED FOR GRAVITY SEWERS.



MANATEE COUNTY PUBLIC WORKS DEPARTMENT			TRENCH WITH TYPE A-3 PIPE BEDDING	UG-16
REV.BY	DATE			
		DATE OF APPROVAL		

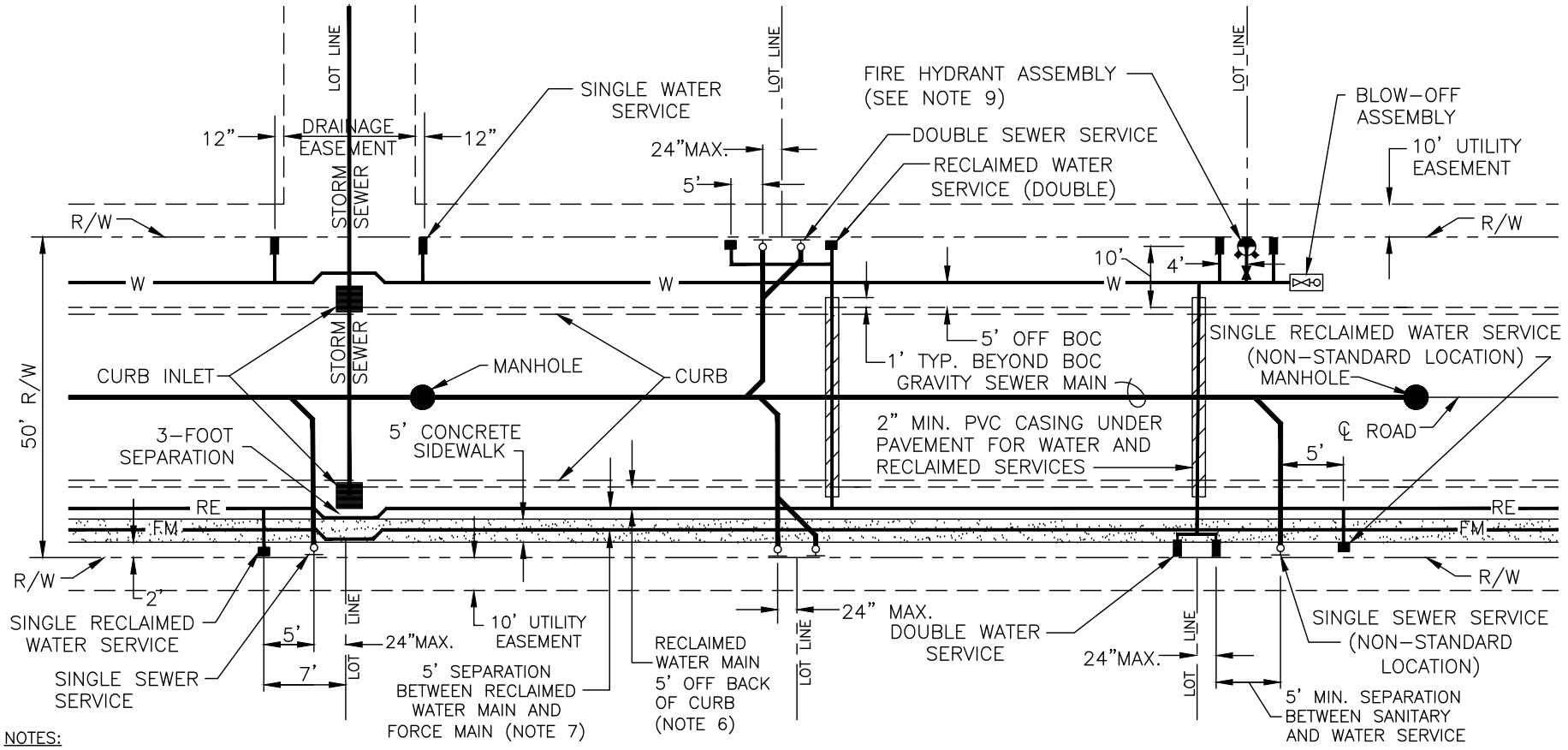
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

UTILITY LAYOUT FOR 50' R/W

UG-17



NOTES:

1. 5' WIDE SIDEWALK TO BE LOCATED 2' OFF RIGHT-OF-WAY LINE (4' SEPARATION FROM SIDEWALK TO BACK OF CURB). SEE PLAN FOR SIDEWALK LOCATION.
2. WATER SERVICES TO BE 24" MAX. OFF LOT LINE, 12" MAX. AT DRAINAGE EASEMENTS. SANITARY CLEAN-OUTS TO BE 12" OFF RIGHT-OF-WAY LINE AND 24" MAX. OFF LOT LINE, 12" MAX. AT DRAINAGE EASEMENTS. RECLAIMED WATER SERVICES TO BE 7' MAX. OFF LOT LINE (5' AWAY FROM SANITARY SERVICES), 6' MAX. AT DRAINAGE EASEMENTS.
3. ALL PRESSURE MAINS SHALL BE MIN. 3 FEET FROM STRUCTURES.
4. POTABLE WATER MAIN TO BE 5' OFF BACK OF CURB, ON OPPOSITE SIDE OF ROAD FROM SIDEWALK.
5. SEWER MAIN TO BE ALONG CENTERLINE OF ROADWAY, EXCEPT IN CURVES, AND SHALL IN NO CASE BE CLOSER THAN 10' AWAY FROM POTABLE WATER MAINS AND 5' AWAY FROM RECLAIMED WATER MAINS. MANHOLE COVERS SHALL BE IN CENTERLINE OF ROADWAY, OR CENTER OF TRAVELED LANE.
6. RECLAIMED WATER MAIN TO BE 5' OFF BACK OF CURB (OPPOSITE SIDE OF ROAD FROM POTABLE WATER MAIN), EXCEPT WHEN INSTALLED ON SAME SIDE OF ROAD AND PARALLEL TO FORCE MAIN, IN WHICH CASE RECLAIMED WATER MAIN TO BE 3' OFF BACK OF CURB. 10' UTILITY EASEMENT SHALL BE IN THE FRONT OF THE LOTS IN LIEU OF THE BACK OF THE LOTS.
7. FORCE MAIN TO BE 5' OFF BACK OF CURB (OPPOSITE SIDE OF ROAD FROM POTABLE WATER MAIN), EXCEPT WHEN INSTALLED ON SAME SIDE OF ROAD AND PARALLEL TO RECLAIMED WATER MAIN, IN WHICH CASE FORCE MAIN TO BE 8' OFF BACK OF CURB.
8. POTABLE WATER, RECLAIMED WATER AND FORCE MAINS TO DEFLECT BEHIND AND DO NOT TOUCH CURB INLETS. MAXIMUM OBTAINABLE SEPARATION OF POTABLE WATER, RECLAIMED WATER AND FORCE MAINS TO CURB INLETS SHALL BE PROVIDED WHILE MAINTAINING ALL OTHER SETBACK REQUIREMENTS.
9. FIRE HYDRANTS TO BE 10' OFF BACK OF CURB, ON SAME SIDE OF ROAD AS WATER MAIN, AT LOT LINES (TYPICALLY AT PROPERTY CORNERS WHERE WATER SERVICES ARE LOCATED).
10. PVC OR HDPE CASINGS FOR WATER AND RECLAIMED WATER SERVICE ROADWAY CROSSINGS TO HAVE 36" MINIMUM COVER.
11. ALL OTHER R.O.W. WIDTHS SHALL CONFORM TO THE ABOVE MINIMUM SETBACKS FOR FORCEMAINS, POTABLE & RECLAIMED WATERMAINS. NO SEWER LATERAL CLEANOUTS SHALL BE LOCATED IN THE SIDEWALK OR DRIVEWAYS.

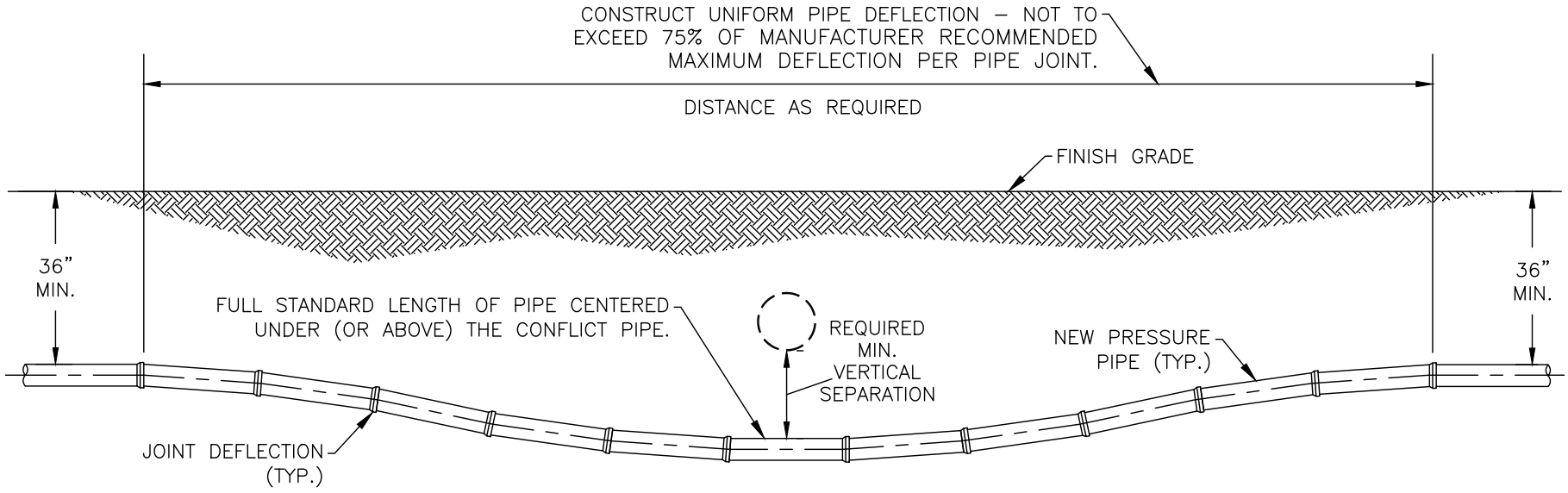
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

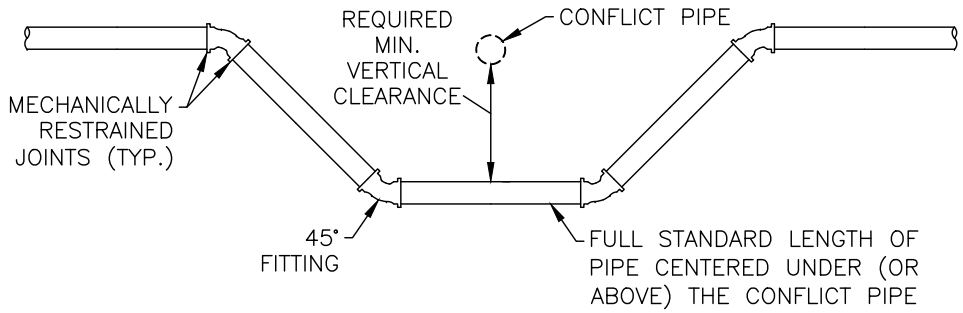
DATE OF APPROVAL

PRESSURE PIPE DEFLECTION AT UTILITY CROSSING

UG–18



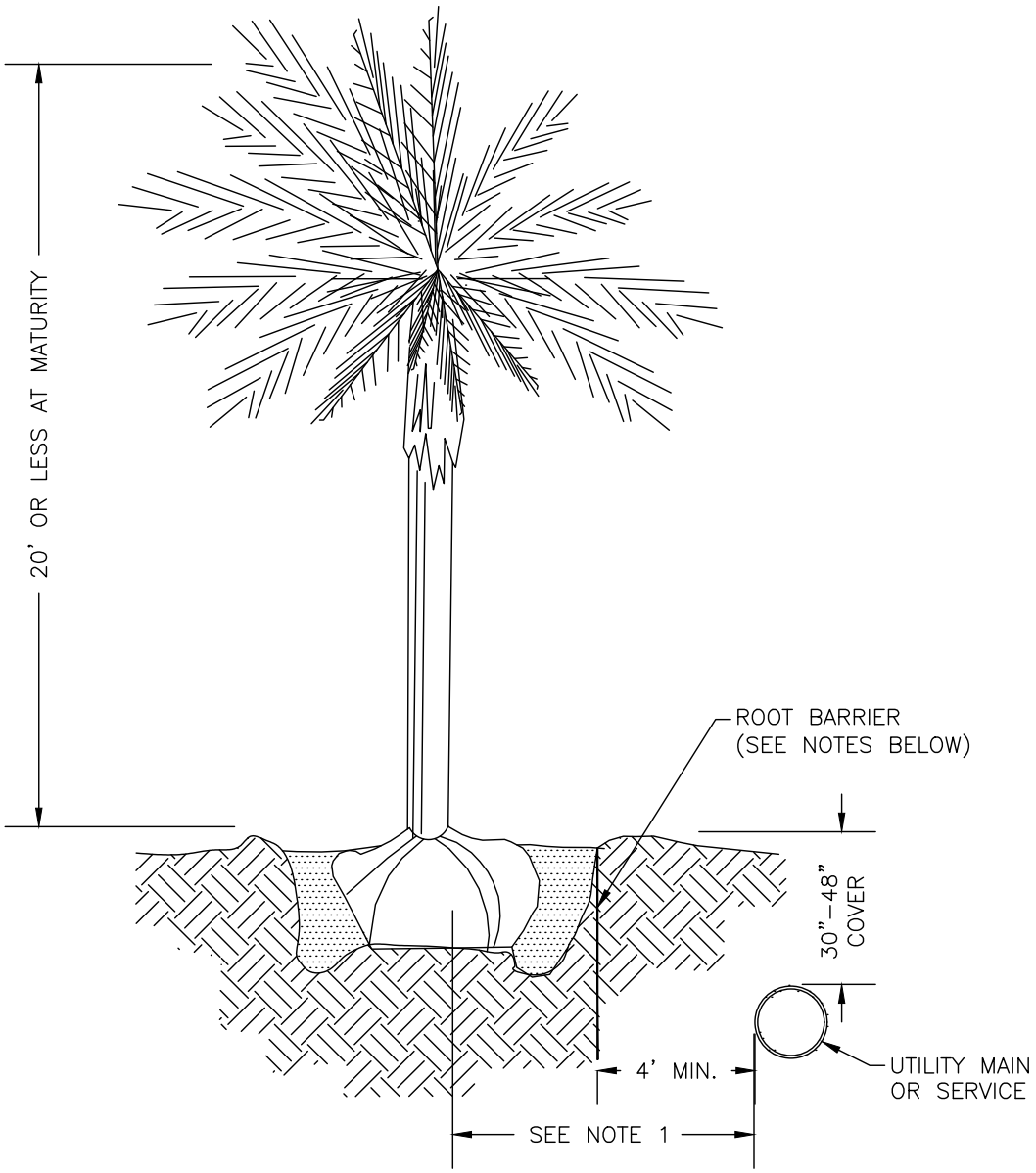
DEFLECTION TYPE



FITTING TYPE

NOTES:

1. AT ALL TIMES, PIPE SHALL CROSS ABOVE CONFLICT WHEN POSSIBLE.
2. THESE METHODS ARE TO BE USED WHEN INSUFFICIENT COVER EXISTS TO ALLOW PRESSURE PIPE TO CROSS ABOVE CONFLICT PIPE WITH 6" VERTICAL SEPARATION AND MAINTAIN REQUIRED COVER TO FINISHED GRADE.
3. THE DEFLECTION TYPE CROSSING IS PREFERRED.
4. DO NOT EXCEED 75% OF MANUFACTURER'S RECOMMENDED MAXIMUM JOINT DEFLECTION.
5. FITTINGS SHALL BE RESTRAINED AS SPECIFIED IN DETAIL UG–8 "RESTRAINED LENGTH FOR PVC PIPE" OR UG–9 "RESTRAINED LENGTH FOR DIP".



NOTES:

1. THIS DISTANCE SHALL BE 7' MINIMUM WITH ROOT BARRIER AND 10' MINIMUM IF NO ROOT BARRIER IS USED.
2. ALL ROOT BARRIERS SHALL BE 4' MINIMUM FROM ALL MAINS AND SERVICES.
3. THE INSTALLATION OF ROOT BARRIERS SHALL BE COORDINATED WITH MANATEE COUNTY AND INSPECTED BY MANATEE COUNTY PRIOR TO BACKFILLING. ALL ROOT BARRIERS SHALL EXTEND UP TO FINISHED GRADE
4. ROOT BARRIERS SHALL BE A FLEXIBLE PANEL BARRIER, A MINIMUM 36" DEEP.
5. ALL ROOT BARRIERS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURES WRITTEN INSTRUCTIONS.

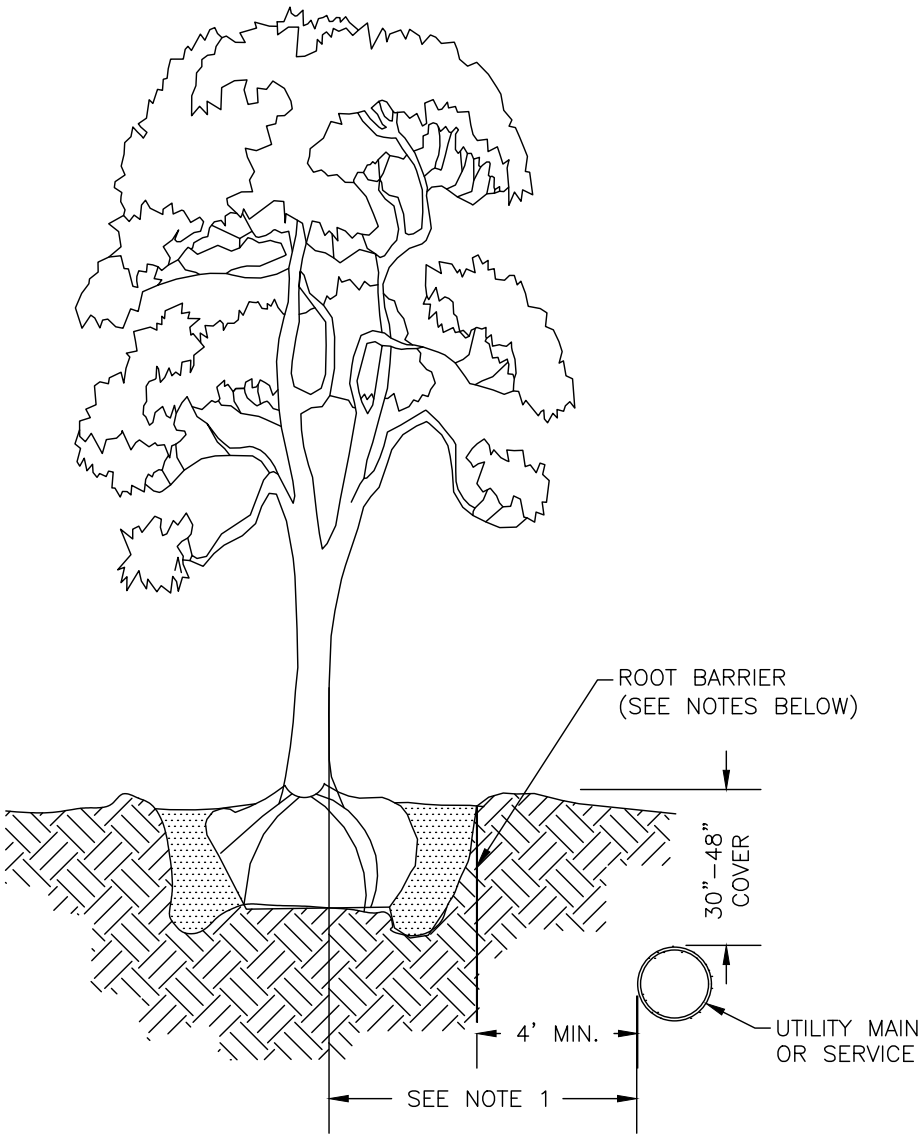
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

TYP. SMALL TREE OR PALM TREE WITH ROOT BARRIER

UG–19



NOTES:

1. THIS DISTANCE SHALL BE 10' MINIMUM WITH ROOT BARRIER AND 15' MINIMUM IF NO ROOT BARRIER IS USED.
2. ALL ROOT BARRIERS SHALL BE 4' MINIMUM FROM ALL MAINS AND SERVICES.
3. THE INSTALLATION OF ROOT BARRIERS SHALL BE COORDINATED WITH MANATEE COUNTY AND INSPECTED BY MANATEE COUNTY PRIOR TO BACKFILLING. ALL ROOT BARRIERS SHALL EXTEND UP TO FINISHED GRADE
4. ROOT BARRIERS SHALL BE MINIMUM 36" DEEP. FLEXIBLE BARRIERS SHALL BE 36" PANELS.
5. ALL ROOT BARRIERS SHALL BE INSTALLED IN ACCORDANCE WITH MANUFACTURES WRITTEN INSTRUCTIONS.
6. LARGE PALM TREES INCLUDE ROYAL, WASHINGTONIAN, BISMARK AND SIMILAR SIZED SPECIES.

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

TYP. CANOPY TREE, LARGE PALM OR EXOTIC TREE WITH ROOT BARRIER

UG–20

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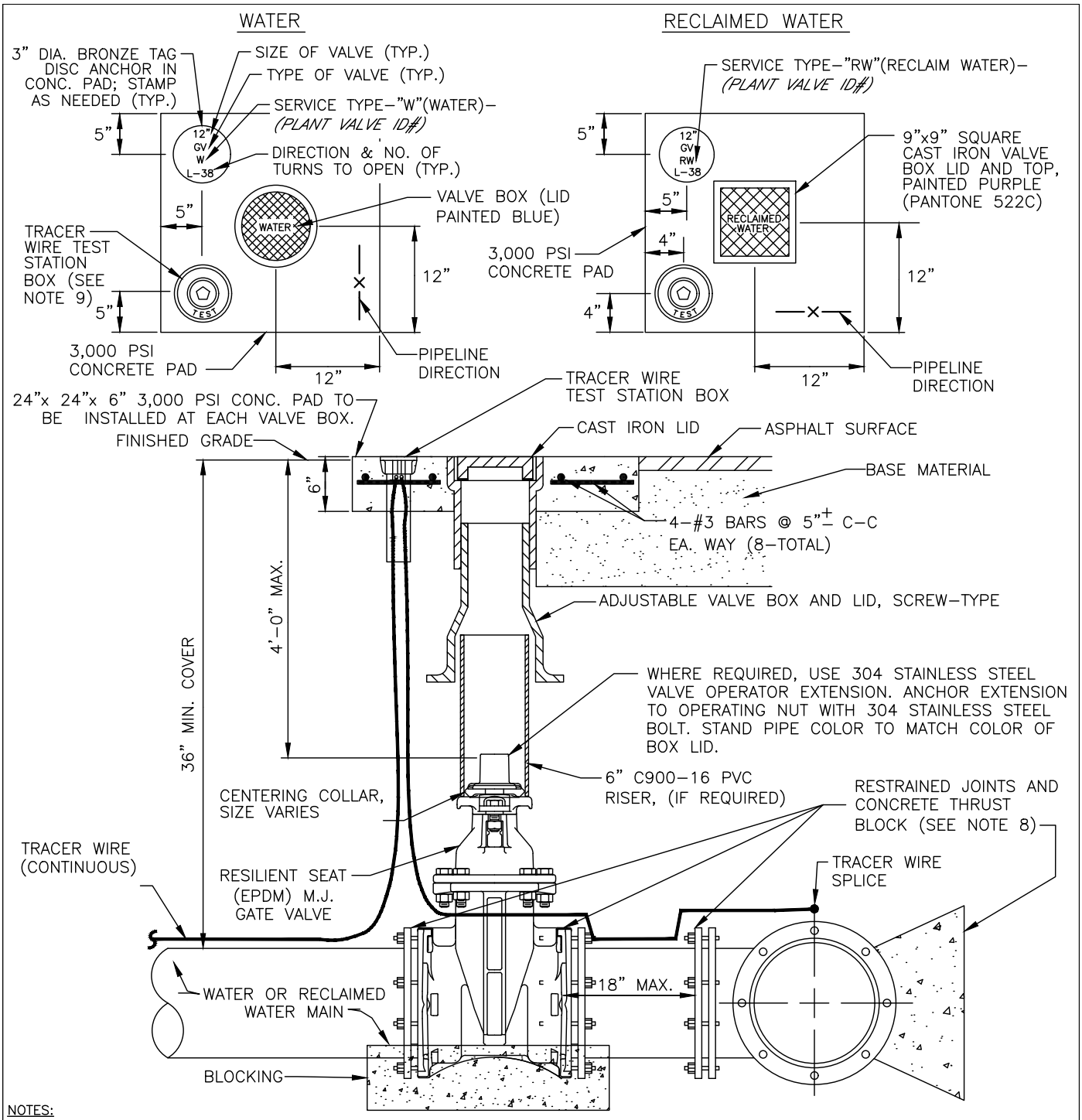
TABLE OF CONTENTS

UTILITY STANDARDS–WATER DISTRIBUTION SYSTEM



NOTES:

1. "WV" OR "RWV" TO BE IMPRESSED INTO THE NEWLY-POURED CONCRETE CURB, ALONG WITH DISTANCE IN FEET TO THE VALVE. IF NO CURB, INSTALL A BLUE DISC WITH "WV" OR PURPLE DISC WITH "RWV" USING A 1/8" x 1" GALVANIZED STEEL SCREW IN THE EDGE OF PAVEMENT WITH THE FOOTAGE FROM THE DISC TO THE VALVE.
2. ALL EXISTING AND PROPOSED VALVE BOXES SHALL BE ADJUSTED TO FINISHED GRADES AS DETERMINED IN THE FIELD.
3. VALVES SHALL NOT BE PLACED IN HANDICAPPED RAMPS, CURBS, OR GUTTERS.
4. PRECAST CONCRETE PADS SHALL NOT BE USED.
5. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 1/2".
6. PIPELINE DIRECTION TO BE IMPRESSED INTO NEWLY POURED CONCRETE PAD.
7. TRACER WIRE TEST STATION BOX IS NOT REQUIRED IN VALVE BOX PAD IF THE GATE VALVE IS LOCATED WITHIN 200 FEET OF A WATER SERVICE, BLOW-OFF, BACKFLOW PREVENTER OR FIRE HYDRANT THAT HAS A TRACER WIRE BOX.
8. WHERE THRUST BLOCK NOT USED, RESTRAINED JOINTS MUST THEN EXTEND FROM TEE FULL LENGTH SPECIFIED FOR "TEES."
9. USE NON-TRAFFIC RATED BOXES FOR NORMAL YARD SERVICE. WHERE VALVE WILL BE IN STREET OR PARKING UNDER VEHICLE TRAFFIC, USE TRAFFIC RATED BOXES. WHERE POSSIBLE, LOCATE TRACE WIRE TESTING STATION OUTSIDE OF TRAVEL LANE OR IN MEDIAN, CENTERED IN SEPARATE CONCRETE PAD SIMILAR TO STANDARD VALVE BOX PAD.
10. THE BRASS TAG SHALL HAVE A "PLANT VALVE ID# WHEN VALVES ARE INSTALLED WITHIN THE COUNTY TREATMENT PLANT LIMITS. THE PLANT VALVE ID# SHALL BE SHOWN ON THE CONSTRUCTION PLANS AND RECORD DRAWINGS.
11. REFER TO SECTION 1.11 GATE VALVES IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL FOR FURTHER DETAILS.

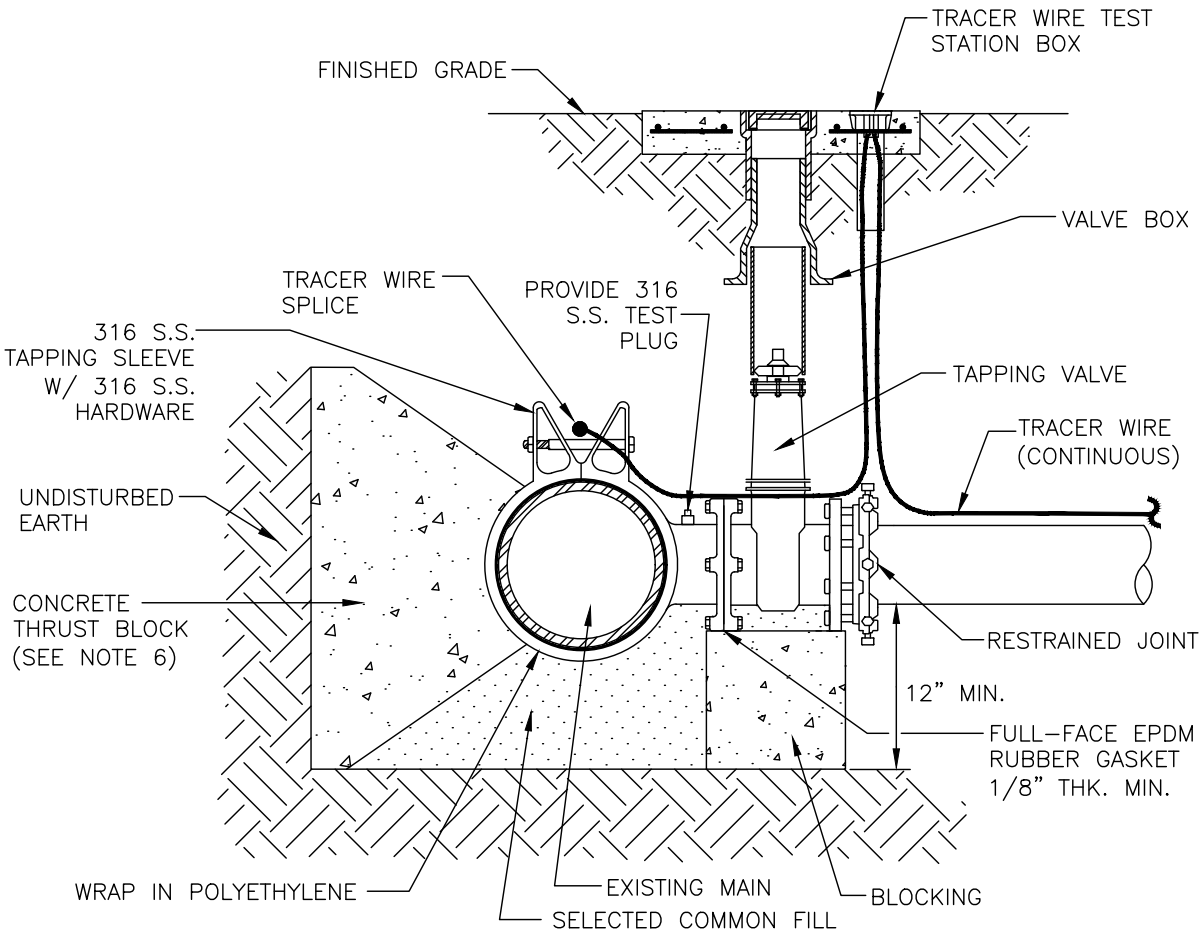
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

GATE VALVE, BOX, LID AND TAG

UW-2

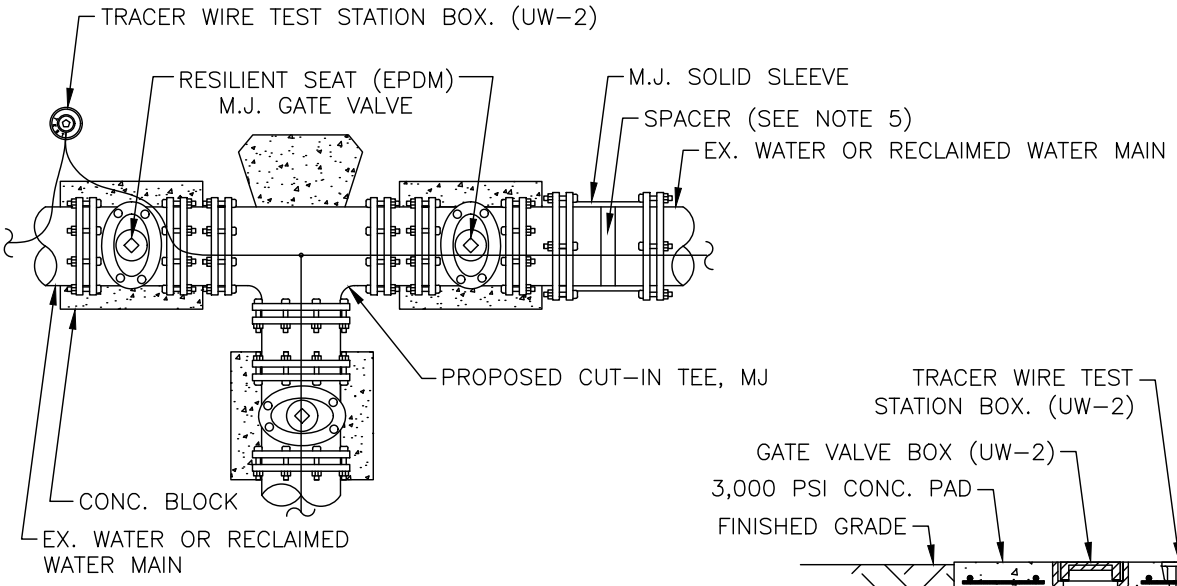


ELEVATION

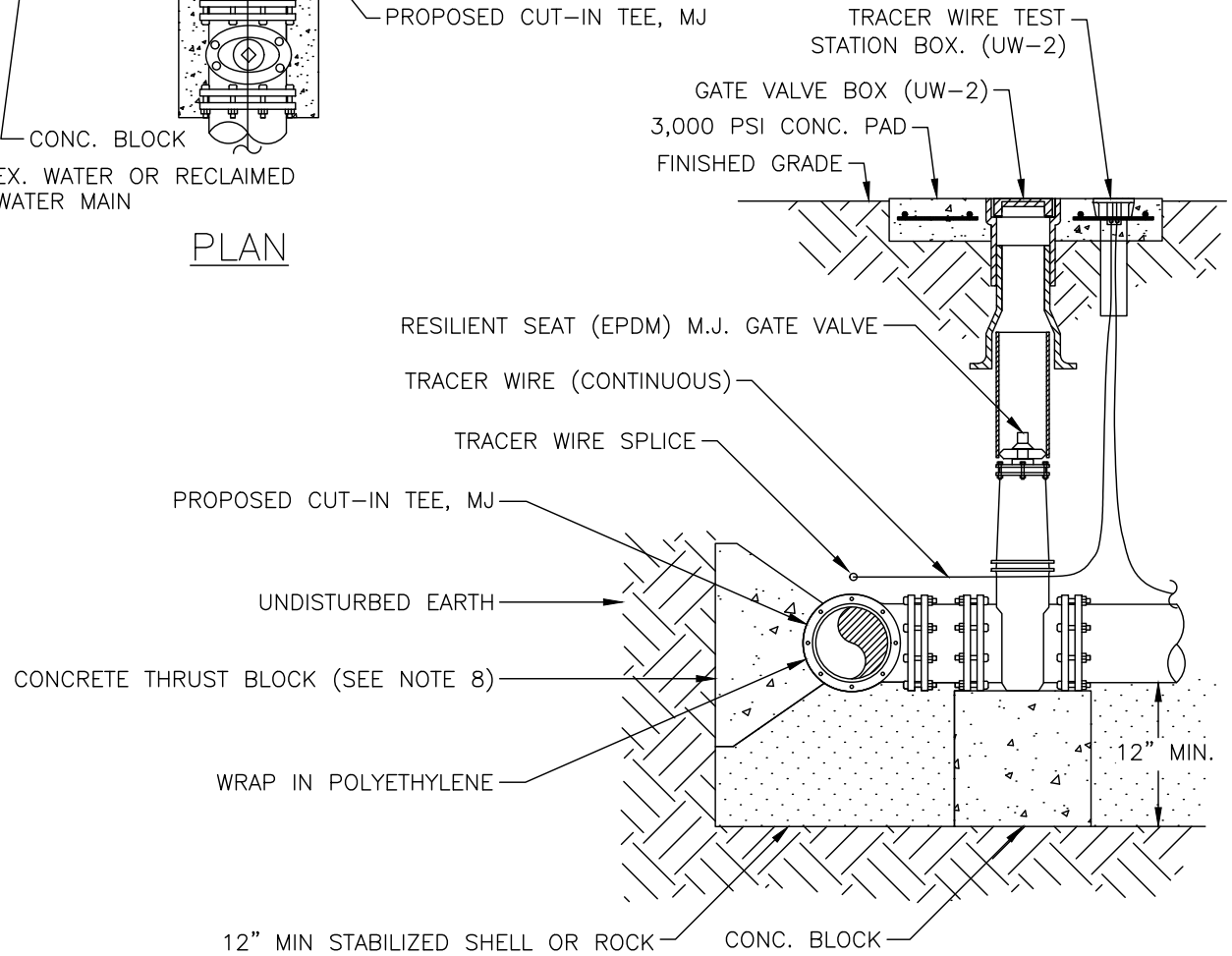
NOTES:

1. PRIOR TO TAPPING, CONTRACTOR TO DEMONSTRATE 60 MINUTE HYDROSTATIC TEST OF THE TAPPING SLEEVE AND VALVE WITH NO LOSS OF 180 PSI PRESSURE FOR WATER AND RECLAIMED WATER.
2. ALL FITTINGS TO BE WRAPPED WITH 20 MIL POLYETHYLENE WRAP AT THRUST BLOCK.
3. ALL TAPS ON CONCRETE WATER MAINS AND LARGER THAN 12" ARE TO BE MADE BY A MANATEE COUNTY APPROVED TAPPING COMPANY. ALL MATERIALS TO BE SUPPLIED BY THE CONTRACTOR.
4. ALL TAPS MUST BE OF A SMALLER SIZE THAN THE MAIN BEING TAPPED & PLACED NO CLOSER THAN 30" OR A DISTANCE EQUAL TO (1) MAIN PIPE DIAMETER PLUS (2) TAP PIPE DIAMETERS (WHICHEVER IS GREATER) FROM A JOINT OR FITTING.
5. CONTRACTOR TO SUPPLY A DRY HOLE FOR TAPPING CREW TO WORK IN AND A BACK-HOE TO LOWER TAPPING MACHINE INTO THE HOLE.
6. WHERE THRUST BLOCK NOT USED, RESTRAINED JOINTS MUST THEN EXTEND FROM TEE FULL LENGTH SPECIFIED FOR "TEES."
7. TRACER WIRE TEST STATION BOX IS REQUIRED AT CONNECTIONS TO EXISTING MAINS.
8. SEE SECTION 1.11 TAPPING SLEEVES AND VALVES IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL FOR FURTHER DETAILS.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			TAPPING SLEEVE AND VALVE (WATER/RECLAIM)	UW-3
REV.BY	DATE			
		DATE OF APPROVAL		



PLAN



PROFILE

NOTES:

1. ALL FITTINGS TO BE WRAPPED WITH 20 MIL POLYETHYLENE WRAP AT THRUST BLOCK.
2. TRACER WIRE TEST STATION BOX IS REQUIRED AT CONNECTIONS TO EXISTING MAINS.
3. WATER VALVES SHALL BE INSTALLED ON ALL SIDES OF TEES AND CROSSES, UNLESS INLINE VALVES ON THAT LEG WITHIN 200 FEET.
4. RESTRAINED JOINTS MUST EXTEND FROM TEE FULL LENGTH SPECIFIED FOR VALVES.
5. SPACER IS REQUIRED IF A GAP EXISTS. SPACER NOT TO EXCEED OVER 30% OF SLEEVE WIDTH.
6. IN ASBESTOS CONCRETE PIPE (AC) APPLICATIONS: TWO COUPLINGS ARE REQUIRED. ALL FITTINGS INCLUDING COUPLINGS SHALL BE SUPPORTED WITH CONCRETE BLOCKING TO PREVENT SETTLEMENT.
7. ALL EXISTING RESTRAINING SHALL BE MODIFIED AND OR RE–INSTATED AS NECESSARY, TO MEET THE RESTRAINT REQUIREMENT FOR VALVES.
8. WHERE THRUST BLOCK NOT USED, RESTRAINED JOINTS MUST THEN EXTEND FROM TEE FULL LENGTH SPECIFIED FOR "TEES".

MANATEE COUNTY
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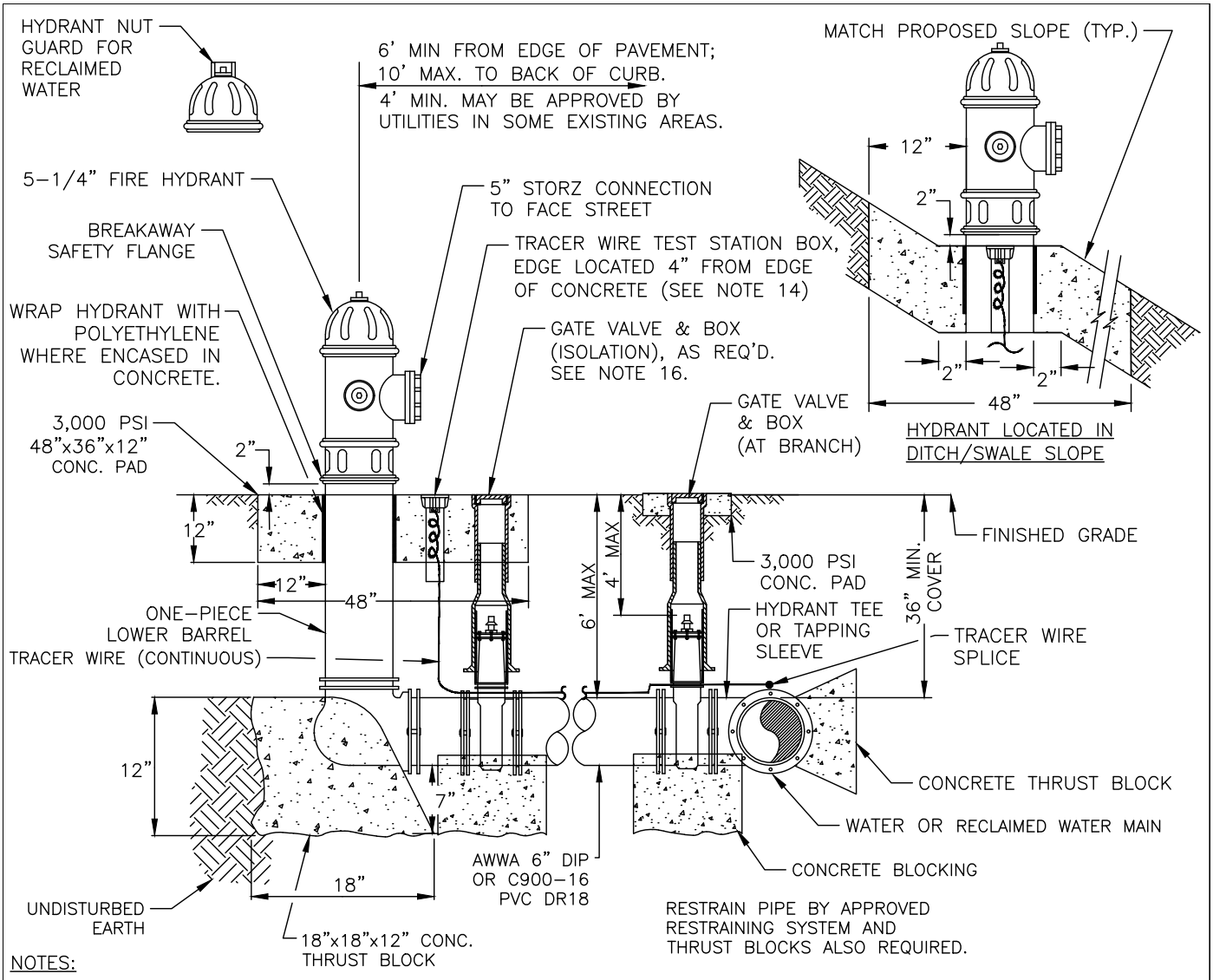
REV.BY	DATE

DATE OF APPROVAL

CUT–IN TEE

UW–4



NOTES:

1. WEEPHOLES SHALL BE EXCLUDED FROM THE FIRE HYDRANT.
2. FIRE HYDRANTS SHALL BE A MINIMUM OF 6' OFF EDGE OF PAVEMENT AND 10' MAX. FROM BACK OF CURB. WHERE POSSIBLE AND WHERE SIDEWALK IS TO BE INSTALLED, FIRE HYDRANT SHALL BE LOCATED BETWEEN SIDEWALK AND RIGHT-OF-WAY LINE.
3. HYDRANT SHALL BE DUCTILE IRON CONSTRUCTION. HYDRANTS SHALL BE FUSION BONDED EPOXY COATED SAFETY YELLOW FOR WATER; PURPLE (PANTONE 522C) FOR RECLAIMED WATER; AND RED FOR PRIVATE.
4. FIRE HYDRANTS SHALL BE PLACED SO THAT STORM WATER FLOWS AWAY FROM THE HYDRANT.
5. FIRE HYDRANTS SHALL BE CONSTRUCTED WITH "GROUND LINE" SET TO FINISHED GRADES AS ESTABLISHED IN THE FIELD. NORMAL BURY IS 3 FEET OF COVER FOR ALL WATER LINES.
6. FIRE HYDRANTS MAY BE CONSTRUCTED WITH "GRADELOK" OFFSET FITTING.
7. RAISED REFLECTIVE PAVEMENT MARKER(S) (BLUE) FOR POTABLE WATER (PURPLE) FOR RECLAIMED WATER SHALL BE INSTALLED ON THE PAVEMENT DIRECTLY ACROSS FROM THE HYDRANT IN ACCORDANCE WITH THE FDOT TRAFFIC ENGINEERING MANUAL, CHAPTER 4, SECTION 4.3 OR MOST CURRENT ADDITION.
8. ALL EXPOSED EDGES OF CONCRETE SHALL HAVE 1/2" CHAMFER.
9. FIRE HYDRANT VALVE SHALL BE FASTENED DIRECTLY TO TEE.
10. IN-LINE VALVES SHOULD BE LOCATED AT HYDRANT TEES.
11. HYDRANTS SHALL BE LOCATED ON SAME SIDE OF ROAD AS WATER OR RECLAIMED MAIN.
12. THERE MUST BE A CLEARANCE OF 7 1/2 FEET FROM FRONT AND BOTH SIDES, AND FOUR FEET TO THE REAR OF THE HYDRANT, TO ABOVE GRADE OBSTRUCTIONS INCLUDING POSTS, FENCES, TREES, ETC, PER THE FLORIDA FIRE PREVENTION CODE.
13. SEE STANDARD DETAIL UW-2 GATE VALVE, BOX, LID AND TAG.
14. SHOULD THE FIRE HYDRANT'S CONCRETE PAD OVERLAP A SIDEWALK, THE TRACER WIRE TEST STATION BOX SHALL NOT BE LOCATED WITHIN THE SIDEWALK.
15. IF A HYDRANT IS LOCATED ON THE SLOPE OF A DITCH OR SWALE; THE CONCRETE PAD SHALL CONFORM TO THE FINISH GRADE/SLOPE. THE CONCRETE PAD SHALL BE LEVEL 2-INCHES BEHIND & IN FRONT OF THE HYDRANT.
16. AT THE DISCRETION OF THE COUNTY AN ADDITIONAL ISOLATION GATE VALVE SHALL BE ADDED, WHEN A PHYSICAL BARRIER IS PRESENT, (I.E. ROADWAY, FENCE, WALL, BERM ETC), BETWEEN THE BRANCH GATE VALVE AND THE HYDRANT.
17. SEE SECTION 1.11 HYDRANTS IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL FOR FURTHER DETAILS.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT				
REV.BY	DATE		FIRE HYDRANT ASSEMBLY	UW-5
		DATE OF APPROVAL		

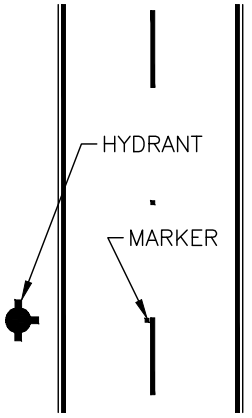


FIG 4.3–1
TWO–LANE STREET

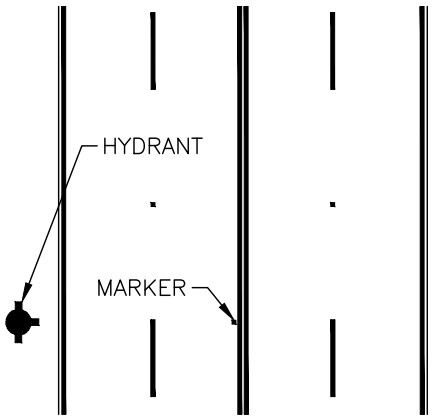


FIG 4.3–2
MULTI–LANE STREET

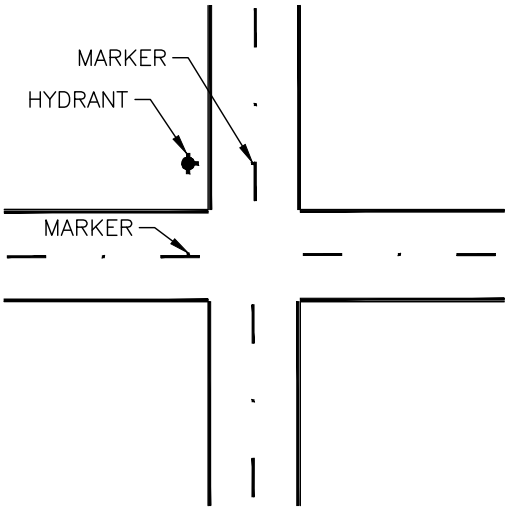


FIG 4.3–3
TWO–LANE STREET
AT INTERSECTION

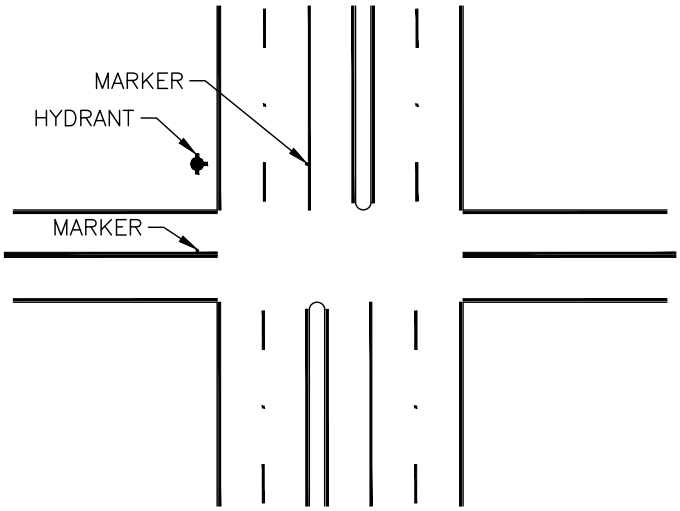


FIG 4.3–4
FOUR–LANE STREET WITH
TURN LANE AT INTERSECTION

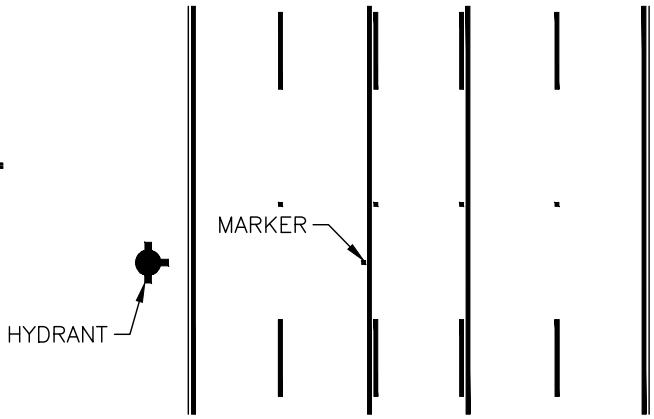
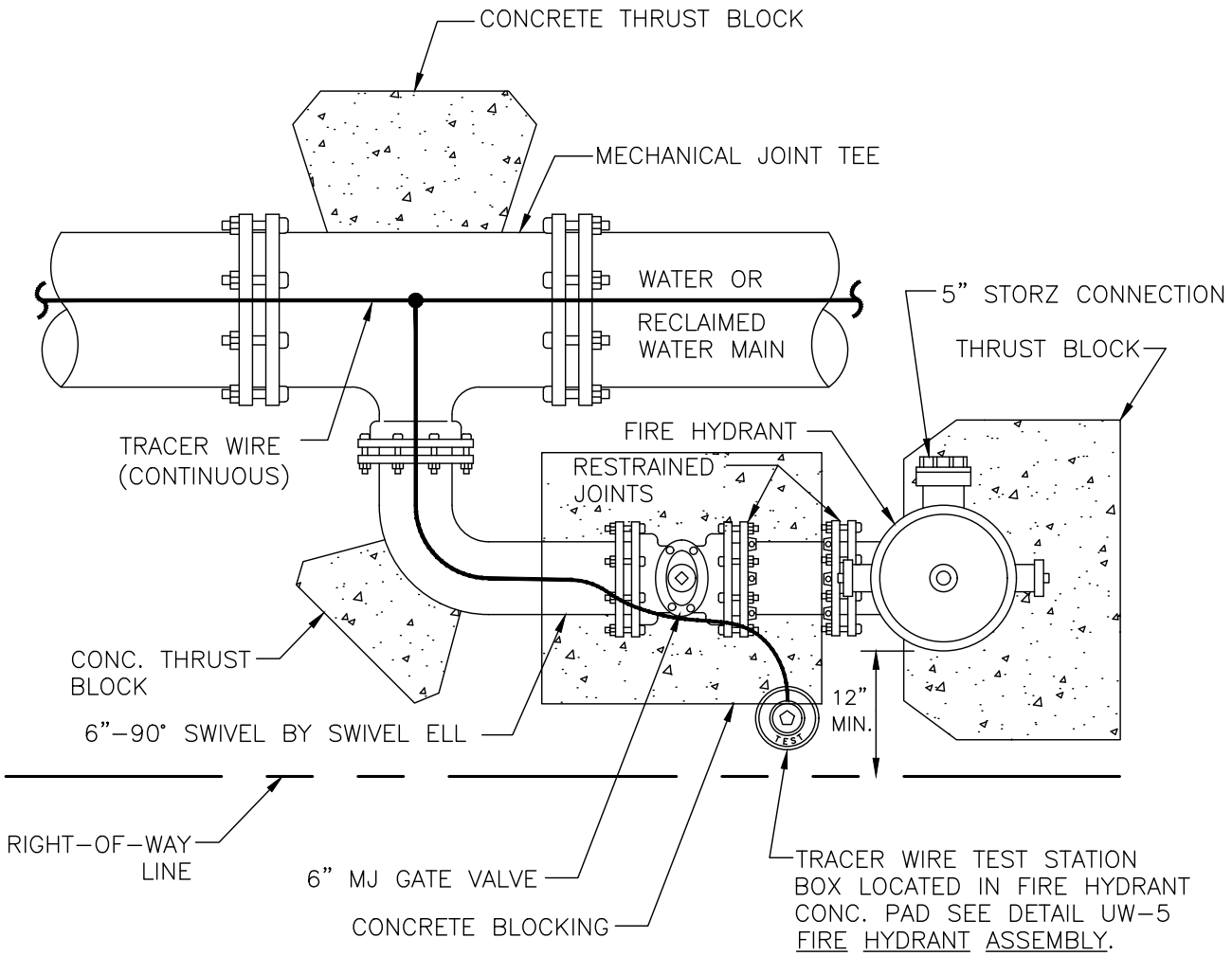


FIG 4.3–5
MULTI–LANE STREET
WITH TURN LANE

NOTES:

1. TWO–WAY STREETS OR ROADS: MARKER SHOULD BE PLACED 6 INCHES FROM EDGE OF PAINTED CENTERLINE ON THE SIDE NEAREST THE FIRE HYDRANT. IF THE STREET HAS NO CENTERLINE, THE MARKER SHOULD BE PLACED 6 INCHES FROM APPROXIMATE CENTER OF THE ROADWAY ON THE SIDE NEAREST THE HYDRANT. SEE FIGURE 4.3–1, 4.3–2, AND 4.3–3.
2. STREETS WITH LEFT TURN LANE AT INTERSECTION: MARKER SHOULD BE PLACED 6 INCHES FROM EDGE OF PAINTED WHITE CHANNELIZING LINE OF THE SIDE NEAREST THE FIRE HYDRANT. SEE FIGURE 4.3–4.
3. STREETS WITH CONTINUOUS TWO–WAY TURN LANE: MARKER SHOULD BE PLACED 6 INCHES FROM THE EDGE OF THE PAINTED YELLOW BARRIER LINE ON THE SIDE NEAREST THE FIRE HYDRANT. SEE FIGURE 4.3–5.
4. MARKER SHALL BE BLUE/BLUE RAISED RETROREFLECTIVE PAVEMENT MARKER.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			HYDRANT LOCATION MARKERS – BLUE (RPMs)	UW–6
REV.BY	DATE			
		DATE OF APPROVAL		



PLAN

NOTES:

1. THIS DETAIL FOR USE ONLY WHEN THE WATER MAIN IS LOCATED TOO CLOSE TO THE RIGHT-OF-WAY LINE TO USE THE FIRE HYDRANT ASSEMBLY DETAIL.
2. SEE STANDARD DETAIL UW-2 GATE VALVE, BOX, LID AND TAG.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT				
REV.BY	DATE		FIRE HYDRANT WITH LOCKED 90° BEND	UW-7
		DATE OF APPROVAL		

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

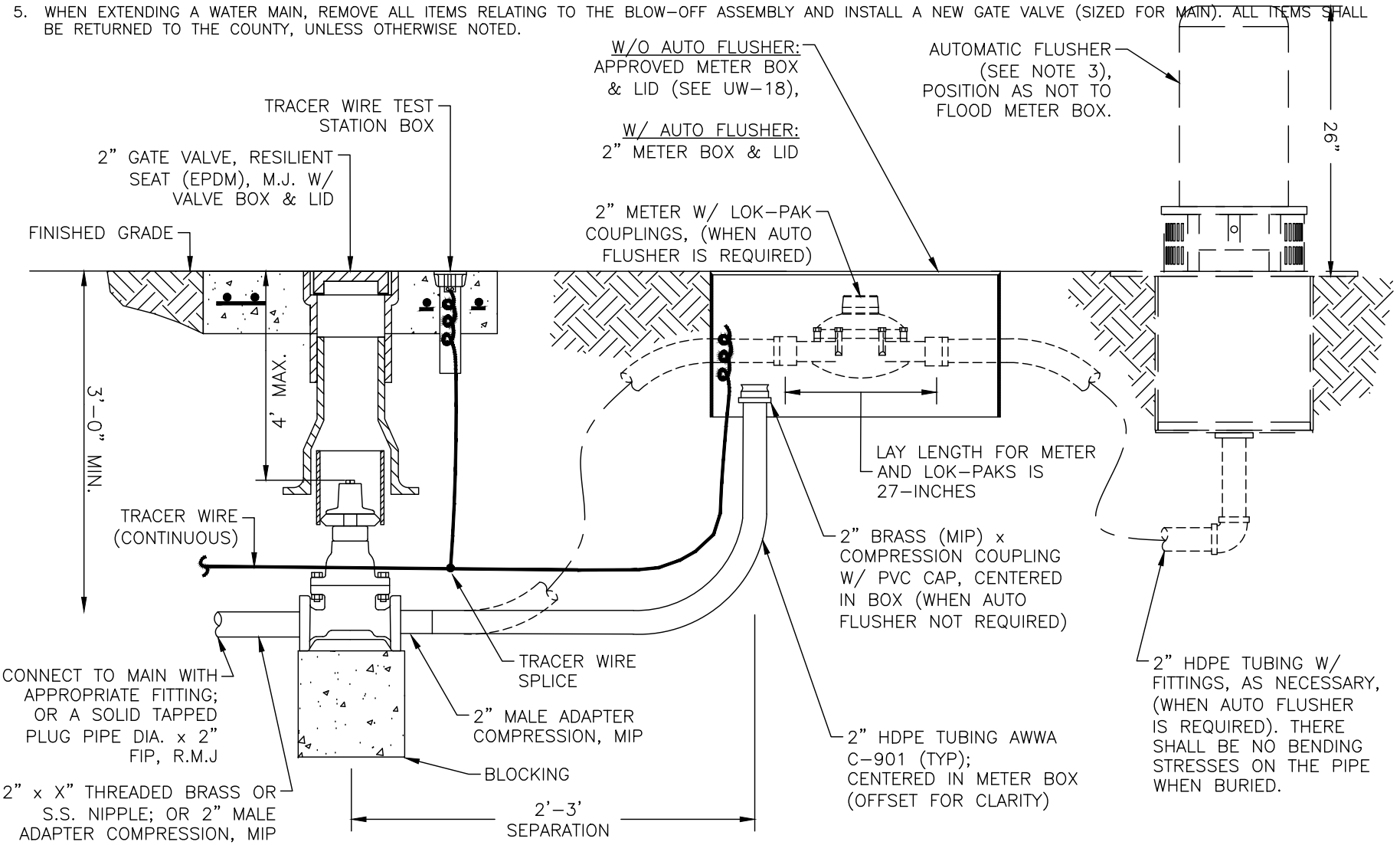
DATE OF APPROVAL

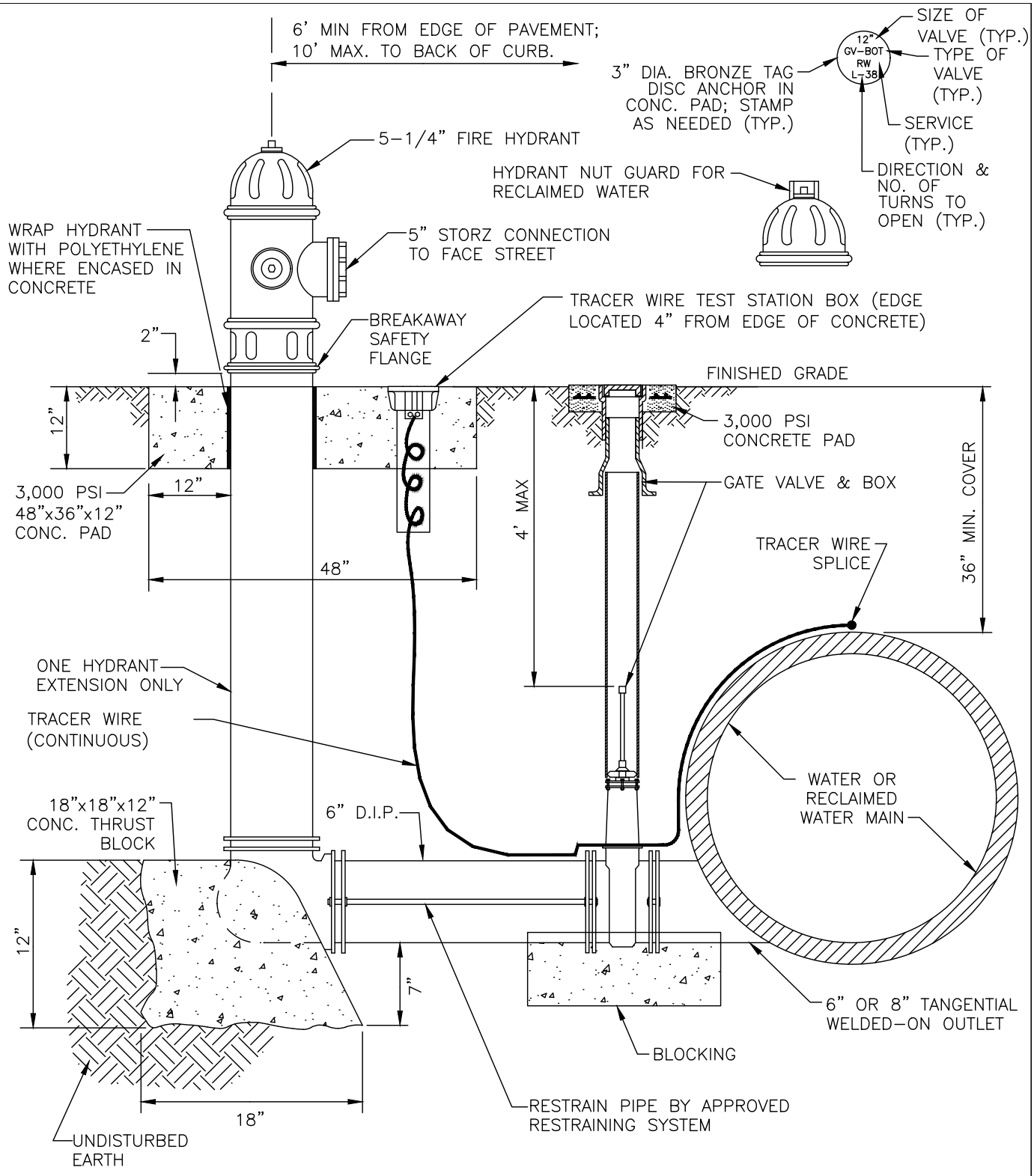
2" BLOW-OFF ASSEMBLY

UW-8

NOTES:

1. ALL DEAD-END WATER MAINS REQUIRE A BLOW-OFF AT THE END, WHETHER TEMPORARY OR PERMANENT.
2. BLOW-OFF VALVE ASSEMBLIES, METER BOXES, AND/OR AUTOMATED FLUSHING DEVICES SHALL NOT BE LOCATED IN DRIVEWAYS OR SIDEWALKS, AND SHALL BE INSTALLED AS CLOSE TO THE LOT LINES AS POSSIBLE.
3. DEAD-END PUBLIC MAINS, WITH MORE THAN A 4-DAY WATER VOLUME TURN-OVER RATE, SHALL REQUIRE A COUNTY-METERED, PRIVATELY OWNED & MAINTAINED AUTOMATIC FLUSHING SYSTEM TO BE INSTALLED WITH AN APPROVED METER BOX/LID, COUNTY METER, AND AN AUTOMATED FLUSHING DEVICE.
4. THE DEVELOPMENT SHALL FURNISH AND MAINTAIN THE FLUSHING DEVICE, INCLUDING ALL ASSOCIATED ITEMS. THE DEVELOPMENT SHALL COORDINATE WITH MANATEE COUNTY LABORATORY PERSONNEL TO ESTABLISH AN APPROVED FLUSHING PLAN TO MAINTAIN WATER QUALITY. ONCE WATER QUALITY CAN BE SUSTAINED BY THE PROPOSED DEVELOPMENT WATER USAGE, THE FLUSHING DEVICE AND ASSOCIATED ITEMS SHALL BE REMOVED. ALL COSTS ASSOCIATED WITH THE FLUSHED WATER SHALL BE THE RESPONSIBILITY OF THE DEVELOPMENT.
5. WHEN EXTENDING A WATER MAIN, REMOVE ALL ITEMS RELATING TO THE BLOW-OFF ASSEMBLY AND INSTALL A NEW GATE VALVE (SIZED FOR MAIN). ALL ITEMS SHALL BE RETURNED TO THE COUNTY, UNLESS OTHERWISE NOTED.

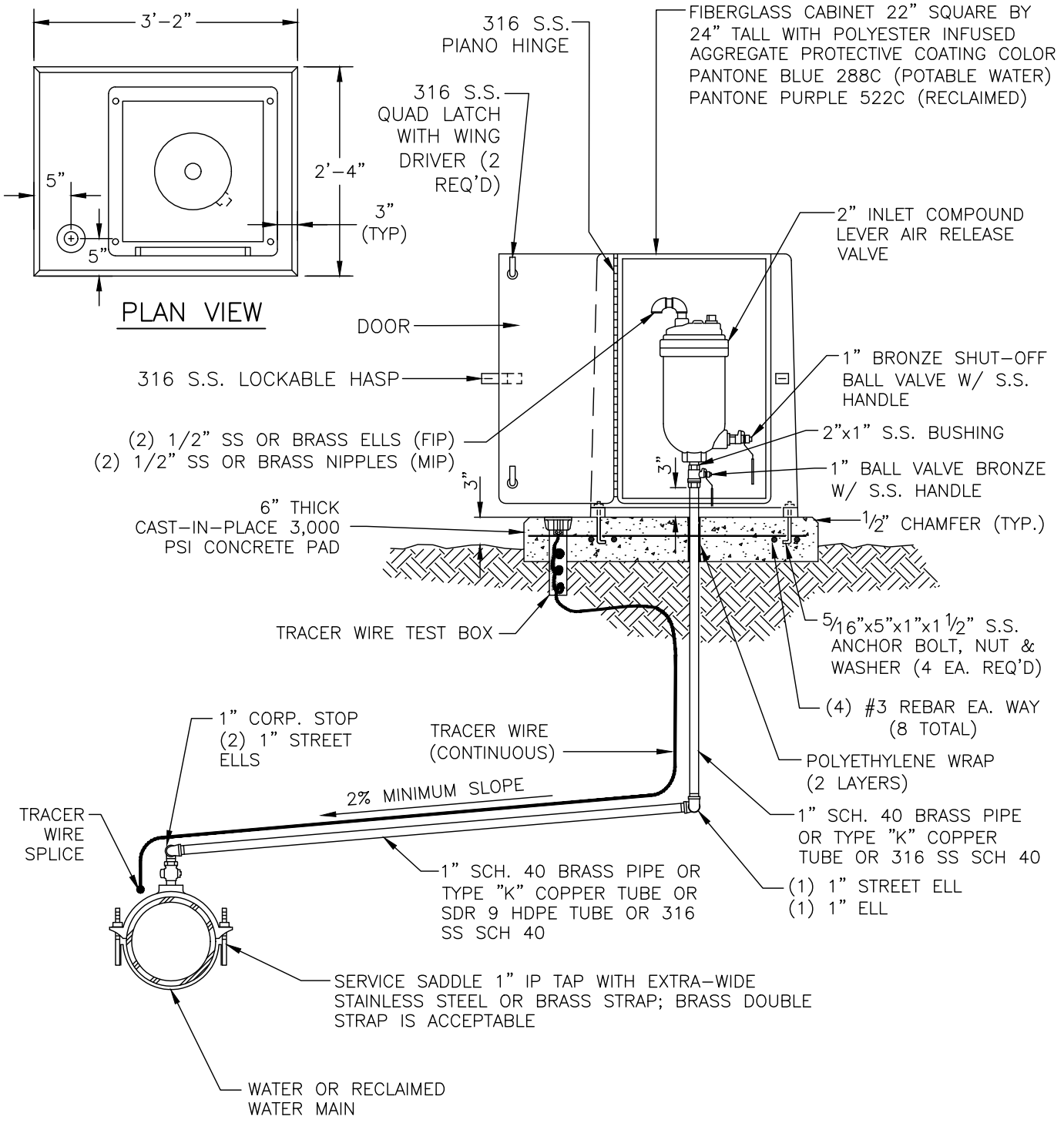




NOTES:

1. FIRE HYDRANT BLOW-OFF ASSEMBLY TO COMPLY WITH NOTES 1-15 OF DETAIL UW-5 FIRE HYDRANT ASSEMBLY DETAIL.
2. TYPICAL LOCATION FOR TANGENTIAL OUTLET IS AT LOW POINT ALONG THE MAIN WHERE SEDIMENTS ACCUMULATE.
3. SEE UW-2 GATE VALVE, BOX, LID AND TAG DETAIL.
4. BRASS TAG SHALL INDICATE FEED IS FROM THE BOTTOM OF THE MAIN, "B.O.T" (BLOW-OFF TANGENT)

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			FIRE HYDRANT BLOW-OFF ASSEMBLY FOR 12" MAINS AND LARGER	UW-9
REV.BY	DATE			
		DATE OF APPROVAL		



NOTES:

1. AIR RELEASE VALVES TO BE INSTALLED AT HIGH POINTS ALONG THE CONSTRUCTED MAINS, WHERE AIR COULD BE TRAPPED.
2. ARV VENT ORIFICE TO BE SIZED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATION FOR WATER MAIN SIZE.
3. ALL INCIDENTAL FITTINGS AND HARDWARE TO BE STAINLESS STEEL, BRASS OR COPPER.
4. ALL PIPE THREADS TO BE SEALED AIR TIGHT.
5. VENT PIPE TO BE LAID ACCURATELY ON SLOPE, WITHOUT HIGH OR LOW POINTS.
6. ARV SHALL BE INSTALLED MINIMUM 6 FT FROM EDGE OF PAVEMENT; 10 FT MAXIMUM FROM BACK OF CURB; 4 FT MIN. MAY BE APPROVED BY UTILITIES IN SOME EXISTING AREAS.

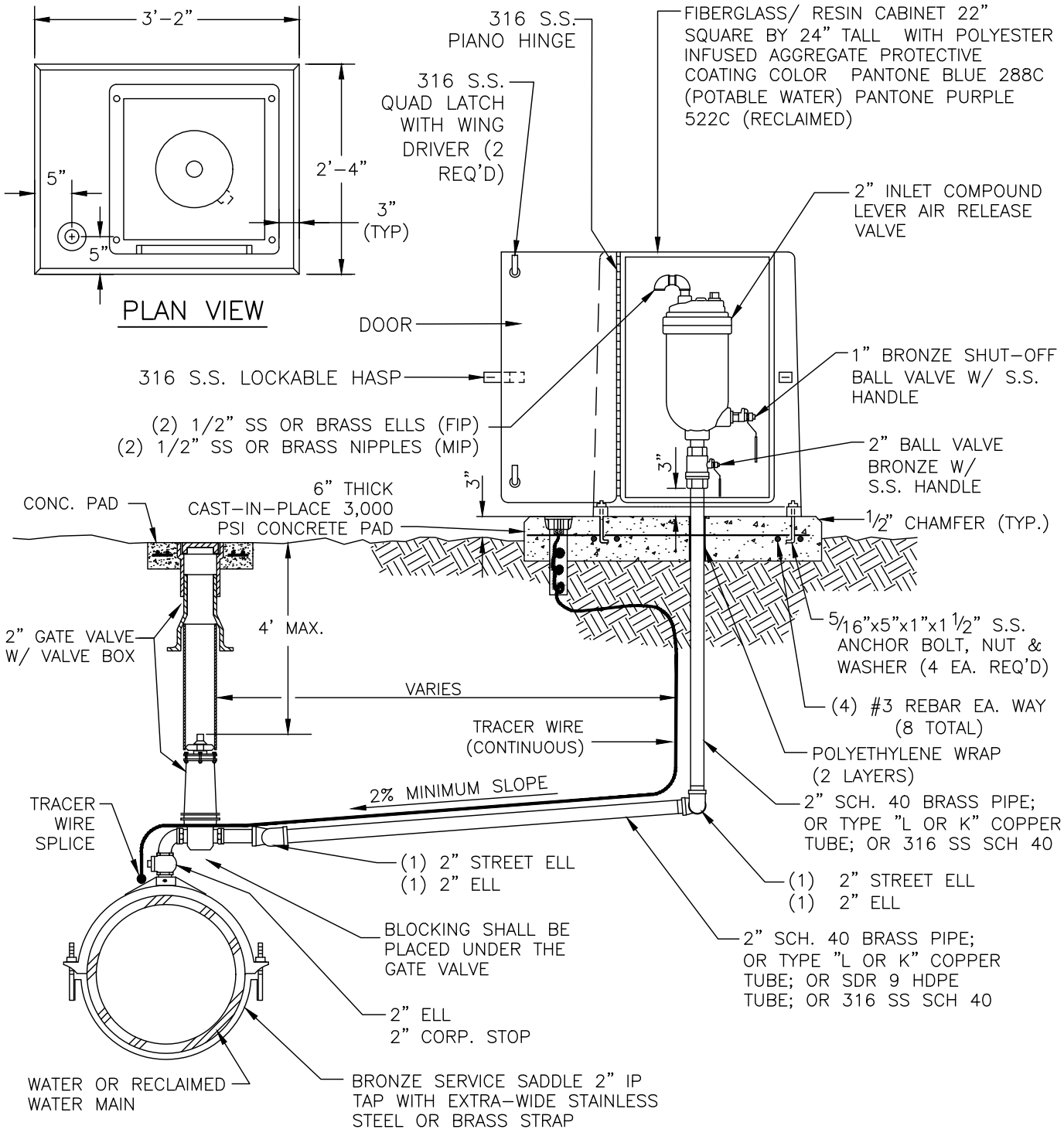
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

ABOVE-GROUND AIR RELEASE VALVE ASSY. FOR 12-INCH AND SMALLER WATER MAINS

UW-10



NOTES:

1. AIR RELEASE VALVES TO BE INSTALLED AT HIGH POINTS ALONG THE MAINS, WHERE ARE COULD BE TRAPPED.
2. ARV VENT ORIFICE TO BE SIZED IN ACCORDANCE WITH MANUFACTURER'S RECOMMENDATION FOR WATER MAIN SIZE.
3. ALL INCIDENTAL FITTINGS AND HARDWARE TO BE STAINLESS STEEL, BRASS OR COPPER.
4. ALL PIPE THREADS TO BE SEALED AIR TIGHT.
6. VENT PIPE TO BE LAID ACCURATELY ON SLOPE, WITHOUT HIGH OR LOW POINTS.
7. ARV SHALL BE INSTALLED MINIMUM 6 FT FROM EDGE OF PAVEMENT; 10 FT MAXIMUM FROM BACK OF CURB; 4 FT MIN. MAY BE APPROVED BY UTILITIES IN SOME EXISTING AREAS.
8. SEE UW-2 GATE VALVE, BOX, LID AND TAG STANDARD DETAIL. CENTERING COLLAR IS NOT REQUIRED ON 2" GATE VALVES.

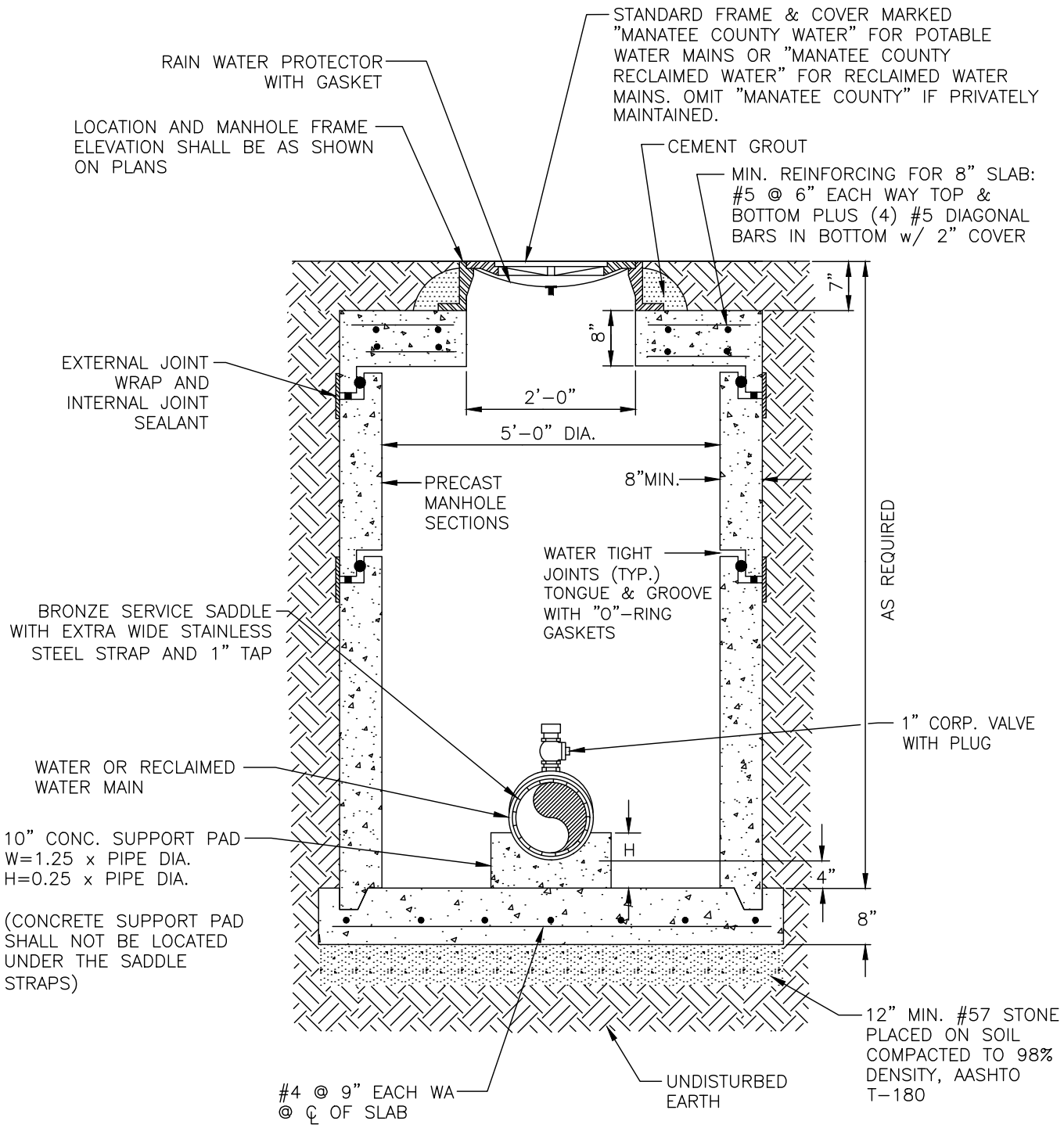
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

ABOVE-GROUND AIR RELEASE VALVE ASSY. FOR 16-INCH AND LARGER MAINS

UW-11



NOTES:

1. AUTOMATIC AIR RELEASE VALVES SHALL NOT BE INSTALLED BELOW GRADE.
2. SADDLE STRAPS, NUTS, BOLTS AND WASHERS TO BE 316 STAINLESS STEEL.
3. MANUALLY OPERATED AIR RELEASE VALVES ARE TO BE INSTALLED AT HIGH POINTS ALONG THE MAINS, WHERE AIR COULD BE TRAPPED.
4. ALL PIPE PENETRATING MANHOLE SHALL HAVE RESILIENT PIPE TO MANHOLE SEALS PER ASTM C-923.

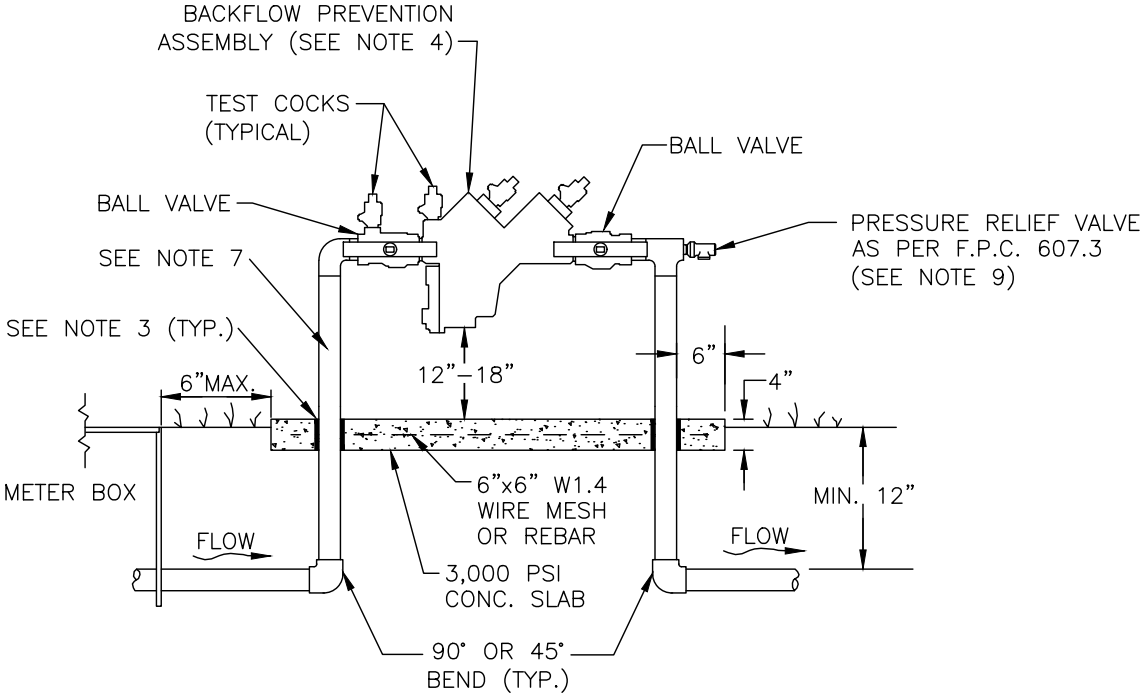
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

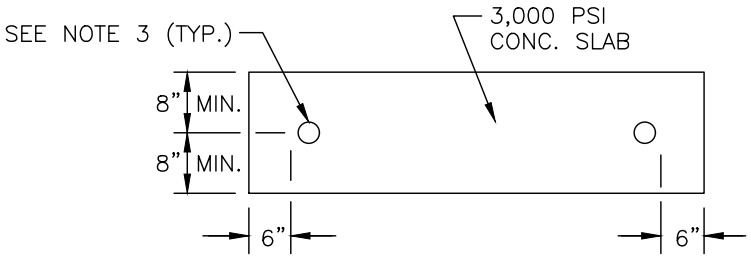
REV.BY	DATE

DATE OF APPROVAL

BELOW GRADE MANUALLY OPERATED AIR RELEASE VALVE

UW-12





NOTES:

1. BACKFLOW PREVENTION ASSEMBLY MUST BE INSTALLED IMMEDIATELY DOWNSTREAM OF METER, AS SHOWN ABOVE
2. COPPER PIPE TYPE "L" (OR "K") OR BRASS PIPE MINIMUM SCHEDULE 40 SHALL BE USED TO A MINIMUM DEPTH OF 12" BELOW GRADE.
3. PIPES PASSING THROUGH CONCRETE SLAB SHALL BE PROPERLY PROTECTED; POLYETHYLENE WRAPPED OR PVC SLEEVED. COPPER SHALL NOT COME IN CONTACT WITH THE CONCRETE.
4. THE SYSTEM MUST MEET ALL REQUIREMENTS OF THE FLORIDA PLUMBING CODE (LATEST EDITION) AND CHAPTER 2–31, ARTICLE X OF THE MANATEE COUNTY CODE OF ORDINANCES.
5. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 1/2".
6. BACKFLOW PREVENTER SHALL BE TESTED AT THE TIME OF INSTALLATION.
7. PRESSURE REDUCING VALVE IS REQUIRED UPSTREAM OF BACKFLOW PREVENTION ASSEMBLY, IF SYSTEM PRESSURE EXCEEDS 80 PSI.
8. 3' MINIMUM CLEARANCE FROM LANDSCAPING PLANTS AND 10' MIN. CLEARANCE FROM TREES TO EDGE OF CONCRETE SLAB AND CLEAR OPENING FOR ACCESS FROM STREET.
9. IN ADDITION TO THE PRV, THE BUILDING DEPT. MAY REQUIRE AN APPROVED DEVICE FOR THERMAL EXPANSION CONTROL DOWNSTREAM OF THE ASSEMBLY.
10. FITTINGS AND CONNECTIONS FOR ABOVE–GROUND INSTALLATIONS SHALL NOT ALLOW ANY MOVEMENT OR ROTATION OF BACKFLOW PREVENTION ASSEMBLY.
11. REFER TO DETAIL US–15 WATER METER & BACKFLOW PREVENTER FOR LIFT STATIONS FOR WATER SERVICE AT SEWAGE PUMPING STATION.
12. BACKFLOW PREVENTION ASSEMBLIES USED FOR POTABLE APPLICATIONS SHALL BE LEAD FREE AS DEFINED IN THE REDUCTION OF LEAD IN DRINKING WATER ACT, SECTION 1417 OF THE SAFE DRINKING WATER ACT, 42 U.S.C. 300g–6, AS MAY BE AMENDED, AND IN COMPLIANCE WITH ALL APPLICABLE REGULATIONS

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			3/4" & 1" BACKFLOW PREVENTION ASSEMBLY	UW–13
REV.BY	DATE			
		DATE OF APPROVAL		

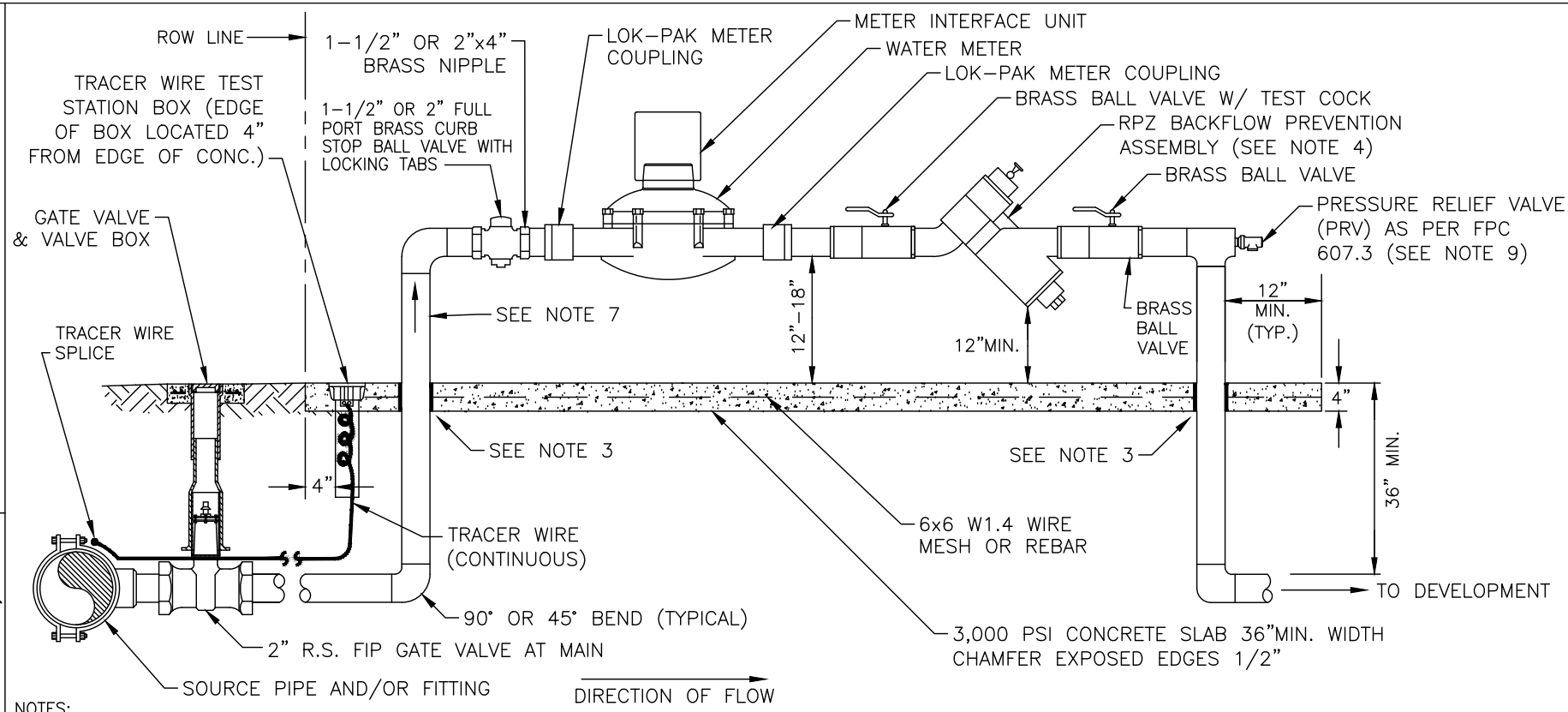
REV.BY | DATE

DATE OF APPROVAL

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

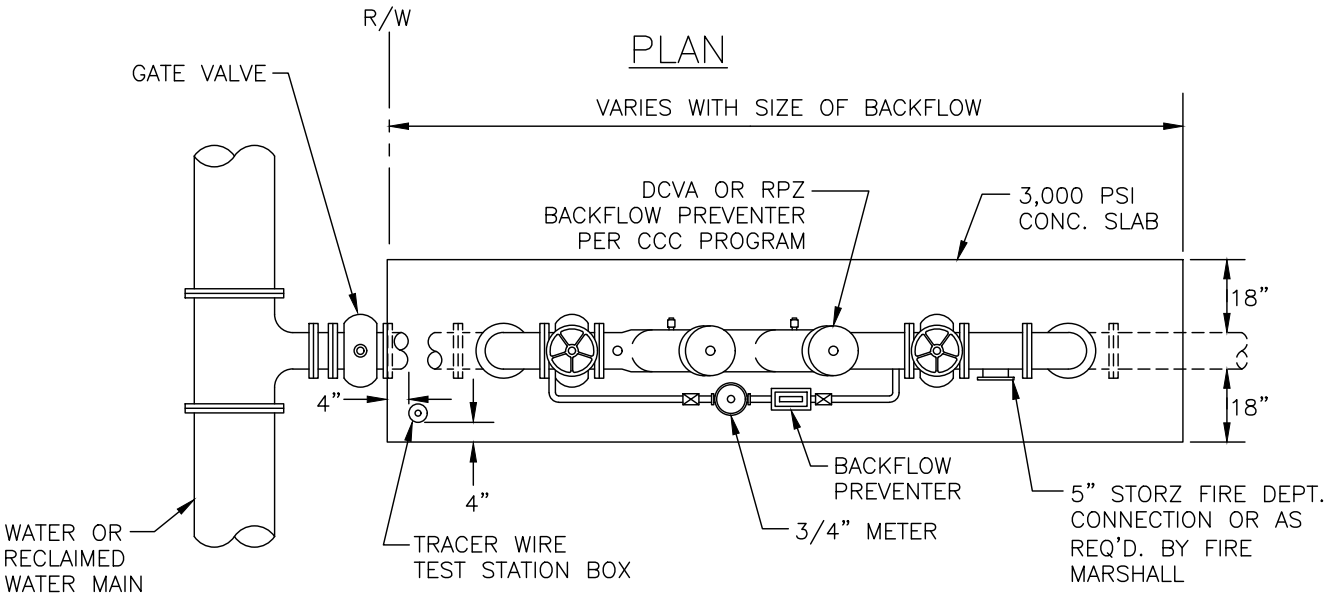
1½" & 2" METER AND BACKFLOW PREVENTION ASSEMBLY

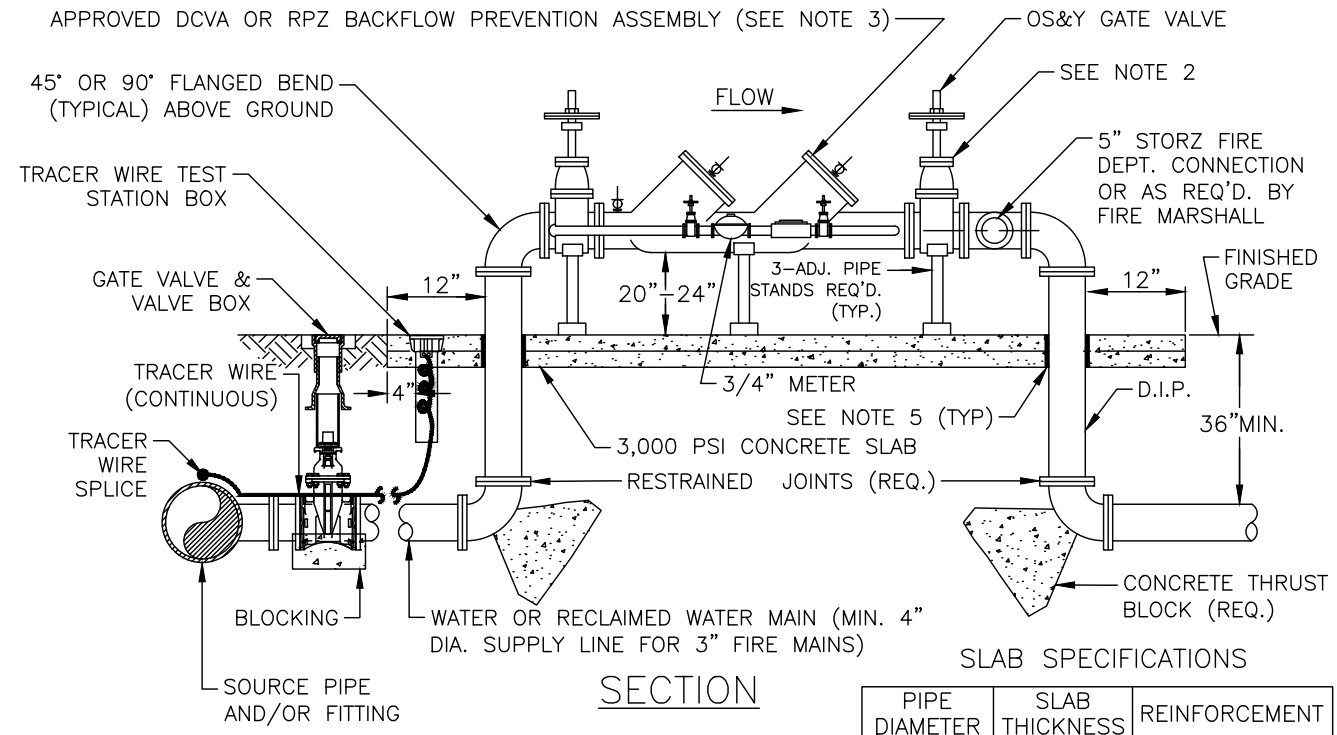
UW-14



NOTES:

1. BACKFLOW PREVENTION ASSEMBLY MUST BE INSTALLED DOWNSTREAM OF METER, AS CLOSE TO METER AS POSSIBLE.
2. COPPER PIPE TYPE "L" (OR "K") OR BRASS PIPE MINIMUM SCHEDULE 40 SHALL BE USED TO A MINIMUM DEPTH OF 36" BELOW GRADE.
3. PIPES THROUGH SLAB AND ALL BELOW-GROUND D.I. PIPE AND FITTINGS SHALL BE POLYETHYLENE WRAPPED.
4. THE SYSTEM MUST MEET ALL REQUIREMENTS OF THE FLORIDA PLUMBING CODE (LATEST EDITION) AND CHAPTER 2-31, ARTICLE X OF THE MANATEE COUNTY CODE OF ORDINANCES.
5. METER, LOCK PACKS AND BRASS NIPPLES WILL BE PROVIDED BY MANATEE COUNTY. INSERT NIPPLES INTO LOCK PACKS HALF WAY.
6. DO NOT PAINT METER OR LOCK PACKS. ALL ABOVE GROUND PIPING SHALL BE PAINTED SAFETY BLUE BY SCOTT PAINT (POTABLE WATER) OR PANTONE PURPLE 522C (RECLAIMED WATER).
7. PRESSURE REDUCING VALVE IS REQUIRED UPSTREAM OF BACKFLOW PREVENTION ASSEMBLY, IF SYSTEM PRESSURE EXCEEDS 80 PSI.
8. 3' MINIMUM CLEARANCE FROM LANDSCAPING PLANTS AND 10' MIN. CLEARANCE FROM TREES TO EDGE OF CONCRETE SLAB AND CLEAR OPENING FOR ACCESS FROM STREET.
9. IN ADDITION TO THE PRV, THE BUILDING DEPT. MAY REQUIRE AN APPROVED DEVICE FOR THERMAL EXPANSION CONTROL DOWNSTREAM OF THE ASSEMBLY.
10. BACKFLOW PREVENTION ASSEMBLY IS ONLY REQUIRED ON RECLAIMED WATER LINE WHEN IRRIGATION SYSTEM INCLUDES CHEMICAL OR FERTILIZER INJECTION METHODS. WHEN BACKFLOW PREVENTION ASSEMBLY IS NOT REQUIRED, A 12" MINIMUM NIPPLE AND A BALL VALVE SHALL BE INSTALLED.
11. ALL ABOVE-GROUND ANCILLARY BOLTS, NUTS, WASHERS, & FASTENERS SHALL BE 316 STAINLESS STEEL. ALL BURIED SHALL BE MIN. 304 STAINLESS STEEL.
12. FITTINGS AND CONNECTION FOR ABOVE-GROUND INSTALLATIONS SHALL NOT ALLOW ANY MOVEMENT OR ROTATION OF THE BACKFLOW PREVENTION ASSEMBLIES.
13. SEE UW-2 GATE VALVE, BOX, LID AND TAG DETAIL. CENTERING COLLAR NOT REQUIRED ON 2" OR SMALLER VALVES.
14. BACKFLOW PREVENTION ASSEMBLIES USED FOR POTABLE APPLICATIONS SHALL BE LEAD FREE AS DEFINED IN THE REDUCTION OF LEAD IN DRINKING WATER ACT, SECTION 1417 OF THE SAFE DRINKING WATER ACT, 42 U.S.C. 300g-6, AS MAY BE AMENDED, AND IN COMPLIANCE WITH ALL APPLICABLE REGULATIONS.
15. FOR USE WHERE BACKFLOW PREVENTION ASSEMBLY IS REQUIRED WITH METER.
16. WHERE MULTIPLE METER AND BACKFLOW PREVENTION ASSEMBLIES ARE INSTALLED, A BELOW GRADE ISOLATION VALVE SHALL BE PROVIDED FOR EACH ASSEMBLY.





SECTION

SLAB SPECIFICATIONS

PIPE DIAMETER	SLAB THICKNESS	REINFORCEMENT
2" TO 10"	4"	6x6 W1.4 WIRE MESH*
12" TO 18"	4"	6x6 W3 WIRE MESH*

* REBAR MAY BE USED.

NOTES:

1. THIS DETAIL FOR FIRE PROTECTION ONLY.
2. WHEN PRESSURE TESTING FIRE LINE, TEST AGAINST DOWNSTREAM GATE VALVE.
3. THE SYSTEM MUST MEET ALL REQUIREMENTS OF THE FLORIDA PLUMBING CODE (LATEST EDITION), CHAPTER 2–31, ARTICLE X OF THE MANATEE COUNTY CODE OF ORDINANCES, AND THE MANATEE COUNTY FIRE MARSHALL REQUIREMENTS.
4. ABOVE GROUND PIPING SHALL BE FLANGED DUCTILE IRON CLASS 53.
5. PIPE THROUGH SLAB AND ALL BELOW–GROUND D.I. PIPE AND FITTINGS SHALL BE POLYETHYLENE WRAPPED.
6. ALL EXPOSED EDGES OF CONCRETE SHALL HAVE 1/2" CHAMFER.
7. THE EDGE OF THE CONCRETE SLAB SHALL BE 6 FEET MIN. FROM LANDSCAPE VEGETATION AND ABOVEGROUND OBJECTS; AND 10 FEET FROM TREES. STREET SIDE OF ASSEMBLY SHALL REMAIN OPEN.
8. ALL ABOVE–GROUND ANCILLARY BOLTS, NUTS, WASHERS, & FASTENERS SHALL BE 316 STAINLESS STEEL. ALL BURIED SHALL BE MIN. 304 STAINLESS STEEL.
9. SEE UW–2 GATE VALVE, BOX, LID AND TAG DETAIL.
10. PIPE STANDS SHALL BE BOLTED TO SLAB.
11. ABOVE GROUND PIPING SHALL BE PAINTED SAFETY RED
12. REFER TO 1.1.1.C IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL FOR FURTHER DETAILS.
13. WHERE MULTIPLE AND BACKFLOW PREVENTION ASSEMBLIES ARE INSTALLED, A BELOW GRADE ISOLATION VALVE SHALL BE PROVIDED FOR EACH ASSEMBLY.

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

2" AND ABOVE FIRE LINE BACKFLOW PREVENTION ASSEMBLY

UW–15

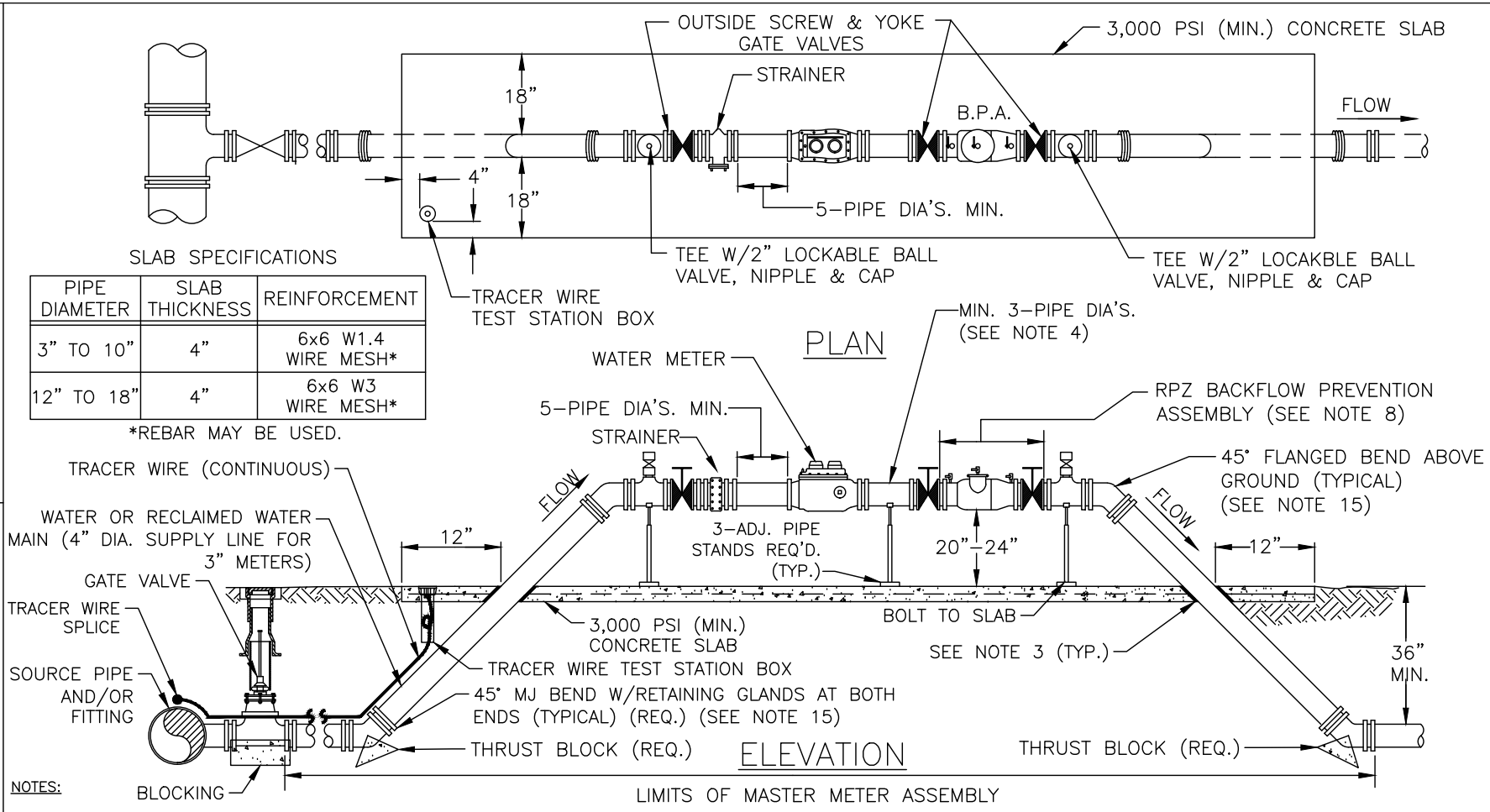
REV.BY | DATE

DATE OF APPROVAL

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

3" AND ABOVE MASTER METER

UW-16



SLAB SPECIFICATIONS

PIPE DIAMETER	SLAB THICKNESS	REINFORCEMENT
3" TO 10"	4"	6x6 W1.4 WIRE MESH*
12" TO 18"	4"	6x6 W3 WIRE MESH*

*REBAR MAY BE USED.

NOTES:

1. ABOVE GROUND PIPING SHALL BE FLANGED DUCTILE IRON CLASS 53, PAINTED SAFETY BLUE BY SCOTT PAINT FOR POTABLE WATER OR PANTONE 522C FOR RECLAIMED WATER.
2. METER ASSEMBLY SHALL BE INSTALLED LEVEL AND PRESSURE TESTED AGAINST UPSTREAM GATE VALVE.
3. PIPE THROUGH SLAB AND ALL BELOW GROUND D.I. PIPE AND FITTINGS SHALL BE POLYETHYLENE WRAPPED.
4. TEE & 2" BALL VALVE (POINTING UP) RIGHT AFTER METER IS REQUIRED ON IRRIGATION TURBINE METERS. TEE IS NOT REQUIRED ON COMPOUND METERS.
5. FIRE SERVICE METER TO BE USED ONLY WHEN POTABLE WATER AND FIRE PROTECTION ARE SUPPLIED THROUGH A SINGLE POTABLE WATER LINE. SEE UW-16A 6"-10" FIRE/POTABLE COMBINATION METER.
6. ALL EXPOSED EDGES OF CONCRETE SHALL HAVE 1/2" CHAMFER.
7. THE EDGE OF THE CONCRETE SLAB SHALL BE 6 FEET MIN. FROM LANDSCAPE VEGETATION AND ABOVEGROUND OBJECTS; AND 10 FEET FROM TREES. STREET SIDE OF ASSEMBLY SHALL REMAIN OPEN.
8. A BACKFLOW PREVENTION ASSEMBLY IS NOT REQUIRED ON RECLAIMED WATER MASTER METER ASSEMBLY, EXCEPT WHERE FERTILIZER OR CHEMICAL INJECTION METHODS WILL BE IN USE. BACKFLOW PREVENTION ASSEMBLY SHALL MEET REQUIREMENTS OF CHAPTER 2-31, ARTICLE X OF THE MANATEE COUNTY CODE OF ORDINANCES.
9. ALL ABOVE-GROUND ANCILLARY BOLTS, NUTS, WASHERS, & FASTENERS SHALL BE 316 STAINLESS STEEL. ALL BURIED SHALL BE MIN. 304 STAINLESS STEEL.
10. BALL VALVES SHALL BE FULL PORT WITH LOCKING TABS.
11. COUNTY WILL PROVIDE STRAINER AND METER. ALL OTHER VALVES, PIPE, FITTINGS AND BACKFLOW PREVENTER TO BE PROVIDED BY SITE CONTRACTOR.
12. BACKFLOW PREVENTION ASSEMBLY USED FOR POTABLE APPLICATIONS SHALL BE LEAD FREE AS DEFINED IN THE REDUCTION OF LEAD IN DRINKING WATER ACT, SECTION 1417 OF THE SAFE DRINKING WATER ACT, 42 U.S.C. 300g-6, AS MAY BE AMENDED, AND IN COMPLIANCE WITH ALL APPLICABLE REGULATIONS.
13. REFER TO 1.1.1.C IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL FOR FURTHER DETAILS.
14. WHERE MULTIPLE METER AND BACKFLOW PREVENTION ASSEMBLIES ARE INSTALLED, A BELOW GRADE ISOLATION VALVE SHALL BE PROVIDED FOR EACH ASSEMBLY.
15. SHOULD THERE BE INSUFFICIENT ROOM TO INSTALL THE METER ASSEMBLY, 90° BENDS AND TEES MAY BE USED AS SHOWN IN UW-17 REPLACEMENT FOR 3" AND ABOVE MASTER METER

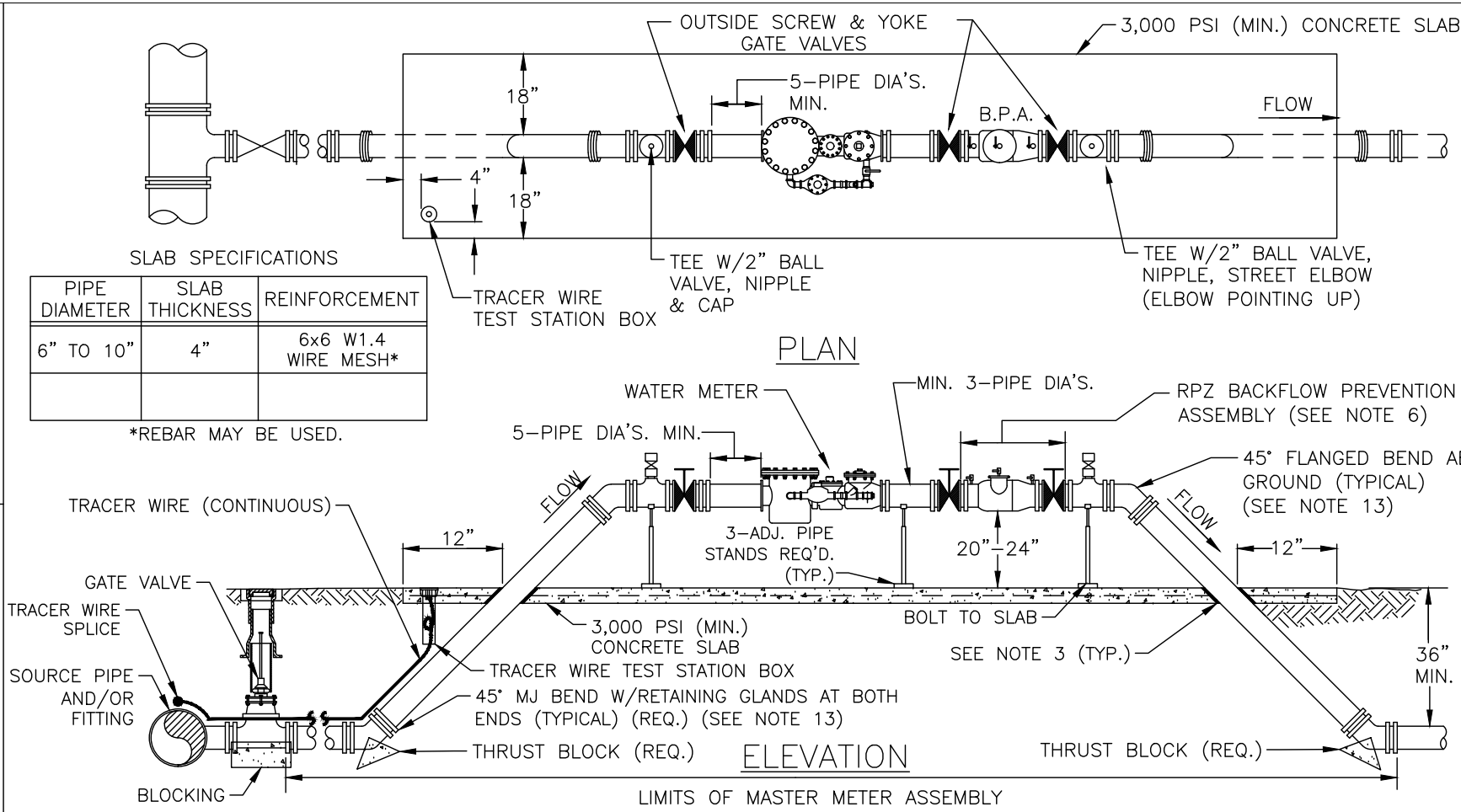
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

6" – 10" MASTER FIRE/POTABLE COMBINATION METER

UW – 16A



SLAB SPECIFICATIONS

PIPE DIAMETER	SLAB THICKNESS	REINFORCEMENT
6" TO 10"	4"	6x6 W1.4 WIRE MESH*

*REBAR MAY BE USED.

NOTES:

1. ABOVE GROUND PIPING SHALL BE FLANGED DUCTILE IRON CLASS 53, PAINTED SAFETY BLUE BY SCOTT PAINT FOR POTABLE WATER OR PANTONE 522C FOR RECLAIMED WATER.
2. METER ASSEMBLY SHALL BE INSTALLED LEVEL AND PRESSURE TESTED AGAINST UPSTREAM GATE VALVE.
3. PIPE THROUGH SLAB AND ALL BELOW GROUND D.I. PIPE AND FITTINGS SHALL BE POLYETHYLENE WRAPPED.
4. ALL EXPOSED EDGES OF CONCRETE SHALL HAVE 1/2" CHAMFER.
5. THE EDGE OF THE CONCRETE SLAB SHALL BE 6 FEET MIN. FROM LANDSCAPE VEGETATION AND ABOVEGROUND OBJECTS; AND 10 FEET FROM TREES. STREET SIDE OF ASSEMBLY SHALL REMAIN OPEN.
6. A BACKFLOW PREVENTION ASSEMBLY IS NOT REQUIRED ON RECLAIMED WATER MASTER METER ASSEMBLY, EXCEPT WHERE FERTILIZER OR CHEMICAL INJECTION METHODS WILL BE IN USE. BACKFLOW PREVENTION ASSEMBLY SHALL MEET REQUIREMENTS OF CHAPTER 2–31, ARTICLE X OF THE MANATEE COUNTY CODE OF ORDINANCES.
7. ALL ABOVE–GROUND ANCILLARY BOLTS, NUTS, WASHERS, & FASTENERS SHALL BE 316 STAINLESS STEEL. ALL BURIED SHALL BE MIN. 304 STAINLESS STEEL.
8. BALL VALVES SHALL BE FULL PORT WITH LOCKING TABS.
9. COUNTY WILL PROVIDE METER. ALL OTHER VALVES, PIPE, FITTINGS AND BACKFLOW PREVENTER TO BE PROVIDED BY SITE CONTRACTOR.
10. BACKFLOW PREVENTION ASSEMBLY USED FOR POTABLE APPLICATIONS SHALL BE LEAD FREE AS DEFINED IN THE REDUCTION OF LEAD IN DRINKING WATER ACT, SECTION 1417 OF THE SAFE DRINKING WATER ACT, 42 U.S.C. 300g–6, AS MAY BE AMENDED, AND IN COMPLIANCE WITH ALL APPLICABLE REGULATIONS.
11. REFER TO 1.1.1.C IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL FOR FURTHER DETAILS.
12. WHERE MULTIPLE METER AND BACKFLOW PREVENTION ASSEMBLIES ARE INSTALLED, A BELOW GRADE ISOLATION VALVE SHALL BE PROVIDED FOR EACH ASSEMBLY.
13. SHOULD THERE BE INSUFFICIENT ROOM TO INSTALL THE METER ASSEMBLY, 90° BENDS AND TEES MAY BE USED AS SHOWN IN UW–17A REPLACEMENT FOR 3" AND ABOVE MASTER METER

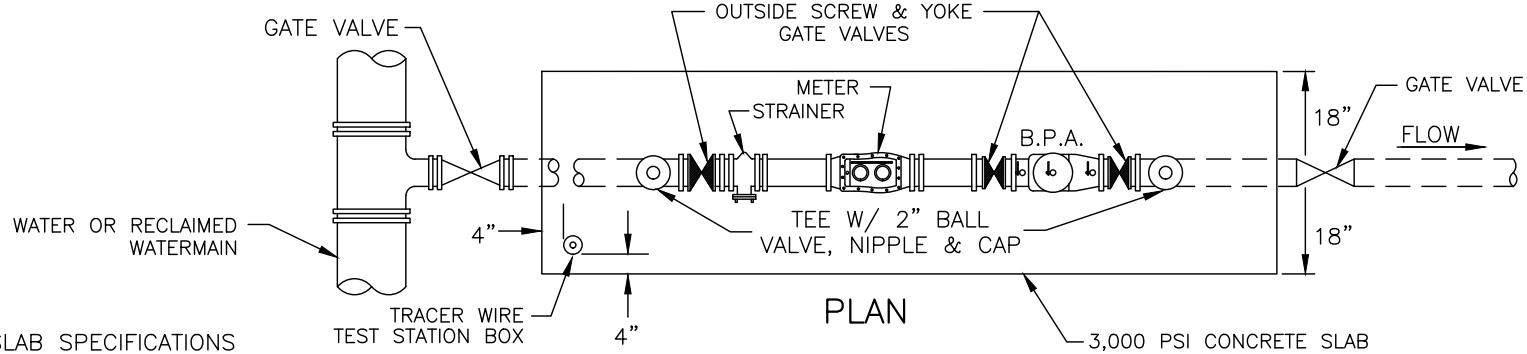
REV.BY | DATE

DATE OF APPROVAL

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REPLACEMENT FOR 3" AND ABOVE MASTER METER

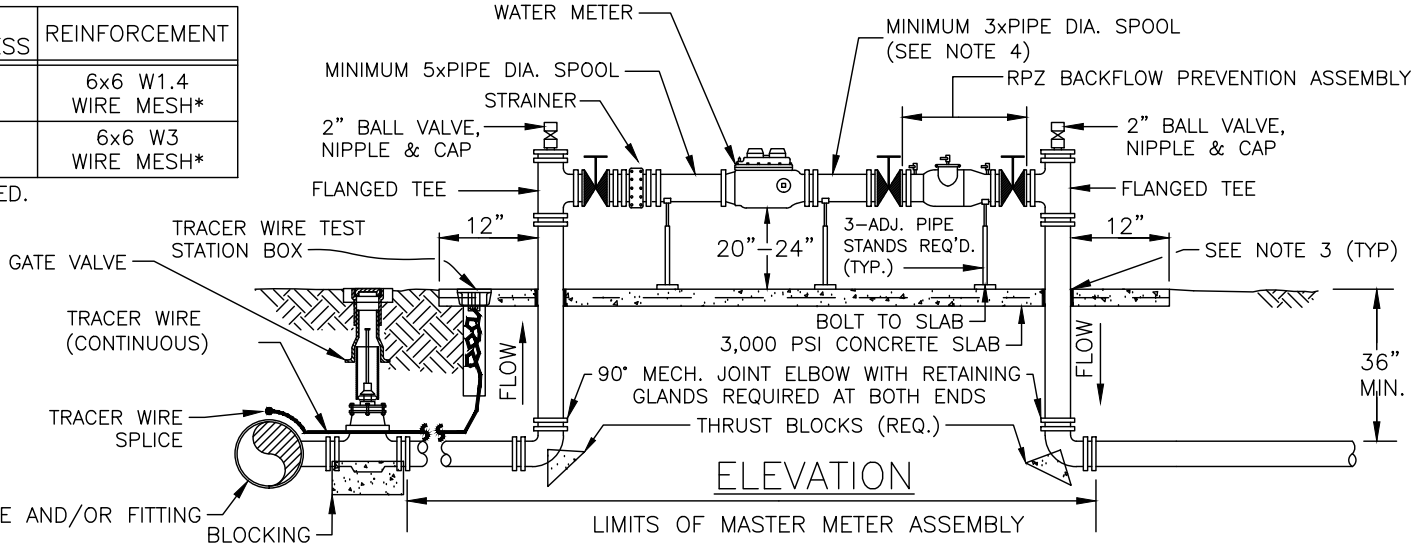
UW-17



SLAB SPECIFICATIONS

PIPE DIAMETER	SLAB THICKNESS	REINFORCEMENT
3" TO 10"	4"	6x6 W1.4 WIRE MESH*
12" TO 18"	4"	6x6 W3 WIRE MESH*

*REBAR MAY BE USED.



NOTES:

1. ABOVE GROUND PIPING SHALL BE FLANGED DUCTILE IRON CLASS 53, PAINTED SAFETY BLUE BY SCOTT PAINT FOR POTABLE WATER OR PANTONE 522C PURPLE FOR RECLAIMED WATER.
2. METER ASSEMBLY SHALL BE INSTALLED LEVEL AND PRESSURE TESTED AGAINST UPSTREAM GATE VALVE.
3. PIPE THROUGH SLAB AND ALL BELOW GROUND D.I. PIPE AND FITTINGS SHALL BE POLYETHYLENE WRAPPED.
4. TEE & 2" BALL VALVE (POINTING UP) RIGHT AFTER METER IS REQUIRED ON IRRIGATION TURBINE METERS. TEE IS NOT REQUIRED ON COMPOUND METERS.
5. FIRE SERVICE METER TO BE USED ONLY WHEN POTABLE WATER AND FIRE PROTECTION ARE SUPPLIED THROUGH A SINGLE POTABLE WATER LINE. SEE UW-17A REPLACEMENT FOR 6"-10" FIRE/POTABLE COMBINATION METER.
6. ALL EXPOSED EDGES OF CONCRETE SHALL HAVE 1/2" CHAMFER.
7. THE EDGE OF THE CONCRETE SLAB SHALL BE 6 FEET MIN. FROM LANDSCAPE VEGETATION AND ABOVEGROUND OBJECTS; AND 10 FEET FROM TREES. STREET SIDE OF ASSEMBLY SHALL REMAIN OPEN.
8. BACKFLOW PREVENTER IS NOT REQUIRED ON RECLAIMED WATER MASTER METER ASSEMBLY, EXCEPT WHERE FERTILIZER OR CHEMICAL INJECTION METHODS WILL BE IN USE. WHEN BACKFLOW PREVENTION ASSEMBLY IS NOT REQUIRED, A SPOOL PIECE OF SAME LAY LENGTH AND AN OS&Y VALVE SHALL BE INSTALLED. BACKFLOW PREVENTION ASSEMBLIES SHALL MEET REQUIREMENTS OF CHAPTER 2-31, ARTICLE X OF THE MANATEE COUNTY CODE OF ORDINANCES.
9. ALL ABOVE-GROUND ANCILLARY BOLTS, NUTS, WASHERS, & FASTENERS SHALL BE 316 STAINLESS STEEL. ALL BURIED SHALL BE MIN. 304 STAINLESS STEEL.
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13. REFER TO 1.1.1.C IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL FOR FURTHER DETAILS.
14. WHERE MULTIPLE METER AND BACKFLOW PREVENTION ASSEMBLIES ARE INSTALLED, A BELOW GRADE ISOLATION VALVE SHALL BE PROVIDED FOR EACH ASSEMBLY.
15. TRACER WIRE TEST STATION BOX NOT REQUIRED FOR REPLACEMENT MASTER METER IF THE EXISTING PIPING TO THE EXISTING METER ASSEMBLY DID NOT HAVE A TRACER WIRE.

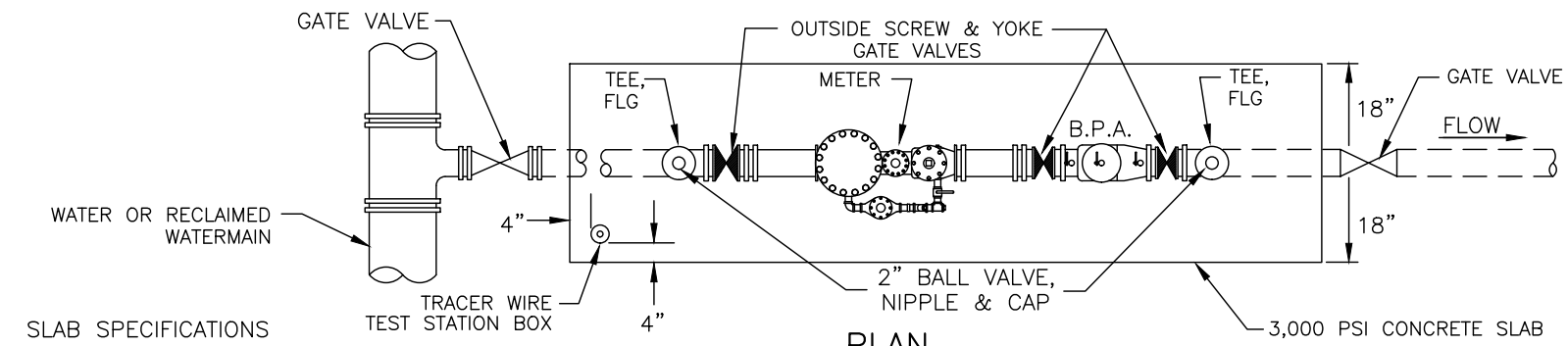
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

REPLACEMENT FOR 6"–10" MASTER FIRE/POTABLE COMBINATION METER

UW–17A

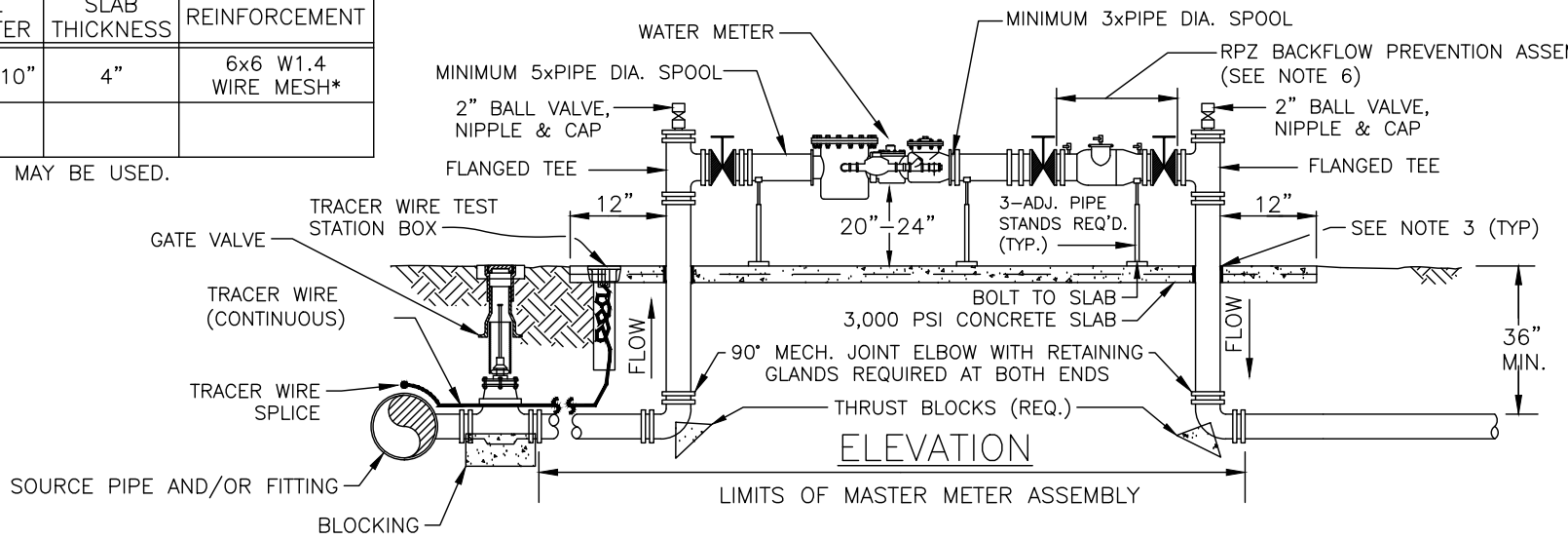


PLAN

SLAB SPECIFICATIONS

PIPE DIAMETER	SLAB THICKNESS	REINFORCEMENT
6" TO 10"	4"	6x6 W1.4 WIRE MESH*

*REBAR MAY BE USED.



NOTES:

1. ABOVE GROUND PIPING SHALL BE FLANGED DUCTILE IRON CLASS 53, PAINTED SAFETY BLUE BY SCOTT PAINT FOR POTABLE WATER OR PANTONE 522C PURPLE FOR RECLAIMED WATER.
2. METER ASSEMBLY SHALL BE INSTALLED LEVEL AND PRESSURE TESTED AGAINST UPSTREAM GATE VALVE.
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4. ALL EXPOSED EDGES OF CONCRETE SHALL HAVE 1/2" CHAMFER.
5. THE EDGE OF THE CONCRETE SLAB SHALL BE 6 FEET MIN. FROM LANDSCAPE VEGETATION AND ABOVEGROUND OBJECTS; AND 10 FEET FROM TREES. STREET SIDE OF ASSEMBLY SHALL REMAIN OPEN.
6. BACKFLOW PREVENTER IS NOT REQUIRED ON RECLAIMED WATER MASTER METER ASSEMBLY, EXCEPT WHERE FERTILIZER OR CHEMICAL INJECTION METHODS WILL BE IN USE. WHEN BACKFLOW PREVENTION ASSEMBLY IS NOT REQUIRED, A SPOOL PIECE OF SAME LAY LENGTH AND AN OS&Y VALVE SHALL BE INSTALLED. BACKFLOW PREVENTION ASSEMBLIES SHALL MEET REQUIREMENTS OF CHAPTER 2–31, ARTICLE X OF THE MANATEE COUNTY CODE OF ORDINANCES.
7. ALL ABOVE–GROUND ANCILLARY BOLTS, NUTS, WASHERS, & FASTENERS SHALL BE 316 STAINLESS STEEL. ALL BURIED SHALL BE MIN. 304 STAINLESS STEEL.
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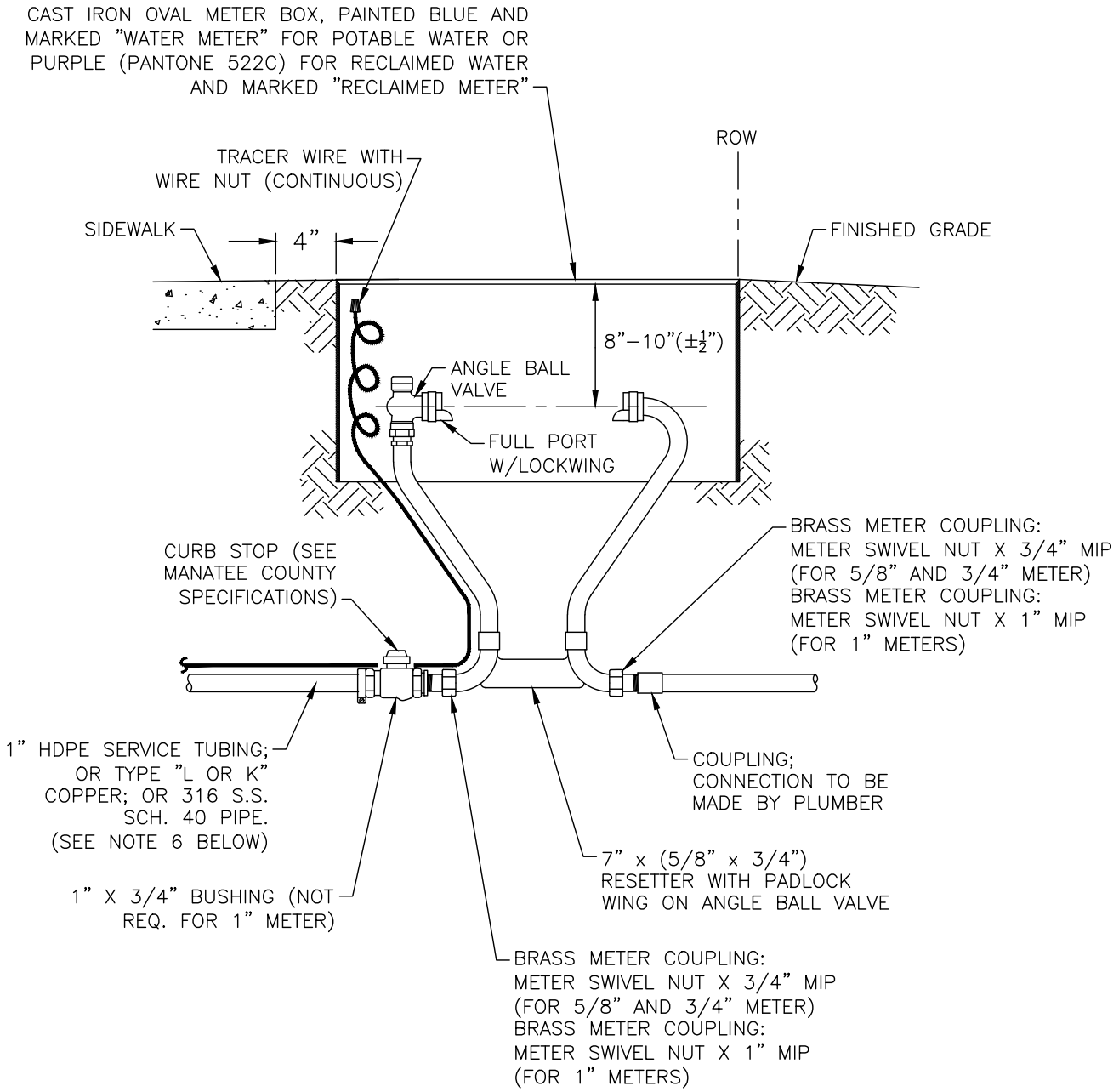
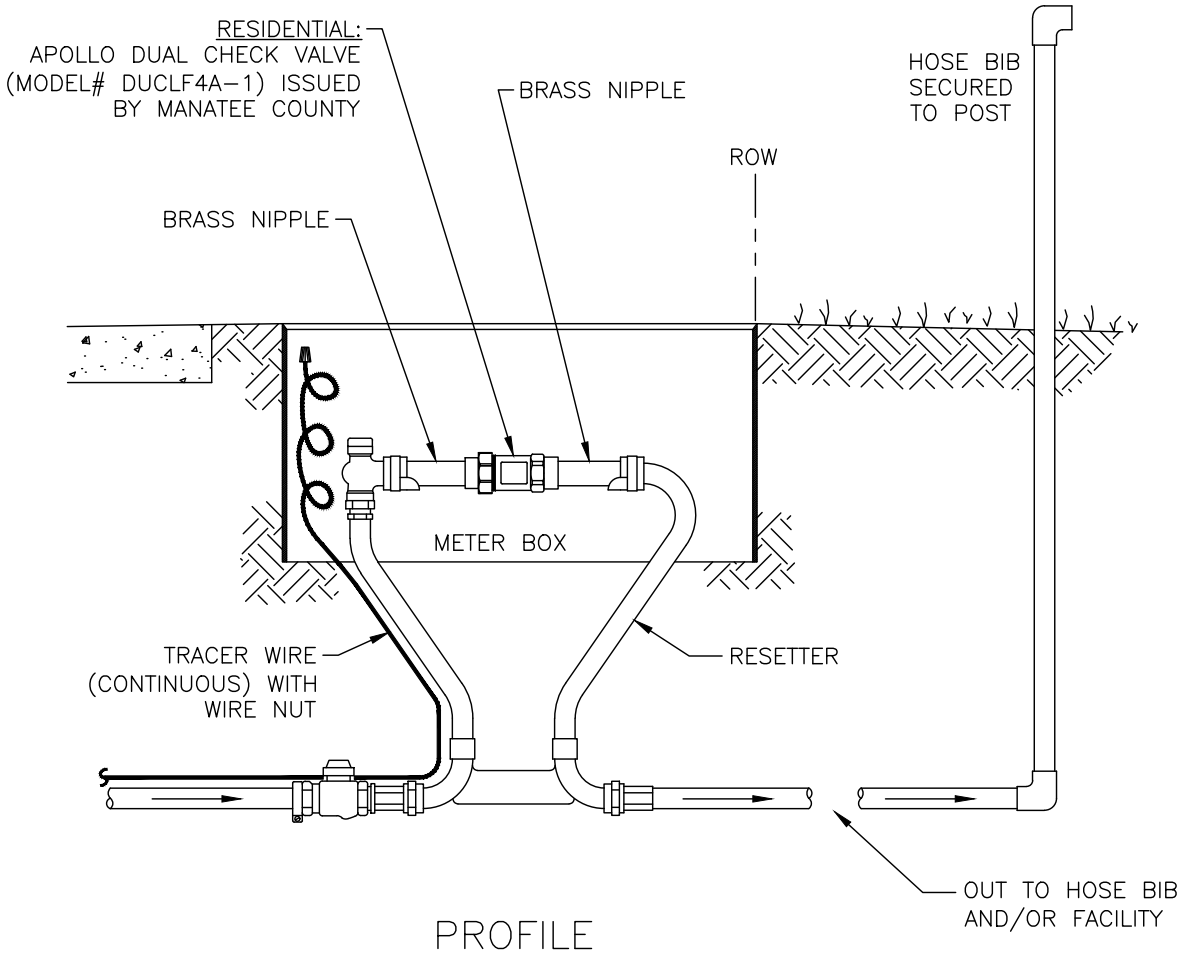
9. COUNTY WILL PROVIDE METER. ALL OTHER VALVES, PIPE, FITTINGS AND BACKFLOW PREVENTER TO BE PROVIDED BY SITE CONTRACTOR.
10. BACKFLOW PREVENTION ASSEMBLIES USED FOR POTABLE APPLICATIONS SHALL BE LEAD FREE AS DEFINED IN THE REDUCTION OF LEAD IN DRINKING WATER ACT, SECTION 1417 OF THE SAFE DRINKING WATER ACT, 42 U.S.C. 300g–6, AS MAY BE AMENDED, AND IN COMPLIANCE WITH ALL APPLICABLE REGULATIONS.
11. REFER TO 1.1.1.C IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL FOR FURTHER DETAILS.
12. WHERE MULTIPLE METER AND BACKFLOW PREVENTION ASSEMBLIES ARE INSTALLED, A BELOW GRADE ISOLATION VALVE SHALL BE PROVIDED FOR EACH ASSEMBLY.
13. TRACER WIRE TEST STATION BOX NOT REQUIRED FOR REPLACEMENT MASTER METER IF THE EXISTING PIPING TO THE EXISTING METER ASSEMBLY DID NOT HAVE A TRACER WIRE.



NOTES:

1. METER BOX AND RESETTER ARE TO BE INSTALLED BY THE INFRASTRUCTURE CONTRACTOR AND SHALL NOT BE SET IN DRAINAGE SWALES, SIDEWALKS OR DRIVEWAYS. WITH PRIOR APPROVAL BY COUNTY, METER BOXES WITH LOCKABLE LIDS MAY BE LOCATED IN SIDEWALKS.
2. THE METER RESETTER SHALL BE INSTALLED IN SUCH A MANNER AS TO ALLOW REMOVAL AND REPLACEMENT WITHOUT DISTURBING THE STRUCTURAL INTEGRITY OF THE PIPING SYSTEM, THE SHUTOFF VALVES, OR THE RESETTER.
3. FOR COMPLETE SERVICE CONNECTION ASSEMBLY, SEE DETAIL UW–21 TYPICAL SERVICE CONNECTION.
4. WHEN THE DISTANCE BETWEEN THE EDGE OF THE SIDEWALK AND THE R/W IS ONE FOOT (CUL–DE–SAC W/ MEDIAN) A 10–FOOT–WIDE PUBLIC UTILITY EASEMENT SHALL BE LOCATED IN THE FRONT OF THE LOTS, ADJACENT TO THE ROW.
5. 3' MINIMUM CLEARANCE FROM LANDSCAPING PLANTS AND 10' MIN. CLEARANCE FROM TREES TO EDGE OF METER, CLEAR ACCESS OPENING TO STREET.
6. SERVICE TUBING SHALL NOT BE CRIMPED OR KINKED TO RE–ADJUST CURB STOP LOCATION.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			METER BOX ASSEMBLY FOR 5/8" X 3/4"; 3/4"; AND 1" METERS	UW–18
REV.BY	DATE			
		DATE OF APPROVAL		



PROFILE

NOTES:

SEC. 2-31-253 – GENERAL REQUIREMENTS

(a) DIRECT CONNECTION.

(1) THE BOARD MAY ADOPT, BY REGULATION, FEES AND CHARGES FOR DIRECT CONNECTION, INCLUDING, BUT NOT LIMITED TO, AN INITIAL PERIOD AND ANY ADDITIONAL PERIODS.

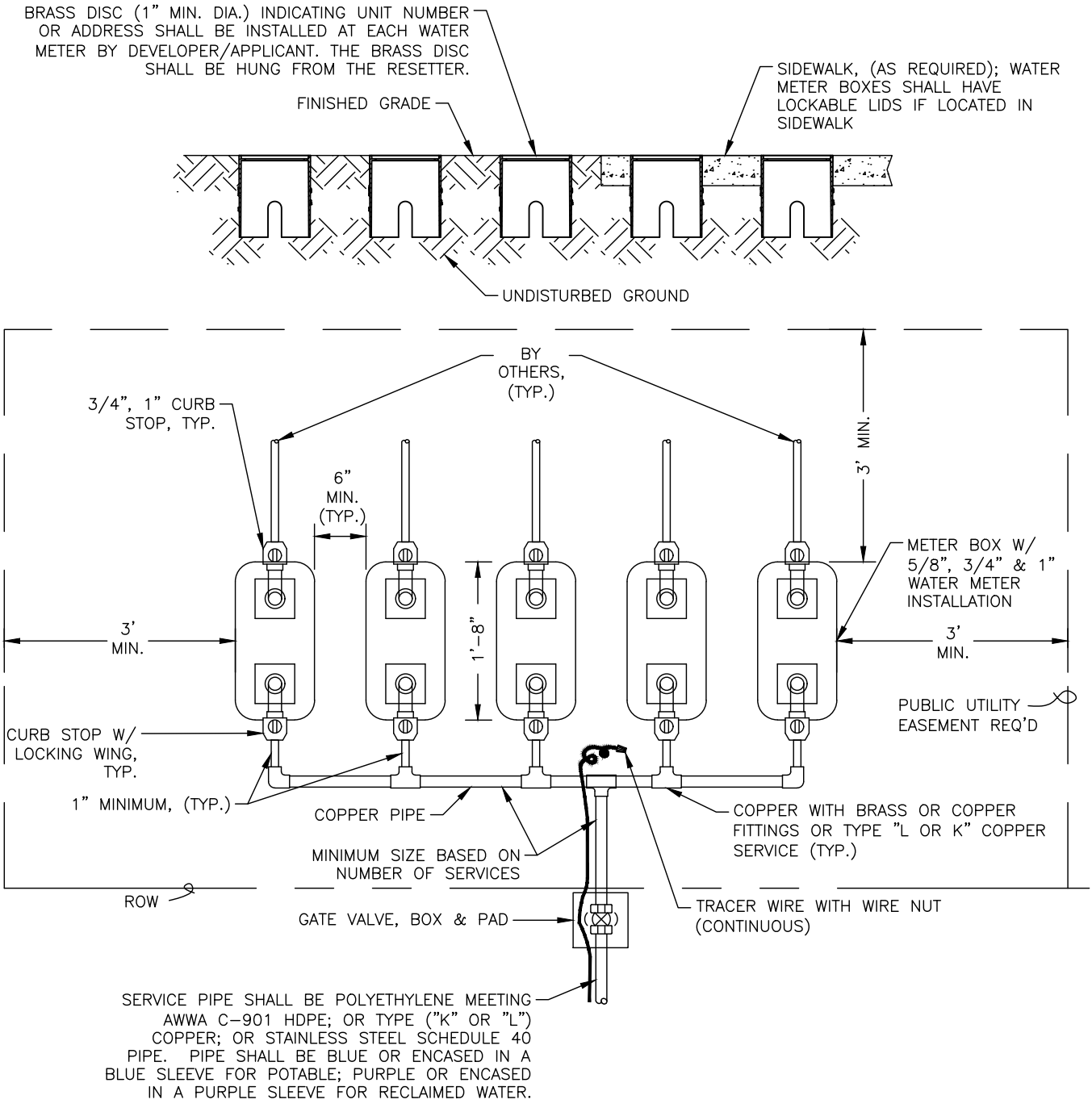
(2) DURING CONSTRUCTION OF NEW SINGLE-FAMILY RESIDENCES, CONTRACTORS SHALL BE REQUIRED TO USE POTABLE WATER THROUGH UNMETERED DIRECT CONNECTION TO POTABLE WATER DISTRIBUTION LINES. EXCEPTIONS TO THE REQUIREMENT FOR DIRECT CONNECTION MAY BE GRANTED BY THE COUNTY ADMINISTRATOR FOR GOOD CAUSE SHOWN.

(3) AN APPROVED BACKFLOW PREVENTION ASSEMBLY SHALL BE INSTALLED PRIOR TO ANY DIRECT CONNECTION.

(4) A DIRECT CONNECTION SHALL CONTINUE UNTIL INSTALLATION OF A PERMANENT METER AND ISSUANCE OF A CERTIFICATE OF OCCUPANCY FOR THE RESIDENCE. THE PERMANENT METER SHALL NOT BE INSTALLED UNTIL THE RESIDENCE IS READY FOR THE METER AND ALL REQUIRED FEES AND CHARGES ARE PAID. IF A PERMANENT METER IS NOT INSTALLED WITHIN ONE YEAR FROM THE COMMENCEMENT DATE OF A DIRECT CONNECTION, INSPECTION OF THE DIRECT CONNECTION BY THE COUNTY IS REQUIRED PRIOR TO EXTENSION FOR ANY ADDITIONAL PERIOD. AT THE DISCRETION OF THE COUNTY ADMINISTRATOR, A DIRECT CONNECTION MAY BE EXTENDED FOR ADDITIONAL PERIODS UNTIL THE RESIDENCE MEETS THE REQUIREMENTS OF THE PARAGRAPH.

(5) CONTRACTOR SHALL CONTACT UTILITY CUSTOMER SERVICE, 4410 66TH STREET WEST, BRADENTON, FL 34210, 941.792.8811 FOR DUAL CHECK VALVE ISSUANCE.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			TEMPORARY RESIDENTIAL DIRECT CONNECTION	UW-19
REV.BY	DATE			
		DATE OF APPROVAL		



NOTES:

1. A PUBLIC UTILITY EASEMENT IS REQUIRED FOR METER READING AND MAINTENANCE.
2. BACKFLOW PREVENTION ASSEMBLIES MAY BE REQUIRED DOWNSTREAM OF METERS. IF BACKFLOW PREVENTION ASSEMBLIES ARE REQUIRED, THE BACKFLOW PREVENTION ASSEMBLIES SHALL BE LOCATED OUTSIDE OF THE UTILITY EASEMENT.

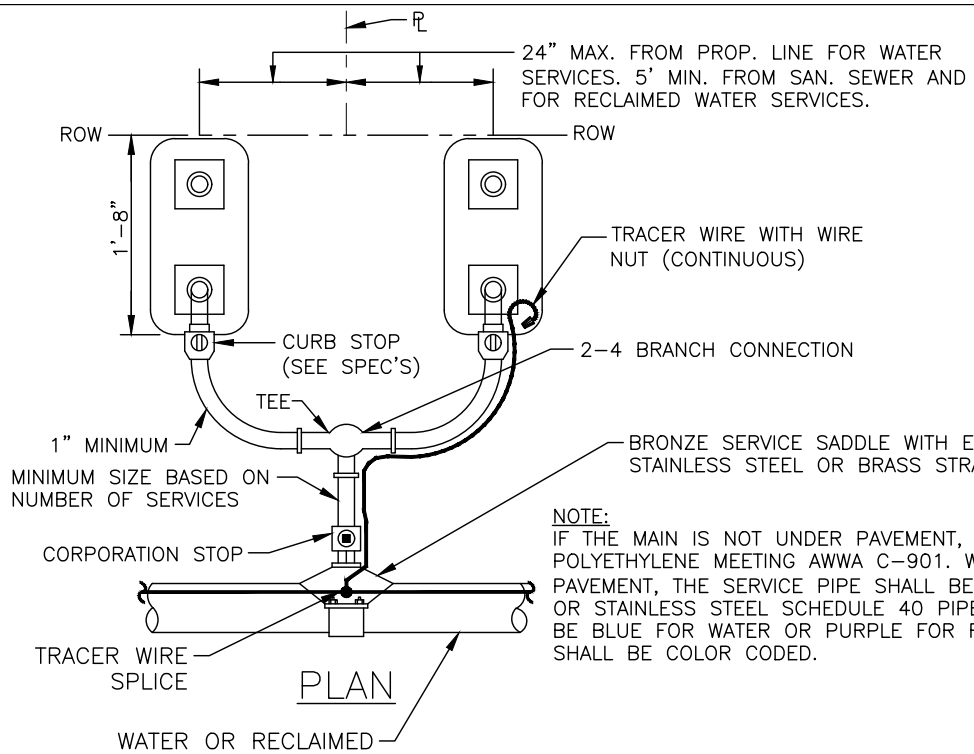
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

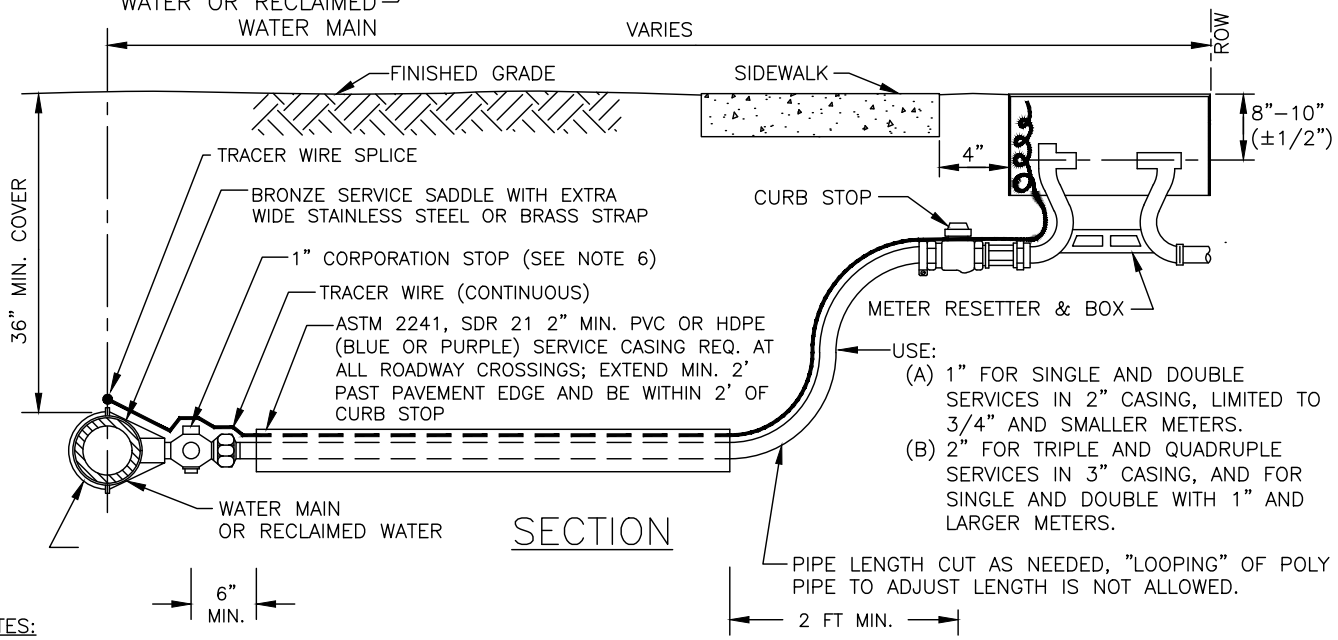
DATE OF APPROVAL

MULTIPLE METER LAYOUT

UW-20



NOTE:
IF THE MAIN IS NOT UNDER PAVEMENT, THE SERVICE PIPE SHALL BE POLYETHYLENE MEETING AWWA C-901. WHEN THE MAIN IS UNDER PAVEMENT, THE SERVICE PIPE SHALL BE TYPE ("L OR K") COPPER, OR STAINLESS STEEL SCHEDULE 40 PIPE. PE SERVICE PIPE SHALL BE BLUE FOR WATER OR PURPLE FOR RECLAIMED WATER. CASINGS SHALL BE COLOR CODED.



NOTES:

1. ALL SERVICE TAPS TO BE LOCATED IN THE FIELD. TAPS SHALL BE NO CLOSER THAN 2'-0" STAGGERED INTERVALS OR WITHIN 2'-0" FROM BELL OR SPIGOT ENDS.
2. METER BOXES & RESETTERS ARE TO BE INSTALLED BY THE INFRASTRUCTURE CONTRACTOR AND SHALL NOT BE SET IN DRAINAGE SWALES, SIDEWALKS OR DRIVEWAYS. WITH PRIOR APPROVAL BY COUNTY, METER BOXES WITH LOCKABLE LIDS MAY BE LOCATED IN SIDEWALKS.
3. "WM" OR "RWM" TO BE IMPRESSED INTO THE NEWLY POURED CONCRETE CURB ALONG WITH DISTANCE IN FEET TO THE METER. IF NO CURB, INSTALL A BLUE DISC WITH "WM" OR A PURPLE DISC WITH "RWM" AND A 1/8"x 1" GALVANIZED STEEL SCREW IN THE EDGE OF PAVEMENT WITH THE DISTANCE (IN FEET) FROM THE DISC TO THE METER.
4. COLOR CODED TRACER WIRE SHALL BE INSTALLED WITH WATER AND RECLAIMED MAIN AND ALL SERVICES. SERVICE WIRE SHALL BE CONNECTED TO THE TRACER WIRE ALONG THE MAIN. ON DOUBLE SERVICES, WHEN SECOND METER IS OVER 8 FT APART, TWO TRACER WIRES SHALL BE INSTALLED; ONE FOR EACH METER.
5. WATER AND RECLAIMED WATER SERVICE LINES TO BE 5' MINIMUM FROM SEWER SERVICE PIPES.
6. FOR 2" SERVICES REPLACE CORPORATION STOP WITH 2" RESILIENT WEDGE FIP GATE VALVE W/BOX, LID & TAG.
7. WHEN THE DISTANCE BETWEEN THE EDGE OF THE SIDEWALK AND THE ROW IS ONE FOOT (CUL-DE-SAC W/MEDIAN) A 10-FOOT-WIDE PUBLIC UTILITY EASEMENT SHALL BE LOCATED IN THE FRONT OF THE LOTS, ADJACENT TO THE ROW.
8. TEMPORARY RESIDENTIAL USE CAN BE PROVIDED BY CONTACTING THE UTILITY CUSTOMER SERVICE. SEE DETAIL UW-19.
9. SERVICE TUBING SHALL NOT BE CRIMPED OR KINKED TO RE-ADJUST CURB STOP LOCATION.

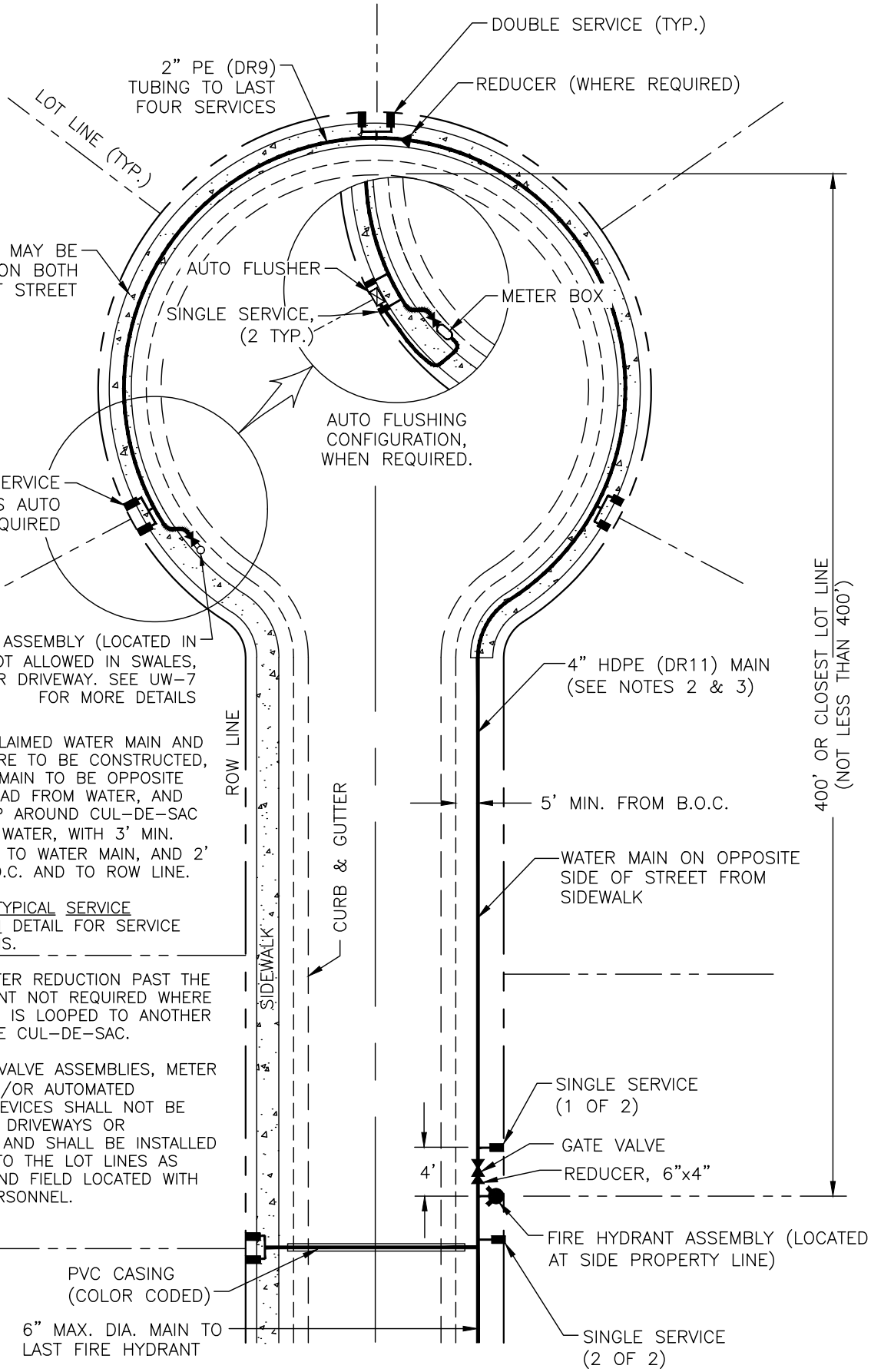
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

TYPICAL SERVICE CONNECTION

UW-21



NOTES:

1. WHERE RECLAIMED WATER MAIN AND SERVICES ARE TO BE CONSTRUCTED, RECLAIMED MAIN TO BE OPPOSITE SIDE OF ROAD FROM WATER, AND SHALL WRAP AROUND CUL-DE-SAC SIMILAR TO WATER, WITH 3' MIN. SEPARATION TO WATER MAIN, AND 2' MIN. TO B.O.C. AND TO ROW LINE.
2. REFER TO TYPICAL SERVICE CONNECTION DETAIL FOR SERVICE CONNECTIONS.
3. PIPE DIAMETER REDUCTION PAST THE FIRE HYDRANT NOT REQUIRED WHERE WATER MAIN IS LOOPED TO ANOTHER MAIN AT THE CUL-DE-SAC.
4. BLOW-OFF VALVE ASSEMBLIES, METER BOXES, AND/OR AUTOMATED FLUSHING DEVICES SHALL NOT BE LOCATED IN DRIVEWAYS OR SIDEWALKS, AND SHALL BE INSTALLED AS CLOSE TO THE LOT LINES AS POSSIBLE AND FIELD LOCATED WITH COUNTY PERSONNEL.

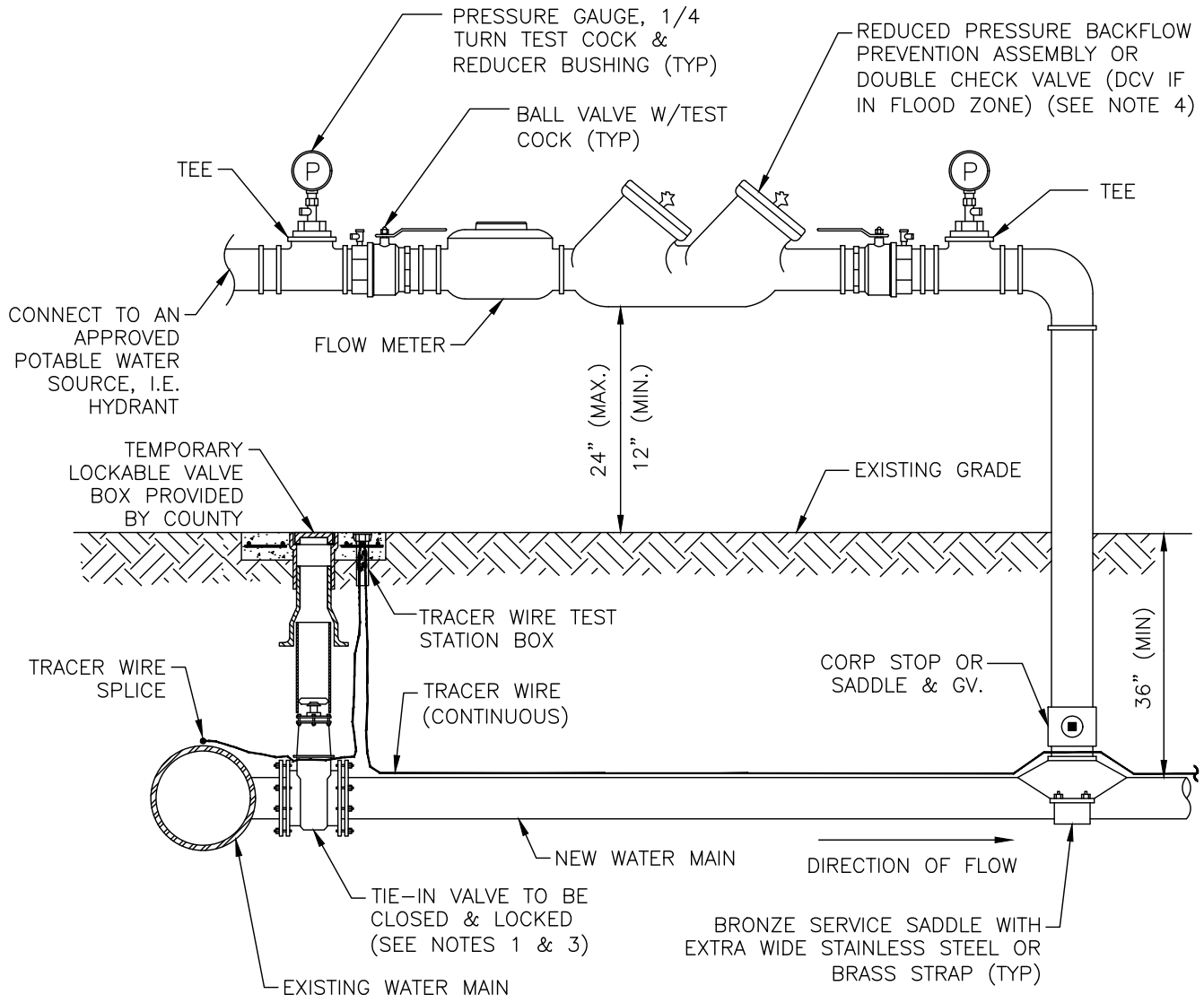
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

CUL-DE-SAC MAINS

UW-22



PROFILE

NOTES:

1. FOR TIE-IN VALVE, SEE DETAIL UW-3 FOR TAPPING SLEEVE VALVE AND UW-2 FOR GATE VALVE.
2. CORPORATION STOP CONNECTIONS TO WATER MAINS SHALL BE AT A SUFFICIENT DISTANCE FROM NEW TAPPING SLEEVE & VALVE (TIE-IN VALVE). ALL CORPORATION STOP TAPS SHALL BE PLACED NO CLOSER THAN 30" OR A DISTANCE EQUAL TO (1) MAIN PIPE DIAMETER PLUS (2) TAP DIAMETERS (WHICHEVER IS LARGER) FROM THE NEW TIE-IN VALVE (TAPPING VALVE & SLEEVE). SIZE-ON-SIZE TAPS ARE NOT ALLOWED. A CUT-IN TEE SHALL BE USED.
3. IF THE EXISTING WATER MAIN IS LOCATED UNDER PAVEMENT OR CLOSE TO THE ROADWAY, BOTH JUMPER CORPORATION STOPS MAY CONNECT TO THE NEW WATER MAIN LOCATED OUTSIDE OF THE PAVEMENT. AN ADDITIONAL GATE VALVE SHALL BE INSTALLED AND THE VALVE MAY BE LOCATED AT THE ROW LINE. PIPING AND APPURTENANCES BETWEEN THE EXISTING MAIN AND ISOLATION VALVE AND JUMPER SHALL BE DISINFECTED BY SPRAYING OR SWABBING.
4. BACKFLOW PREVENTION ASSEMBLY SHALL BE STRUCTURALLY SUPPORTED.
5. THE TIE-IN VALVE SHALL REMAIN CLOSED AND THE LOCKABLE VALVE BOX SHALL BE LOCKED BY MANATEE COUNTY. THE TIE-IN VALVE SHALL REMAIN CLOSED AND LOCKED UNTIL THE NEW SYSTEM HAS BEEN CLEARED FOR USE BY THE FDEP AND ALL OTHER PERTINENT AGENCIES. AFTER CLEARANCE IS OBTAINED, THE LOCKABLE VALVE BOX SHALL BE REMOVED, RETURNED TO THE COUNTY, AND REPLACED WITH A STANDARD VALVE BOX.
6. IN THE EVENT THE LOCKED TIE-IN VALVE MUST BE OPENED, THE VALVE SHALL ONLY BE OPERATED BY MANATEE COUNTY PERSONNEL.
7. SEE DETAIL UW-24 FOR ADDITIONAL JUMPER CONNECTION NOTES.

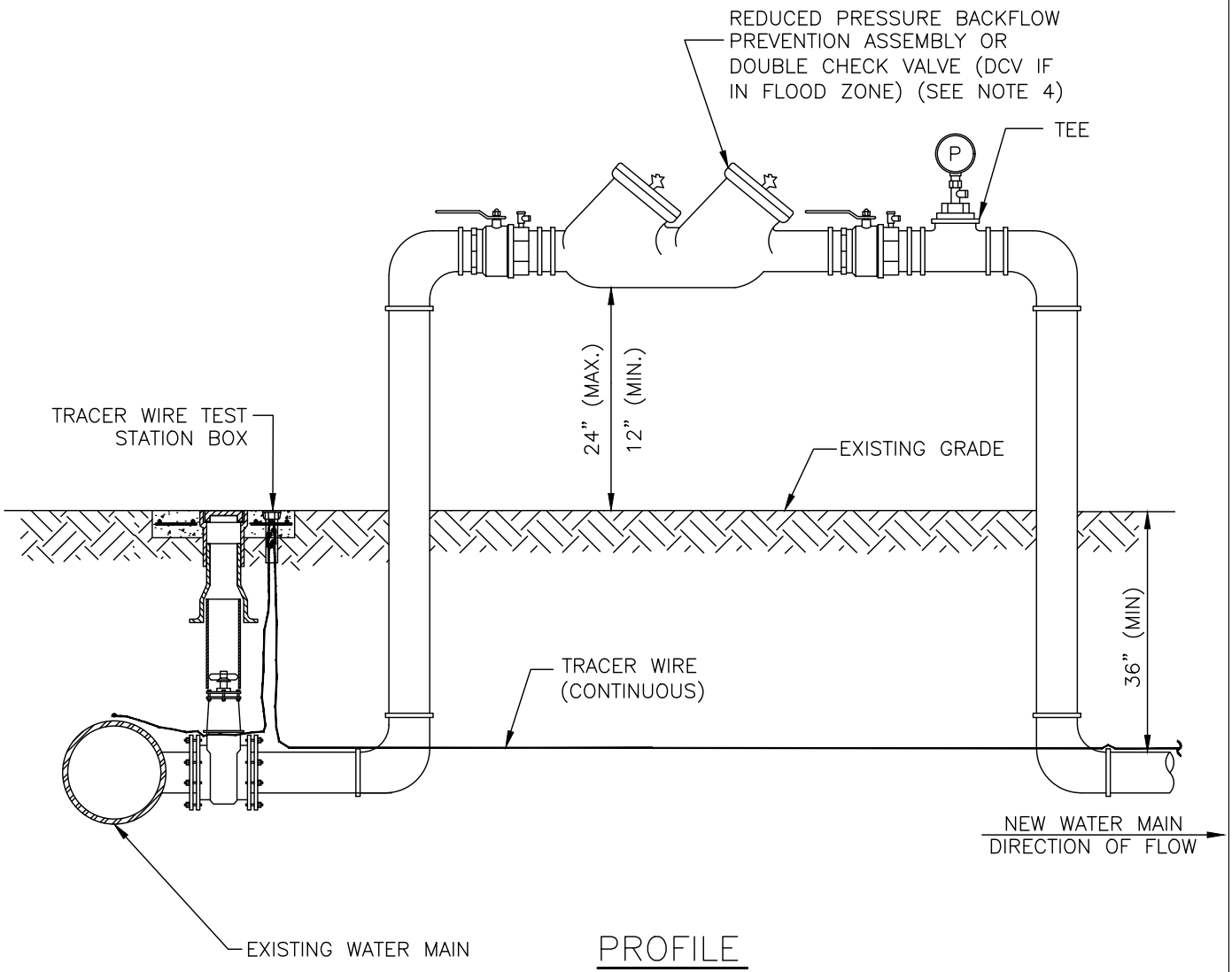
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

TEMPORARY JUMPER CONNECTION-HYDRANT AVAILABLE

UW-23A



PROFILE

NOTES:

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4. BACKFLOW PREVENTION ASSEMBLY SHALL BE STRUCTURALLY SUPPORTED.
5. SEE DETAIL UW–24 FOR ADDITIONAL JUMPER CONNECTION NOTES.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			TEMPORARY JUMPER CONNECTION – NO HYDRANT AVAILABLE	UW–23B
REV.BY	DATE			
		DATE OF APPROVAL		

1. A 2–INCH MINIMUM TEMPORARY JUMPER CONNECTION IS REQUIRED AT ALL CONNECTIONS BETWEEN EXISTING ACTIVE POTABLE WATER MAINS AND PROPOSED NEW WATER MAIN IMPROVEMENTS WITH THE FOLLOWING EXCEPTIONS:

   a. PROJECTS THAT INCLUDE A PERMANENT BACKFLOW PREVENTER AT THE RIGHT–OF–WAY WHICH IS ADJACENT TO THE EXISTING WATER MAIN;

   b. PROJECTS THAT INCLUDE NEW WATER MAINS THAT ARE LESS THAN OR EQUAL TO 18 LINEAR FEET IN LENGTH; OR

   c. OTHER PROPOSED CASES THAT ARE APPROVED BY MANATEE COUNTY AND THE CONSTRUCTION DRAWINGS SPECIFICALLY STATE THAT A TEMPORARY JUMPER CONNECTION IS NOT REQUIRED.

2. A TEMPORARY JUMPER SHALL BE USED AND BE CONNECTED TO AN APPROVED POTABLE WATER SOURCE (E.G., EXISTING FIRE HYDRANT, EXISTING MAIN, EXISTING SERVICE TAP OR TANK TRUCK, ETC.) AS SHOWN IN THE STANDARD TEMPORARY JUMPER DETAIL UW–23A OR UW–23B.

   A TEMPORARY JUMPER SHALL BE USED FOR FILLING, FLUSHING AND FOR DISINFECTION OF ANY NEW MAIN OF ANY SIZE. THE TEMPORARY JUMPER CONNECTION SHALL BE MAINTAINED UNTIL AFTER THE FILLING, FLUSHING, TESTING AND DISINFECTION OF THE NEW MAIN HAS BEEN SUCCESSFULLY COMPLETED AND CLEARANCE FOR USE FROM THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION (FDEP) HAS BEEN OBTAINED.

3. THE LOCATION AND ORIENTATION OF TEMPORARY JUMPERS ASSOCIATED WITH CONNECTIONS TO EXISTING WATER MAINS THAT ARE LOCATED UNDER THE ROADWAY PAVEMENT SHALL BE APPROVED ON A CASE–BY–CASE BASIS.

4. PIPE AND FITTINGS USED FOR CONNECTING THE NEW PIPE TO THE EXISTING PIPE SHALL BE DISINFECTED PRIOR TO INSTALLATION IN ACCORDANCE WITH AWWA C651, LATEST EDITION. UNLESS APPROVED OTHERWISE, THE TAPPING SLEEVE, AND EXTERIOR OF THE EXISTING MAIN TO BE TAPPED, PIPING WITHIN THE JUMPER, AND NEW PIPING SHOWN ON STANDARD TEMPORARY JUMPER DETAIL UW–23A OR UW–23B SHALL BE DISINFECTED BY SPRAYING OR SWABBING PER SECTION 4.6 OF AWWA C651.

5. THE JUMPER SHALL INCLUDE A FLOW METER TO ENSURE THAT THE FLOW FROM THE SUPPLY SOURCE IS AT A CONSTANT MEASURED RATE WHILE CHLORINATING THE NEW MAIN. THE CHLORINE CONCENTRATION SHALL BE MEASURED AT REGULAR INTERVALS TO ENSURE THAT IT IS FED AT A CONSTANT RATE OF NOT LESS THAN 25 MILLIGRAMS PER LITER (MG/L) OF FREE CHLORINE.

6. THE JUMPER CONNECTION SHALL ALSO BE USED TO MAINTAIN A MINIMUM PRESSURE OF 20 PSI IN THE NEW MAINS CONTINUOUSLY AFTER DISINFECTION AND UNTIL FDEP CLEARANCE LETTER IS OBTAINED.

7. ALL TEMPORARY BACKFLOW PREVENTION ASSEMBLY OR "JUMPERS" UTILIZED DURING PIPELINE CONSTRUCTION MUST SHOW CERTIFICATION THAT THEY HAVE BEEN TESTED ANNUALLY AND PASSED ACCORDING TO THE FLORIDA BUILDING CODE, PLUMBING SECTION, CHAPTER 3, SECTION 312.9.1, 312.9.2, CHAPTER 6, SECTION 608, AND RESOLUTION R87–125. ANNUAL CERTIFICATION MUST BE VALID AT TIME OF INSTALLATION AND PROVIDED TO THE MANATEE COUNTY INSPECTOR UPON REQUEST.

8. ALL INSTALLATION AND MAINTENANCE OF THE TEMPORARY JUMPER CONNECTION AND ASSOCIATED BACKFLOW PREVENTION ASSEMBLY, FLOW METER, FITTINGS, VALVES, ETC., SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR.

9. TEMPORARY JUMPER SIZE DEPENDS ON THE SITUATION: JUMPERS LARGER THAN 2–INCHES MAY BE USED FOR FLUSHING PURPOSES OR IF PARTIAL FIRE PROTECTION IS REQUIRED DURING INITIAL CONSTRUCTION, AS DETERMINED BY THE ENGINEER OF RECORD OR FIRE DEPARTMENT.

10. PRIOR TO REMOVAL OF THE TEMPORARY JUMPER, THE NEWLY–CONSTRUCTED WATER SYSTEM SHALL HAVE RECEIVED CLEARANCE FROM THE FDEP.

11. AFTER RECEIPT OF CLEARANCE FOR USE BY FDEP, MANATEE COUNTY, AND ALL OTHER PERTINENT AGENCIES, THE CONTRACTOR SHALL REMOVE THE TEMPORARY JUMPER CONNECTION AND COMPLETE THE WATER MAIN. ALL CORPORATION STOPS LEFT–IN–PLACE ARE TO BE CLOSED AND PLUGGED WITH 2–INCH BRASS.

12. IF THE TEMPORARY JUMPER IS LOCATED WITHIN A STANDARD PIPE LENGTH AWAY FROM THE PROPOSED TIE–IN AND A SINGLE STANDARD LENGTH OF PIPE IS USED FOR COMPLETING THE CONNECTION, THEN THE COUNTY WILL PERFORM A VISUAL INSPECTION AND A SEPARATE HYDROSTATIC TEST MAY NOT BE REQUIRED.

    IF MULTIPLE LENGTHS OF PIPES ARE USED TO COMPLETE THE CONNECTION, THEN A SEPARATE HYDROSTATIC TEST WILL BE REQUIRED. THE HYDROSTATIC TEST SHALL BE PERFORMED BETWEEN THE PROPOSED TIE–IN VALVE AND THE FIRST DOWNSTREAM VALVE FROM THE TEMPORARY JUMPER LOCATION.

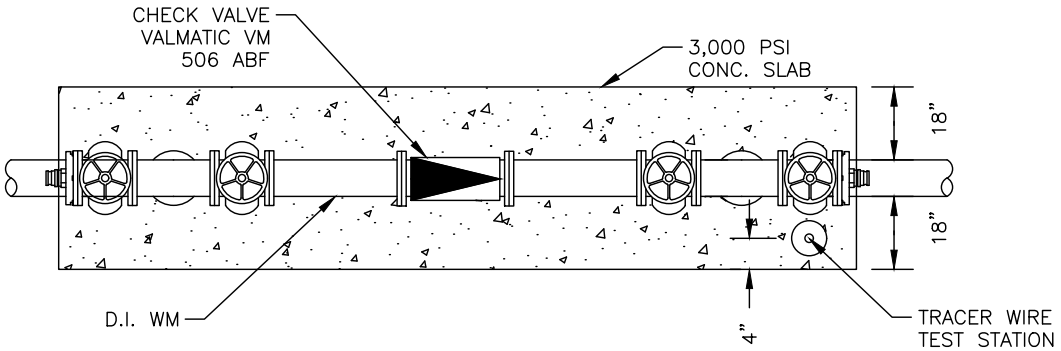
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

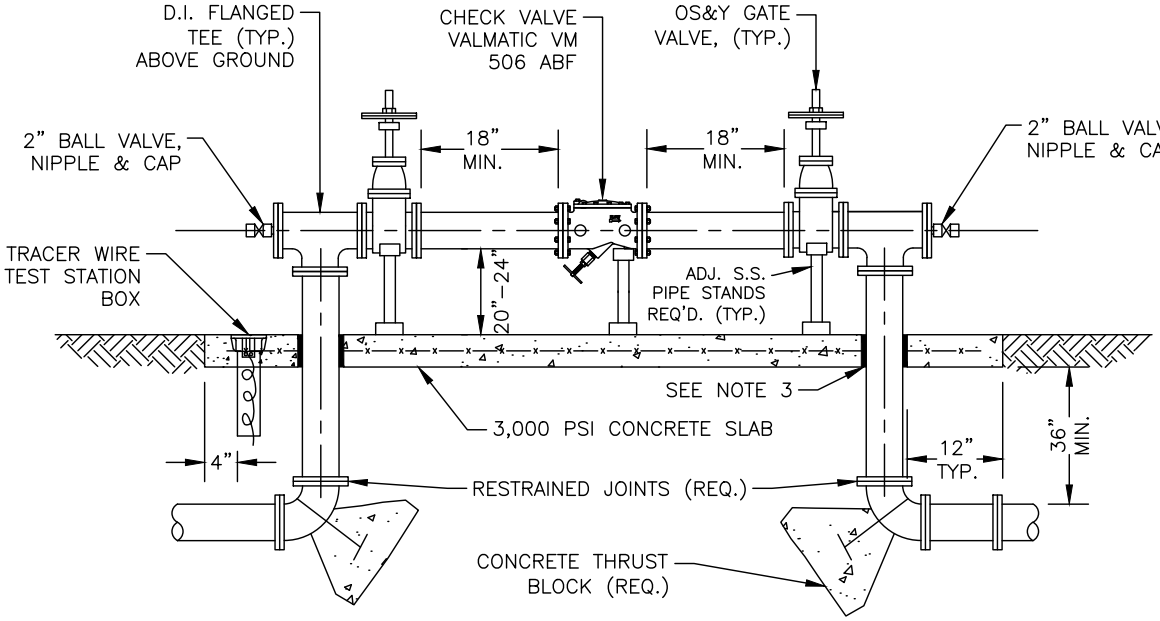
TEMPORARY JUMPER CONNECTION NOTES

UW–24



PLAN

FLOW



SECTION

SLAB SPECIFICATIONS

PIPE DIAMETER	SLAB THICKNESS	REINFORCEMENT
3" TO 10"	4"	6x6 W1.4 WIRE MESH OR REBAR

NOTES:

1. WHEN PRESSURE TESTING, TEST AGAINST DOWNSTREAM GATE VALVE.
2. THE SYSTEM MUST MEET ALL REQUIREMENTS OF THE FLORIDA PLUMBING CODE (LATEST ED.).
3. PIPE THROUGH SLAB AND ALL BELOW GROUND D.I. PIPE AND FITTINGS SHALL BE POLYETHYLENE WRAPPED.
4. ABOVE GROUND PIPING SHALL BE FLANGED DUCTILE IRON CLASS 53 AND PAINTED SAFETY BLUE BY SCOTT PAINT.
5. ALL EXPOSED EDGES OF CONCRETE SHALL BE 1/2" CHAMFER.
6. LANDSCAPE VEGETATION SHALL BE 6' MIN. AND TREES SHALL BE 10' MIN. FROM EDGE OF CONCRETE SLAB. STREET SIDE OF ASSEMBLY SHALL REMAIN OPEN.
7. ALL ABOVE-GROUND ANCILLARY BOLTS, NUTS, WASHERS, & FASTENERS SHALL BE 316 STAINLESS STEEL. ALL BURIED SHALL BE MIN. 304 STAINLESS STEEL.
8. SEE UW-2 GATE VALVE, BOX, LID AND TAG DETAIL.
9. ADJUSTABLE 316 S.S. PIPE STANDS SHALL BE BOLTED TO SLAB WITH 316 S.S. HARDWARE.

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

INTERCONNECT TO MANATEE COUNTY

UW-25

TABLE OF CONTENTS

UTILITY STANDARDS–SANITARY SEWER

NOTE:

SEWAGE WORKS SHALL BE DESIGNED IN ACCORDANCE WITH F.D.E.P. REGULATIONS AND "RECOMMENDED STANDARDS FOR WASTEWATER FACILITIES" BY THE GREAT LAKES–UPPER MISSISSIPPI RIVER BOARD OF STATE AND PROVINCIAL PUBLIC HEALTH AND ENVIRONMENTAL MANAGERS – LATEST EDITION.

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

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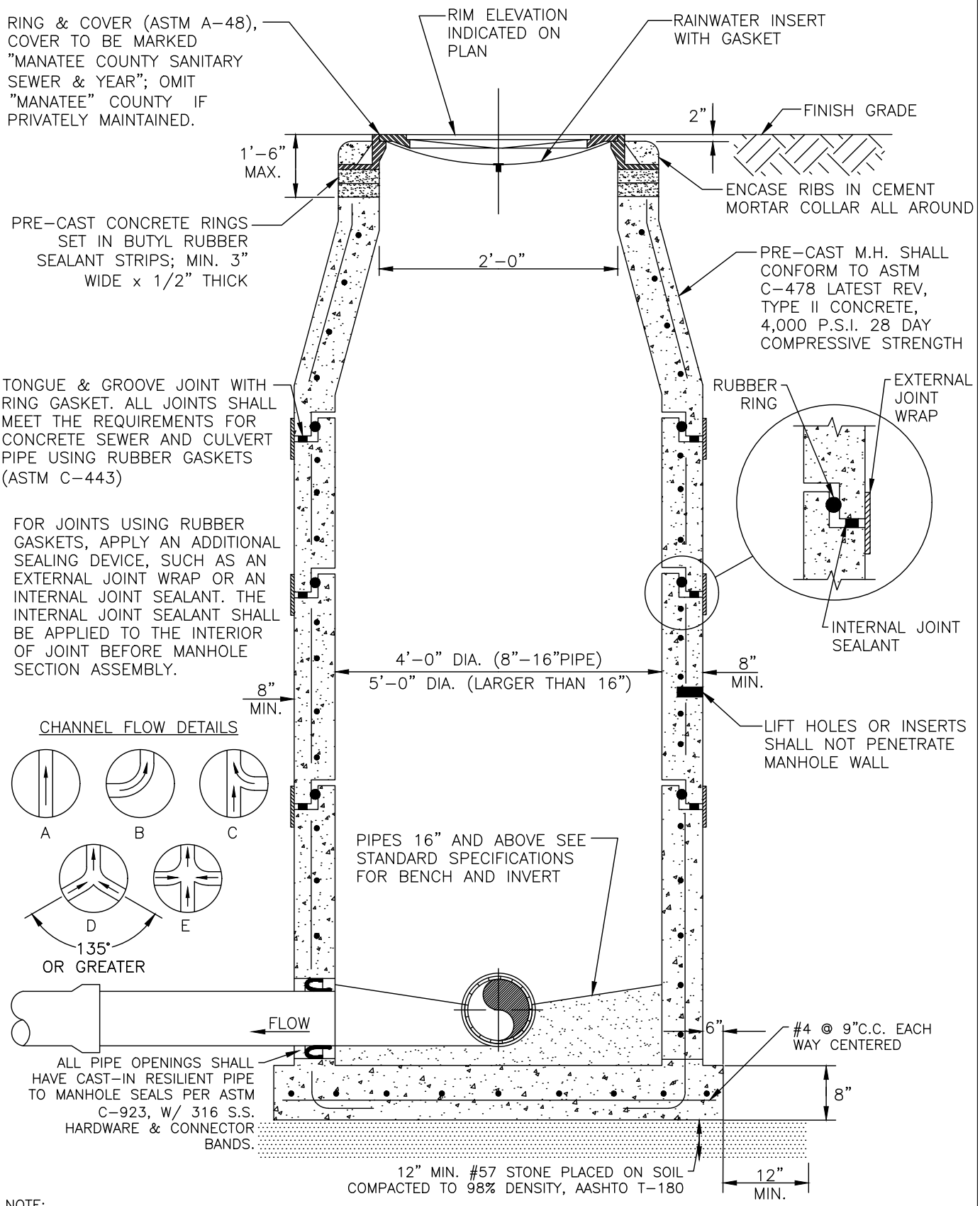
SANITARY SEWER

US–1



NOTE:

DROP MANHOLES, MANHOLES WITH OPPOSING FLOW (DETAILS D & E), MANHOLES UPSTREAM OF A LIFT STATION WET WELL (SEE US-17A), MANHOLES WITH GRAVITY SEWERS GREATER THAN 12 INCHES IN DIAMETER, MANHOLES RECEIVING A FORCE MAIN AND THE FIRST TWO GRAVITY MANHOLES DOWNSTREAM OF MANHOLES RECEIVING A FORCE MAIN SHALL BE A POLYMER CONCRETE MANHOLE (SEE US-3); OR EXISTING PORTLAND CONCRETE MANHOLE SHALL RECEIVE AN APPROVED LINER.

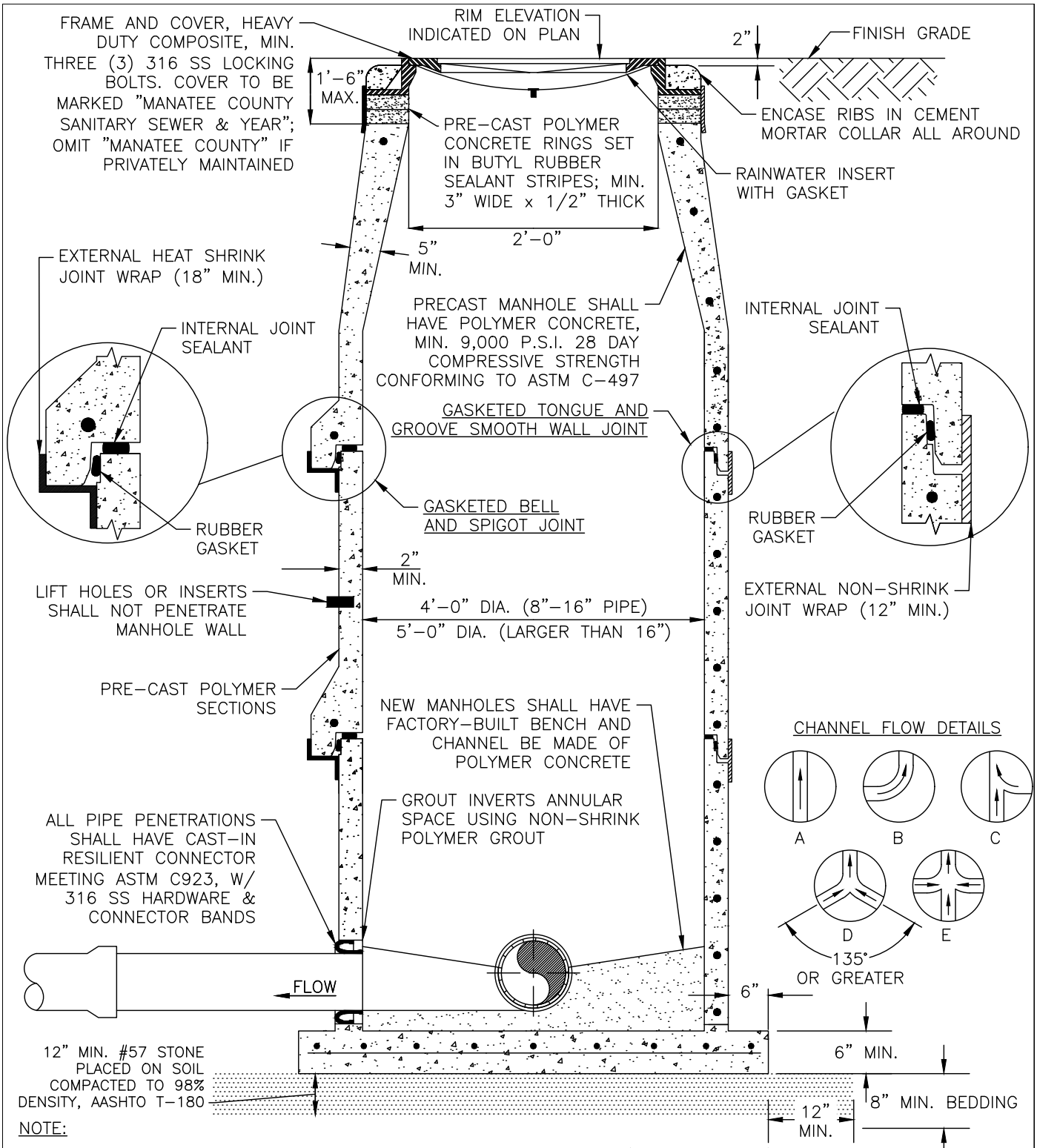
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

STANDARD PRE-CAST SANITARY SEWER MANHOLE FOR UNDISTURBED FLOW

US-2



NOTE:

1. DROP MANHOLES, MANHOLES WITH OPPOSING TURBULENT FLOW (DETAILS D & E), MANHOLES UPSTREAM OF A LIFT STATION WET WELL (SEE US-17A), MANHOLES WITH GRAVITY SEWERS GREATER THAN 12 INCHES IN DIAMETER, FORCE MAIN TERMINAL MANHOLE AND THE NEXT TWO DOWNSTREAM MANHOLES SHALL BE MADE OF POLYMER CONCRETE.
2. MANHOLES SHALL HAVE A GASKETED BELL & SPIGOT OR TONGUE & GROOVE SMOOTH WALL JOINT DESIGN.
3. ALL JOINTS SHALL MEET THE REQUIREMENTS OF ASTM C-443 AND ASTM C-990 FOR CONCRETE SEWER AND CULVERT PIPE USING RUBBER GASKETS AND FLEXIBLE JOINT SEALANTS.
4. ALL FRP/STEEL REINFORCEMENT, MANHOLE RISERS, CONES, BASES, AND FLAT LIDS SHALL BE DESIGNED BY MANUFACTURER TO MEET LOADING REQUIREMENTS OF ASTM C-478, ASTM C-857, ACI 350, AND ACI 440.1R AS MODIFIED FOR POLYMER CONCRETE MANHOLES.

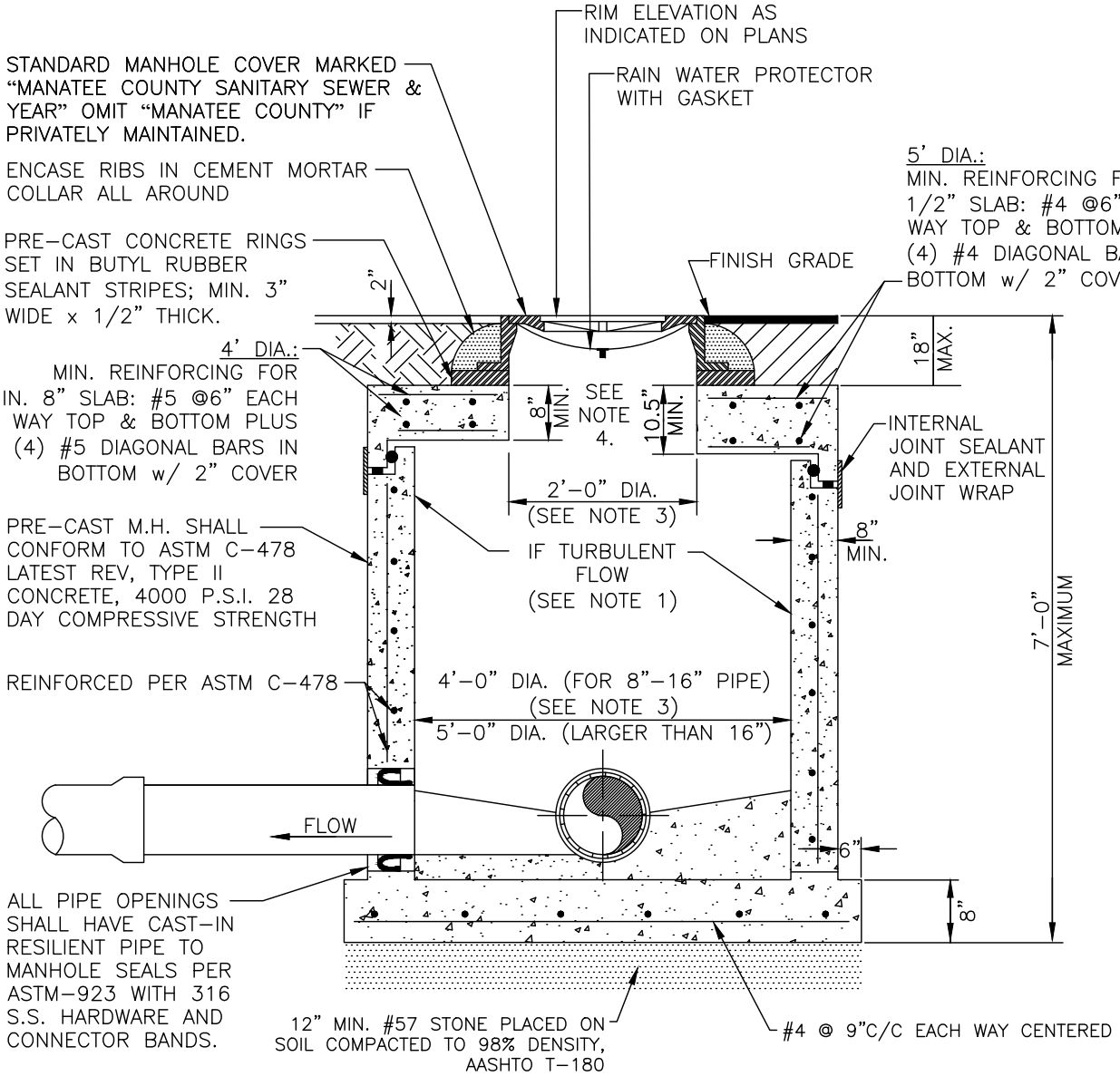
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

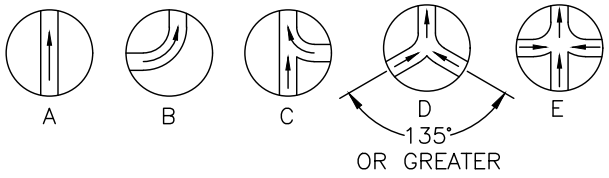
DATE OF APPROVAL

STANDARD PRE-CAST POLYMER CONCRETE SANITARY SEWER MANHOLE FOR TURBULENT FLOW

US-3



CHANNEL FLOW DETAILS



NOTES:

1. DROP MANHOLES, MANHOLES WITH OPPOSING FLOW (DETAILS D & E), MANHOLES UPSTREAM OF A LIFT STATION WET WELL (SEE US-17A), MANHOLES WITH GRAVITY SEWERS GREATER THAN 12 INCHES IN DIAMETER, MANHOLES RECEIVING A FORCE MAIN AND THE FIRST TWO GRAVITY MANHOLES DOWNSTREAM OF MANHOLES RECEIVING A FORCE MAIN SHALL HAVE BE A POLYMER CONCRETE MANHOLE (SEE US-3); OR EXISTING PORTLAND CONCRETE MANHOLE SHALL RECEIVE AN APPROVED LINER.
2. LIFT HOLES OR INSERTS SHALL NOT PENETRATE THE WALLS OF THE MANHOLES.
3. A MINIMUM COVER OF 3' OVER THE GRAVITY SEWER SHALL BE PROVIDED. FOR MANHOLES WITH LESS THAN 4' OF COVER OVER THE GRAVITY SEWER, THE MANHOLE INSIDE DIAMETER SHALL BE 5'-0" AND THE FRAME AND COVER SHALL BE 32" OPENING.
4. MANHOLE SHALL BE AASHTO H-20 RATED, WHEN LOCATED WITHIN THE RIGHT OF WAY.

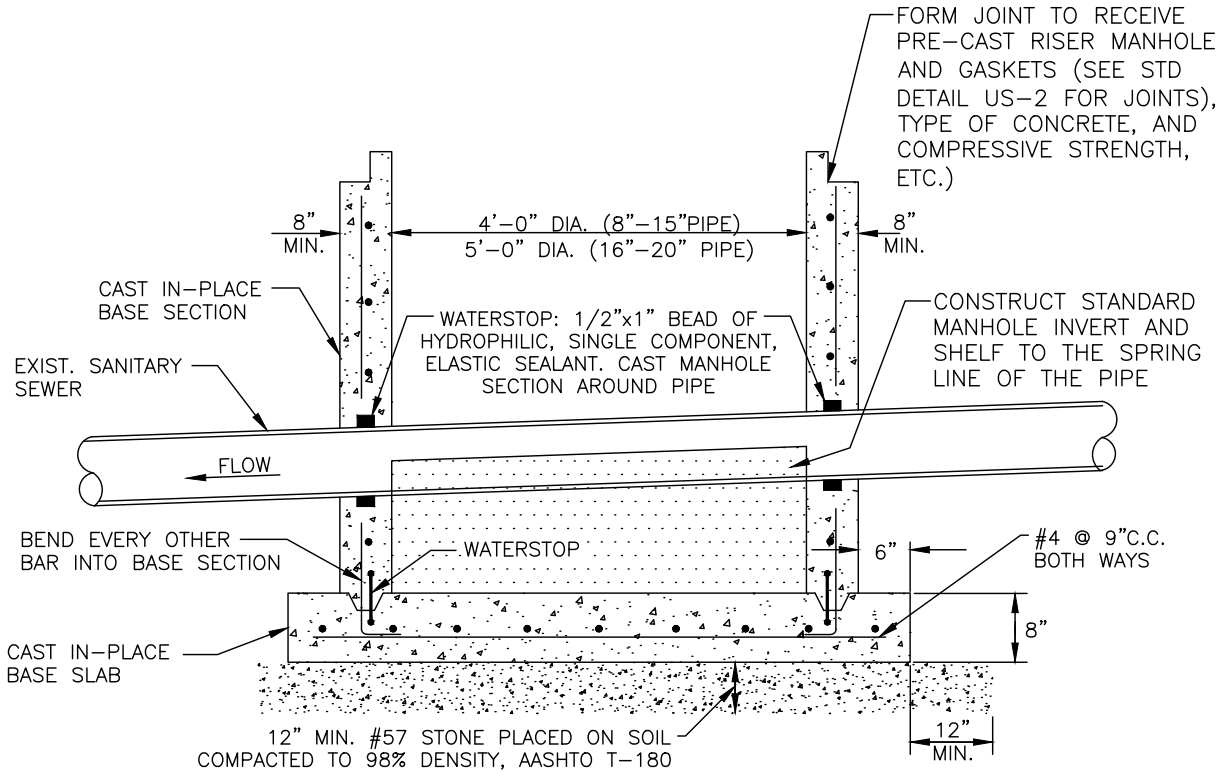
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

STANDARD PRE-CAST PORTLAND CEMENT SHALLOW MANHOLE

US-4



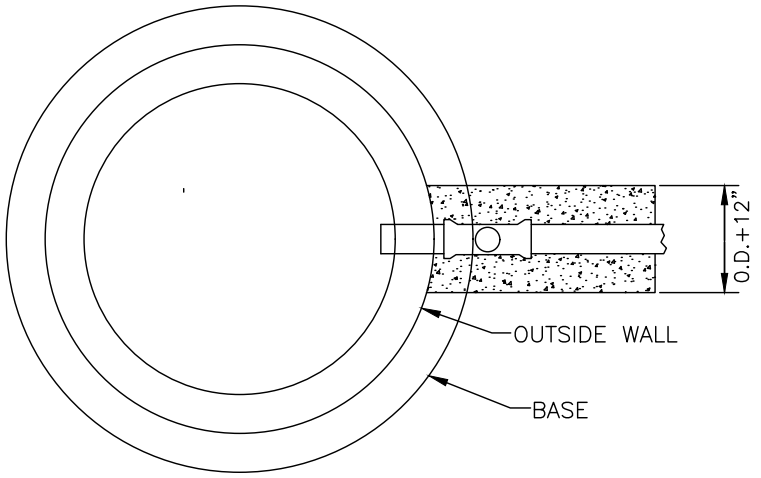
NOTES:

1. PREFERRED CONSTRUCTION IS BY "CUTTING-IN" A STANDARD SANITARY SEWER MANHOLE WITH A TEMPORARY FLOW BY-PASS SYSTEM.
2. PRIOR TO ANY EXCAVATION OVER THE PIPE, A TV RECORDING OF THE EXISTING SEWER MAIN SHALL OCCUR BETWEEN THE UPSTREAM AND DOWNSTREAM MANHOLES WHILE THE COUNTY INSPECTOR IS PRESENT.
3. THE CONTRACTOR SHALL CAREFULLY EXCAVATE AROUND AND PROPERLY SUPPORT THE EXISTING PIPE.
4. SEWER LINES GREATER THAN 20" REQUIRE SPECIAL DESIGN AND APPROVAL BY MANATEE COUNTY UTILITIES ENGINEERING.
5. ALLOW SUFFICIENT CURING TIME, 24-36 HOURS, FOR THE HYDROPHILIC, SINGLE COMPONENT, ELASTIC SEALANT, BEFORE POURING CONCRETE.
6. FOLLOWING SATISFACTORY CURING OF THE INVERT CHANNEL AND SHELF, THE CONTRACTOR SHALL CUT AND REMOVE THE TOP HALF OF THE EXISTING PIPE WITHIN THE MANHOLE, TAKING CARE NOT TO ALLOW ANY PIECES TO BE WASHED DOWN STREAM IN THE PIPE. CUTTING OF THE PIPE SHALL BE IN A WORKMAN LIKE MANNER, PROVIDING A SMOOTH AND EVEN FINISHED PRODUCT.
7. A TV RECORDING OF THE SEWER MAIN SHALL ALSO OCCUR AFTER CONSTRUCTION WHILE THE COUNTY INSPECTOR IS PRESENT. PIPE DEFLECTION SHALL NOT DEVIATE BY MORE THAN 1 INCH FROM THE DESIGN LINE.
8. THERE SHALL BE NO VISIBLE LEAKS IN THE MANHOLE.

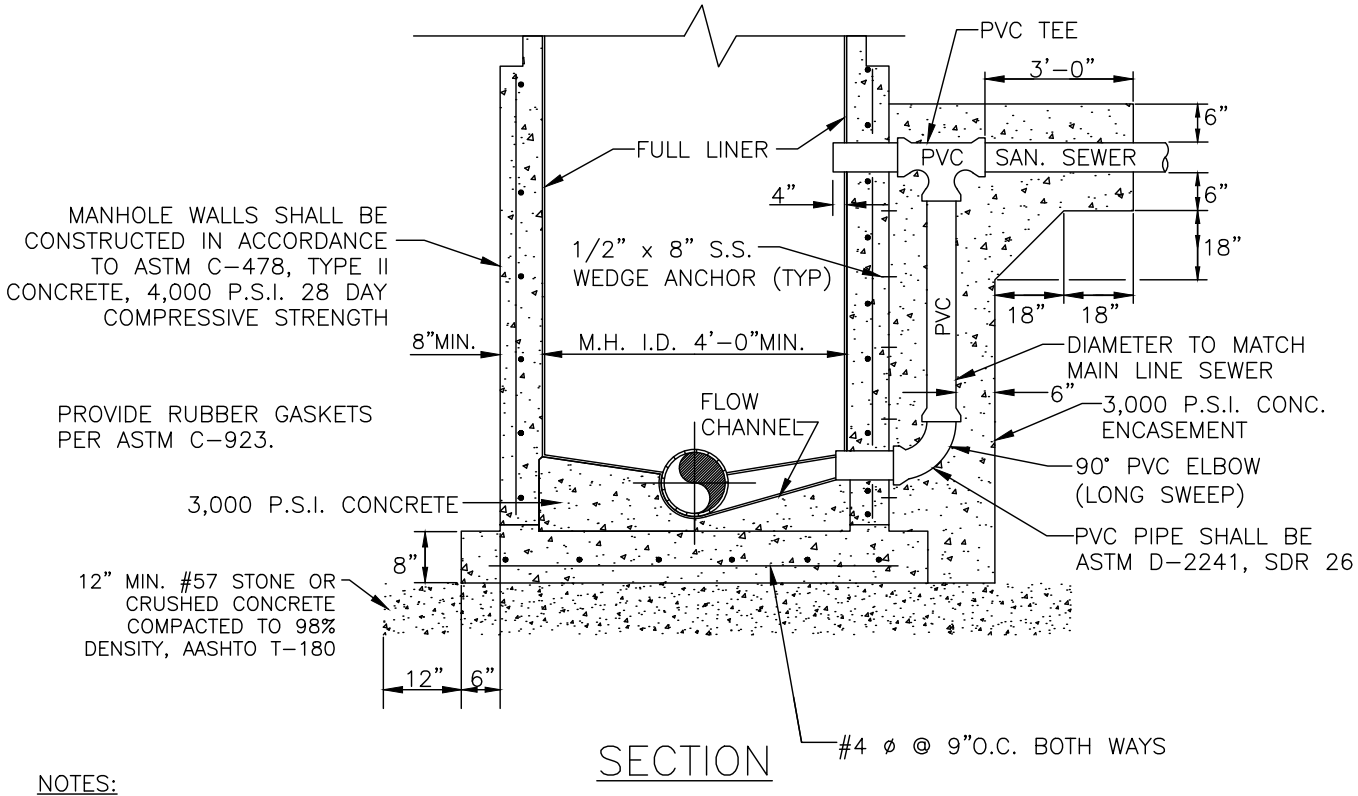
MANATEE COUNTY PUBLIC WORKS DEPARTMENT			SANITARY SEWER MANHOLE CONSTRUCTED OVER EXISTING SEWER LINE	US-5
REV.BY	DATE			
		DATE OF APPROVAL		

NOTES:

1. A PRECAST CONCRETE OUTSIDE DROP MAY BE USED IN LIEU OF THE CAST IN PLACE ENCASEMENT SHOWN BELOW.



PLAN



SECTION

NOTES:

1. THIS IS A TURBULENT FLOW MANHOLE AND SHALL BE LINED WITH AN APPROVED LINER. IN NEW CONSTRUCTION, THIS MANHOLE SHALL BE MADE OF POLYMER CONCRETE, SEE US-3.
2. DROP MANHOLES ARE REQUIRED WHEN THE VERTICAL DISTANCE BETWEEN THE LOWEST EXISTING MANHOLE INVERT AND THE HIGHEST PIPE INVERT IS 2'-0" OR GREATER.
3. MANHOLE SHALL BE AASHTO H-20 RATED, WHEN LOCATED WITHIN THE RIGHT OF WAY.

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

OUTSIDE DROP CONNECTION TO EX. PORTLAND CEMENT MANHOLE

US-6

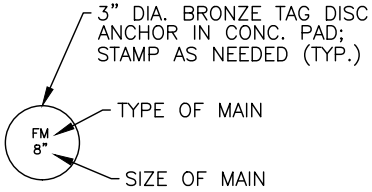
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

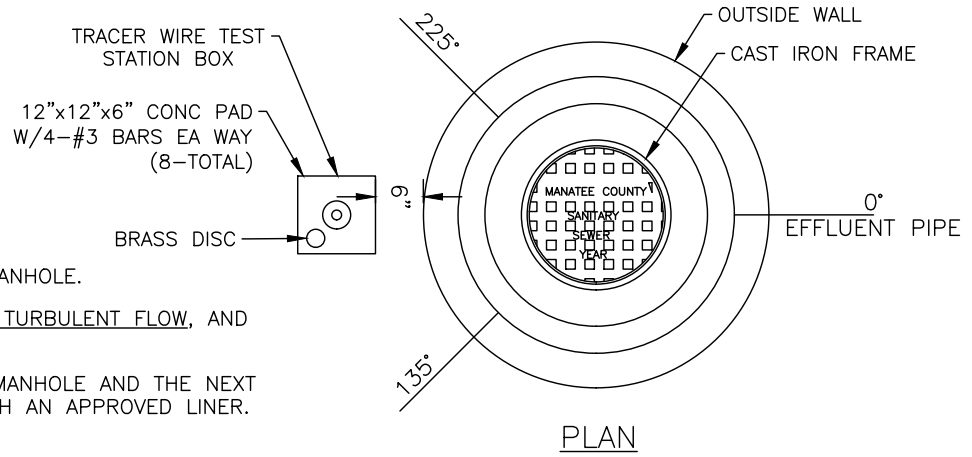
REV.BY	DATE

DATE OF APPROVAL

FORCE MAIN CONNECTION TO EX. PORTLAND CONCRETE MANHOLE (3–6 FEET DEEP)

US–7A

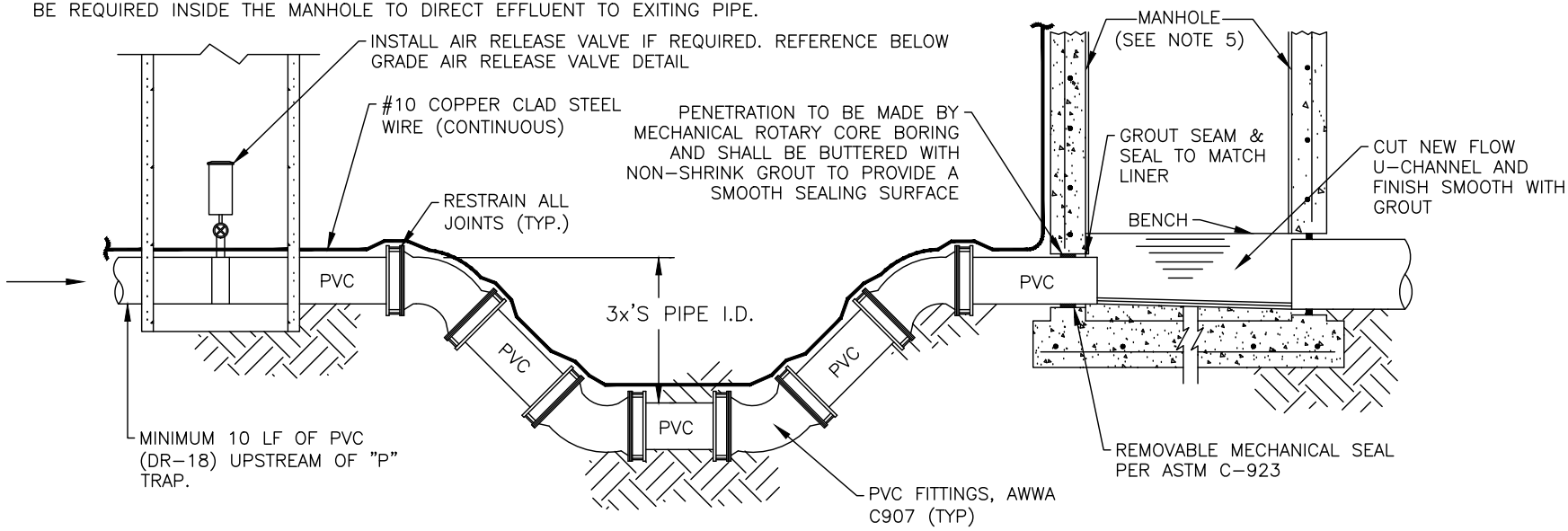




NOTES:

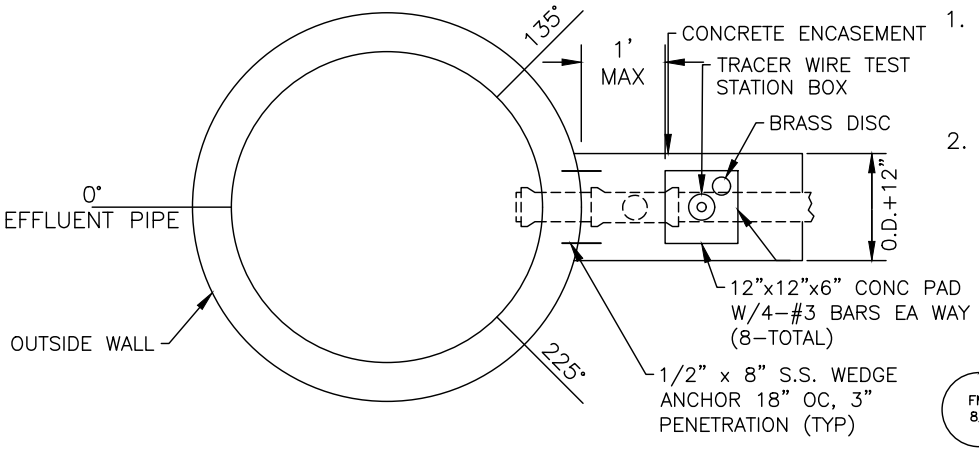
1. PIPE FITTINGS TO BE PVC AWWA C907, CLASS 235.
2. APPROVED PVC RESTRAINERS SHALL BE USED.
3. FORCE MAIN CONNECTION SHALL BE AT THE BOTTOM OF THE MANHOLE.
4. BUILD FLOW CHANNEL PER DETAIL US–3 SEWER MANHOLE FOR TURBULENT FLOW, AND FINISH SMOOTH WITH GROUT.
5. THIS IS AN INTERCEPT MANHOLE WITH TURBULENT FLOW; THIS MANHOLE AND THE NEXT TWO DOWNSTREAM MANHOLES SHALL BE COMPLETELY LINED WITH AN APPROVED LINER. ALL THREE MANHOLES SHALL BE REHABILITATED AS NECESSARY.

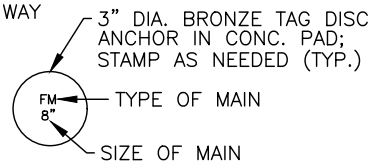
   IN NEW CONSTRUCTION, THIS MANHOLE AND THE NEXT TWO DOWNSTREAM MANHOLES SHALL BE POLYMER CONCRETE, SEE US–3.
6. FORCE MAIN SHALL CONNECT TO THE BOTTOM OF THE MANHOLE 0.1 FT ABOVE EXISTING PIPE. DISCHARGE SHALL BE DIRECTED TO THE EXITING PIPE BY A CONSTRUCTED U–CHANNEL.
7. ANGLE BETWEEN INFLUENT FORCE MAIN AND GRAVITY EFFLUENT PIPE IS PREFERRED TO BE BETWEEN 135°–225°. IF OUTSIDE THE ACCEPTED ANGLES, ADDITIONAL PVC FITTINGS MAY BE REQUIRED INSIDE THE MANHOLE TO DIRECT EFFLUENT TO EXITING PIPE.



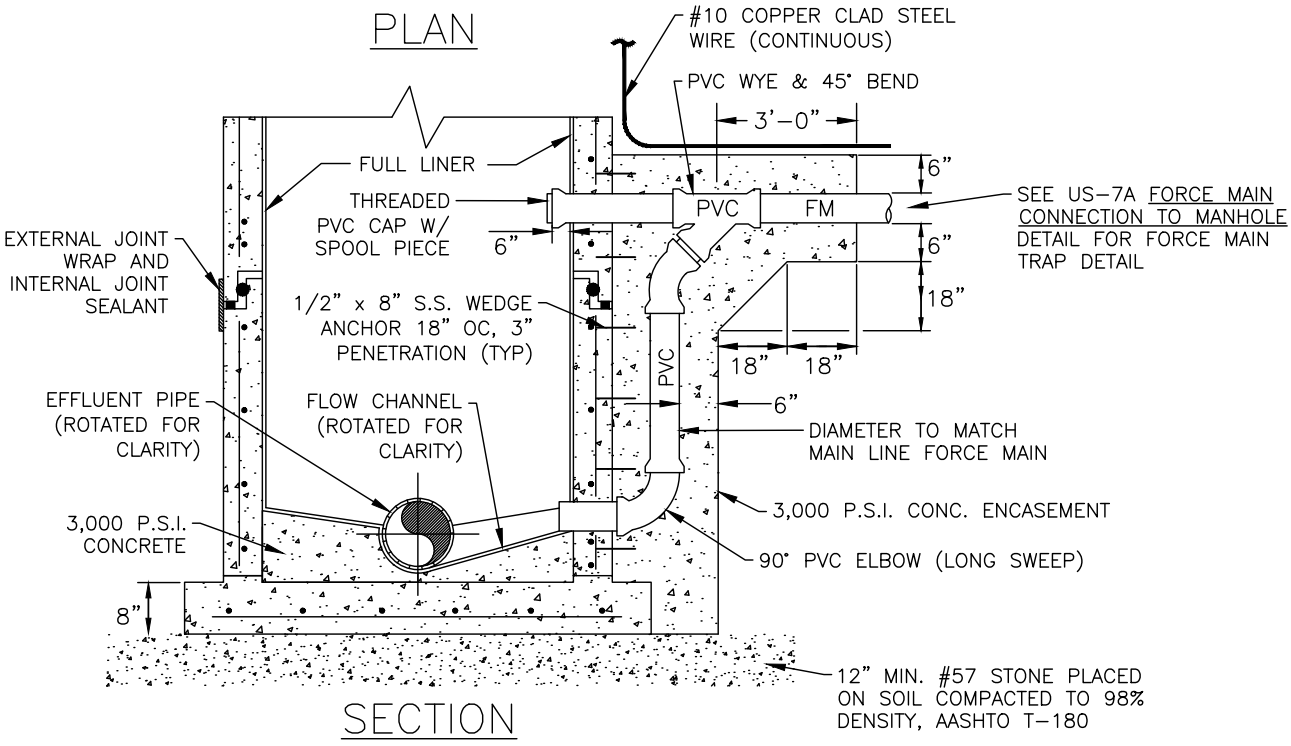
NOTES:

1. SEE US–2 THRU US–4 FOR DETAILED INFORMATION ABOUT PRECAST CONCRETE MANHOLES.
2. A PRE–CAST CONCRETE OUTSIDE DROP MAY BE USED IN LIEU OF THE CAST IN PLACE ENCASEMENT SHOWN BELOW.





PLAN



SECTION

NOTES:

1. THIS IS AN INTERCEPT MANHOLE WITH TURBULENT FLOW; THIS MANHOLE AND THE NEXT TWO DOWNSTREAM MANHOLES SHALL BE COMPLETELY LINED WITH AN APPROVED LINER. ALL THREE MANHOLES SHALL BE REHABILITATED AS NECESSARY.

   IN NEW CONSTRUCTION, THIS MANHOLE AND THE NEXT TWO DOWNSTREAM MANHOLES SHALL BE POLYMER CONCRETE, SEE US–3.
2. ALL FITTINGS SHALL BE PVC AWWA C–907, CLASS 235 MIN. FORCE MAIN DROP PIPE SHALL BE AWWA C900–16 (CLASS 235, DR 18). APPROVED PVC RESTRAINTS SHALL BE USED.
3. A TRAP IS REQUIRED IN THE FORCE MAIN BEFORE THE DROP.
4. FORCE MAIN SHALL CONNECT TO THE BOTTOM OF THE MANHOLE 0.1 FT ABOVE EXITING PIPE. DISCHARGE SHALL BE DIRECTED TO THE EXITING PIPE BY A CONSTRUCTED U–CHANNEL.
5. BUILD FLOW CHANNEL PER DETAIL SEWER MANHOLE FOR TURBULENT FLOW, AND FINISH SMOOTH WITH GROUT.
6. ANGLE BETWEEN INFLUENT FORCE MAIN AND GRAVITY EFFLUENT PIPE IS PREFERRED TO BE BETWEEN 135°–225°. IF OUTSIDE THE ACCEPTED ANGLES, ADDITIONAL PVC FITTINGS MAY BE REQUIRED INSIDE THE MANHOLE TO DIRECT EFFLUENT TO EXITING PIPE.

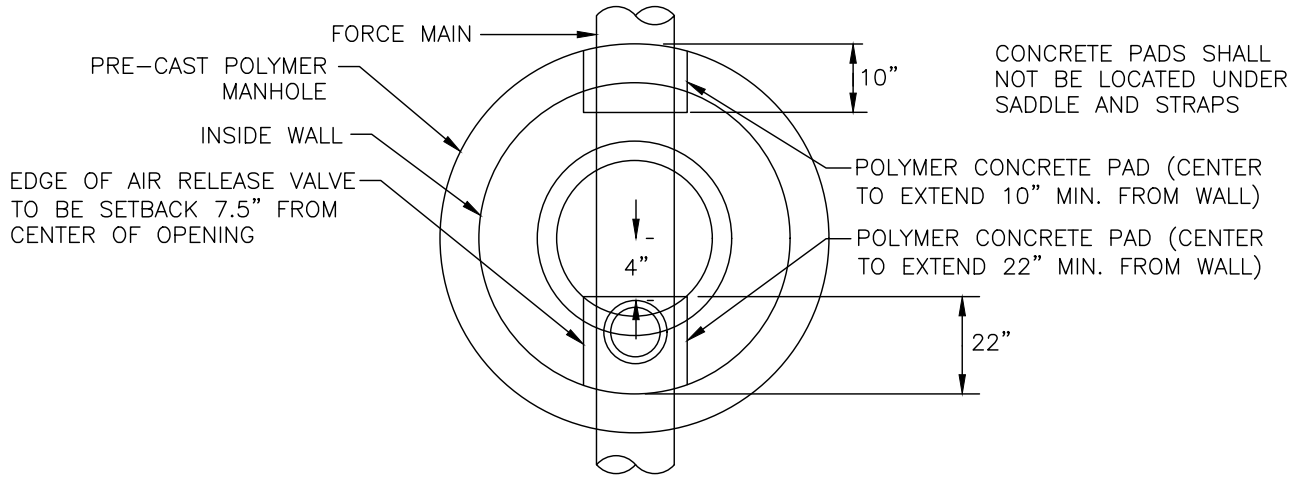
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

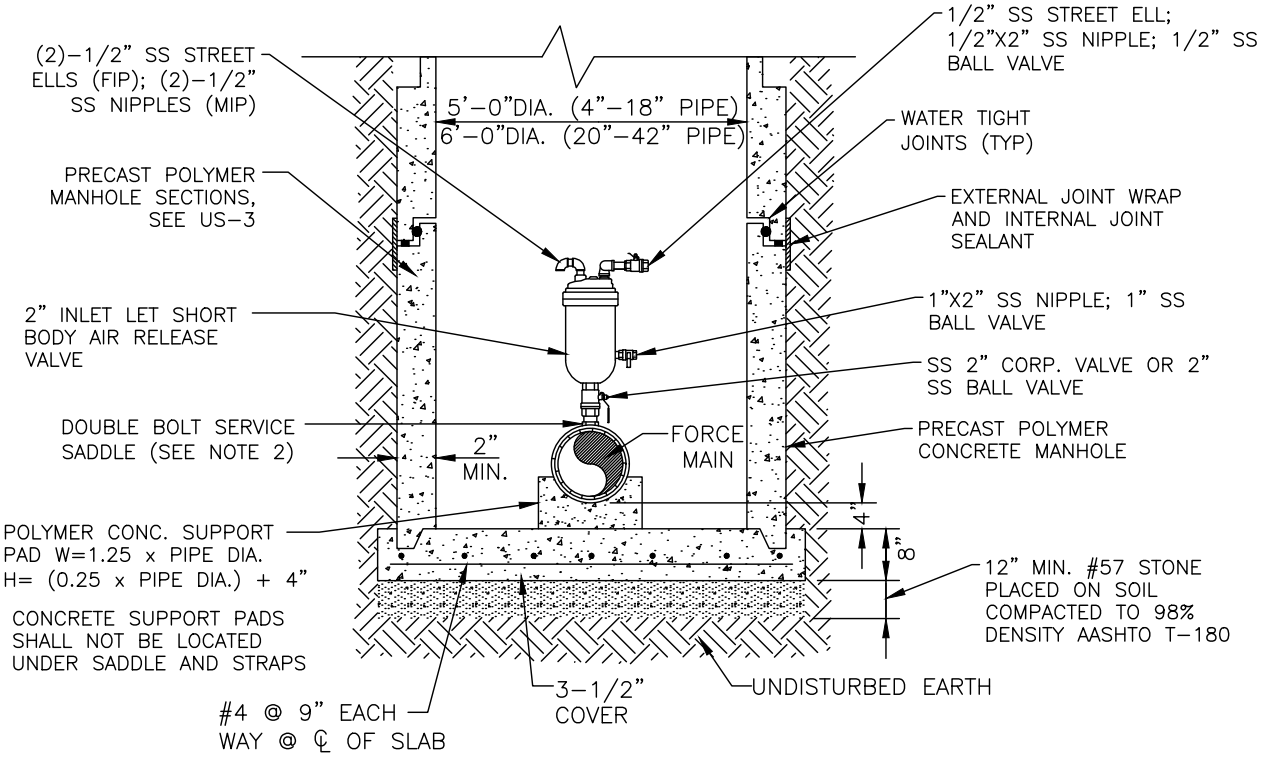
DATE OF APPROVAL

FORCE MAIN CONNECTION TO EX. PORTLAND CONCRETE MANHOLE (>6 FEET DEEP)

US–7B



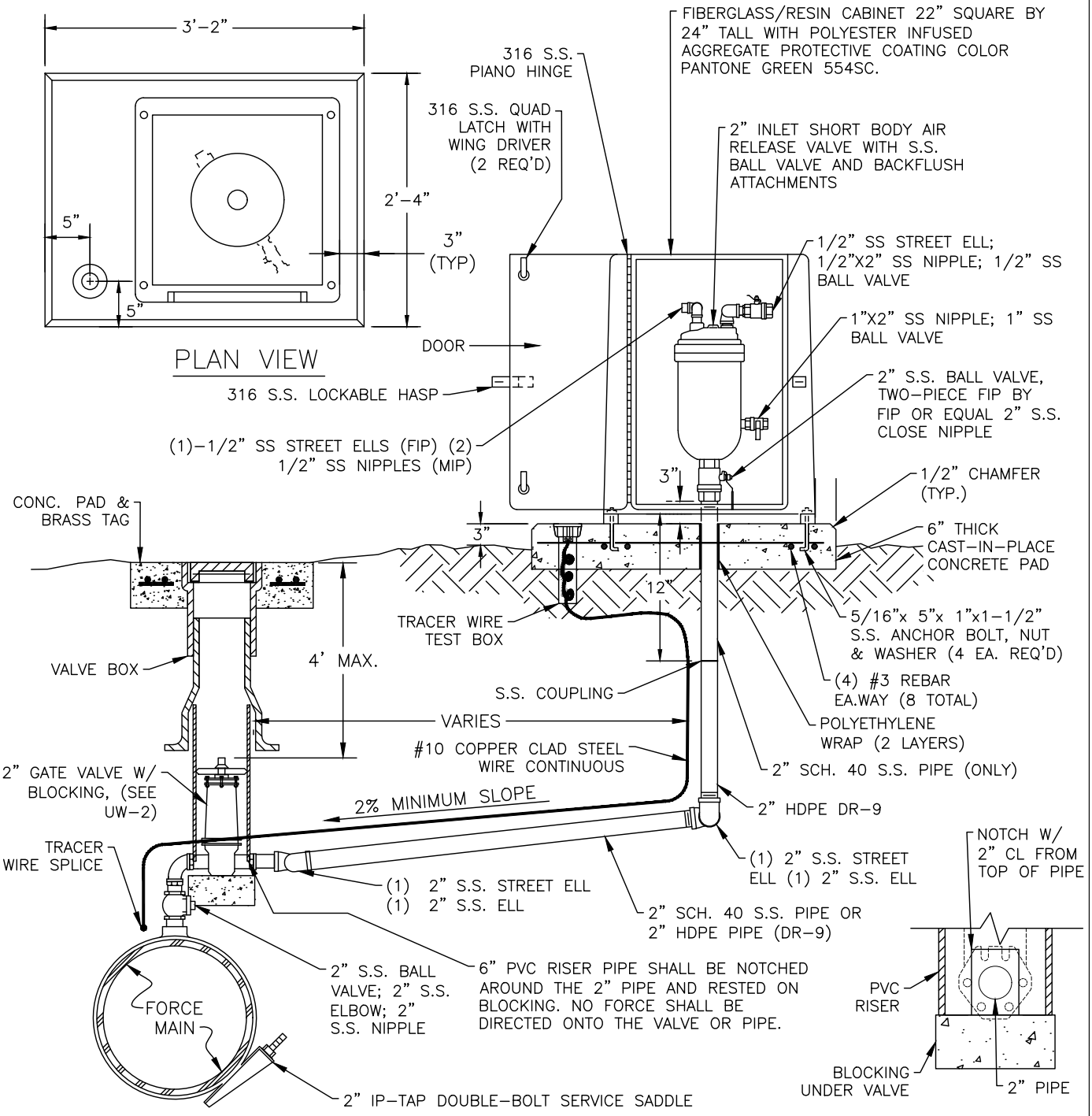
PLAN



NOTES:

1. AIR RELEASE VALVES WHERE REQUIRED ON 4" AND LARGER FORCE MAINS.
2. ARV TO BE SIZED ACCORDING TO MANUFACTURER'S RECOMMENDATION FOR FORCE MAIN SIZE, MINIMUM 2" ARV REQUIRED.
3. SERVICE SADDLE, NIPPLES AND CORPORATION BALL VALVE SHALL BE 316 STAINLESS STEEL.
4. FOR MANHOLES WITH LESS THAN 44 INCHES OF COVER FROM TOP-OF-PIPE TO TOP-OF-FRAME, FRAME & COVER TO HAVE A 32-INCH OPENING. MINIMUM ALLOWABLE COVER IS 36 INCHES.
5. ALL PIPE PENETRATING MANHOLE SHALL HAVE RESILIENT PIPE TO MANHOLE SEALS PER ASTM-923.
6. FINAL GRADE TO BE SLOPED AWAY FROM MANHOLE.
7. MANHOLE SHALL BE AASHTO H-20 RATED, WHEN LOCATED WITHIN THE RIGHT OF WAY.
8. ALL STAINLESS STEEL SHALL BE 316 STAINLESS STEEL.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			BELOW GRADE AIR RELEASE VALVE FOR FORCE MAINS	US-8
REV.BY	DATE			
		DATE OF APPROVAL		



NOTES:

1. AIR RELEASE VALVES TO BE ABOVE-GROUND INSTALLATIONS, UNLESS IMPRACTICAL. INSTALLATIONS MAY BE BELOW-GROUND ONLY WHERE APPROVED AND SPECIFICALLY INDICATED ON THE PLAN.
2. AIR RELEASE VALVES TO BE INSTALLED AT HIGH POINTS, OR WHERE AIR WOULD BE ENTRAPPED, ALONG 4" AND LARGER FORCE MAINS.
3. FORCE MAIN VERTICAL ALIGNMENT TO BE DESIGNED SUCH THAT THE MINIMUM NUMBER OF REQUIRED AIR RELEASE VALVES ARE INSTALLED.
4. ALL INCIDENTAL FITTINGS AND HARDWARE TO BE 316 STAINLESS STEEL.
5. ALL PIPE THREADS TO BE SEALED AIR TIGHT.
6. VENT PIPE TO BE LAID ACCURATELY ON SLOPE, WITHOUT HIGH OR LOW POINTS.
7. CONCRETE PAD SHALL BE TYPE I CONCRETE W/ 3,000 P.S.I., 28 DAY COMPRESSIVE STRENGTH.
8. ARV SHALL BE INSTALLED MINIMUM 6 FT FROM EDGE OF PAVEMENT; 10 FT MAXIMUM FROM BACK OF CURB; 4 FT MIN. MAY BE APPROVED BY UTILITIES IN SOME EXISTING AREAS.
9. SEE UW-2 GATE VALVE, BOX, LID AND TAG STANDARD DETAIL. CENTERING COLLAR IS NOT REQUIRED ON 2" GATE VALVES.

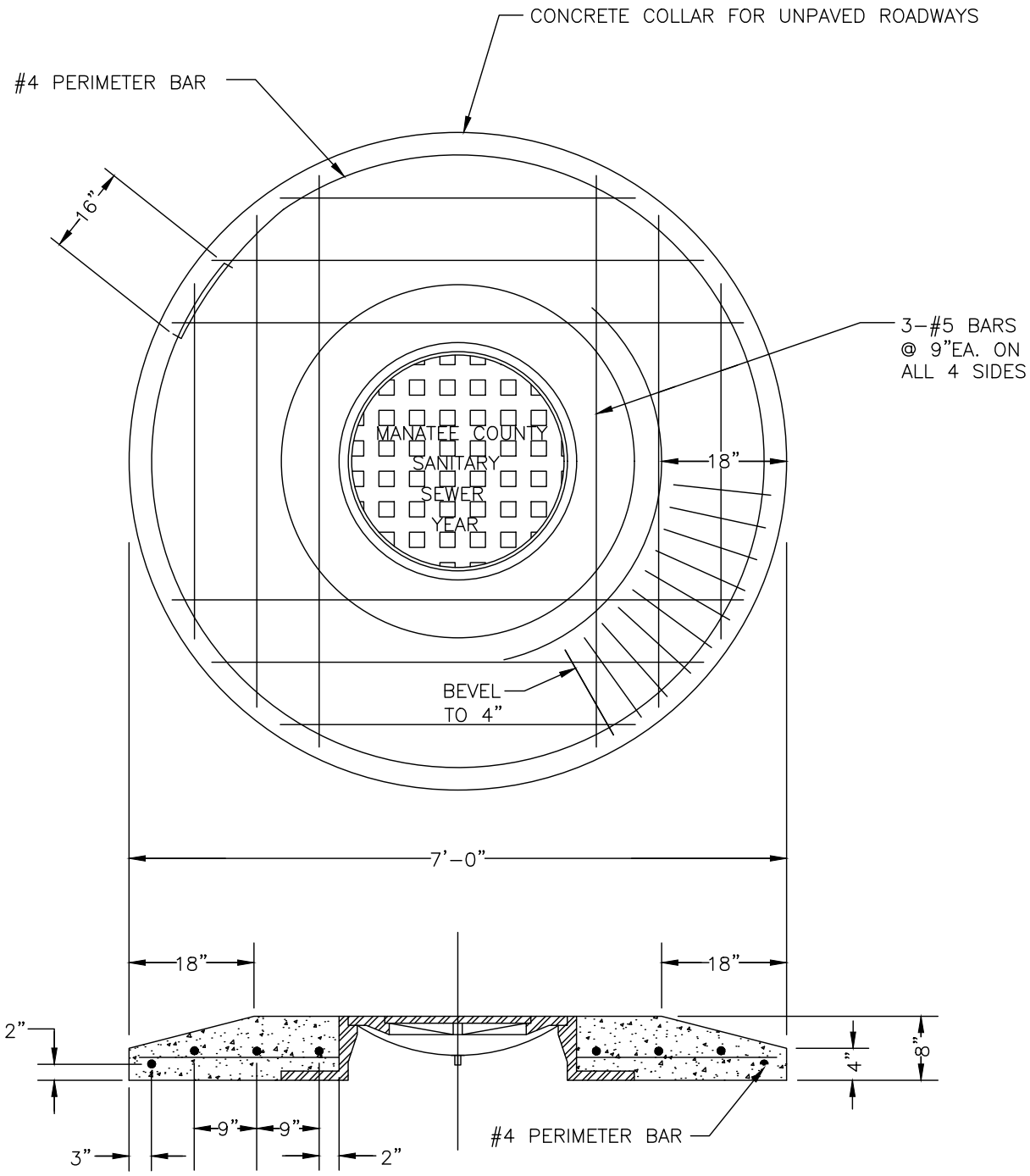
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

ABOVE-GROUND AIR RELEASE VALVE ASSY. FOR FORCE MAINS

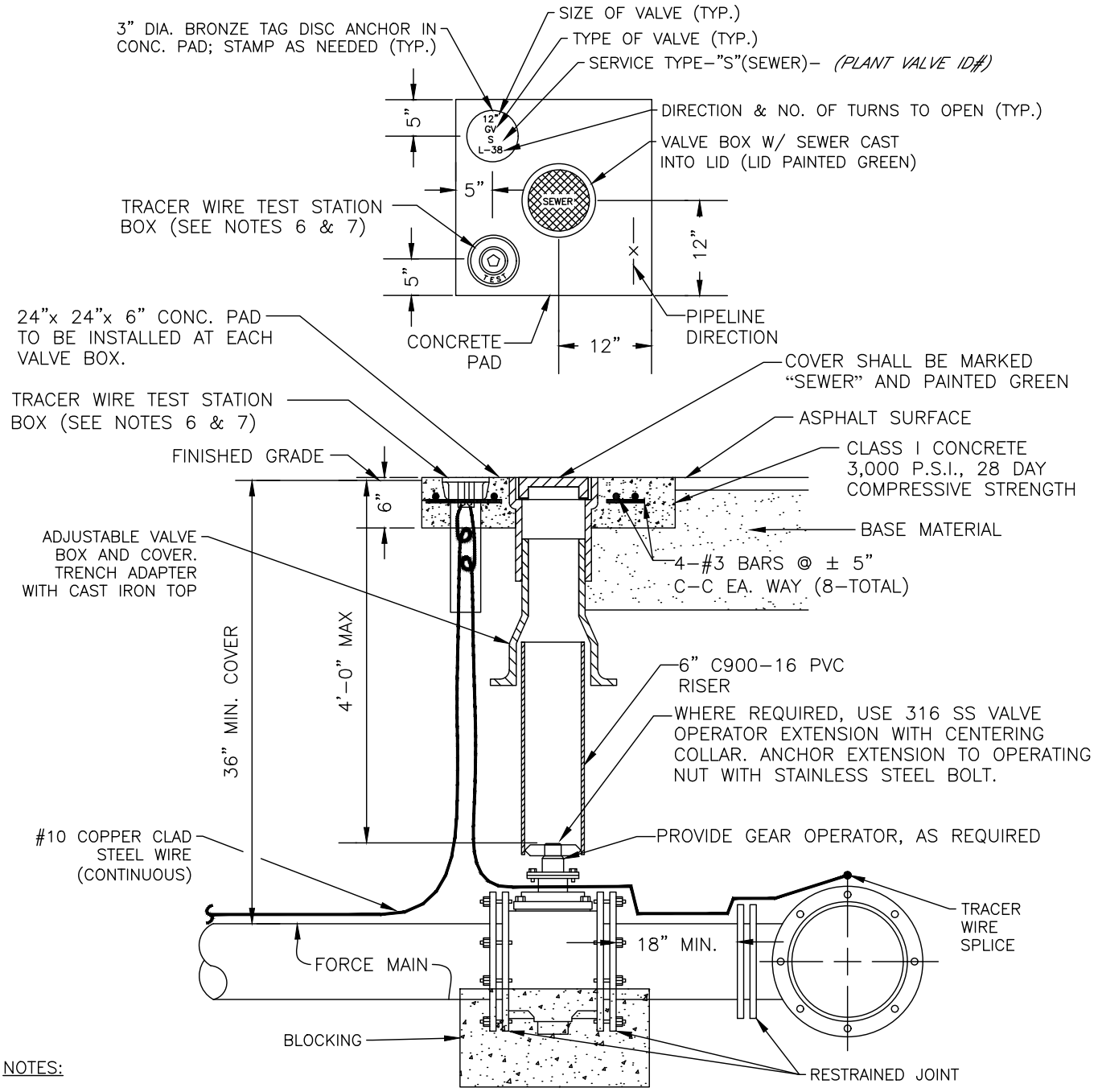
US-9



NOTES:

1. OMIT "MANATEE COUNTY", IF PRIVATELY MAINTAINED.
2. PORTLAND CEMENT SHALL CONFORM TO ASTM C150, TYPE 1, AND CONCRETE SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 4,000 P.S.I.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			MANHOLE COVER & CONCRETE COLLAR FOR UNPAVED ROADWAYS	US–10
REV.BY	DATE			
		DATE OF APPROVAL		



NOTES:

1. "SV" TO BE IMPRESSED INTO THE NEWLY-POURED CONCRETE CURB, ALONG WITH DISTANCE IN FEET TO THE VALVE. IF NO CURB, INSTALL A GREEN DISC WITH "SV" AND A 1/8" x 1" GALVANIZED STEEL SCREW IN THE EDGE OF PAVEMENT WITH THE FOOTAGE FROM THE DISC TO THE VALVE.
2. ALL EXISTING AND PROPOSED VALVE BOXES SHALL BE ADJUSTED TO FINISHED GRADES AS DETERMINED IN THE FIELD.
3. VALVES SHALL NOT BE PLACED IN HANDICAPPED RAMPS, CURBS OR GUTTERS.
4. PRECAST CONCRETE PADS AND THRUST BLOCKS SHALL NOT BE USED.
5. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 1/2".
6. USE NON-TRAFFIC RATED BOXES FOR NORMAL YARD SERVICE. WHERE VALVE WILL BE IN STREET OR PARKING UNDER VEHICLE TRAFFIC, USE TRAFFIC RATED BOXES. WHERE POSSIBLE, LOCATE TRACE WIRE TESTING STATION OUTSIDE OF TRAVEL LANE OR IN MEDIAN, CENTERED IN SEPARATE CONCRETE PAD SIMILAR TO STANDARD VALVE BOX PAD.
7. TRACER WIRE BOX SHALL BE LOCATED OUTSIDE THE ROADWAY ON THOROUGHFARES, LOCAL ARTERIAL AND STATE ROADWAYS.
8. THE BRASS TAG SHALL HAVE A "PLANT VALVE ID# WHEN VALVES ARE INSTALLED WITHIN THE COUNTY TREATMENT PLANT LIMITS. THE PLANT VALVE ID# SHALL BE SHOWN ON THE CONSTRUCTION PLANS AND RECORD DRAWINGS.
9. REFER TO SECTION 1.11 IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL FOR FURTHER DETAILS.

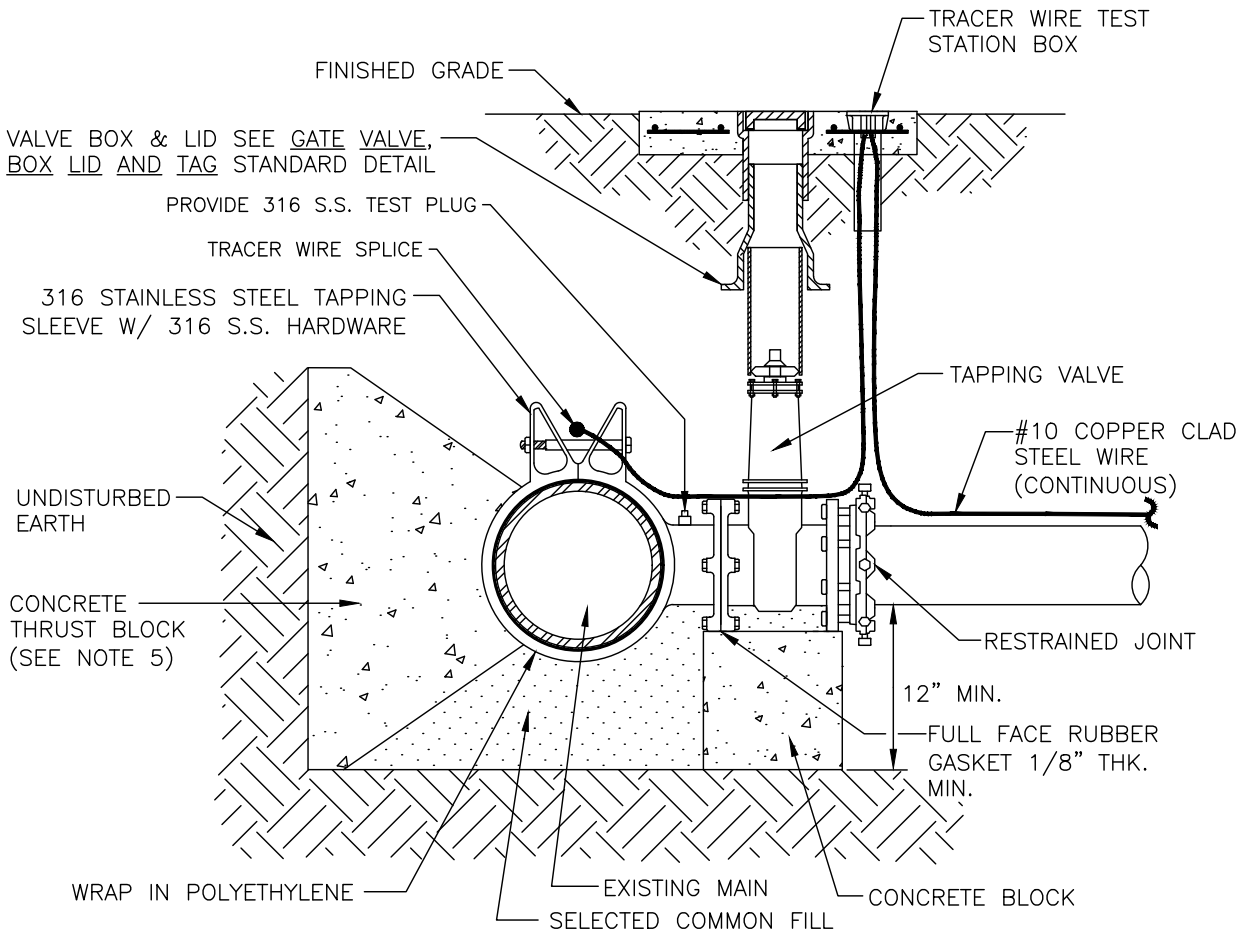
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

VALVE, BOX, COVER AND TAG

US-11



ELEVATION

NOTES:

1. PRIOR TO TAPPING, CONTRACTOR TO DEMONSTRATE 60 MINUTE HYDROSTATIC TEST OF THE TAPPING SLEEVE AND VALVE WITH NO LOSS OF 150 PSI FOR FORCE MAIN.
2. ALL FITTINGS TO BE WRAPPED WITH 20 MIL POLYETHYLENE PLASTIC SHEETING AT THRUST BLOCK.
3. ALL TAPS MUST BE OF A SMALLER SIZE THAN THE MAIN BEING TAPPED & PLACED NO CLOSER THAN 30" OR A DISTANCE EQUAL TO (1) MAIN PIPE DIAMETER PLUS (2) TAP PIPE DIAMETERS (WHICHEVER IS GREATER) FROM A JOINT OR FITTING.
4. CONTRACTOR TO SUPPLY A DRY HOLE FOR TAPPING CREW TO WORK IN AND A BACK–HOE TO LOWER TAPPING MACHINE INTO THE HOLE.
5. WHERE THRUST BLOCK NOT USED, RESTRAINED JOINTS MUST THEN EXTEND FROM TEE FULL LENGTH SPECIFIED FOR "TEES."
6. TRACER WIRE TEST STATION BOX IS REQUIRED AT CONNECTIONS TO EXISTING MAINS.
7. SEE SECTION 1.11 TAPPING SLEEVES AND VALVES IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL FOR FURTHER DETAILS.

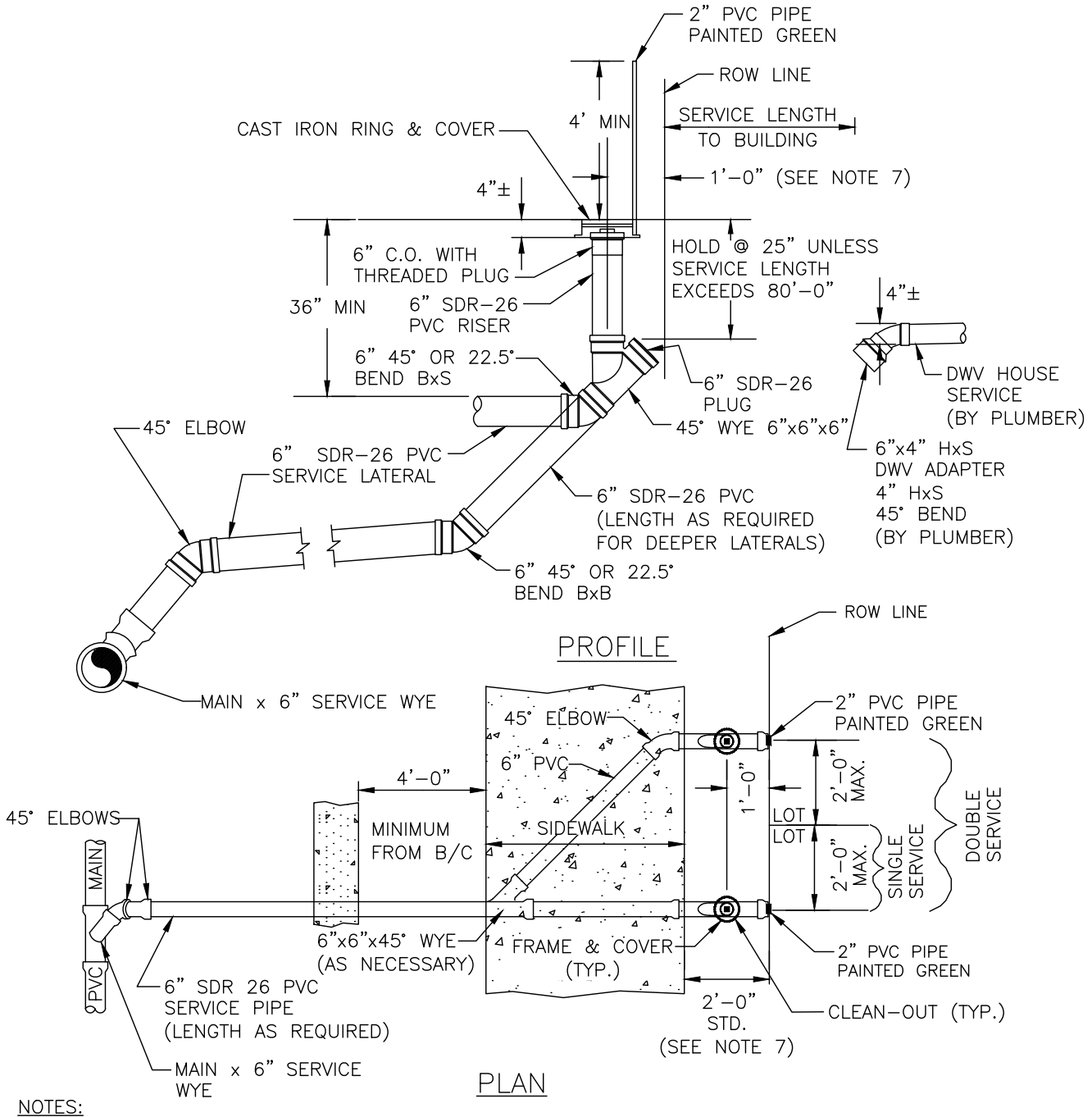
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

TAPPING SLEEVE AND VALVE (FORCE MAINS)

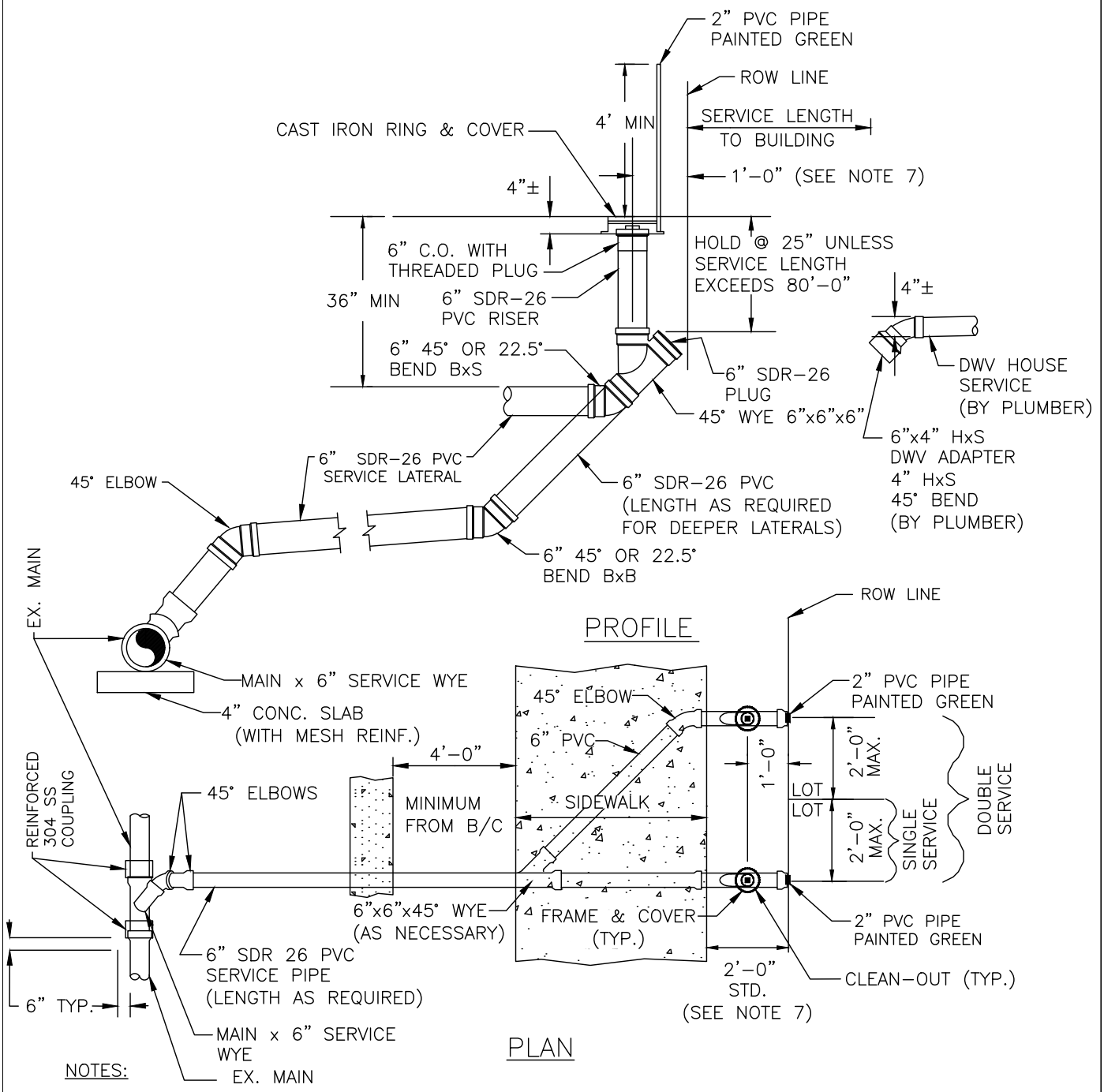
US–12



NOTES:

1. RUBBER DONUTS ARE NOT TO BE USED.
2. "SCO" TO BE IMPRESSED INTO THE NEWLY-POURED CONCRETE CURB, ALONG WITH DISTANCE IN FEET TO THE CLEAN-OUT. IF NO CURB INSTALL A GREEN DISC WITH "SCO" AND ⅛" X 1" GALVANIZED STEEL SCREW IN THE EDGE OF PAVEMENT WITH THE FOOTAGE FROM THE DISC TO THE CLEAN-OUT.
3. SANITARY SEWER CLEAN-OUTS SHALL NOT BE LOCATED IN DRAINAGE SWALES, EASEMENTS, SIDEWALKS OR DRIVEWAYS.
4. NO SERVICE CONNECTIONS TO BE MADE TO THE CLEAN-OUT RISER. ALL DOMESTIC CONNECTIONS SHALL BE MADE TO THE STUB-OUT PROVIDED.
5. SEWER SERVICE SHALL BE 5' MIN. FROM WATER SERVICE OR FIRE HYDRANT.
6. CLEAN-OUT ADAPTER TO BE SOLVENT-WELDED TO RISER TOP. CLEAN-OUT THREADS SHALL BE WRAPPED WITH TEFLON PLUMBERS TAPE TO SEAL PLUG WATERTIGHT.
7. WHEN THE DISTANCE BETWEEN THE EDGE OF THE SIDEWALK & THE ROW LINE IS ONE FOOT (CUL-DE-SAC W/MEDIAN) THE DISTANCE BETWEEN THE CENTER OF THE CLEAN-OUT RISER & THE ROW LINE SHALL BE 6".

MANATEE COUNTY PUBLIC WORKS DEPARTMENT				
REV.BY	DATE		SINGLE AND DOUBLE SERVICE CONNECTION	US-13A
		DATE OF APPROVAL		



NOTES:

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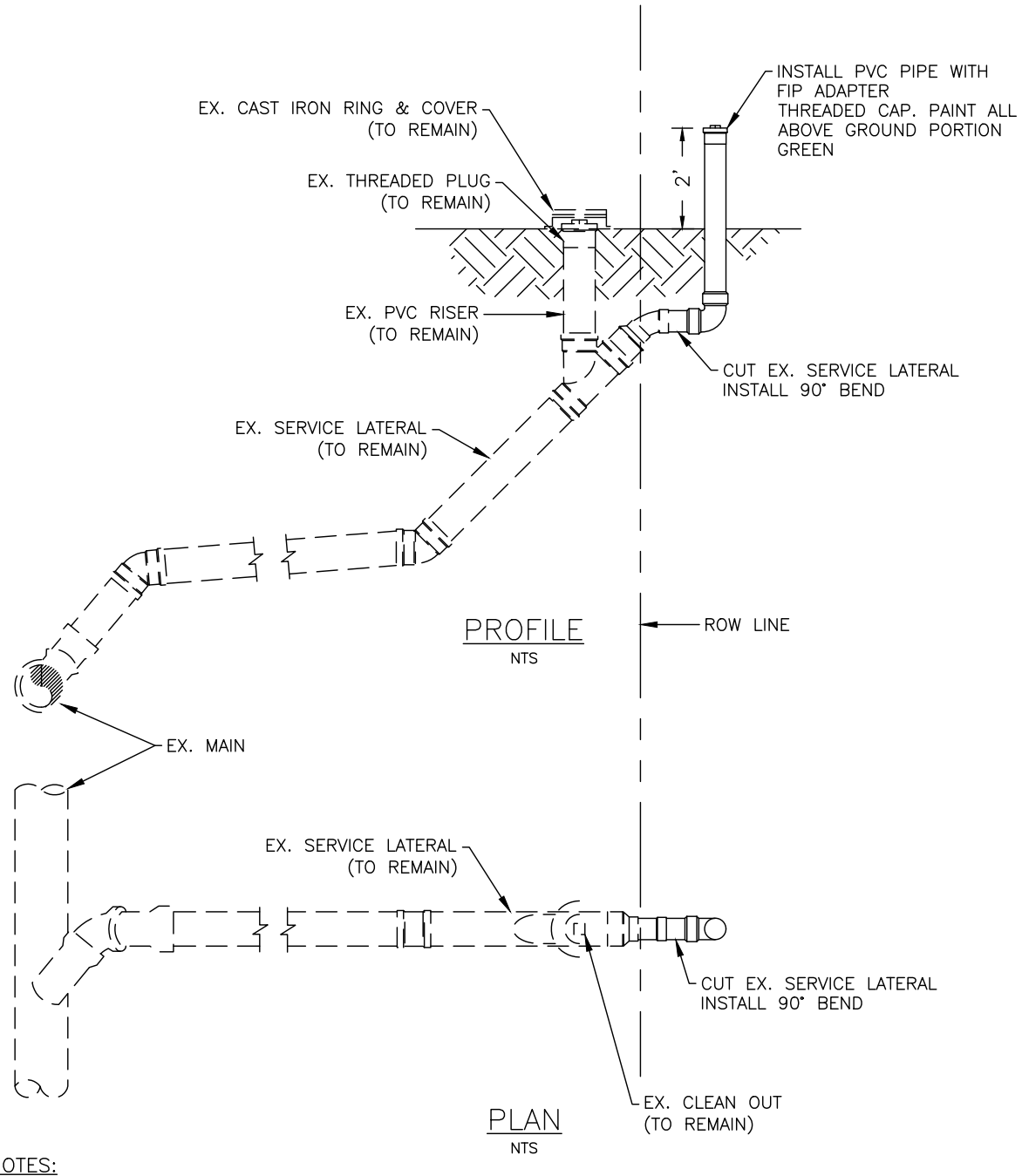
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

CUT-IN SINGLE AND DOUBLE SERVICE WYES

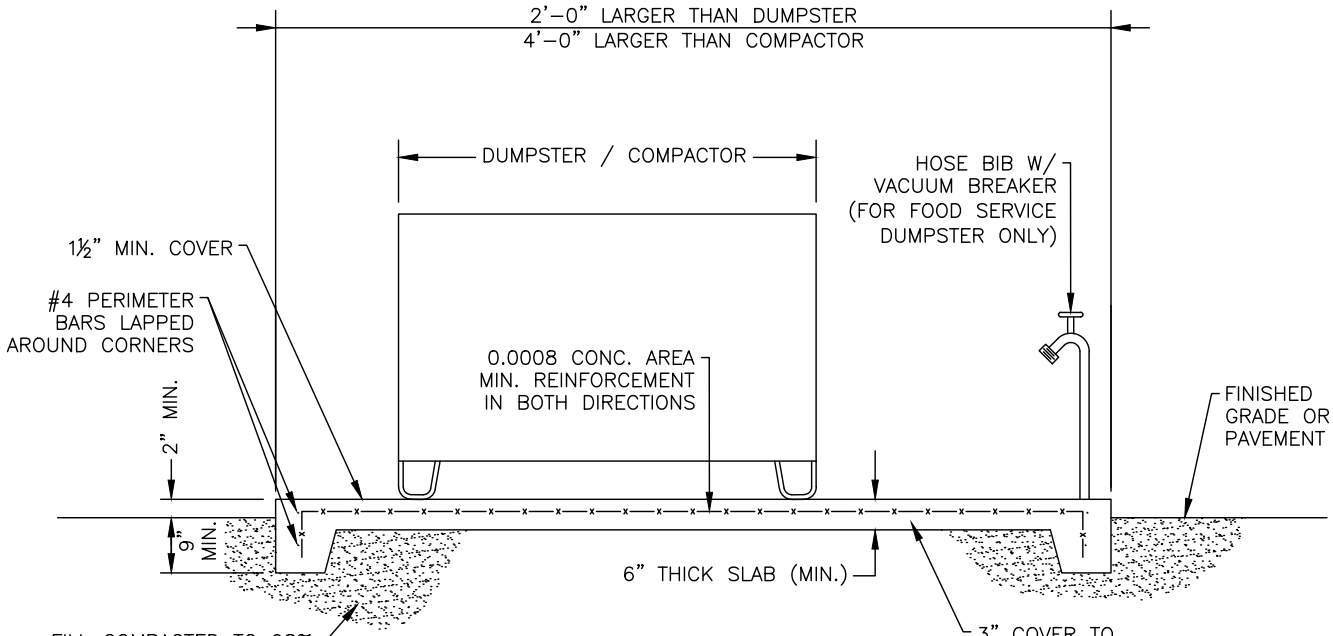
US-13B



NOTES:

1. RUBBER DONUTS ARE NOT TO BE USED.
2. ALL CONNECTIONS TO BE SOLVENT WELDED, OR WATER–TIGHT PUSH ON JOINTS W/ ELASTOMERIC GASKETS, AWWA C907.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			EXISTING SERVICE CONNECTION (BUILDING DEMOLITION)	US–13C
REV.BY	DATE			
		DATE OF APPROVAL		



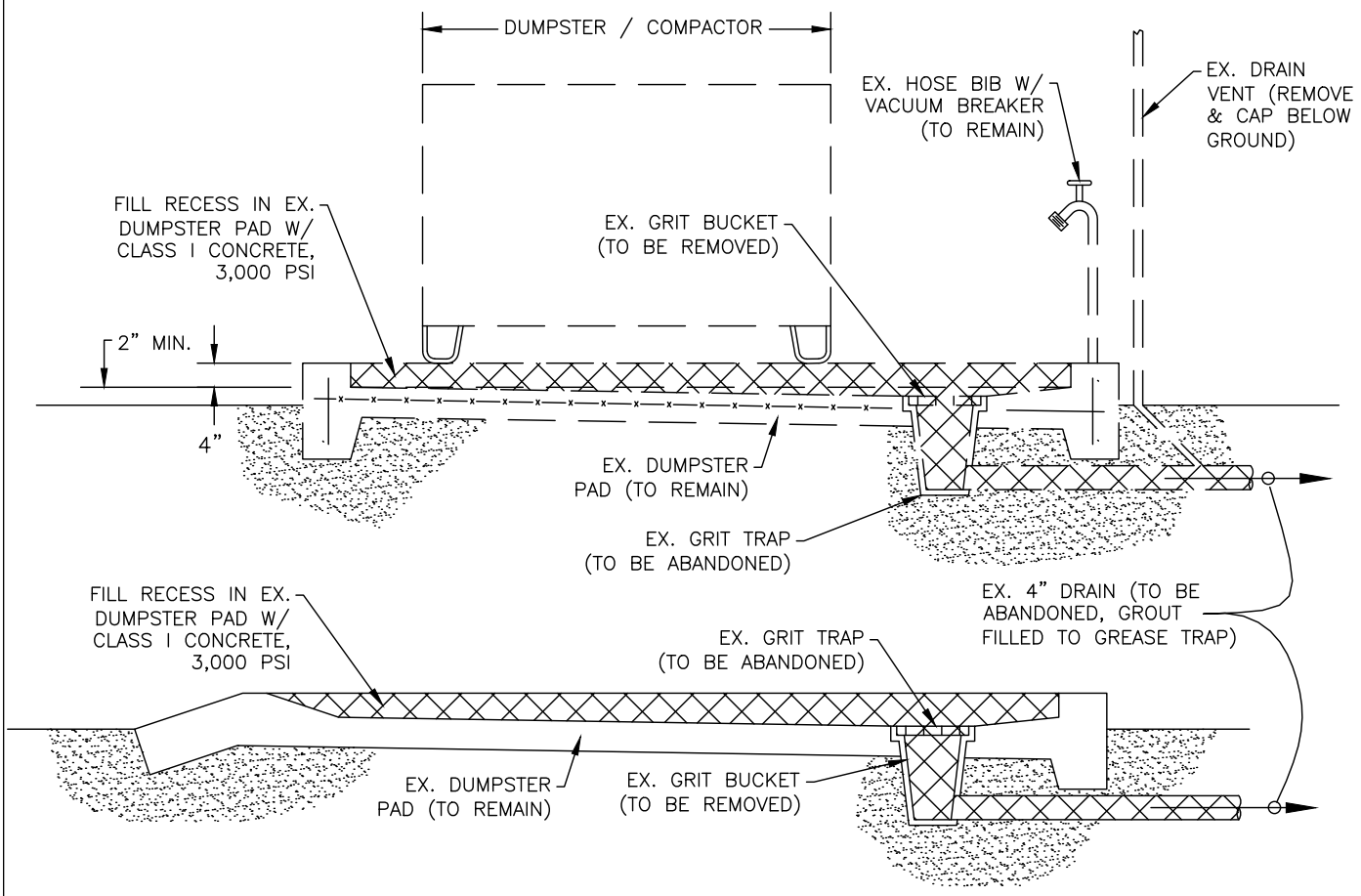
PAD DETAIL

MINIMUM REQUIRED FOR ALL DUMPSTER OR COMPACTOR PAD

NOTES:

1. DUMPSTER PAD SHALL BE CLASS I CONCRETE W/ MIN. COMP. STRENGTH f'c= 3000 P.S.I. & MIN. REINFORCEMENT STRENGTH fy= 60,000 P.S.I.
2. DUMPSTER PAD SHALL BE FENCED IN ACCORDANCE WITH THE MANATEE COUNTY LAND DEVELOPMENT CODE.
3. ENCLOSURE SIZE TO BE A MINIMUM 10'x20' TO ACCOMMODATE RECYCLING CONTAINERS AND HAVE A MIN. TEN (10') FOOT GATE OPENING FOR EACH CONTAINER.
4. DISCHARGE FROM THE DUMPSTER PAD SHALL BE DIRECTED TO THE ONSITE STORMWATER MANAGEMENT SYSTEM, I.E. CATCH BASIN, SWALES, RETENTION AREA, ETC.
5. WHEN DUMPSTER PAD IS LOCATED ADJACENT TO PROPERTY LINE, DISCHARGE SHALL BE DIRECTED IN THE OPPOSITE DIRECTION AND SHALL NOT DISCHARGE ONTO ADJACENT PROPERTY.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT				
REV.BY	DATE		COMPACTOR AND DUMPSTER PADS	US–14A
		DATE OF APPROVAL		



EX. PAD RETROFIT DETAIL

(REQUIRED FOR EX. DUMPSTER OR COMPACTOR PAD AT FOOD SERVICE LOCATION)

NOTES:

1. EX. FOOD DUMPSTER PADS SHALL BE RETROFITTED W/ CONCRETE AND SLOPED TO DRAIN AS INDICATED BELOW TO REMOVE ANY DIRECT CONNECTION(S) TO A SANITARY SEWER SYSTEM.
2. CLASS I CONCRETE W/ MIN. COMP. STRENGTH f'c= 3000 P.S.I. & MIN. REINFORCEMENT STRENGTH fy= 60,000 P.S.I. SHALL BE USED. FLOWABLE FILL MAY BE USED TO ABANDONED THE EXISTING UNDERGROUND PIPING TO THE GREASE TRAP.
3. ALL SURFACE DISCHARGE FROM THE DUMPSTER PAD SHALL BE DIRECTED TO THE ONSITE STORMWATER MANAGEMENT SYSTEM, I.E. CATCH BASIN, SWALES, RETENTION AREA, ETC.
4. WHEN DUMPSTER PAD IS LOCATED ADJACENT TO PROPERTY LINE, DISCHARGE SHALL BE DIRECTED IN THE OPPOSITE DIRECTION AND SHALL NOT DISCHARGE ONTO ADJACENT PROPERTY.

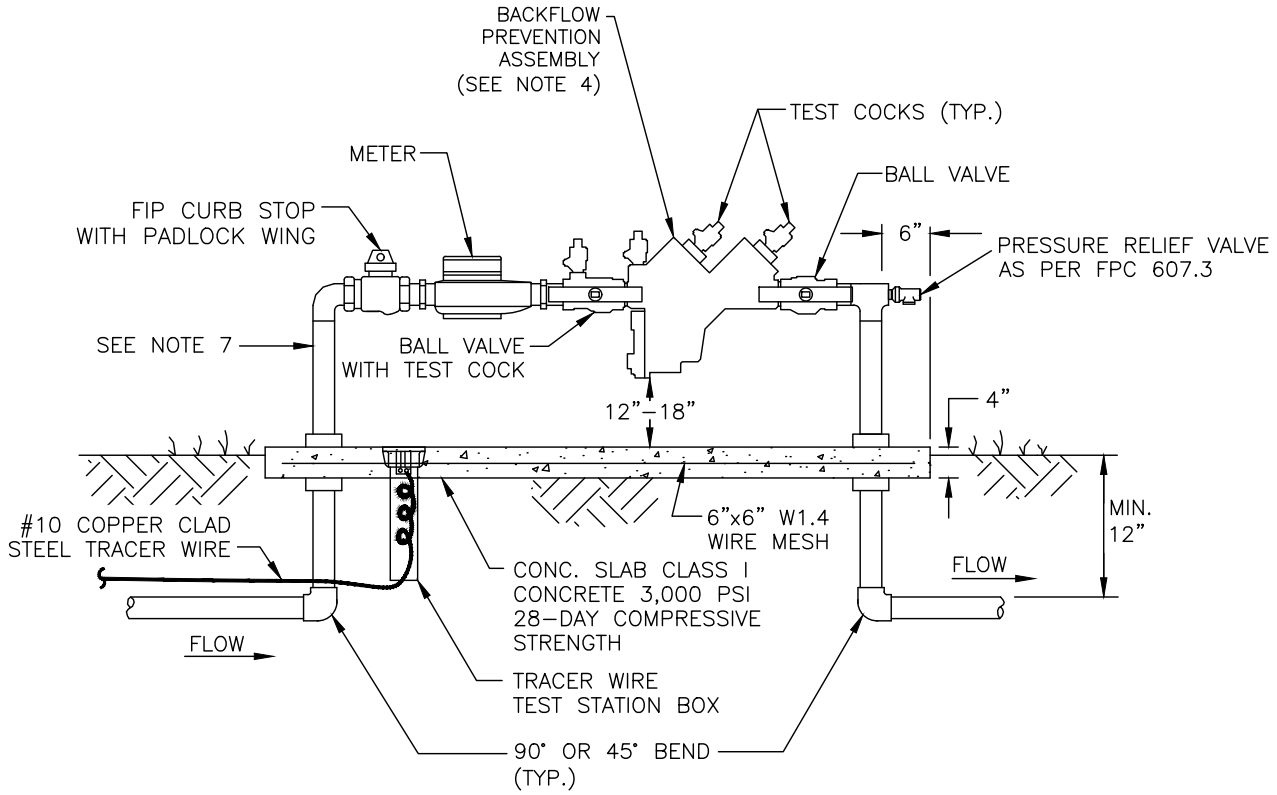
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

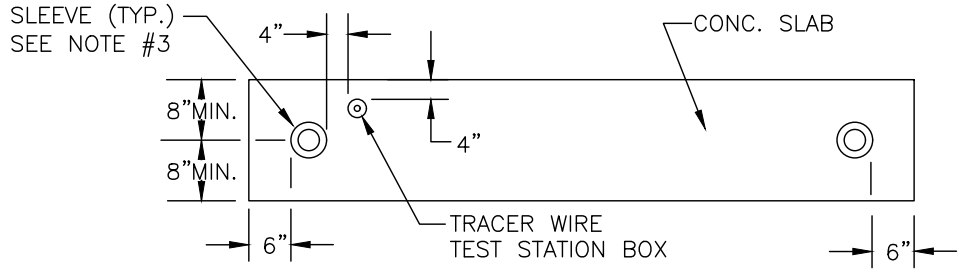
REV.BY	DATE

DATE OF APPROVAL

MODIFICATIONS TO EX. COMPACTOR AND DUMPSTER PADS

US-14B





NOTES:

1. BACKFLOW PREVENTION ASSEMBLY DEVICE MUST BE INSTALLED DOWNSTREAM OF METER, AS CLOSE TO METER AS POSSIBLE.
2. COPPER PIPE TYPE ("K" OR "L") OR BRASS PIPE MINIMUM SCHEDULE 40 SHALL BE USED TO A MINIMUM DEPTH OF 12" BELOW GRADE.
3. PIPES PASSING THROUGH OR ENCASED IN CONCRETE MUST BE PROPERLY PROTECTED AND SLEEVED.
4. THE SYSTEM MUST MEET ALL REQUIREMENTS OF THE FLORIDA PLUMBING CODE (LATEST EDITION) AND CHAPTER 2–31, ARTICLE X OF THE MANATEE COUNTY CODE OF ORDINANCES.
5. ALL EXPOSED EDGES OF CONCRETE SHALL BE CHAMFERED 1/2".
6. BACKFLOW PREVENTER SHALL BE TESTED AT THE TIME OF INSTALLATION.
7. PRESSURE REDUCING VALVE REQUIRED UPSTREAM OF BACKFLOW PREVENTION ASSEMBLY, IF SYSTEM PRESSURE EXCEEDS 80 PSI.
8. 3' MIN. CLEARANCE FROM LANDSCAPING PLANTS AND 10' MIN. CLEARANCE FROM TREES TO EDGE OF CONCRETE SLAB AND CLEAR OPENING FOR ACCESS FROM STREET.
9. THE WATER METER AND BACKFLOW PREVENTION ASSEMBLY SHALL BE LOCATED AT THE ROW LINE. THE BACKFLOW PREVENTION ASSEMBLY FOR PRIVATE LIFT STATIONS SHALL BE LOCATED ADJACENT TO THE ROW LINE OR WITHIN AN EASEMENT OUTSIDE OF THE FENCING.
10. SATELLITE LIFT STATIONS SHALL HAVE A 5/8–INCH WATER METER, WITH A 3/4–INCH REDUCED PRESSURE (RPZ) BACKFLOW PREVENTION ASSEMBLY. STATIONS WITH WETWELL DIAMETERS 12 FEET AND LARGER TO HAVE A 2–INCH METER AND RPZ BACKFLOW PREVENTION ASSEMBLY.
11. BACKFLOW PREVENTION ASSEMBLIES USED FOR POTABLE APPLICATIONS SHALL BE LEAD FREE AS DEFINED IN THE REDUCTION OF LEAD IN DRINKING WATER ACT, SECTION 1417 OF THE SAFE DRINKING WATER ACT, 42 U.S.C. 300g–6, AS MAY BE AMENDED, AND IN COMPLIANCE WITH ALL APPLICABLE REGULATIONS

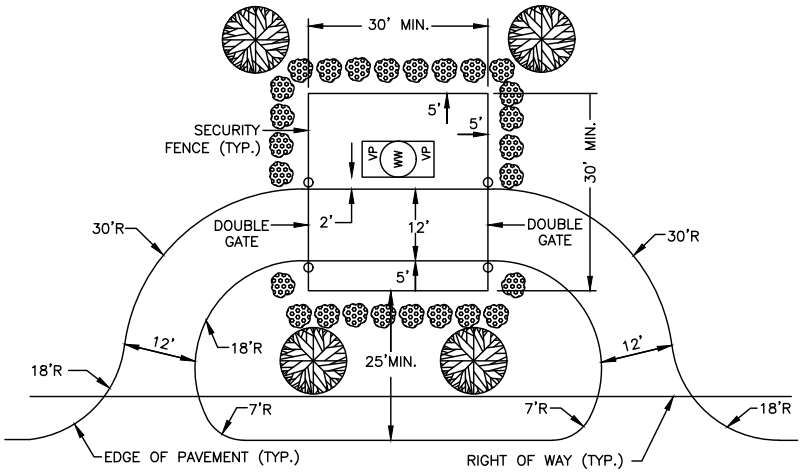
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

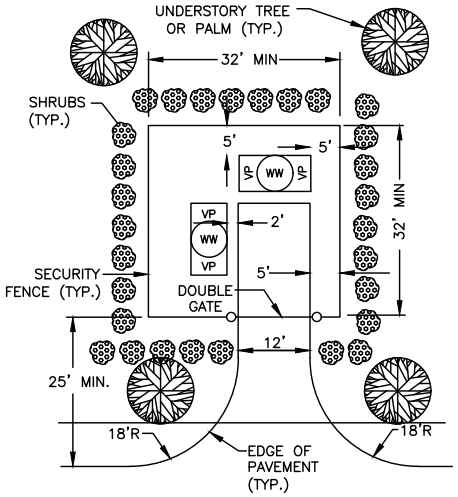
WATER METER & BACKFLOW PREVENTION ASSEMBLY FOR LIFT STATIONS

US–15



THOROUGHFARE DRIVEWAYS

N.T.S



NON–THOROUGHFARE DRIVEWAY

N.T.S

NOTES:

1. A MINIMUM SETBACK OF 5 FT SHALL BE PROVIDED BETWEEN LIFT STATION STRUCTURES/EQUIPMENT/VALVE ASSEMBLY AND THE FENCE.
2. DRIVEWAY SHALL EXTEND UP TO OR BE EVEN WITH THE FURTHEST POINT OF THE WET WELL OR VALVE PAD.
3. LIFT STATION EASEMENT SHALL EXTEND A MINIMUM OF 15 FT BEYOND ALL FOUR SIDES OF THE LIFT STATION SECURITY FENCE.
4. OPTIONS FOR PLACEMENT OF WW & VALVE ASSEMBLY (IF NEEDED) ARE INDICATED FOR CLARITY.
5. A MINIMUM SETBACK OF 5 FT SHALL BE PROVIDED BETWEEN THE SHRUB'S BASE STEM AND THE LIFT STATION SECURITY FENCE.
6. A MINIMUM SETBACK OF 10 FT SHALL BE PROVIDED BETWEEN THE TRUNK OF SMALL TREES AND THE LIFT STATION SECURITY FENCE.
7. SPECIFIC LANDSCAPING REQUIREMENTS SHALL BE IN ACCORDANCE WITH SECTION 1.13.11 IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL.
8. DRIVEWAY MATERIAL SHALL BE CONCRETE AND SHALL BE IN ACCORDANCE WITH MANATEE COUNTY HIGHWAY & TRAFFIC STANDARDS MANUAL FOR THE ENTIRE LENGTH OF THE DRIVEWAY.
9. DRIVEWAY WILL BE INSTALLED AT GRADE OF SHELL SURROUNDING WET WELL & VALVE ASSEMBLY.

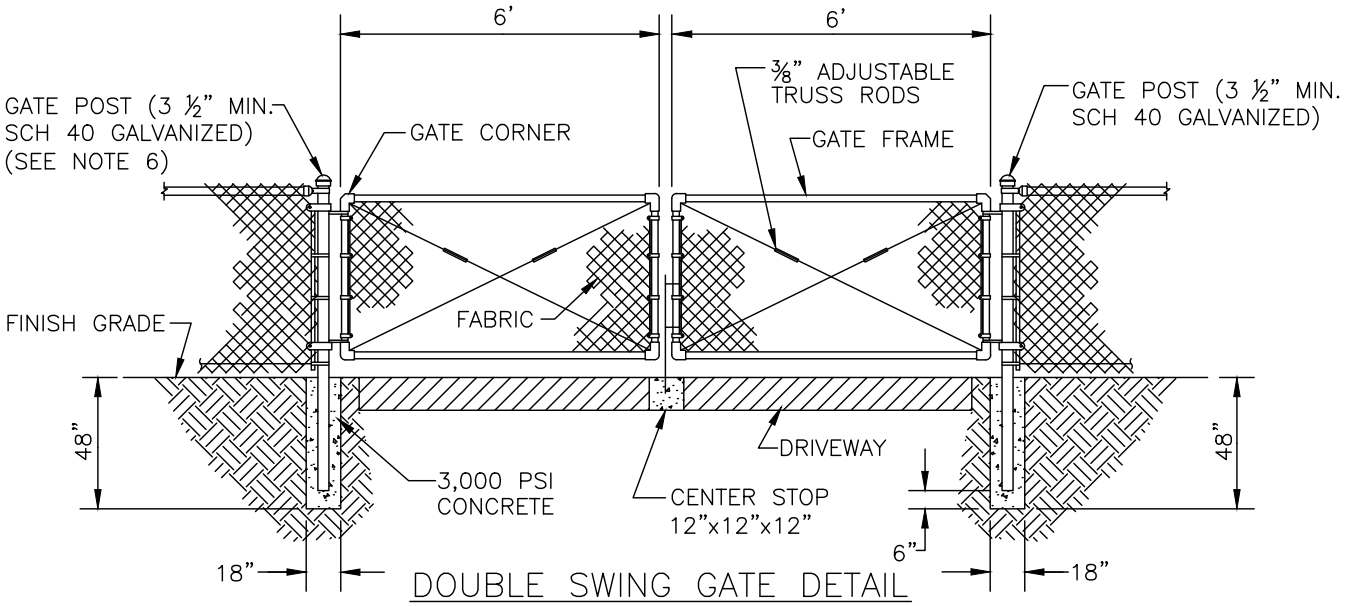
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

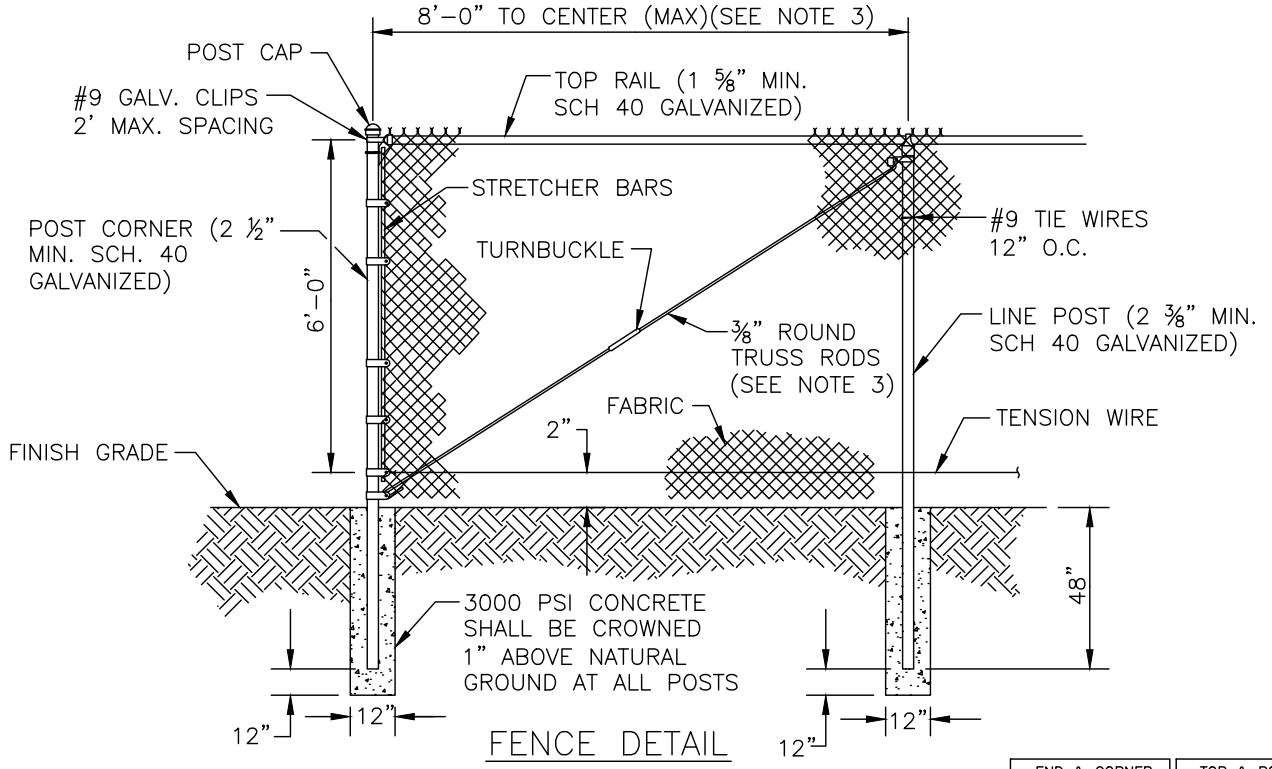
DATE OF APPROVAL

MINIMUM ACCESS/EGRESS AND LANDSCAPING REQUIREMENTS FOR LIFT STATIONS

US–16



DOUBLE SWING GATE DETAIL



FENCE DETAIL

END & CORNER POST TOP OPTIONS		TOP & BOTTOM FABRIC OPTIONS	
STANDARD	DOME	TWIST	KNUCKLE
			

NOTES:

1. FENCING SHALL BE CHAIN LINK, W/ PRIVACY DECORATIVE SLATS (COLOR MATCHED).
2. CHAIN LINK FENCING SHALL BE #9 GAUGE, GALVANIZED STEEL WITH VINYL COATING (BLACK OR GREEN).
3. TRUSS BARS ON CHAIN LINK FENCES ARE REQUIRED FOR THE FIRST SPAN ON EACH SIDE OF THE CORNER POST AND FOR EACH GATE SECTION.
4. LANDSCAPE SCREENING SHALL BE LOCATED ON THE EXTERIOR OF LIFT STATION FENCING.
5. SWING GATES SHALL BE CAPABLE OF SWINGING BOTH INWARDS AND OUTWARDS. CANTILEVER SLIDE GATES AND ROLL SLIDE GATES MEETING FDOT DESIGN STANDARDS MAY BE USED AS AN OPTION TO SWING GATES.
6. GATE POSTS AND TRACK LINE POSTS SHALL BE 4 INCH SCHEDULE 40 FOR CANTILEVER SLIDE GATES AND ROLL SLIDE GATES.

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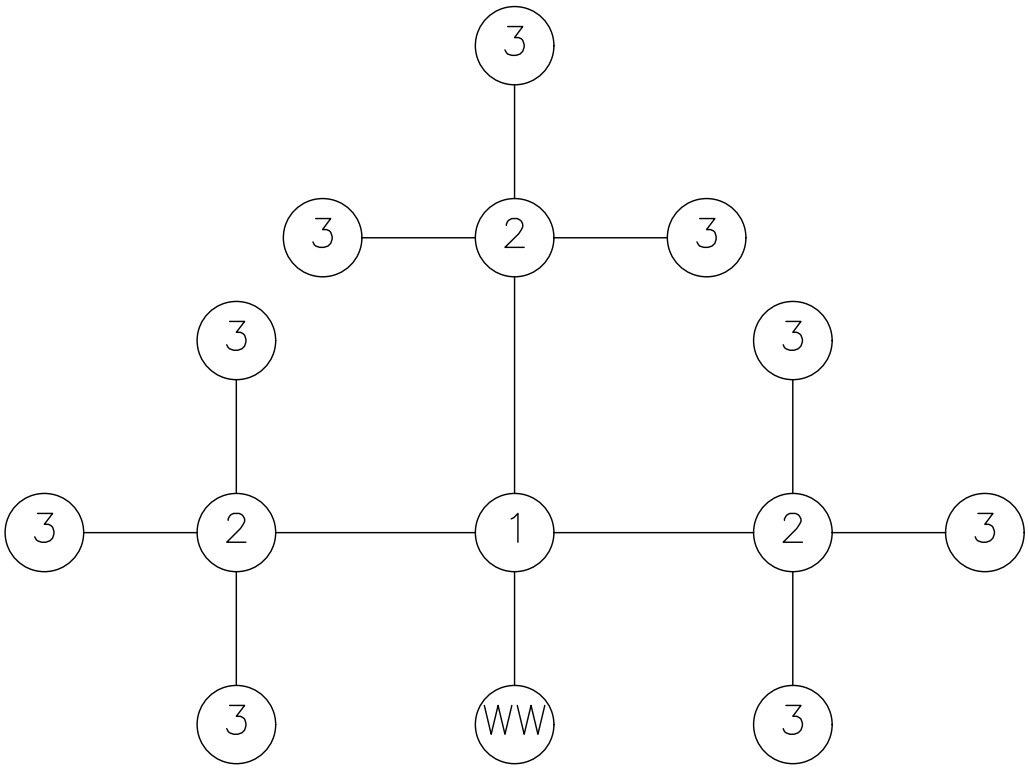
DATE OF APPROVAL

SECURITY FENCING

US–17



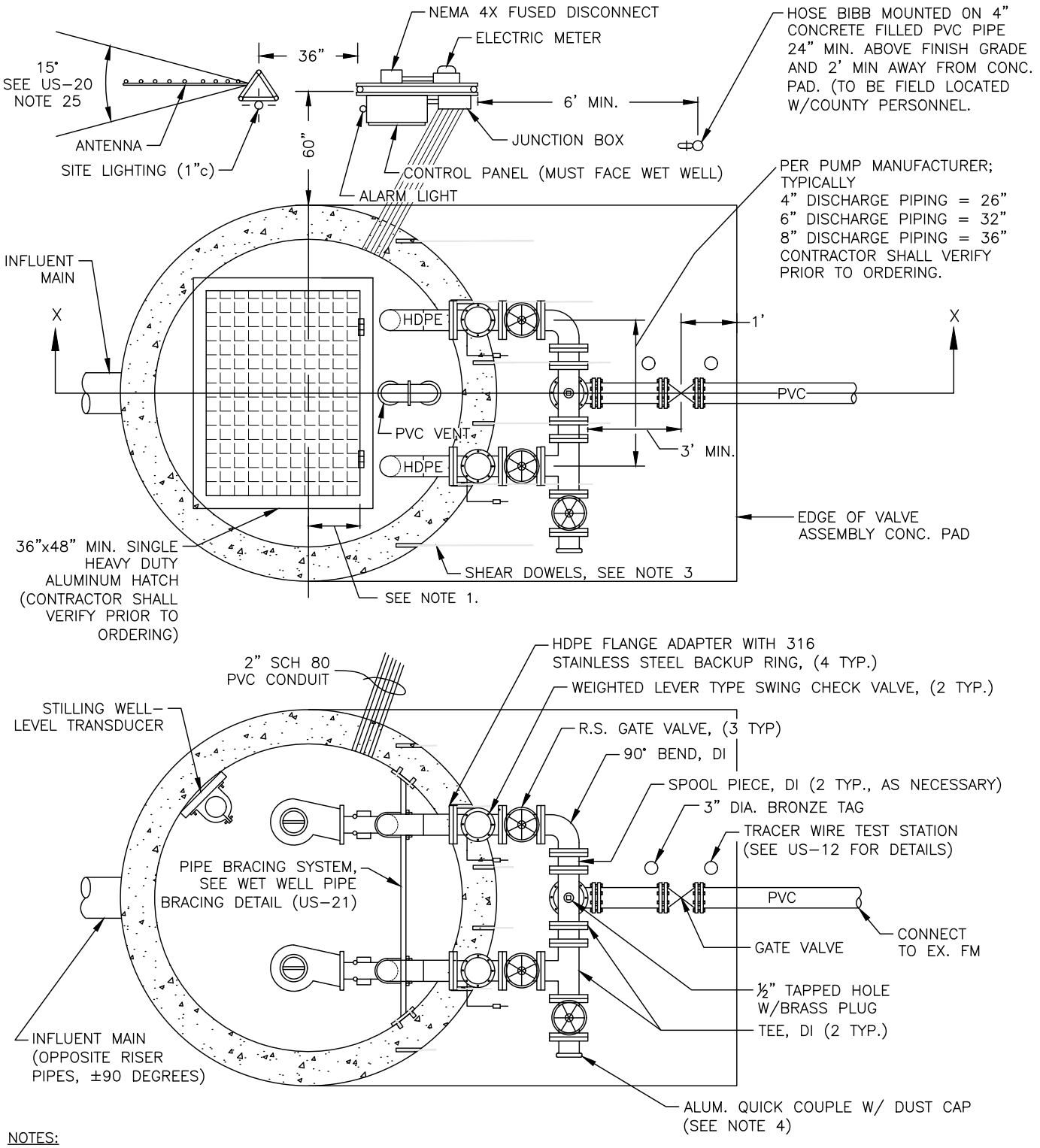
EXAMPLE OF ALL POSSIBLE SCENARIOS

(#) # = THE STEP NUMBER FROM THE WET WELL.

NOTES:

1. UPSTREAM MANHOLES WITHIN THREE "STEPS" FROM THE WET WELL SHALL BE POLYMER CONCRETE MANHOLES AS DESCRIBED IN US-3 STANDARD PRE-CAST POLYMER CONCRETE SANITARY SEWER MANHOLE FOR TURBULENT FLOW.
2. THE ABOVE SCHEMATIC SHOWS THE OVERALL INTENT OF WHICH MANHOLES SHALL BE POLYMER CONCRETE AS COUNTED UPSTREAM FROM THE WET WELL.
3. THE FOURTH MANHOLE MAY BE A STANDARD PORTLAND CEMENT CONCRETE MANHOLE, UNLESS THE MANHOLE IS A TURBULENT FLOW MANHOLE AS DESCRIBED IN US-3.

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			POLYMER CONCRETE MANHOLES UPSTREAM FROM LIFT STATIONS	US-17A
REV.BY	DATE			
		DATE OF APPROVAL		



NOTES:

1. FOR 6' DIA. WET WELLS, THE HINGED SIDE OF THE HATCH OPENING SHALL BE OFFSET 12" FROM CENTERLINE.
2. A FLOW METER SHALL BE INSTALLED UPSTREAM OF ISOLATION GATE VALVE FOR ALL LIFT STATIONS THAT RE-PUMP SEWAGE FROM OTHER LIFT STATIONS.
3. #5 REBAR (6 TYP.) SHALL BE EPOXY EMBEDDED INTO THE WET WELL TOP 3-4 INCHES DEEP AND CAST 3-4 FEET INTO THE VALVE ASSEMBLY PAD TO ENSURE THE TOPS OF THE WET WELL AND VALVE ASSEMBLY PAD WILL REMAIN FLUSH.
4. QUICK COUPLE SHALL BE PLACED ON THE SIDE CLOSEST TO THE LIFT STATION DRIVEWAY.
5. POLYMER CONCRETE W/ 9,000 PSI COMPRESSIVE STRENGTH SHALL BE USED IN THE WET WELL CONSTRUCTION. STANDARD PORTLAND CONCRETE MAY BE USED FOR THE VALVE ASSEMBLY PAD, 3,000 PSI 28-DAY COMPRESSIVE STRENGTH.
6. FOR SECTION X-X SEE SEWAGE LIFT STATION, SECTION VIEW ON DETAIL US-19.

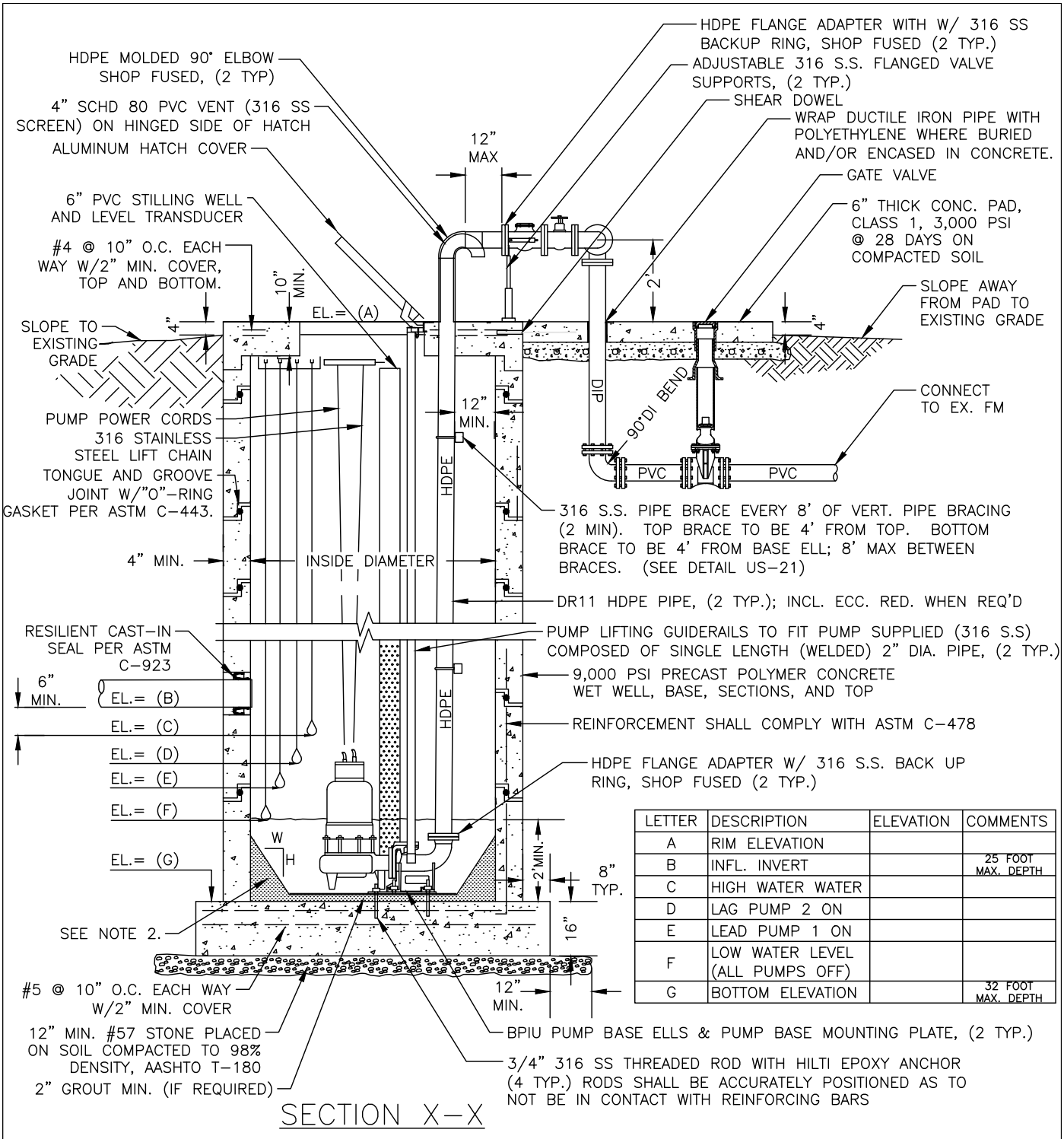
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

SEWAGE LIFT STATION PLAN VIEW

US-18



SECTION X-X

LETTER	DESCRIPTION	ELEVATION	COMMENTS
A	RIM ELEVATION		
B	INFL. INVERT		25 FOOT MAX. DEPTH
C	HIGH WATER WATER		
D	LAG PUMP 2 ON		
E	LEAD PUMP 1 ON		
F	LOW WATER LEVEL (ALL PUMPS OFF)		
G	BOTTOM ELEVATION		32 FOOT MAX. DEPTH

1. 6" MINIMUM VERTICAL SPACING BETWEEN ALL PUMP AND ALARM CONTROL LEVELS.
2. POLYMER CONCRETE FILLET ALL AROUND WET WELL: 6-FT DIA.=12"H x 6"W; 8-FT DIA. & GREATER=18"H x 12"W.
3. THE VALVE CONCRETE PAD SHALL BE GIVEN A BROOM FINISH. THE SURFACE VARIATIONS SHALL BE NOT MORE THAT 1/4" UNDER A TEN FOOT (10') STRAIGHT EDGE, NOT MORE THAN 1/8" ON A FIVE FOOT (5') TRANSVERSE SECTION. THE EDGE OF THE CONCRETE PAD SHALL BE CAREFULLY FINISHED WITH A EDGING TOOL HAVING A RADIUS OF 1/2".
4. EXPANSION JOINT: EXPANSION JOINTS BETWEEN THE CONC. PAD AND THE WET WELL SHALL BE 1/2" MATERIAL AND SHALL MEET THE REQUIREMENTS OF AASHTO M153 OR AASHTO M213.
5. THIS DETAIL SHALL APPLY TO LIFT STATIONS WITH 4" OR GREATER FORCE MAINS. LIFT STATIONS WITH FORCE MAINS LESS THAN 4" REFER TO DETAIL US-27A.

MANATEE COUNTY
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SEWAGE LIFT STATION
SECTION VIEW

US-19

GENERAL LIFT STATION NOTES:

1. ALL ACCESS COVERS SHALL BE ALUMINUM, WITH 316 STAINLESS STEEL HARDWARE AND RATED FOR 300 P.S.F. LOADING. ALL ALUMINUM SURFACES IN CONTACT WITH CONCRETE SHALL HAVE 2 COATS BITUMASTIC EPOXY, TOTAL 16 MILS DFT. ALL ACCESS COVERS SHALL BE EQUIPPED WITH A LOCKING STAPLE OR BAR FOR USE WITH A PADLOCK. PADLOCKS FOR WETWELL, FENCE GATE AND CONTROL PANELS OF PUBLICLY OWNED & MAINTAINED LIFT STATIONS SHALL BE FURNISHED BY THE MANATEE COUNTY UTILITIES DEPARTMENT, UPON ACCEPTANCE.
2. INSTALL WET WELL VENT ON THE HINGED SIDE OF THE WET WELL HATCH COVER, BETWEEN DISCHARGE PIPING AND MATCH HEIGHT.
3. GROUND SHALL BE SLOPED AWAY FROM SLAB TO NATURAL GROUND ELEVATION IN ALL DIRECTIONS. A 4–INCH REVEAL SHALL BE PROVIDED AROUND THE STRUCTURES. SITE SHALL INCLUDE A WEED BARRIER FABRIC THAT IS COVERED WITH WASHED SHELL OR ROCK WITHIN LIFT STATION FENCING; SITE SHALL INCLUDE A WEED BARRIER FABRIC THAT IS COVERED WITH SHREDDED WOOD TYPE MULCH UNDER THE SHRUBS AND UP TO OUTSIDE OF THE FENCE. WEED BARRIER FABRIC THAT IS COVERED WITH SHREDDED WOOD–TYPE MULCH SHALL BE LOCATED UNDER THE TREES FOR A MINIMUM DISTANCE OF 3 FEET FROM THE TREE. SODDING OR SHREDDED WOOD–TYPE MULCH SHALL BE INSTALLED ON THE REMAINDER OF THE SITE TO THE EDGE OF THE EASEMENT.
4. ALL FORCE MAIN PIPING AND FITTINGS FROM THE PUMP BASE ELBOW IN THE WETWELL UP TO THE CHECK VALVE IN THE ABOVE GROUND VALVE ASSEMBLY, SHALL BE DR11 HDPE. THE HDPE FITTINGS SHALL BE MOLDED FITTINGS. ALL CONNECTIONS TO IRON BODIED FLANGE FITTINGS IN THE WETWELL (PUMP BASE ELLS) AND TO THE CHECK VALVES SHALL BE MADE USING HDPE FLANGE ADAPTERS WITH 316 STAINLESS STEEL BACKUP RINGS. ALL HDPE CONNECTIONS SHALL BE THERMAL FUSED. ALL PIPING DOWNSTREAM OF THE VALVE ASSEMBLY TO THE FIRST BURIED FITTING SHALL BE DUCTILE IRON PIPE (CL–53), THEN PVC (DR18).
5. ALL PIPING BELOW GROUND SHALL BE COLOR CODED IN ACCORDANCE WITH THESE STANDARDS. GREEN–RAW SEWAGE; PURPLE–RECLAIMED: BLUE–POTABLE WATER.
6. ANCHORS & LIFTING DEVICES SHALL NOT PENETRATE THE WALLS OF THE WET WELL.
7. ALL TOP, SECTIONS, AND BASE SHALL BE PRECAST POLYMER CONCRETE, MIN. 9,000 PSI COMPRESSIVE STRENGTH. SEE PRECAST POLYMER CONCRETE SANITARY SEWER MANHOLE FOR TURBULENT FLOW DETAIL.
8. ALL ABOVE–GROUND METAL APPURTENANCES INCLUDING BOLTS, NUTS AND WASHERS SHALL BE 316 STAINLESS STEEL. ALL STAINLESS STEEL BOLTS SHALL BE TREATED WITH NEVER–SEIZE PRIOR TO ASSEMBLY.
9. VERTICAL HDPE PUMP DISCHARGE PIPE IN THE WET WELL SHALL BE BRACED PER DETAIL US–21. THE PIPE SHALL BE CLAMPED TO A SINGLE LENGTH OF 2" 316 SS TUBING (OR 2" 316 SS ANGLE) INSTALLED HORIZONTALLY. THE TUBE SHALL HAVE 6"X6"X¼" PLATES WELDED TO EACH END AND ATTACH TO THE WALL BY 316 SS ANCHORS. THE PIPE SHALL BE CLAMPED TO THE TUBING WITH CUSHIONED 316 SS U–BOLTS.
10. CONTRACTOR SHALL TAKE ALL NECESSARY PRECAUTIONS TO PREVENT FLOTATION.
11. TOP OF WET WELL AND VALVE ASSEMBLY SLAB SHALL BE AT THE SAME ELEVATION.
12. THE EXTERIOR SURFACES OF THE CONCRETE WET WELL AND VALVE ASSEMBLY PAD EXPOSED ABOVE GRADE SHALL BE COATED WITH A LEAST TWO COATS OF H&C SILICONE ACRYLIC CONCRETE STAIN, PATIO GREEN, MANUFACTURED BY FLR PAINTS, INC. ABOVE GROUND VALVE ASSEMBLY & PIPING SHALL BE PAINTED, RUSTOLEUM 7538 HUNTER GREEN. CONTRACTOR SHALL TAKE PRECAUTIONS TO AVOID OVER–SPRAY ONTO THE VALVE ASSEMBLY CONCRETE PAD.
13. FOR 5/8" WATER METER, PROVIDE POTABLE WATER SERVICE CONNECTION WITH 3/4" BRASS HOSE BIB. PROVIDE AN APPROVED BACKFLOW PREVENTION ASSEMBLY INSTALLED AT THE ROW. ALL WATER SERVICE PIPING FROM WATER METER TO BE TYPE "K" COPPER OR BRASS; 3/4" MIN. DIAMETER FOR 5/8" METER AND 2" MIN. DIAMETER PIPING FOR 2" METER.
14. LANDSCAPING SHALL BE IRRIGATED WITH NON–POTABLE WATER. A RAIN SENSOR SHALL BE FURNISHED AND INSTALLED.
15. HOSE BIB TO BE A MINIMUM OF 6 FEET FROM THE ELECTRICAL CONTROL PANEL, 24" ABOVE THE SURROUNDING FINISH GRADE, AND ANCHORED TO A 4" PVC CONCRETE FILLED PIPE. EXACT LOCATION TO BE DETERMINED IN THE FIELD W/COUNTY PERSONNEL.
16. WATER METER ASSEMBLY TO BE INSTALLED BY CONTRACTOR AS PART OF WATER SERVICE CONNECTION WITH FEES PAID BY THE DEVELOPER.
17. BASE AND FIRST WALL SECTION OF WET WELL SHALL BE MONOLITHIC.
18. EVERY EFFORT SHALL BE MADE BY THE CONTRACTOR TO CONSTRUCT WATERTIGHT STRUCTURES WITH NO VISIBLE LEAKS. COMPLETED STRUCTURES THAT ARE NOT WATERTIGHT AND/OR DO NOT MEET THE REQUIREMENTS OF ASTM C–443 WILL BE REJECTED.
19. FLEXIBLE GASKET CONNECTORS SHALL MEET THE REQUIREMENTS OF ASTM C–923 LATEST REVISION.
20. ALL GATE VALVES SHALL BE RESILIENT SEAT NON–RISING STEM TYPE IN ACCORDANCE WITH THESE STANDARDS.
21. ELECTRICAL SERVICE SHALL BE 3 PHASE MINIMUM, UNLESS THE ELECTRICAL UTILITY PROVIDES CORRESPONDENCE STATING THAT 3 PHASE SERVICE IS UNAVAILABLE.
22. ELECTRICAL CONDUIT SHALL BE RUN BY THE SHORTEST ROUTE POSSIBLE FROM THE ELECTRICAL SOURCE TO THE CONTROL PANEL AND FROM THE CONTROL PANEL TO THE LIFT STATION WET WELL.
23. A FLOW METER AND EMERGENCY BACKUP PUMP SHALL BE REQUIRED FOR ALL LIFT STATIONS THAT MEET THE CRITERIA LISTED IN SECTION 1.14.14 OF THE PUBLIC WORKS UTILITY STANDARDS MANUAL.
24. THE CONTROL PANEL, HOSE BIB, EMERGENCY BACKUP PUMP, FUEL STORAGE TANK AND ANTENNA SHALL NOT BE LOCATED BETWEEN THE WET WELL, VALVE ASSEMBLY AND THE DRIVEWAY. THE PUMP SHALL NOT BE LOCATED WITHIN 25 FEET OF THE EDGE OF THE LIFT STATION EASEMENT AT THE ROW LINE.
25. THE ANTENNA FOR THE RADIO TELEMETRY UNIT REQUIRES DIRECT LINE–OF–SIGHT SIGNALING CAPABILITY TO THE UTILITIES DEPARTMENT'S OFFICE THAT WILL RECEIVE THE SIGNAL. THERE SHALL BE AN UNOBSTRUCTED HORIZONTAL ANGLE OF FIFTEEN (15) DEGREES FROM THE ANTENNA MAST (7.5 DEGREES ON BOTH SIDES OF THE DIRECT LINE–OF–SIGHT AZIMUTH). NO TREE SHALL BE PLANTED WITHIN THE DESIGNATED UNOBSTRUCTED ANGLE FOR A TWENTY (20) FEET HORIZONTAL DISTANCE MEASURED FROM THE MAST. LANDSCAPE BUFFER PLANTINGS ARE TO BE FIELD ADJUSTED IN COORDINATION WITH THE LOCATION OF THE CONSTRUCTED TELEMETRY ANTENNA. THE ANTENNA TOWER/MAST SHALL BE TO THE LEFT OF THE CONTROL PANEL.

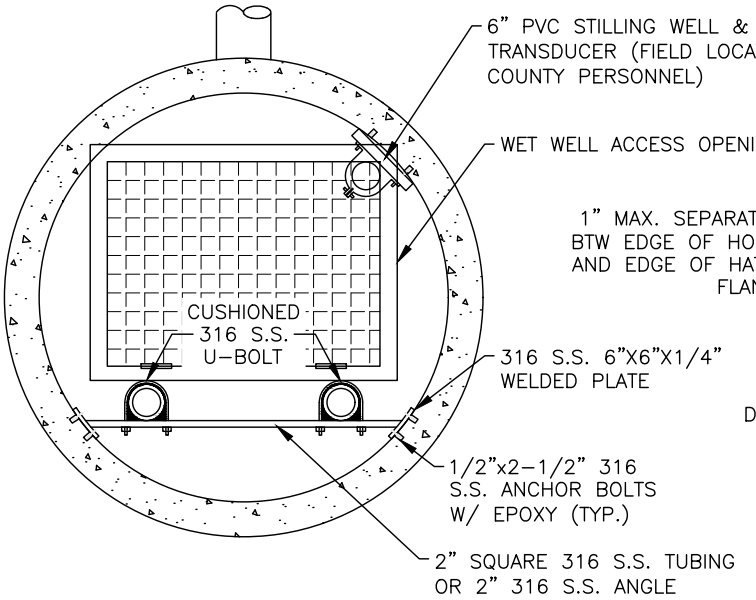
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

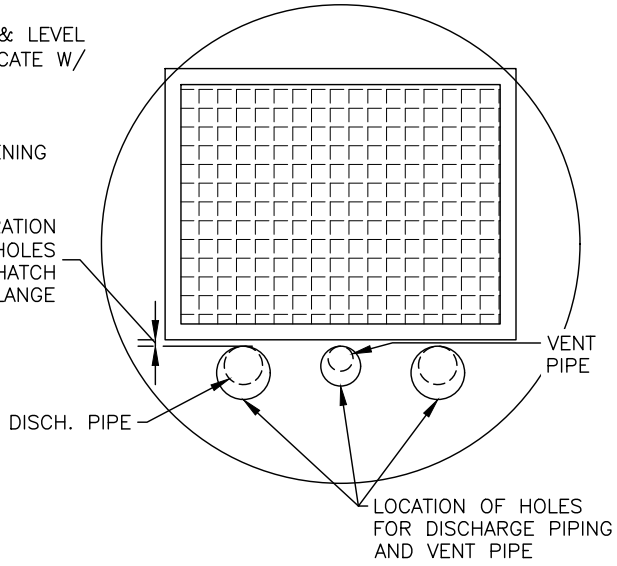
DATE OF APPROVAL

LIFT STATION NOTES

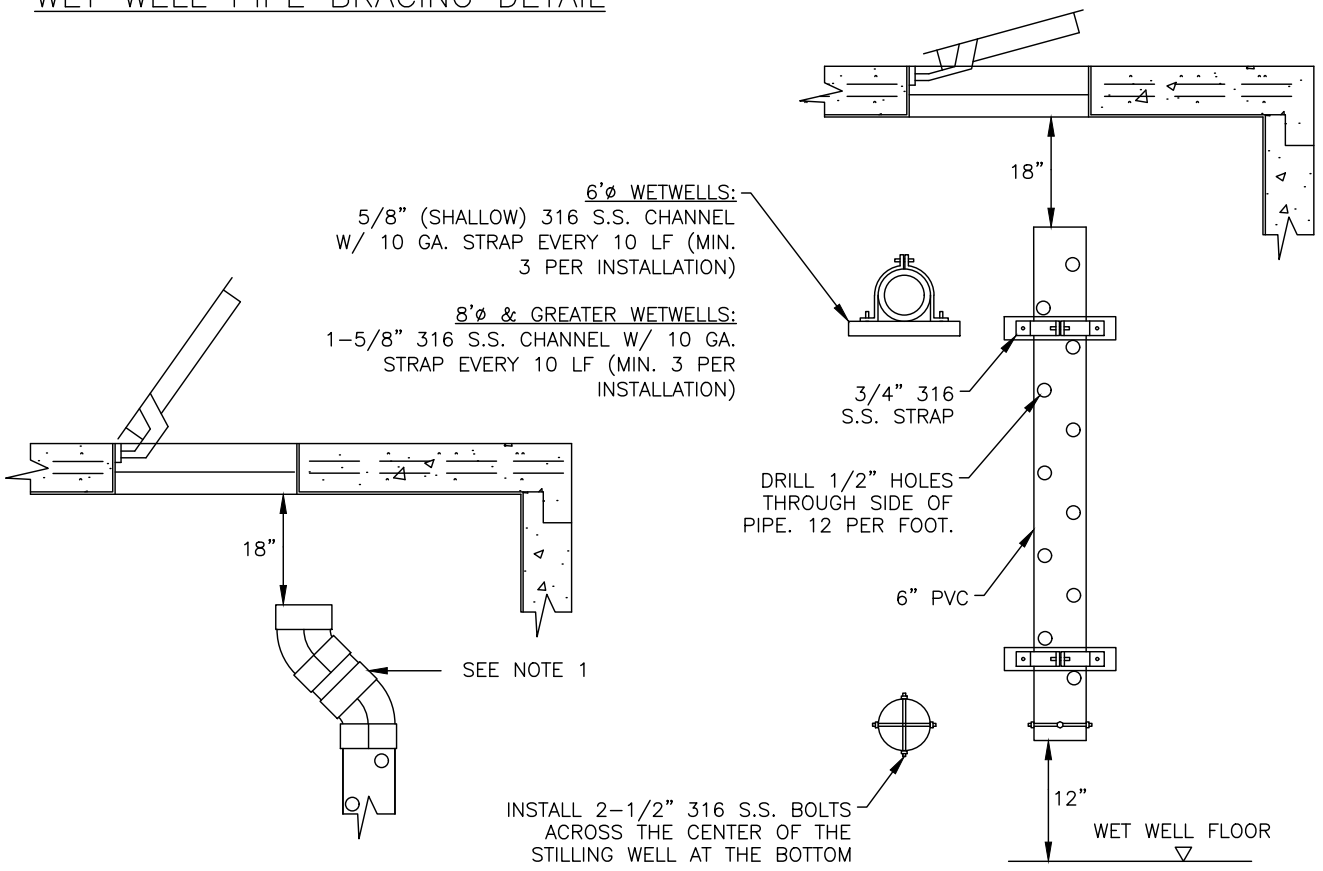
US–20



WET WELL PIPE BRACING DETAIL



PIPING HOLE LOCATION DETAIL



STILLING WELL DETAILS

NOTES:

1. FOR LARGER LIFT STATIONS, PROVISIONS SHALL BE MADE TO MAKE THE TOP OF THE STILLING WELL VISIBLE AND ACCESSIBLE FROM THE HATCH OPENING, I.E. 45° FITTINGS, ETC.
2. REFER TO STANDARD DETAILS US-18, US-19 & US-20 FOR LIFT STATION DETAILS.
3. NYLON LOCK NUTS SHALL NOT BE USED ON WEDGE ANCHORS.

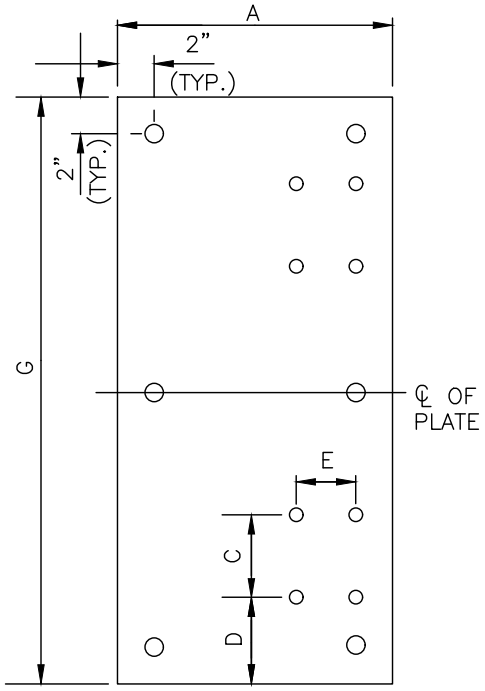
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

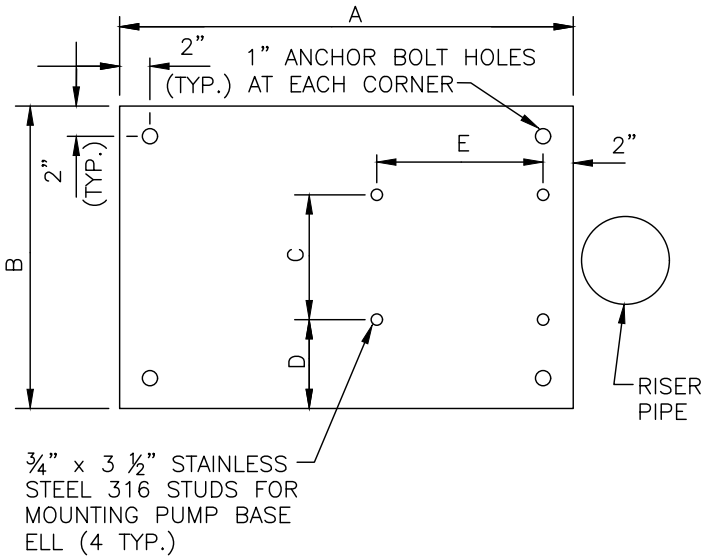
DATE OF APPROVAL

LIFT STATION PIPE BRACING, & STILLING WELL DETAILS

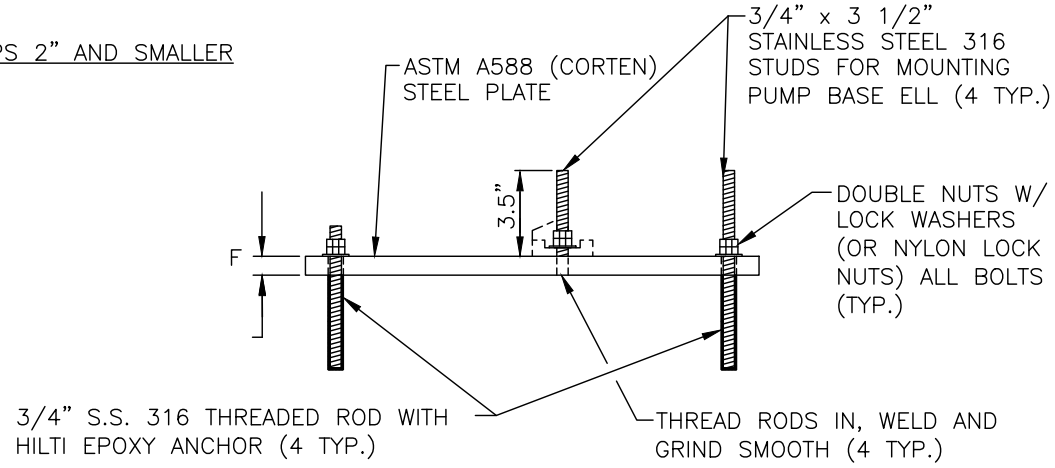
US-21



PLAN FOR PUMPS 2" AND SMALLER



PLAN



PROFILE

PUMP BASE ELL MOUNTING PLATE DIMENSIONS							
DIMENSIONS	A	B	C	D	E	F	G
FOR 6" PUMPS	24"	20"	8.25"	5.875"	11"	¾"	N/A
FOR 4" PUMPS	20"	16"	6"	5"	10"	½"	N/A
2" PUMPS & SMALLER	15"	N/A	4.5"	4.75"	3.25"	½"	32"

NOTES:

1. INSTALL DOUBLE NUTS (OR NYLON LOCK NUTS) ON ALL EIGHT (8) THREADED RODS.
2. THE PLATE EDGES AND ALL HOLES SHALL BE GROUND SMOOTH TO REMOVE ALL BURRS.
3. DIMENSIONS "C" & "E" ARE FOR BARNEY'S PUMPS, INC. BASE ELLS.
4. FOR PUMPS WITH A 2–INCH DISCHARGE OR LESS, A SINGLE BASE PLATE SHALL BE INSTALLED UNDER BOTH GRINDER PUMPS.

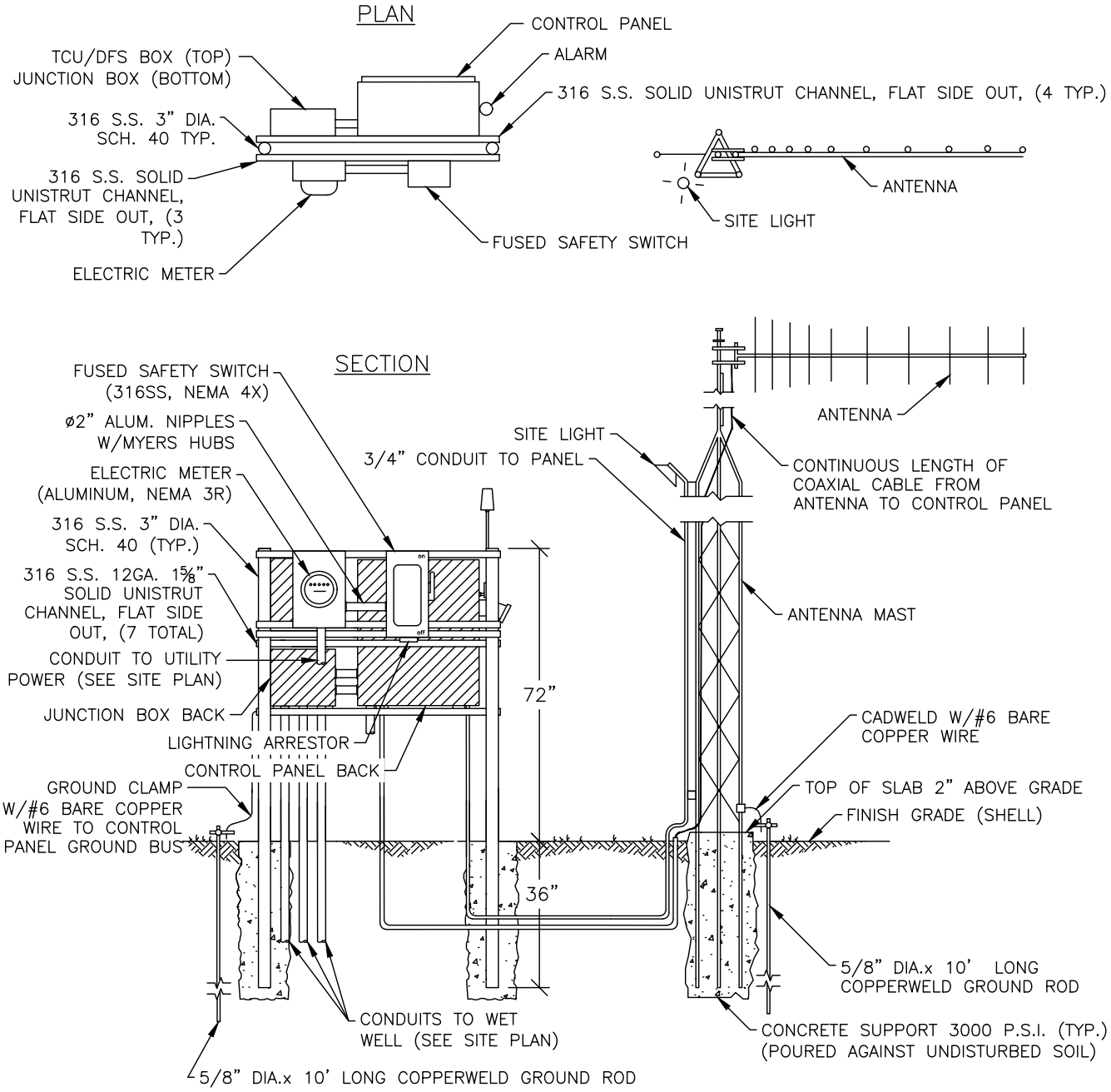
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

PUMP BASE ELL MOUNTING PLATE

US–22



TYPICAL SERVICE ENTRANCE STRUCTURE

NOTES

1. ALL EQUIPMENT FURNISHED FOR THE LIFT STATION SHALL CONFORM TO MANATEE COUNTY PUBLIC WORKS UTILITY STANDARDS.
2. POWER TO BE SUPPLIED AS DIRECTED, THE CONTRACTOR SHALL BE RESPONSIBLE FOR ALL COSTS ASSOCIATED WITH PROVIDING TEMPORARY AND PERMANENT ELECTRICAL SERVICE.
3. STAINLESS STEEL CONTROL PANEL SUPPORT POSTS SHALL BE TREATED WITH TWO COATS OF BITUMINOUS EPOXY TO 16 MILS WHERE EMBEDDED IN CONCRETE.
4. CONTROL AND FLOW METER ENCLOSURE TO BE NEMA 3R/12 304 STAINLESS STEEL WITH RAIN SHIELD. DISCONNECT ENCLOSURE TO BE NEMA 4X 304 STAINLESS. STEEL.
5. ALL P.V.C. CONDUIT SHALL BE SCHEDULE 80.
6. ANTENNA MAST SHALL BE RATED FOR 150 MPH WINDS.
7. IF ANTENNA MAST IS MORE THAN 18" FROM PANEL, RUN CONDUIT FOR SITE LIGHT UNDERGROUND.

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

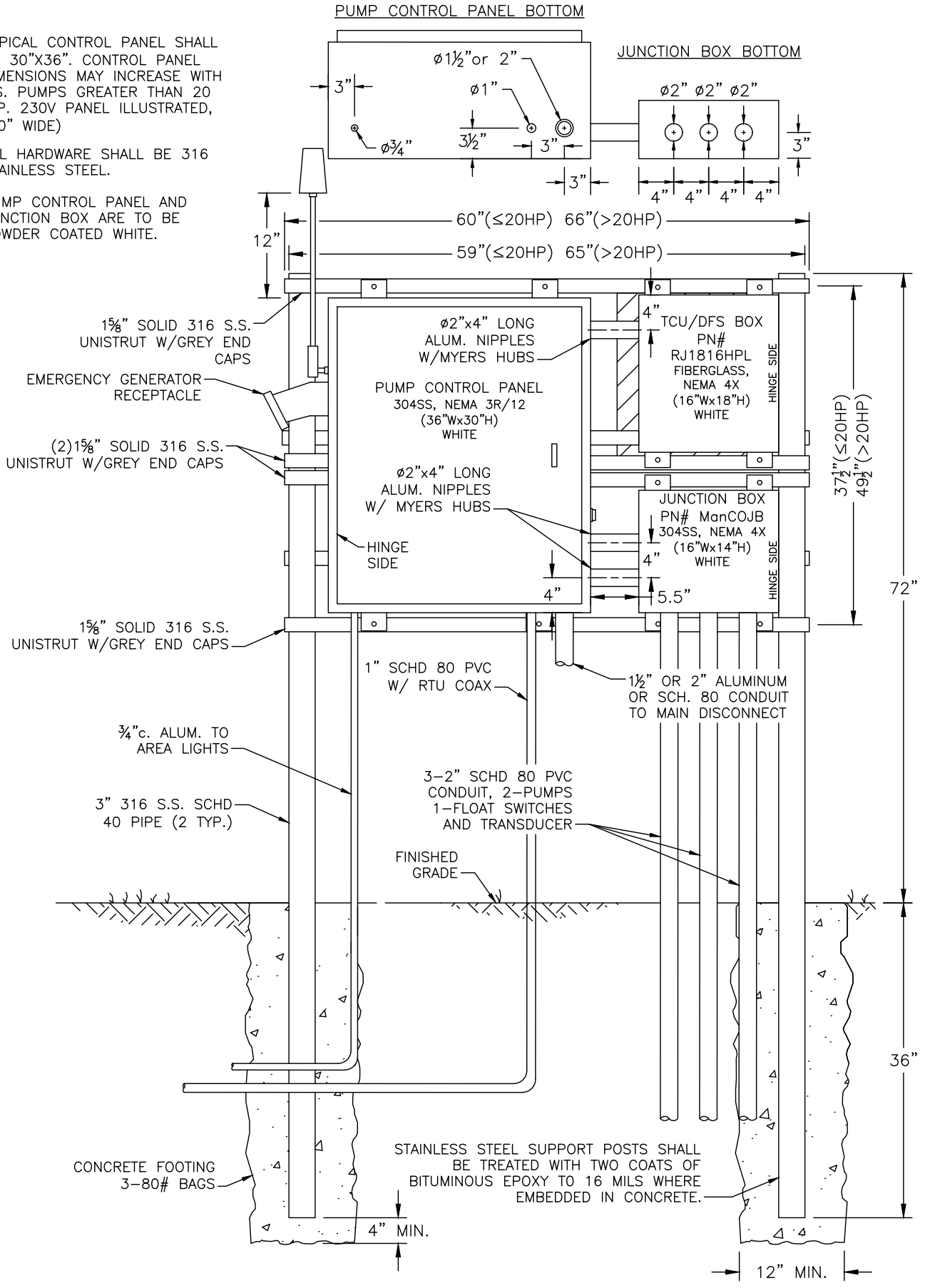
DATE OF APPROVAL

SEWAGE LIFT STATION METER & ELECTRICAL DETAILS

US–23

NOTES

1. TYPICAL CONTROL PANEL SHALL BE 30"X36". CONTROL PANEL DIMENSIONS MAY INCREASE WITH L.S. PUMPS GREATER THAN 20 H.P. 230V PANEL ILLUSTRATED, (30" WIDE)
2. ALL HARDWARE SHALL BE 316 STAINLESS STEEL.
3. PUMP CONTROL PANEL AND JUNCTION BOX ARE TO BE POWDER COATED WHITE.



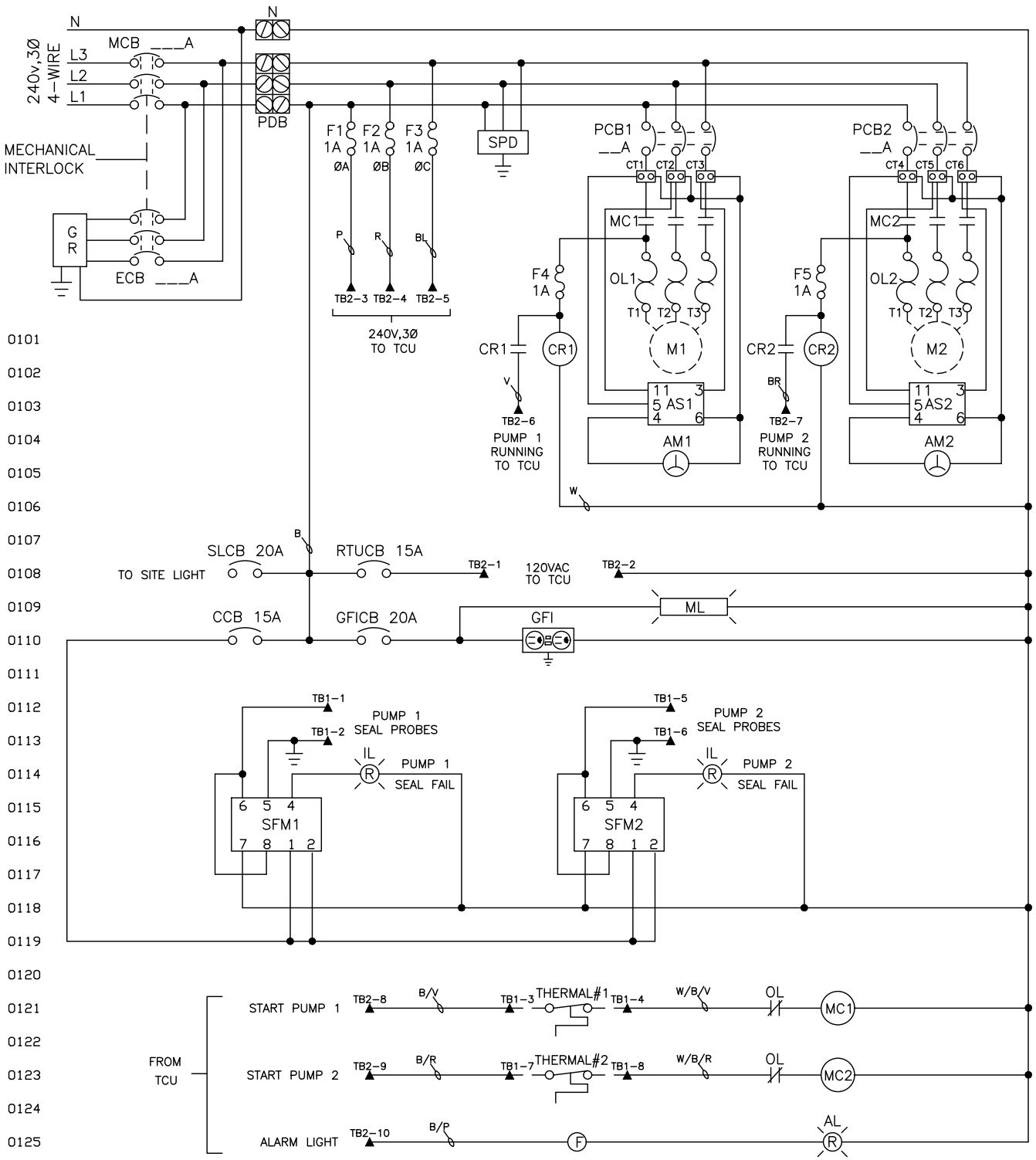
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

DATE OF APPROVAL

SEWAGE LIFT STATION CONTROL PANEL

US–24



MANATEE COUNTY PUBLIC WORKS DEPARTMENT			SEWAGE LIFT STATION CONTROL PANEL (230V)	US-25A
REV.BY	DATE			
		DATE OF APPROVAL		

PUMP CONTROL PANEL BILL OF MATERIALS			
QTY.	ABBR.	DESCRIPTION	MANUFACTURER, PART#
1	ENC	ENCLOSURE, 304SS N3R/12 (WHITE)	HOFFMAN, A36H3012SSLP–P8743 (MINIMUM SIZE)
1	MCB	MAIN CIRCUIT BREAKER	SQ.D, (SIZE AS REQUIRED – 100A MIN.)
1	ECB	EMERGENCY CIRCUIT BREAKER	SQ.D, (SIZE AS REQUIRED – 100A MIN.)
2	PCB1,2	PUMP CIRCUIT BREAKER	SQ.D, (SIZE AS REQUIRED)
1	CCB	CONTROL CIRCUIT BREAKER	SQ.D, QOU115
1	RTUCB	RTU CIRCUIT BREAKER	SQ.D, QOU115
1	GFICB	GFI CIRCUIT BREAKER	SQ.D, QOU120
1	SLCB	SITE LIGHT CIRCUIT BREAKER	SQ.D, QOU120
2	MC1,2	NEMA 4 CONTACTOR	CRYDOM, A53TP_____ (SIZE AS REQUIRED)
2	CR1–2	CURRENT RELAY	CRYDOM, CWA2410 + HS501DR + HSP–2
2	OL1–2	OVERLOAD RELAY	SIEMENS, ESP200 (SIZE AS REQUIRED)
1	GR	GENERATOR RECEPTACLE	RUSSELL STOLL, JRSB1044FR (230V, 100A) RUSSELL STOLL, JRSB2044FR (230V, 200A)
1	SPD	SURGE PROTECTOR	DITEK, DTK–2403CMX+
6	CT1–6	CURRENT TRANSFORMER __:5	ELECTRO. IND, 2SFT–____ (SIZE AS REQUIRED)
2	AS1–2	AMMETER SELECTOR SWITCH	SPRECHER & SCHUH, LE2–12–8751
2	AM1–2	AMMETER 0–__ A	CROMPTON, 013–75AA–LS__–C6–B3 (SIZE AS REQD)
5	F1–5	FUSE, 1A	FERRAZ, ATMR–1
1	GFI	120V RECEPTACLE	PASS & SEYMOUR, 1597–I
1	ML	MAINTENANCE LIGHT, LED	HOFFMAN, LEDA1S35
2	SFM1,2	SEAL FAIL MODULE	SYRELEC, PNRU–110A
2	IL	INDICATING LIGHT, RED LED	EATON, C22–L–XR–120
1	ASB	ALARM SILENCE BUTTON	SQ.D, 9001–SKR1BH5
1	F	FLASHER	INGRAM, SSF–150W
1	AL	ALARM LIGHT, 120V LED	FEDERAL, LP3PL–120R

WIRE COLOR CODE

SYMBOL	COLOR
B	BLACK
W	WHITE
G	GREEN
BL	BLUE
R	RED
P	PINK
V	VIOLET
BR	BROWN
B/R	BLACK/RED
B/V	BLACK/VIOLET
B/P	BLACK/PINK
GY/P	GREY/PINK
GY/R	GREY/RED
GY/BL	GREY/BLUE
GY/BR	GREY/BROWN
W/R	WHITE/RED
W/B/V	WHT/BLK/VIOLET
W/B/R	WHT/BLK/RED

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

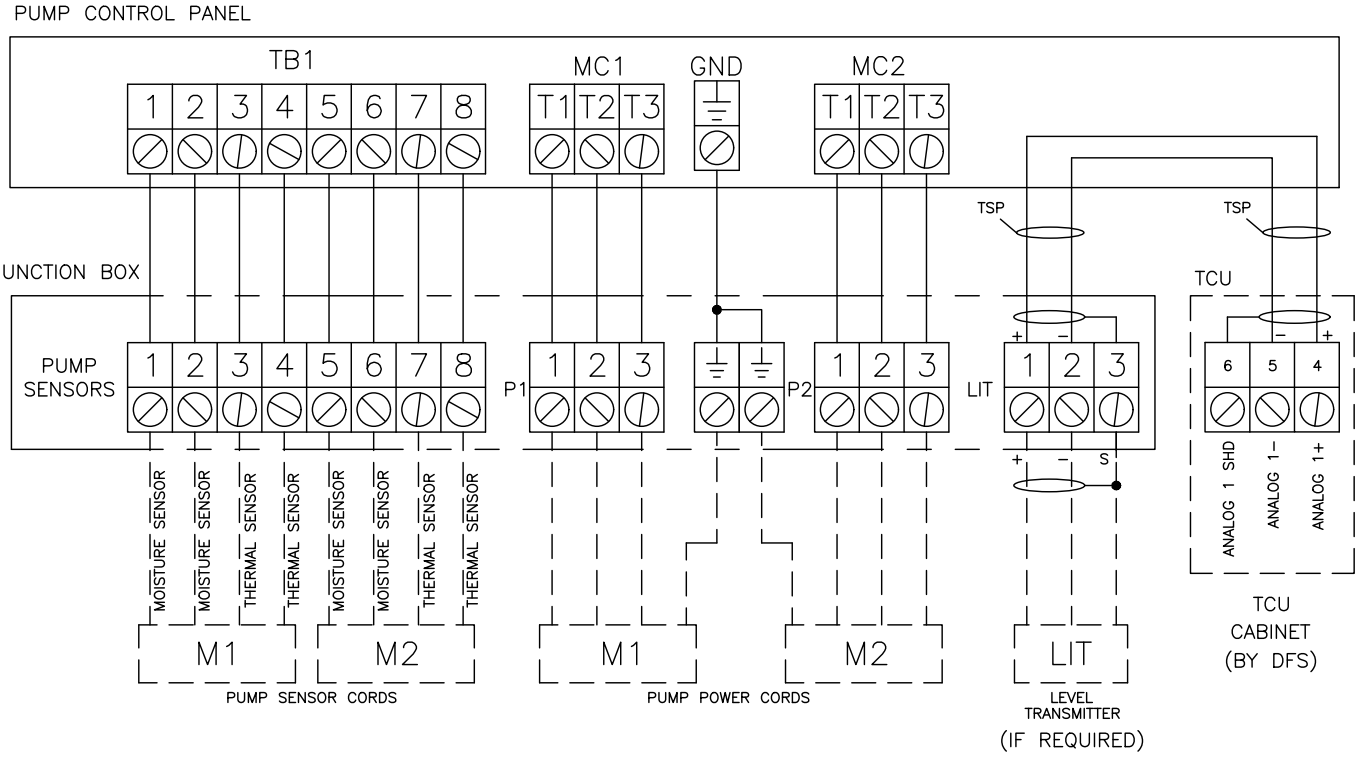
REV.BY	DATE

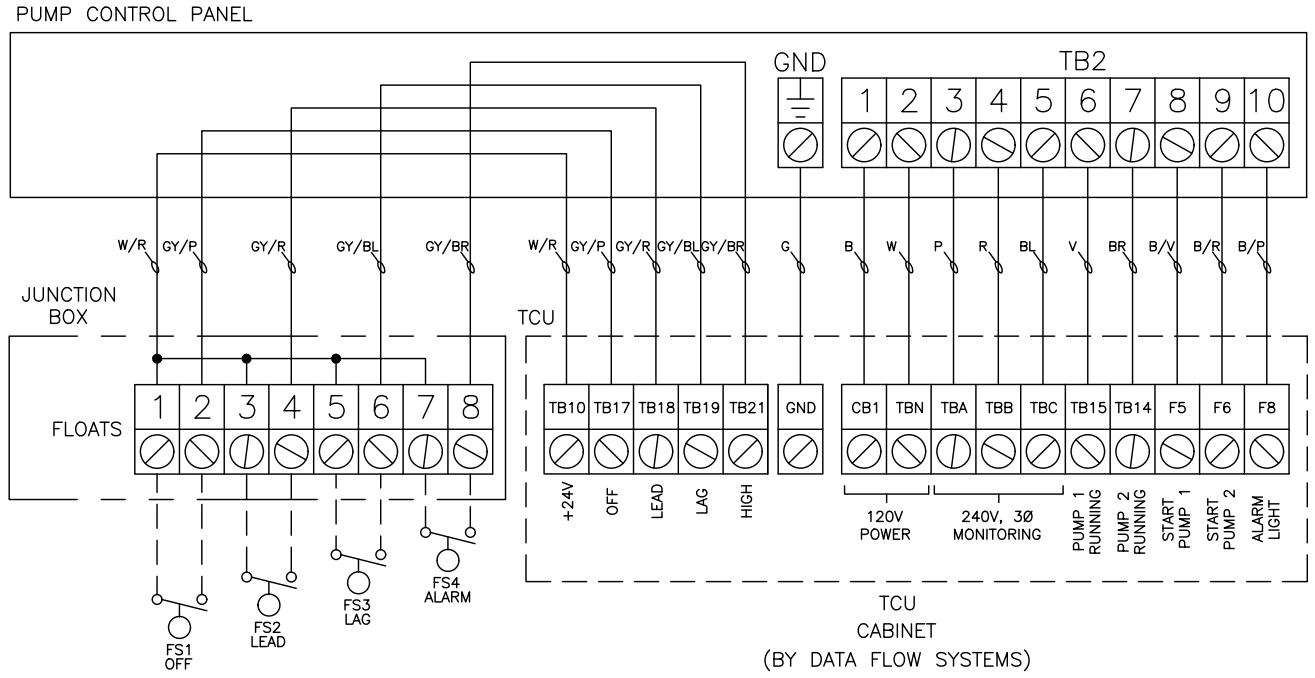
DATE OF APPROVAL

SEWAGE LIFT STATION
CONTROL PANEL
(230V)

US–25B

TERMINALS





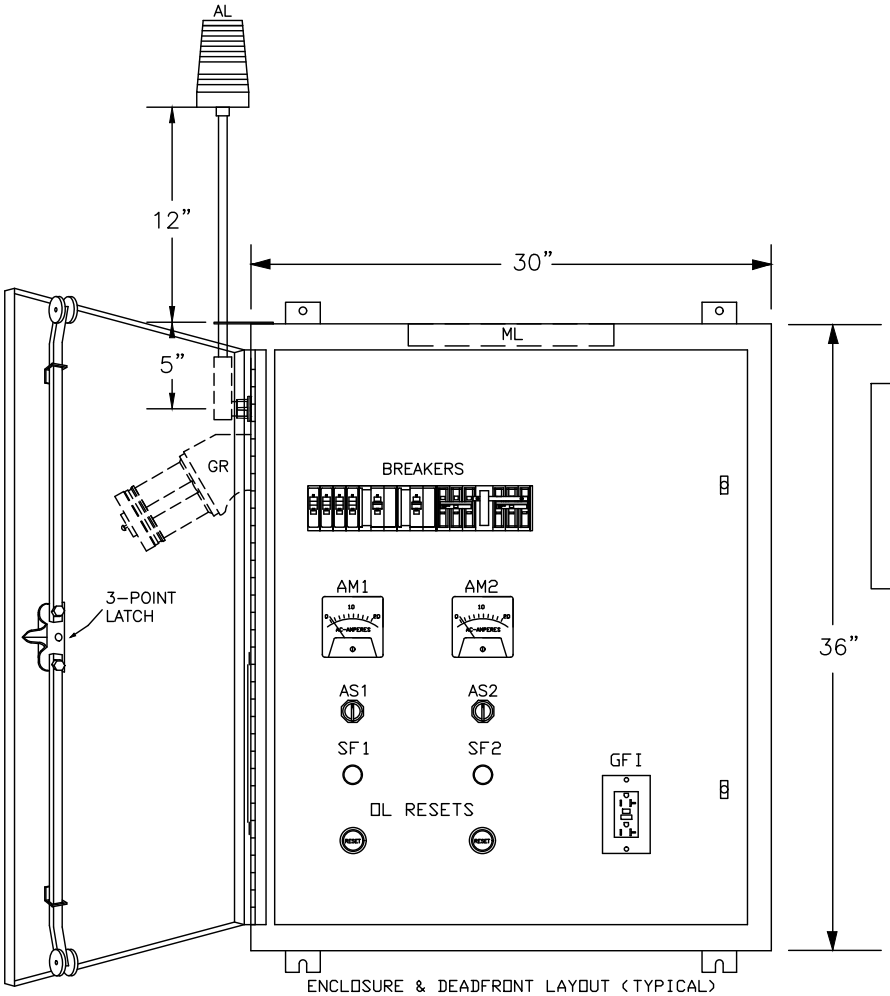
MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

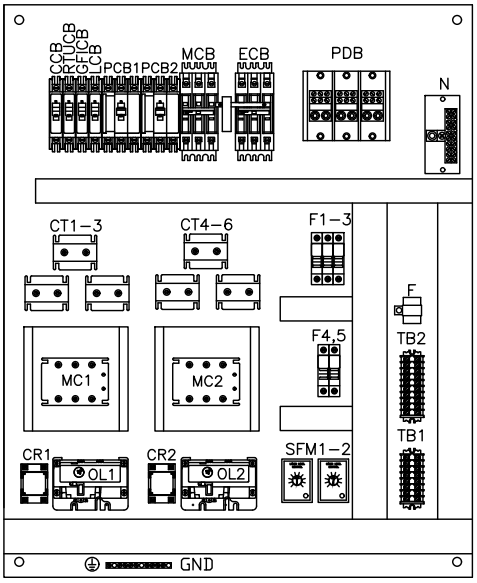
DATE OF APPROVAL

SEWAGE LIFT STATION CONTROL PANEL (230V)

US–25C



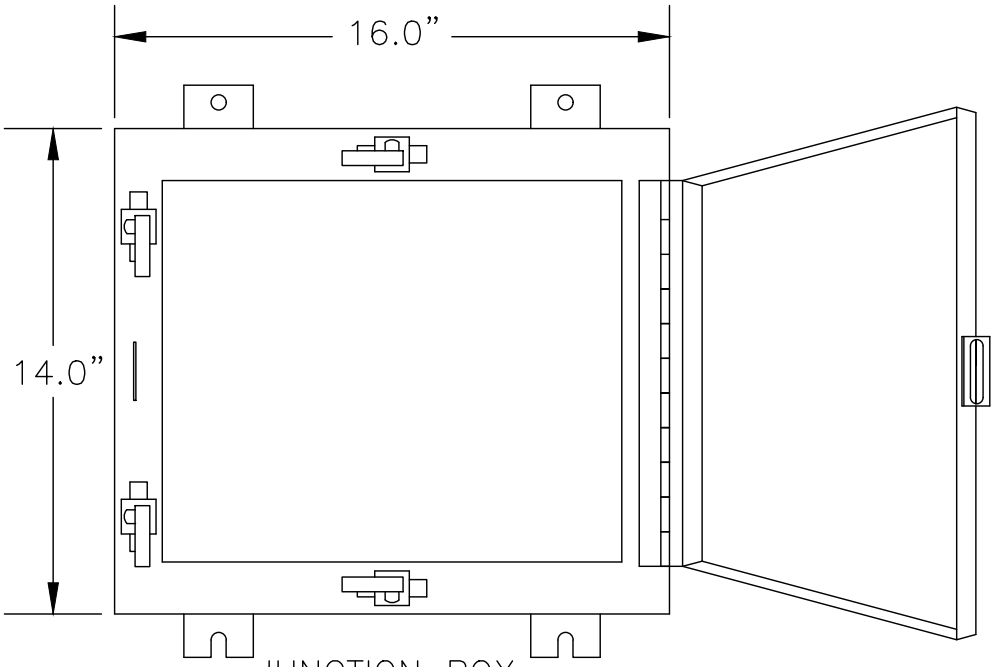
ENCLOSURE & DEADFRONT LAYOUT (TYPICAL)



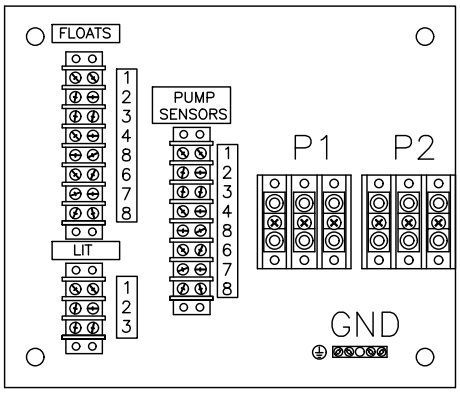
BASE PLATE LAYOUT (TYPICAL)

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			SEWAGE LIFT STATION CONTROL PANEL (230V)	US-25D
REV.BY	DATE			
		DATE OF APPROVAL		

JUNCTION BOX BILL OF MATERIALS			
QTY.	ABBR.	DESCRIPTION	MANUFACTURER, PART#
1	ENC	ENCLOSURE, 304SS N4X (WHITE)	SCHAEFER'S, SPN4SS-14168-587
2		8-POINT TERMINAL BLOCK	IDEAL, 89-208
1		3-POINT TERMINAL BLOCK	IDEAL, 89-203
2		PUMP TERMINAL BLOCK	MARATHON, 1323572
1	G	GROUND BAR	EATON, GBK5



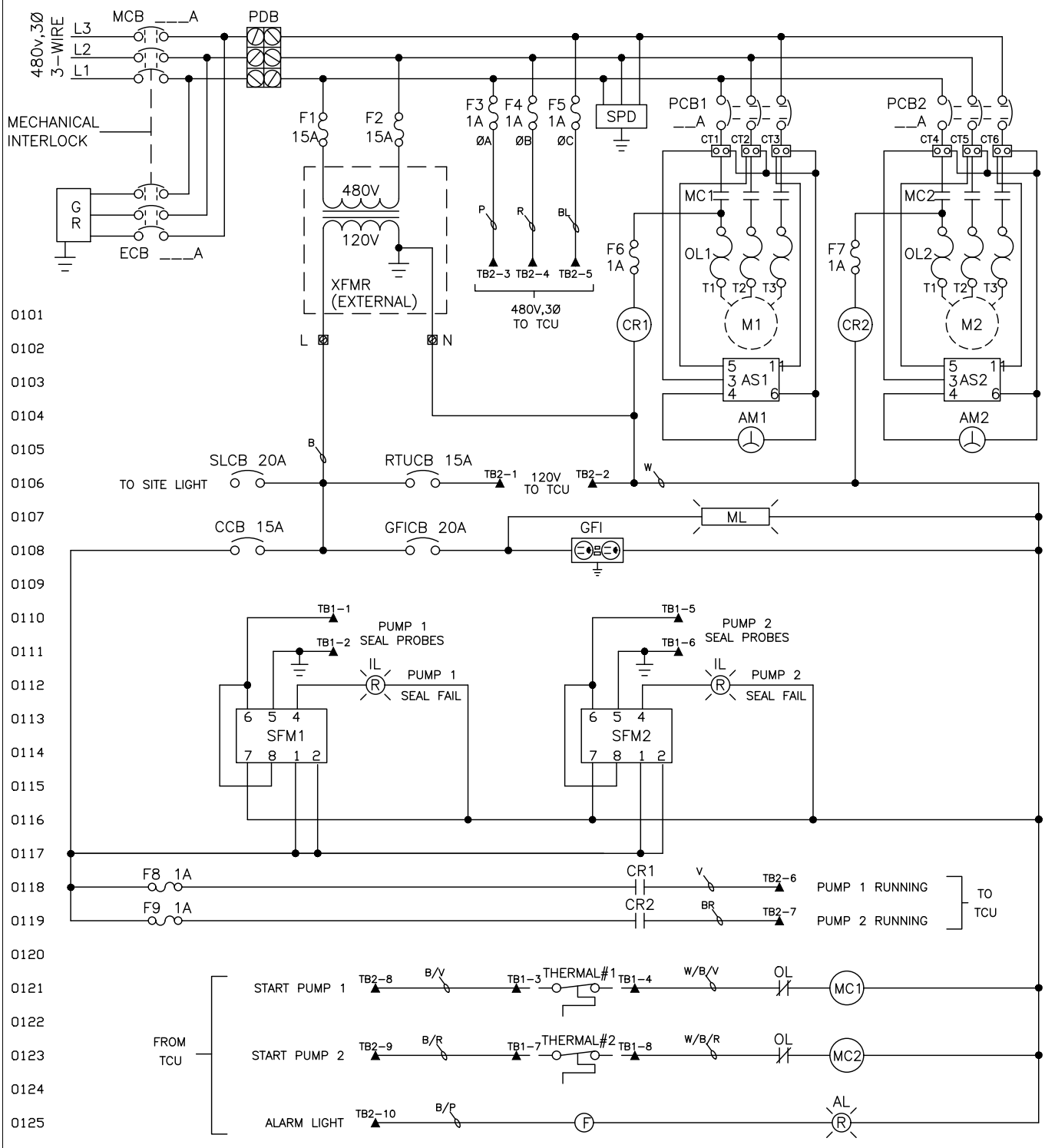
JUNCTION BOX
(POWDER COATED WHITE)



BASE PLATE

NOTE: J-BOX GROUND
MUST BE BONDED TO
CONTROL PANEL GROUND

MANATEE COUNTY PUBLIC WORKS DEPARTMENT			SEWAGE LIFT STATION CONTROL PANEL (230V)	US-25E
REV.BY	DATE			
		DATE OF APPROVAL		



MANATEE COUNTY PUBLIC WORKS DEPARTMENT			SEWAGE LIFT STATION CONTROL PANEL (460V)	US-26A
REV.BY	DATE			
		DATE OF APPROVAL		

PUMP CONTROL PANEL BILL OF MATERIALS			
QTY.	ABBR.	DESCRIPTION	MANUFACTURER, PART#
1	ENC	ENCLOSURE, 304SS N3R/12 (WHITE)	HOFFMAN, A36H3012SSLP–P8743 (MINIMUM SIZE)
1	MCB	MAIN CIRCUIT BREAKER	SQ.D, HGL (SIZE AS REQUIRED – 100A MIN.)
1	ECB	EMERGENCY CIRCUIT BREAKER	SQ.D, HGL (SIZE AS REQUIRED – 100A MIN.)
2	PCB1,2	PUMP CIRCUIT BREAKER	SQ.D, HGL (SIZE AS REQUIRED) + S29450
1	CCB	CONTROL CIRCUIT BREAKER	SQ.D, QOU115
1	RTUCB	RTU CIRCUIT BREAKER	SQ.D, QOU115
1	GFICB	GFI CIRCUIT BREAKER	SQ.D, QOU120
1	SLCB	SITE LIGHT CIRCUIT BREAKER	SQ.D, QOU120
2	MC1,2	NEMA 4 CONTACTOR	CRYDOM, A53TP_____ (SIZE AS REQUIRED)
2	CR1–2	CURRENT RELAY	CRYDOM, CWA2410 + HS501DR + HSP–2
2	OL1–2	OVERLOAD RELAY	SIEMENS, ESP200 (SIZE AS REQUIRED)
1	GR	GENERATOR RECEPTACLE	RUSSELL STOLL, JRSB2034HR
1	SPD	SURGE PROTECTOR	DITEK, DTK–4803CMX+
6	CT1–6	CURRENT TRANSFORMER __:5	ELECTRO. IND, 2SFT–____ (SIZE AS REQUIRED)
2	AS1–2	AMMETER SELECTOR SWITCH	SPRECHER & SCHUH, LE2–12–8751
2	AM1–2	AMMETER 0–__ A	CROMPTON, 013–75AA–LS__–C6–B3 (SIZE AS REQD)
2	F1–2	FUSE, 15A	FERRAZ, ATQR–15
1	XFMR	TRANSFORMER, 480V/120VAC 3KVA	SQ.D, 7400–3S1F (SHIPPED LOOSE)
7	F3–9	FUSE, 1A	FERRAZ, ATMR–1
1	GFI	120V RECEPTACLE	PASS & SEYMOUR, 1597–I
1	ML	MAINTENANCE LIGHT, LED	HOFFMAN, LEDA1S35
2	SFM1,2	SEAL FAIL MODULE	SYRELEC, PNRU–110A
2	IL	INDICATING LIGHT, RED LED	EATON, C22–L–XR–120
1	F	FLASHER	INGRAM, SSF–150W
1	AL	ALARM LIGHT, 120V LED	FEDERAL, LP3PL–120R

WIRE COLOR CODE

SYMBOL	COLOR
B	BLACK
W	WHITE
G	GREEN
BL	BLUE
R	RED
P	PINK
V	VIOLET
BR	BROWN
B/R	BLACK/RED
B/V	BLACK/VIOLET
B/P	BLACK/PINK
GY/P	GREY/PINK
GY/R	GREY/RED
GY/BL	GREY/BLUE
GY/BR	GREY/BROWN
W/R	WHITE/RED
W/B/V	WHT/BLK/VIOLET
W/B/R	WHT/BLK/RED

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

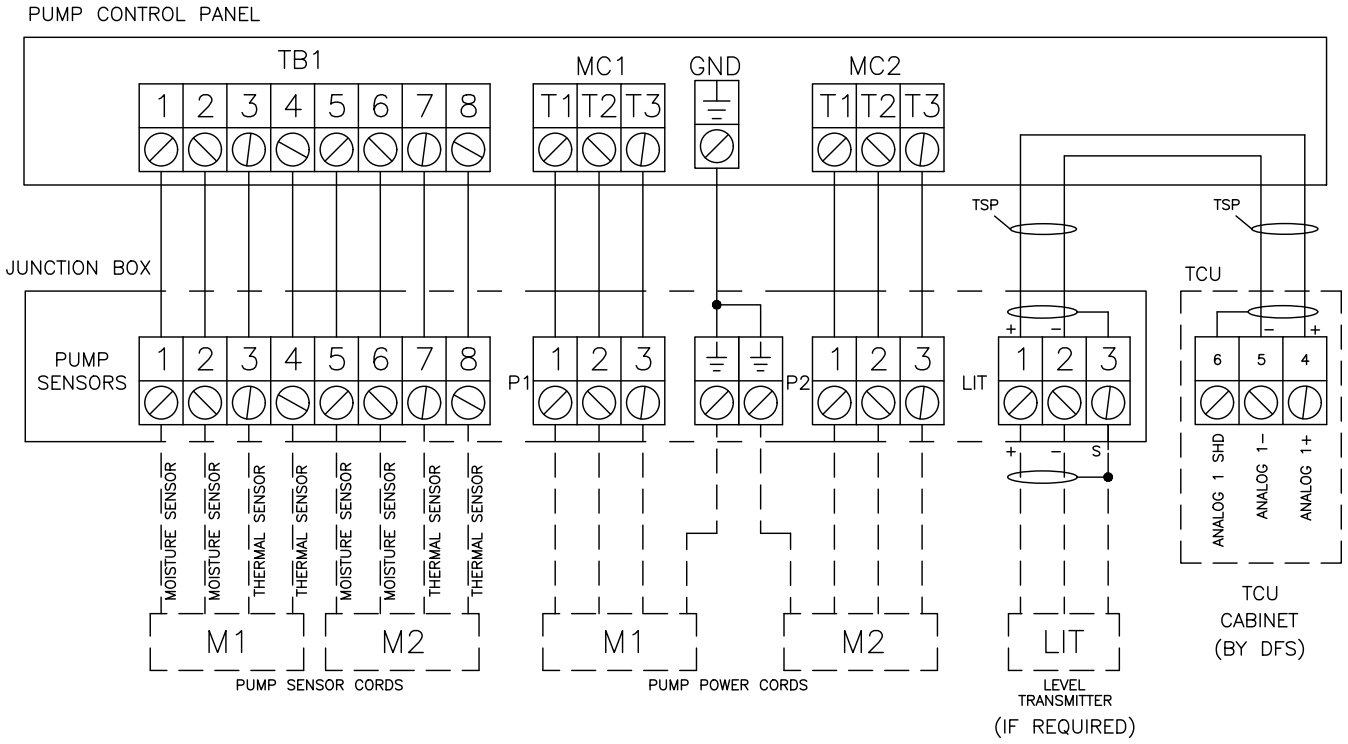
REV.BY	DATE

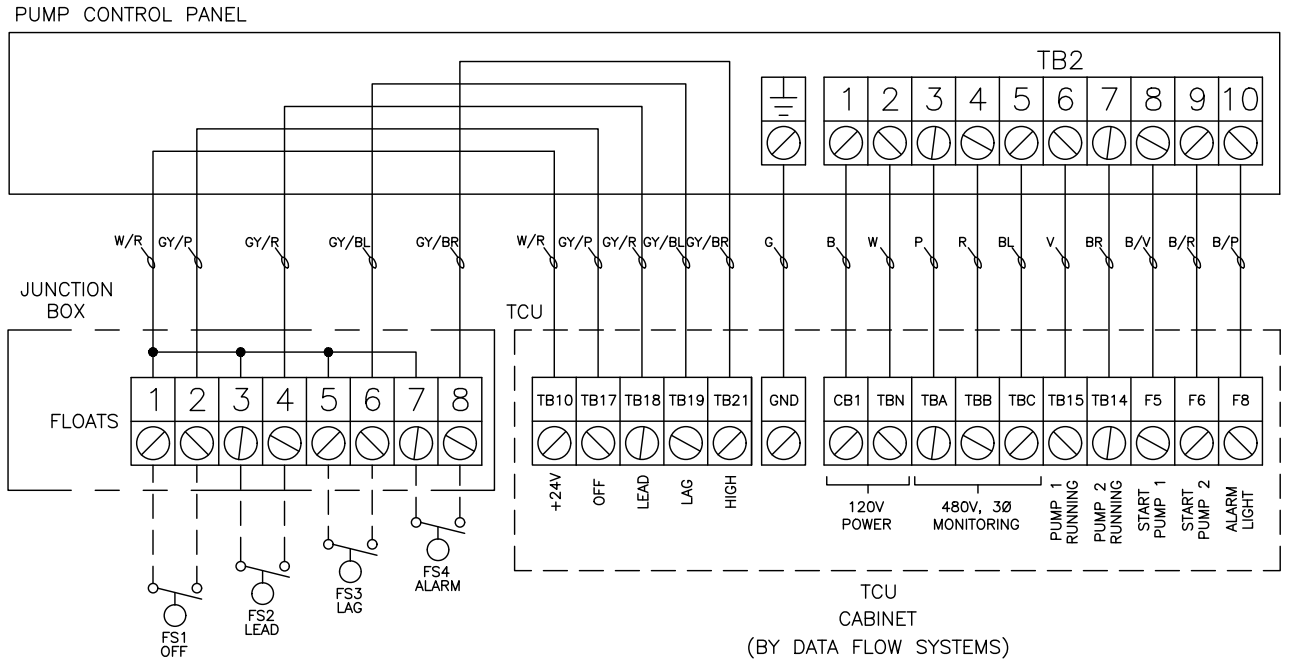
DATE OF APPROVAL

SEWAGE LIFT STATION
CONTROL PANEL
(460V)

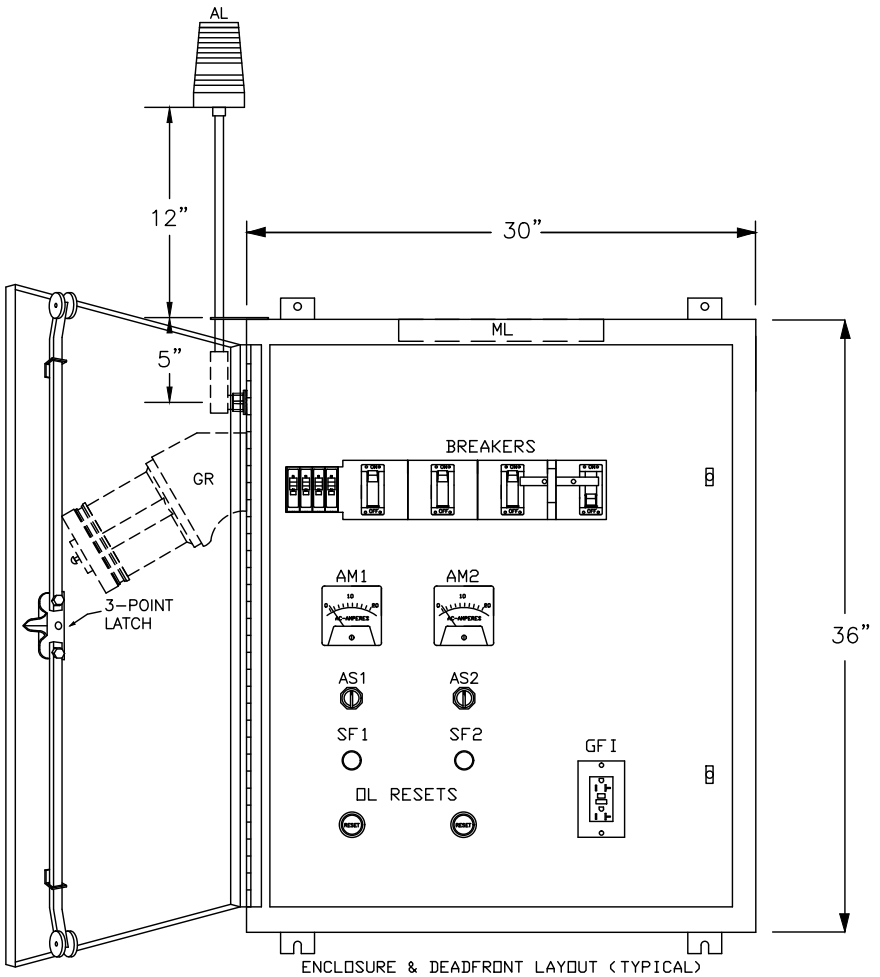
US–26B

TERMINALS



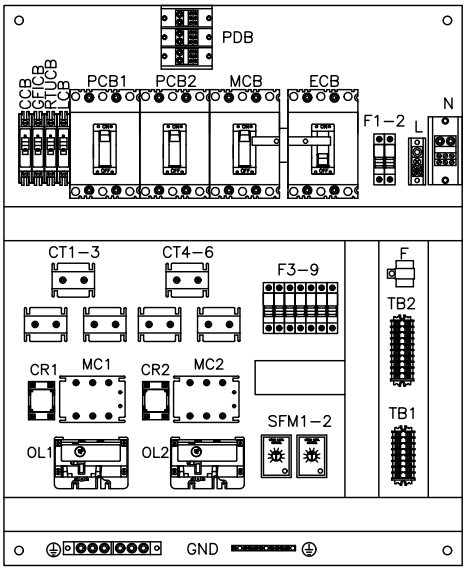


MANATEE COUNTY PUBLIC WORKS DEPARTMENT			SEWAGE LIFT STATION CONTROL PANEL (460V)	US–26C
REV.BY	DATE			
		DATE OF APPROVAL		

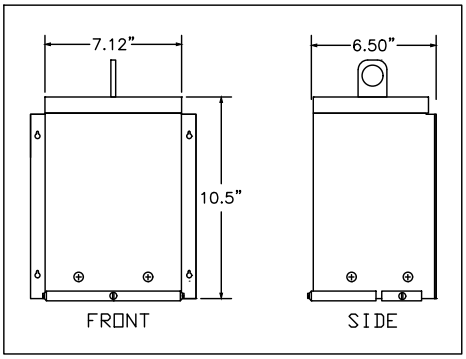


ENCLOSURE
POWDER
COATED
WHITE

ENCLOSURE & DEADFRONT LAYOUT (TYPICAL)



BASE PLATE LAYOUT (TYPICAL)



TRANSFORMER
(SHIPPED LOOSE - TO BE
INSTALLED ON EQUIPMENT RACK)

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

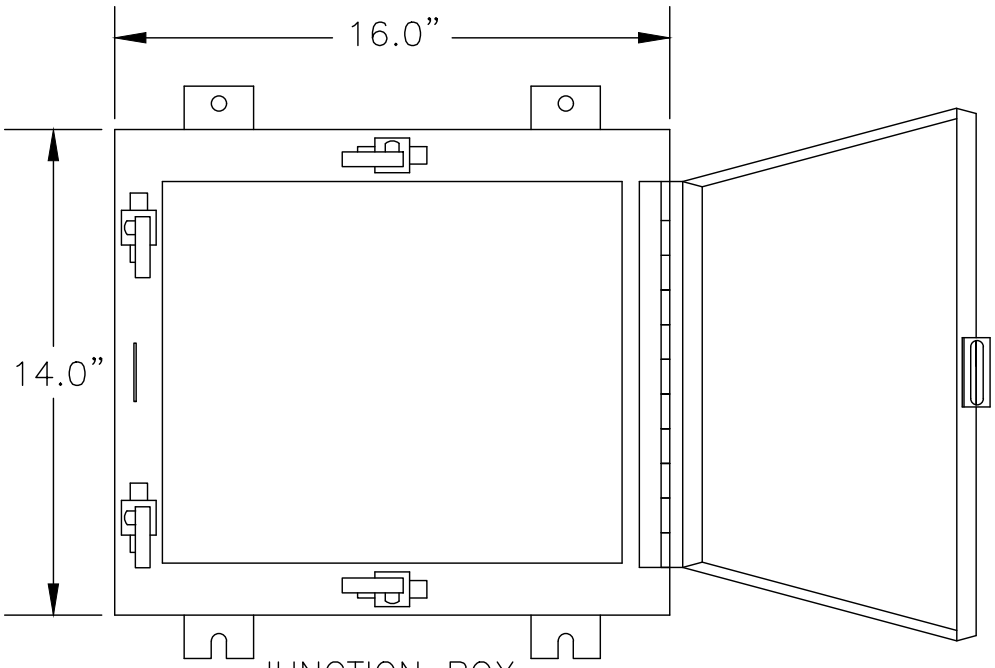
REV.BY	DATE

DATE OF APPROVAL

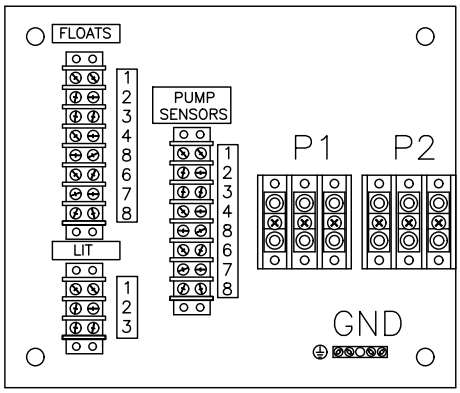
SEWAGE LIFT STATION CONTROL PANEL (460V)

US-26D

JUNCTION BOX BILL OF MATERIALS			
QTY.	ABBR.	DESCRIPTION	MANUFACTURER, PART#
1	ENC	ENCLOSURE, 304SS N4X (WHITE)	SCHAEFER'S, SPN4SS-14168-587
2		8-POINT TERMINAL BLOCK	IDEAL, 89-208
1		3-POINT TERMINAL BLOCK	IDEAL, 89-203
2		PUMP TERMINAL BLOCK	MARATHON, 1323572
1	G	GROUND BAR	EATON, GBK5



JUNCTION BOX
(POWDER COATED WHITE)



BASE PLATE

NOTE: J-BOX GROUND
MUST BE BONDED TO
CONTROL PANEL GROUND

MANATEE COUNTY
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REV.BY	DATE

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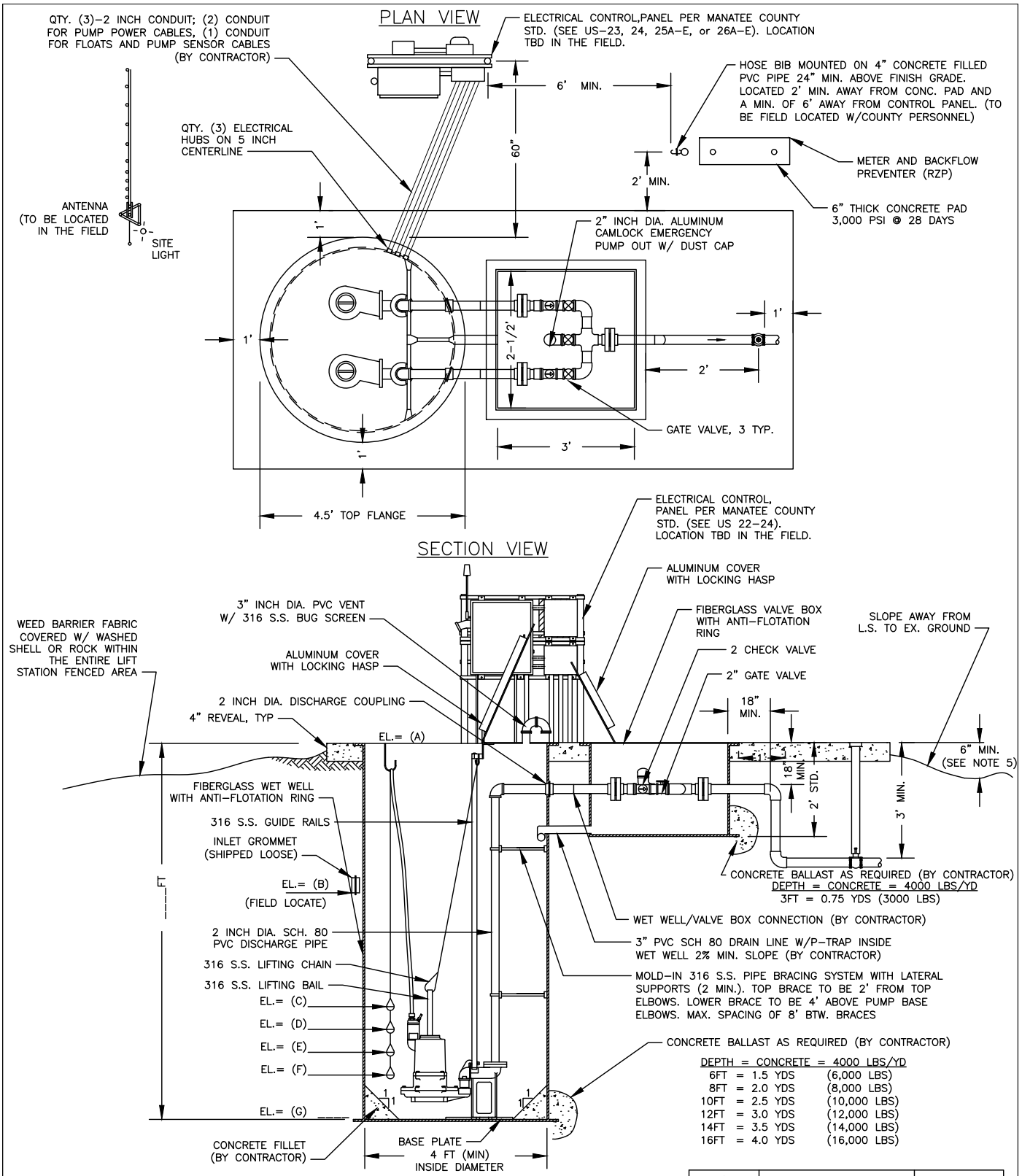
SEWAGE LIFT STATION
CONTROL PANEL
(460V)

US-26E



A	RIM ELEVATION	
B	INFL. INVERT	
C	HIGH WATER WATER	
D	LAG PUMP 2 ON	
E	LEAD PUMP 1 ON	
F	LOW WATER LEVEL (ALL PUMPS OFF)	
G	BOTTOM ELEVATION	

NOTES:

1. THE GRINDER LIFT STATION SHALL MEET THE CRITERIA OF THE LATEST MANATEE COUNTY PUBLIC WORKS UTILITY STANDARDS FOR LIFT STATIONs, SECTION 1.14 IN THE PUBLIC WORKS UTILITY STANDARDS MANUAL.
2. METER, BFP, & HOSE BIB SHALL BE PER M.C. UTILITY STANDARDS & LOCATED AS SUCH TO PROVIDE UNIMPEDED VEHICULAR ACCESS TO THE LIFT STATION FOR PUMP REMOVAL. COORDINATE LOCATION WITH COUNTY PERSONNEL.
3. ALL ELECTRICAL PANELS SHALL BE ABOVE THE REQUIRED 100 YEAR FLOOD PROTECTION ELEVATION (FPE).
4. FENCING AROUND THE GRINDER LIFT STATION SHALL BE FIELD LOCATED AND INSTALLATION COORDINATED WITH MANATEE COUNTY PERSONNEL.
5. SEE "ENTRANCE HATCH ELEVATION" CRITERIA IN THE M.C. P.W. UTILITY STANDARDS, 1.14.6

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GRINDER LIFT STATION

US–27A

GRINDER LIFT STATION NOTES:

1. GRINDER LIFT STATION SHALL BE IN ACCORDANCE WITH THE LATEST MANATEE COUNTY UTILITY STANDARDS, UNLESS OTHERWISE STATED BELOW. SEE US-15 THROUGH US-26A-E.
2. ALL THE HATCH COVERS SHALL BE 2/3 HINGED TO ALLOW FOR MAXIMUM ACCESS TO THE WET WELL. THE HATCH COVER SHALL INCLUDE A SINGLE OR DUAL DOOR OF DIMENSIONS SPECIFIED BY THE PUMP MANUFACTURER FOR PROPER PUMP CLEARANCE.
3. ALL FORCE MAIN PIPING AND FITTINGS WITHIN THE WET WELL AND THE VALVE VAULT SHALL BE PVC SCHEDULE 80. THE FORCE MAIN SHALL BE AT LEAST 18 INCHES BELOW THE TOP WITHIN THE WET WELL & VALVE VAULT. A 90 DEGREE BEND, THAT IS TURNED DOWN, SHALL BE INSTALLED 18 INCHES OUTSIDE OF THE VALVE VAULT TO OBTAIN A MINIMUM 3 FEET OF COVER. ALL PIPING SHALL BE COLOR CODED IN ACCORDANCE WITH THESE STANDARDS. GREEN-RAW SEWAGE; PURPLE-RECLAIMED: BLUE-POTABLE WATER.
4. ANCHORS & LIFTING DEVICES SHALL NOT PENETRATE THE WALLS OF THE WET WELL.
5. VERTICAL PVC PUMP DISCHARGE PIPE IN THE WET WELL SHALL BE BRACED, TOP BRACE TO BE 2' FROM TOP ELBOW, LOWER BRACE TO BE 4' ABOVE BASE ELBOW, MAX. SPACING OF 8' BETWEEN BRACES. THE PIPE SHALL BE CLAMPED TO A SINGLE LENGTH OF 1-5/8" 316 S.S. CHANNEL (UNISTRUT P1000 OR EQUAL) INSTALLED HORIZONTALLY AND ANCHORED TO THE WET WELL WALL AT EACH END WITH A CENTER BRACE OF 1-5/8" 316 S.S. CHANNEL ATTACHED TO THE BACK OF THE WET WELL. THE PIPE CLAMPS SHALL BE UNISTRUT P1117 316 STAINLESS STEEL.

DESIGN CONDITIONS

MODEL	_____	_____	HP
GPM	_____	_____	FT/TDH
VOLTAGE	_____	_____	PHASE
DISCHARGE (INCHES)	_____	_____	IMPELLER (INCHES)

PUMPS SHALL BE OF THE SUBMERSIBLE TYPE. EACH PUMP SHALL BE MOUNTED ON A BPIU.12 RAIL SYSTEM. THE RAIL SYSTEM SHALL BE SELF ENGAGING RESULTING IN A LEAKPROOF COUPLING. THE RAIL SYSTEM SHALL INCLUDE THE BASE ELBOW, DISCHARGE FLANGE ASSEMBLY, Ø1" 316 SS GUIDE RAILS, 316 SS UPPER GUIDE BRACKET, 316 SS LIFTING BAIL AND CABLE, AND A SIX-HOOK 316 SS CABLE HOLDER. THE RAIL SYSTEM SHALL BE MOUNTED AND PRE-PIPED BY THE PUMP SUPPLIER.

PUMP CONSTRUCTION
THE PUMP VOLUTE, MOTOR AND SEAL HOUSING SHALL BE CONSTRUCTED OF CAST IRON, ASTM A-48. ALL EXTERNAL FASTENERS SHALL BE 316 STAINLESS STEEL. THE PUMP SHAFT SHALL BE CONSTRUCTED OF SERIES 416 STAINLESS STEEL.

IMPELLER
THE IMPELLER SHALL BE OF MULTI-VANE, SEMI-OPEN BRONZE CONSTRUCTION. THE IMPELLER SHALL INCLUDE PUMP-OUT VANES ON THE BACK OF THE IMPELLER AND SHALL BE STATICALLY AND HYDRAULICALLY BALANCED.

CUTTERS
A TWO-STAGE CUTTER ASSEMBLY SHALL BE MOUNTED ON THE SUCTION SIDE OF THE PUMP WITH DIRECT DISCHARGE INTO THE PUMP IMPELLER. THE GRINDER SHALL BE CAPABLE OF GRINDING ALL MATERIALS FOUND IN NORMAL, DOMESTIC SEWAGE, INCLUDING PLASTICS, RUBBER, SANITARY NAPKINS, DISPOSABLE DIAPERS AND WOOD PARTICLES, INTO A FINE SLURRY. BOTH THE STATIONARY AND ROTATING CUTTERS SHALL BE CONSTRUCTED OF 440C STAINLESS STEEL HARDENED TO ROCKWELL 60C.

MOTOR
THE MOTOR SHALL BE MOUNTED IN A SEALED, SUBMERSIBLE TYPE HOUSING. THE STATOR SHALL BE SECURELY HELD IN PLACE WITH A REMOVABLE END RING AND THREADED FASTENERS FOR EASE OF REMOVAL WITHOUT THE USE OF HEAT OR A PRESS. THE MOTOR WILL HAVE TWO HEAVY-DUTY BALL BEARINGS; ONE UPPER (RADIAL) AND ONE LOWER (THRUST), TO SUPPORT THE SHAFT. THE MOTOR SHALL BE EQUIPPED WITH A WINDING THERMOSTAT THAT AUTOMATICALLY SHUTS THE MOTOR OFF IN CASE OF MOTOR OVERHEATING.

SEAL CHAMBER
THE PUMP SHALL HAVE TWO MECHANICAL SEALS, MOUNTED IN TANDEM WITH AN OIL CHAMBER BETWEEN THE SEALS (OR EQUIVALENT). THE PUMP SHALL BE EQUIPPED WITH A SEAL LEAK DETECTION PROBE AND WARNING SYSTEM BY USING A SEAL FAILURE SENSOR INSTALLED IN THE SEAL CHAMBER.

WET WELL
THE PUMP SUPPLIER SHALL PROVIDE THE FIBERGLASS WET WELL. THIS GLASS FIBER-REINFORCED POLYESTER BASIN SHALL BE CONSTRUCTED OF A COMMERCIAL GRADE OF GLASS FIBER AND SHALL BE PROVIDED WITH AN ANTI-FLOTATION RING WITH A MINIMUM DIAMETER OF THREE INCHES LARGER THAN THE BASIN DIAMETER. THE RAIL SYSTEM, INTERNAL PIPING AND DISCHARGE CONNECTIONS SHALL BE PRE-INSTALLED BY THE PUMP SUPPLIER.

VALVE BOX
THE VALVE BOX IS FIBERGLASS WITH ALUMINUM LOCKABLE COVER. STANDARD SIZE VALVE BOX IS 3' X 2 1/2' X 2'.

VALVES
VALVES SHALL BE SEWAGE SWING CHECK WITH CLEAN-OUT PORTS AND BRASS GATE VALVES.

FLOATS
FLOATS SHALL BE A MECHANICAL-TYPE SWITCH.

CONTROLS
THE CONTROL PANEL SHALL CONFORM TO THE CURRENT MANATEE COUNTY SPECIFICATIONS.

SUPPLIER
PUMP SUPPLIER SHALL PROVIDE SUBMERSIBLE PUMPS, SLIDE RAIL ASSEMBLIES, CONTROL PANEL, FLOAT SWITCHES, ALUMINUM HATCHES AND ACCESSORIES TO ENSURE PROPER OPERATIONS AND WARRANTY. THE COMPLETE PACKAGE LIFTING STATION SHALL HAVE PUMP BASES, RAIL ASSEMBLIES, AND DISCHARGE PIPING READY FOR FIELD INSTALLATION.

MANATEE COUNTY
PUBLIC WORKS DEPARTMENT

REV.BY	DATE

_____
DATE OF APPROVAL

GRINDER LIFT STATION NOTES

US-27B

INTENTIONALLY
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BID ATTACHMENT 6, UTILITY APPROVED LIST (APL)

Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Piping	Pressurized PVC AWWA C900-16	Standard Push-On Joint	4" and Larger		✓	✓	✓	JM Eagle	Blue Brute (C900)/ Big Blue (C905)	Pipe size 14" shall only be used with prior written approval by Manatee County All PVC pipe shall be color-coded per service application **Potable/Reclaimed Water:** Pipe sizes 4" - 12": Pressure Class 235, DR 18, Ductile Iron Pipe Size (DIPS), AWWA C900-16 Shall have EPDM rubber gaskets with the letters "EPDM" factory embossed or etched into the gasket Pipe and gaskets for potable water shall be NSF61 certified **Wastewater:** Pipe sizes 4" - 36": Pressure Class 235, DR 18, DIPS, AWWA C900-16 **Self-Restrained Push-On Joint:** All self-restrained push-on joint pipe shall be field checked for proper engagement per manufacturer's recommendations Pipe shall have weather-resistant, min. 6 mil thick, 4" wide, solid red PVC marking tape around bell RieberLok: Gaskets shall only be used on manufacturer approved pipe Bulldog Restraint: Gaskets shall only be factory applied to Diamond Plastic "Lok 21" and JM Eagle "Eagle Loc 900" Pipe
					✓	✓	✓	Diamond Plastics Corp.	C900/Trans-21	
					✓	✓	✓	North American Pipe Corp.	C900/IB	
					✓	✓	✓	National Pipe & Plastics	Dura-Blue C900	
					✓	✓	✓	Sanderson Pipe	C900	
		Self-Restrained Push-On Joint	4" - 24"		✓	✓	✓	Bulldog Restraint	Bulldog Gasket	
			4" - 12"		✓	✓	✓	RieberLok	RieberLok Gasket	
	Gravity Sewer PVC	4" - 15"					✓	JM Eagle	Ring-Tite Gravity Sewer	Pipe size 14" shall only be used with prior written approval by Manatee County Push-on joints shall use elastomeric gaskets in accordance with ASTM D3212 Pipe shall be color coded green for sewer applications Pipe sizes 4" - 15": Pipe Stiffness 115, SDR 26, ASTM D3034
							✓	Diamond Plastics Corp.	Sani-21	
							✓	North American Pipe Corp.	ASTM D3034/IB	
							✓	National Pipe & Plastics	Sewer ASTM D3034/F679	
							✓	Sanderson Pipe	ASTM D3034/IB	
		18" - 54"					✓	JM Eagle	Big Blue (C905)	Push-on joints shall use elastomeric gaskets in accordance with ASTM D3212 Pipe shall be color coded green for sewer applications Pipe sizes 18" - 54": Pressure Class 165, DR 25, Ductile Iron Pipe Size (DIPS), AWWA C900-16
							✓	Diamond Plastics Corp.	C900/Trans-21	
							✓	North American Pipe Corp.	C900/IB	
							✓	National Pipe & Plastics	Dura-Blue C900	

Contractor shall check/mark which product is intended to be used in the submittal box. If multiple manufacturers are to be used, each manufacturer shall be marked.

Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Piping	HDPE	For Mains	4" and Larger		✓	✓	✓	JM Eagle	HDPE (DIPS) Pressure Pipe	Pressure Class 200, PE4710, Ductile Iron Pipe Size (DIPS), DR 11, AWWA C906 Min. Cell Classification per ASTM D3350 shall be 445574 Pipe sizes 3" and 14" shall only be used with prior written approval by Manatee County All HDPE pipe must have color coded striping on 3-sides (120 degree apart) per service application **Potable/Reclaimed Water:** For pipe sizes 4" - 12" HDPE pipe shall not be installed in roadways, unless in a casing Pipe sizes 16" and larger shall only be used with prior written approval by Manatee County Pipe for potable water shall be NSF61 certified **Wastewater:** For pipe sizes 4" - 36"
					✓	✓	✓	WL Plastics	PE 4710 (DIPS)	
					✓	✓	✓	GF Central Plastics	Design-Flow PE100/PE4710	
					✓	✓	✓	Performance Pipe	DriscoPlex 4000	
					✓	✓	✓	Endot	PE 4710 (DIPS)	
					✓	✓	✓	Charter Plastics	PE 4710 - Blue/Lavender/ Green Stripe	
	PE	For Services	2" and Smaller		✓	✓		Endot	Endopure	Pressure Class 250, PE4710, Copper Tube Size (CTS), SDR 9, AWWA C901 Min. Cell Classification per ASTM D3350 shall be 445574 Tubing shall be fully color coded blue for potable water or purple for reclaimed water services Tubing for potable water shall be NSF61 certified PE Tubing shall only be used if water main is not under pavement Butt-Fusion or CTS brass connections shall be used
					✓	✓		ADS	Polyflex	
					✓			Charter Plastics	4710 - CTS Tubing	
	PEX				✓	✓		Rehau	Municipex	Pressure Class 200, PEXa 3306, Copper Tube Size (CTS), SDR 9, AWWA C904 Tubing shall be fully color coded blue for potable water or purple for reclaimed water services Tubing for potable water shall be NSF61 certified PEX Tubing shall only be used if water main is not under pavement Butt-Fusion or CTS brass connections shall be used

Contractor shall check/mark which product is intended to be used in the submittal box. If multiple manufacturers are to be used, each manufacturer shall be marked.

Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Piping	Ductile Iron AWWA C150/C151	Flanged Joint	4" and Larger		✓	✓	✓	American Cast Iron Pipe Company	Flanged Joint	**Pipe Ratings:** Aboveground Installation: Flanged Joint, 250 PSI, Special Class 53 Buried Installation: Mechanical Joint, 350 PSI for 4" - 16", 250 PSI for 18" and larger Buried pipe shall be wrapped with an approved external polyethylene encasement color coded blue for potable water, purple for reclaimed water, and green for sewer Pipe size 14" shall only be used with prior written approval by Manatee County **Potable/Reclaimed Water:** For pipe sizes 4" and larger Interior Coating: Std. thickness cement lining per AWWA C104 Exterior Coating: Buried pipe shall have a std. 1-mil asphaltic coating per AWWA C151; aboveground pipe shall have a factory-applied epoxy primer For uncontaminated soils: Shall have EPDM rubber gaskets with the letters "EPDM" factory embossed and/or etched into gasket For contaminated soils: Shall have NBR or FKM rubber gasket Refer to Manatee County Public Works Utility Standards Section 1.4.2.F for gasket material details Pipe and gaskets for potable water shall be NSF61 certified **Wastewater:** For force mains: Pipe sizes 36" and larger For lift station aboveground valve and metering assemblies: Pipe sizes 4" and larger Holiday-free factory certification per ASTM G62, Method B (High-Voltage) shall be provided for the interior coating at the point of delivery Interior Coating: Green, factory applied dry film thickness 40-mil Tnemec Series 431 Perma-Shield PL or Permox CTF coating Exterior Coating: Buried pipe shall have a std. 1-mil asphaltic coating per AWWA C151; aboveground pipe shall have a factory-applied epoxy primer **Self-Restrained Push-On Joint:** All self-restrained push-on joint pipe shall have weather-resistant, min. 6 mil thick, 4" wide, solid red PVC marking tape around bell
					✓	✓	✓	McWane Ductile	Flanged Joint	
					✓	✓	✓	U.S. Pipe	Flanged Joint	
		Standard Push-On Joint			✓	✓	✓	American Cast Iron Pipe Company	Fastite Joint	
					✓	✓	✓	McWane Ductile	Tyton Joint	
					✓	✓	✓	U.S. Pipe	Tyton Joint	
		Self-Restrained Push-On Joint			✓	✓	✓	American Cast Iron Pipe Company	Fastite Joint w/ Amarillo Fast-Grip Gasket (4" - 24")	
					✓	✓	✓		Lok-Ring Joint (54" - 64")	
					✓	✓	✓		Flex-Ring Joint (4" - 54")	
					✓	✓	✓	McWane Ductile	Tyton Joint w/ Sure Stop 350 Gasket (4" - 24")	
					✓	✓	✓		TR Flex Joint (4" - 36")	
					✓	✓	✓	U.S. Pipe	Tyton Joint w/ Field Lok 350 Gasket (4" - 16")	
					✓	✓	✓		HP Lok Joint (30" - 64")	
					✓	✓	✓		TR Flex Joint (4" - 36")	

Contractor shall check/mark which product is intended to be used in the submittal box. If multiple manufacturers are to be used, each manufacturer shall be marked.

Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Piping	Pressurized PVC ASTM D2241	3" and Smaller		✓	✓		JM Eagle	Ring-Tite	Shall only be used for potable/reclaimed water service casings under pavement Pressure Class 200, SDR 21, Iron Pipe Size (IPS), ASTM D2241
				✓	✓		Diamond Plastics Corp.	D2241	
				✓	✓		North American Pipe Corp.	ASTM D2241/IB	
				✓	✓		National Pipe & Plastics	Dura-Flow SDR Series	
	Pressurized Sch. 80 PVC ASTM D1785	2" and Smaller				✓	North American Pipe Corp. Products	-	Shall only be used for grinder pump stations Iron Pipe Size (IPS), ASTM D1785 Only for working pressures up to 125 psi
						✓	JM Eagle Products	-	
						✓	GF Central Plastics Products	-	
						✓	Charlotte Pipe Products	-	
						✓	Harrison Plastic Products	-	
	Fiberglass	Centrifugally Cast				✓	Hobas Products	-	Shall only be used for slip lining existing gravity sewer main Bell and Spigot shall meet requirements of ASTM D3262 O-ring or profile type elastomeric gasket shall meet requirements of ASTM F477
		Filament Wound				✓	Flowtite Products	-	

Contractor shall check/mark which product is intended to be used in the submittal box. If multiple manufacturers are to be used, each manufacturer shall be marked.

Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Fittings	Ductile Iron AWWA C110/C153	For Pressurized PVC C900-16 and DI Pipe		✓	✓	✓	Sigma Corp. Products	-	**Mechanical Joint Fittings (Buried Installations Only):** 4" - 16": 350 psi pressure rating 18" and larger: 250 psi pressure rating **Flanged Fittings (Aboveground Installations Only):** All sizes: 250 psi pressure rating Buried fittings shall be wrapped with an approved external polyethylene encasement color coded blue for potable water, purple for reclaimed water, and green for sewer For buried installations: T-bolts, bolts, tie rods, nuts, and washers shall be High Strength, Low Alloy Steel conforming to AWWA C111/ANSI A21.11-17 or ASTM A242. Hardware referenced above shall be coated with a blue fluoropolymer coating (Xylan 1424, FluoroKote #1 or AFT-PTFE-Blue). Alternatively, hardware shall be 316 SS. For aboveground installations: T-bolts, bolts, tie rods, nuts, and washers shall be 316 SS **Potable/Reclaimed Water:** Interior Coating: Double the std. thickness cement lining per AWWA C104 Exterior Coating: Buried fittings shall have a std. 1-mil asphaltic coating per AWWA C110/C153; aboveground fittings shall have a factory-applied epoxy primer For uncontaminated soils: Shall have EPDM rubber gaskets with the letters "EPDM" embossed and/or etched into gasket For contaminated soils: Shall have NBR or FKM rubber gasket Refer to Manatee County Public Works Utility Standards Section 1.4.2.F for gasket material details Fittings and gaskets for potable water shall be NSF61 certified **Wastewater:** Holiday-free factory certification per ASTM G62, Method B (High-Voltage) shall be provided for the interior coating at the point of delivery Interior Coating: Green, factory applied dry film thickness 40-mil Tnemec Series 431 Perma-Shield PL or Permox CTF coating Exterior Coating: Buried fittings shall have a std. 1-mil asphaltic coating per AWWA C110/C153; aboveground fittings shall have a factory-applied epoxy primer
				✓	✓	✓	Star Pipe Products	-	
				✓	✓	✓	Infact Corp.	Flex T-2/T-3	
				✓	✓	✓	SIP Industries Products	-	
				✓	✓	✓	Tyler/Union Products	-	

Contractor shall check/mark which product is intended to be used in the submittal box. If multiple manufacturers are to be used, each manufacturer shall be marked.

Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Fittings	Molded and Fabricated HDPE	For HDPE AWWA C906 Pipe				✓	GF Central Plastics Products	-	<u>Shall only be used in lift stations</u> Refer to Manatee County Public Works Utility Standards Detail US-19 Pressure Class 200, PE4710, Ductile Iron Pipe Size (DIPS), DR 11, AWWA C906 Min. Cell Classification per ASTM D3350 shall be 445574 Fittings shall be fused per manufacturer's recommendations
						✓	Charter Plastics Products	-	
						✓	Performance Pipe Products	-	
						✓	Specified Fittings Products	-	
						✓	Integrity Fusion Products	-	
	Molded and Fabricated PVC	For Pressurized PVC AWWA C900-16 Pipe				✓	NACO	Pressure Gasketed Fittings	<u>Shall only be used for P-traps and drop manholes</u> All fittings shall be connected via water-tight push-on joints using elastomeric gaskets per ASTM D3139 rated for pressurized PVC pipe Pressure Class 150, DR 18, AWWA C900-16/C907
						✓	Harrington Corp	C900 Fittings	
						✓	Multi Fittings Corp.	C900/C905 Fittings	
						✓	Specified Fittings	C900 Fittings	
		For Gravity Sewer PVC AWWA C900-16 Pipe (18" and Larger)				✓	Harrington Corp	C900 Fittings	<u>Shall only be used for drop manholes</u> All fittings shall be connected via water-tight push-on joints using elastomeric gaskets per ASTM D3212 rated for gravity sewer PVC pipe Pipe sizes 18" - 54": DR 25, AWWA C900-16/C907
						✓	Multi-Fittings Corp.	C900/C907 Fittings	
						✓	North American Pipe Corp.	N-Series	
		For Gravity Sewer PVC ASTM D3034 Pipe				✓	Harrington Corp.	SDR 26 Fittings	<u>Shall only be used for sewer laterals and drop manholes</u> All fittings shall be connected via water-tight push-on joints using elastomeric gaskets per ASTM D3212 rated for gravity sewer PVC pipe Pipe sizes 4" - 15": SDR 26, ASTM D3034
						✓	Multi Fittings Corp.	Trench Tough Plus	
						✓	Tigre-ADS USA	SDR 26 Gasketed	
						✓	North American Pipe Corp.	G-Series	

Contractor shall check/mark which product is intended to be used in the submittal box. If multiple manufacturers are to be used, each manufacturer shall be marked.

Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
External Thrust Restraint Devices	PVC AWWA C900-16 (4" - 12")	Pipe to Pipe connections	Split-Casing Restraint		✓	✓	✓	Ford Meter Box Co.	Series UFR1390-C (DI, PVC) (4" - 12")	All sizes: 235 psi rating Buried thrust restraints shall be wrapped with an approved external polyethylene encasement color coded blue for potable water, purple for reclaimed water, and green for sewer For buried installations: T-bolts, tie rods, nuts, and washers shall be High Strength, Low Alloy Steel conforming to AWWA C111/ANSI A21.11-17 or ASTM A242. Side clamping bolts shall be medium carbon steel per SAE J429 Grade 5/ASTM A449 Side clamping nuts shall be medium carbon steel per SAE J995 Grade 2/ASTM A449 Hardware referenced above shall be coated with a blue fluoropolymer coating (Xylan 1424, FluoroKote #1, or AFT-PTFE-Blue). Alternatively, hardware shall be 316 SS. For aboveground installations: T-bolts, tie rods, nuts, and washers shall be 316 SS Side clamping bolts shall be min. 316 SS per ASTM A193 Grade B8M, Class 2 Side clamping nuts shall be min. 316 SS per ASTM A194 Grade 8M, Class 1 **Restraint devices shall have the following factory applied high performance coatings:** Star Pipe Products: Starbond System Sigma Corp.: CORRSAFE System EBAA Iron: MEGA-BOND System Ford Meter Box Co.: Armorguard E-Coat System SIP Industries: EZ Shield System **Potable/Reclaimed Water:** For uncontaminated soils: Shall have EPDM rubber gaskets with the letters "EPDM" factory embossed and/or etched into gasket For contaminated soils: Shall have NBR or FKM rubber gasket Refer to Manatee County Public Works Utility Standards Section 1.4.2.F for gasket material details
					✓	✓	✓	EBAA Iron	Series 1900 (4" - 12")	
					✓	✓	✓	Star Pipe Products	PVC Series 1100G2C (4" - 12")	
					✓	✓	✓	Sigma Corp.	PV-LOK Series D-PWP (DI, PVC) (4" - 12")	
			Wedge-Action Restraint		✓	✓	✓	Star Pipe Products	PVC Stargrip Series 4100P (4" - 12")	
					✓	✓	✓	Sigma Corp.	ONE-LOK Series SLCEH (4" - 12")	
		Pipe to MJ Fittings connections	Split-Casing Restraint		✓	✓	✓	Star Pipe Products	PVC Series 1000G2 (DI, PVC) (4" - 12")	
					✓	✓	✓	Sigma Corp.	PV-LOK Series PWM-C (4" - 12")	
			Wedge-Action Restraint		✓	✓	✓	EBAA Iron	Series 2000PV (4" - 12")	
					✓	✓	✓	Star Pipe Products	PVC Stargrip Series 4000 (HDPE, PVC) (4" - 12")	
					✓	✓	✓	SIP Industries	EZ Grip Series EZPVCP (4" - 12")	
					✓	✓	✓	Sigma Corp.	ONE-LOK Series D-SLCE (4" - 12")	
		Pipe to PVC Fittings connections	Split-Casing Restraint		✓	✓	✓	EBAA Iron	Series 2600 (4" - 12")	
					✓	✓	✓	Star Pipe Products	Series 1200G2C (4" - 12")	
					✓	✓	✓	SIP Industries	Series PTPFC (4" - 12")	
					✓	✓	✓	Sigma Corp.	PV-LOK Series PWPF (4" - 12")	

Contractor shall check/mark which product is intended to be used in the submittal box. If multiple manufacturers are to be used, each manufacturer shall be marked.

Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
External Thrust Restraint Devices	PVC AWWA C900-16 (14" - 36")	Pipe to Pipe connections	Split-Casing Restraint		✓	✓	✓	Star Pipe Products	Series 1100C (14" - 36")	All sizes: 235 psi rating Buried thrust restraints shall be wrapped with an approved external polyethylene encasement color coded blue for potable water, purple for reclaimed water, and green for sewer For buried installations: T-bolts, tie rods, nuts, and washers shall be High Strength, Low Alloy Steel conforming to AWWA C111/ANSI A21.11-17 or ASTM A242. Side clamping bolts shall be medium carbon steel per SAE J429 Grade 5/ASTM A449 Side clamping nut shall be medium carbon steel per SAE J995 Grade 2/ASTM A449 Hardware referenced above shall be coated with a blue fluoropolymer coating (Xylan 1424, FluoroKote #1, or AFT-PTFE-Blue). Alternatively, hardware shall be 316 SS. For aboveground installations: T-bolts, tie rods, nuts, and washers shall be 316 SS Side clamping bolts shall be min. 316 SS per ASTM A193 Grade B8M, Class 2 Side clamping nuts shall be min. 316 SS per ASTM A194 Grade 8M, Class 1 **Restraint devices shall have the following factory applied high performance coatings:** Star Pipe Products: Starbond System Sigma Corp.: CORRSAFE System EBAA Iron: MEGA-BOND System Ford Meter Box Co.: Armorguard E-Coat System SIP Industries: EZ Shield System **Potable/Reclaimed Water:** For uncontaminated soils: Shall have EPDM rubber gaskets with the letters "EPDM" factory embossed and/or etched into gasket For contaminated soils: Shall have NBR or FKM rubber gasket Refer to Manatee County Public Works Utility Standards Section 1.4.2.F for gasket material details
					✓	✓	✓	Sigma Corp.	PV-LOK Series D-PWP (DI, PVC) (14" - 36")	
			Wedge-Action Restraint		✓	✓	✓	EBAA Iron	Megalug Series 2800 (14" - 16")	
					✓	✓	✓	Star Pipe Products	PVC Stargrip Series 4400 (14" - 20")	
					✓	✓	✓		Series 1100C* (24" - 36")	
					✓	✓	✓	Ford Meter Box Co.	Series UFR1390-C* (DI, PVC) (24" - 36")	
		Pipe to MJ Fittings connections	Split-Casing Restraint		✓	✓	✓	Star Pipe Products	Series 1000C (14" - 36")	
					✓	✓	✓	Sigma Corp.	PV-LOK Series D-PWM (14" - 24")	
			Wedge-Action Restraint		✓	✓	✓	EBAA Iron	Series 2000PV (HDPE, PVC) (14" - 16", 24")	
					✓	✓	✓	Star Pipe Products	PVC Stargrip Series 4000 (HDPE, PVC) (14" - 36")	
					✓	✓	✓	SIP Industries	EZ Grip Series EZPVCP (14" - 36")	
					✓	✓	✓	Sigma Corp.	ONE-LOK Series D-SLCE (HDPE, PVC) (24" - 36")	
		Pipe to PVC Fittings connections	Split-Casing Restraint		✓	✓	✓	Sigma Corp.	PV-LOK Series PWPF (14" - 24")	

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Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
External Thrust Restraint Devices	HDPE AWWA C906	Pipe to MJ Fittings connections	Split-Casing Restraint		✓	✓	✓	EBAA Iron	Series 15PF00 (4" - 12")	All sizes: 160 psi rating Buried thrust restraints shall be wrapped with an approved external polyethylene encasement color coded blue for potable water, purple for reclaimed water, and green for sewer For buried installations: T-bolts, tie rods, nuts, and washers shall be High Strength, Low Alloy Steel conforming to AWWA C111/ANSI A21.11-17 or ASTM A242. Side clamping bolts shall be medium carbon steel per SAE J429 Grade 5/ASTM A449 Side clamping nut shall be medium carbon steel per SAE J995 Grade 2/ASTM A449 Hardware referenced above shall be coated with a blue fluoropolymer coating (Xylan 1424, FluoroKote #1, or AFT-PTFE-Blue). Alternatively, hardware shall be 316 SS. For aboveground installations: T-bolts, tie rods, nuts, and washers shall be 316 SS Side clamping bolts shall be min. 316 SS per ASTM A193 Grade B8M, Class 2 Side clamping nuts shall be min. 316 SS per ASTM A194 Grade 8M, Class 1 All restrained joints shall be designed for HDPE Pipe conforming to AWWA C906 and Ductile Iron Pipe Size (DIPS) Dimensions Shall include 316 SS pipe stiffening insert ABS Spacers shall not be removed from actuating bolts on HDPE Pipe (DIPS) **Restraint devices shall have the following factory applied high performance coatings:** Star Pipe Products: Starbond System Sigma Corp.: CORRSAFE System EBAA Iron: MEGA-BOND System Ford Meter Box Co.: Armorguard E-Coat System SIP Industries: EZ Shield System **Potable/Reclaimed Water:** For uncontaminated soils: Shall have EPDM rubber gaskets with the letters "EPDM" factory embossed and/or etched into gasket For contaminated soils: Shall have NBR or FKM rubber gasket Refer to Manatee County Public Works Utility Standards Section 1.4.2.F for gasket material details
					✓	✓	✓		Series 15MJ00 (4" - 12")	
					✓	✓	✓	Sigma Corp.	PV-LOK Series PVM-C (4" - 12)	
			Wedge-Action Restraint		✓	✓	✓	EBAA Iron	Series 2000PV (HDPE, PVC) (4" - 12")	
					✓	✓	✓	Star Pipe Products	PVC StarGrip Series 4000 (HDPE, PVC) (4" - 18")	
					✓	✓	✓	Sigma Corp.	ONE-LOK Series D-SLCE (HDPE, PVC) (4" - 12")	

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Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
External Thrust Restraint Devices	Ductile Iron Pipe AWWA C150 & C151	Pipe to Pipe connections	Split-Casing Restraint		✓	✓	✓	EBAA Iron	Series 1500TD (4" - 12")	Pipe sizes 2" - 16": 350 psi rating Pipe sizes 18" and larger: 250 psi rating Buried thrust restraints shall be wrapped with an approved external polyethylene encasement color coded blue for potable water, purple for reclaimed water, and green for sewer For buried installations: T-bolts, tie rods, nuts, and washers shall be High Strength, Low Alloy Steel conforming to AWWA C111/ANSI A21.11-17 or ASTM A242. Side clamping bolts shall be medium carbon steel per SAE J429 Grade 5/ASTM A449 Side clamping nuts shall be medium carbon steel per SAE J995 Grade 2/ASTM A449 Hardware referenced above shall be coated with a blue fluoropolymer coating (Xylan 1424, FluoroKote #1, or AFT-PTFE-Blue). Alternatively, hardware shall be 316 SS. For aboveground installations: T-bolts, tie rods, nuts, and washers shall be 316 SS Side clamping bolts shall be min. 316 SS per ASTM A193 Grade B8M, Class 2 Side clamping nuts shall be min. 316 SS per ASTM A194 Grade 8M, Class 1 **Restraint devices shall have the following factory applied high performance coatings:** Star Pipe Products: Starbond System Sigma Corp.: CORRSAFE System EBAA Iron: MEGA-BOND System Ford Meter Box Co.: Armorguard E-Coat System SIP Industries: EZ Shield System **Potable/Reclaimed Water:** For uncontaminated soils: Shall have EPDM rubber gaskets with the letters "EPDM" factory embossed and/or etched into gasket For contaminated soils: Shall have NBR or FKM rubber gasket Refer to Manatee County Public Works Utility Standards Section 1.4.2.F for gasket material details **MJ Fitting to MJ Fitting Connections in Potable/Reclaimed Water:** Interior Coating: Std. thickness cement lining per AWWA C104 Exterior Coating: Std. 1-mil asphaltic coating per AWWA C110/C153 **MJ Fitting to MJ Fitting Connections in Wastewater:** Holiday-free factory certification per ASTM G62, Method A (Low-Voltage) shall be provided for the interior coating at the point of delivery Interior Coating: Green, factory applied dry film thickness 40-mil Tnemec Series 431 Perma-Shield PL or Permox CTF coating Exterior Coating: Std. 1-mil asphaltic coating per AWWA C151
					✓	✓	✓	Star Pipe Products	Stargrip Series 3100S (3" - 48")	
					✓	✓	✓	Sigma Corp.	ONE-LOK Series SSLDH (4" - 36")	
			Wedge-Action Restraint		✓	✓	✓	EBAA Iron	Series 1700 (4" - 48")	
					✓	✓	✓	Star Pipe Products	Stargrip Series 3100P (4" - 48")	
					✓	✓	✓	Sigma Corp.	ONE-LOK Series SLDEH (4" - 36")	
		Pipe to MJ Fittings connections	Split-Casing Restraint		✓	✓	✓	EBAA Iron	Series 1100SD (4" - 48")	
					✓	✓	✓	Star Pipe Products	Split Stargrip Series 3000S (4" - 48")	
					✓	✓	✓	Sigma Corp.	ONE-LOK Series SSLDH (4" - 36")	
			Wedge-Action Restraint		✓	✓	✓	EBAA Iron	Series 1100 (4" - 48")	
					✓	✓	✓	Star Pipe Products	Stargrip Series 3000 (4" - 48")	
					✓	✓	✓	SIP Industries	EZ Grip Series EZDP (DI, PVC) (3" - 48")	
					✓	✓	✓	Sigma Corp.	ONE-LOK Series D-SLDE (4" - 48")	
		MJ Fitting to MJ Fitting Connections			✓	✓	✓	Star Pipe Products	Series 100 (3" - 36")	
					✓	✓	✓	SIP Industries	MJ x MJ Adapter (3" - 12")	
					✓	✓	✓	Infact Corp.	Foster Adapter (3" - 36")	

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Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Plain End Couplings	Gravity Sewer PVC ASTM D3034 Plain End to Plain End Couplings	4" - 12"				✓	Fernco Products	Series 5000 RC	Shall be reinforced with 316 SS clamp band, bolts, and nuts Shear band shall be min. 304 SS
	Dissimilar Pipe Materials Plain End to Plain End Couplings	2" - 12"		✓	✓		Romac	Macro	<u>For buried installations:</u> T-bolts, bolts, tie rods, nuts, and washers shall be High Strength, Low Alloy Steel conforming to AWWA C111/ANSI A21.11-17 or ASTM A242. Hardware referenced above shall be coated with a blue fluoropolymer coating (Xylan 1424, FluoroKote #1, or AFT-PTFE-Blue). Alternatively, hardware shall be 316 SS. <u>For aboveground installations:</u> T-bolts, bolts, tie rods, nuts, and washers shall be 316 SS **<u>Couplings shall have the following factory applied high performance coatings:</u>** Romac: Romacoat System Krausz: Factory std. min. 14 mil fusion bonded epoxy EBAA Iron: MEGA-BOND System Holiday-free factory certification per ASTM G62, Method A (Low-Voltage) shall be provided for the interior coating at the point of delivery **<u>Potable/Reclaimed Water:</u>** Couplings and gaskets for potable water shall be NSF61 certified <u>For uncontaminated soils:</u> Shall have EPDM rubber gaskets with the letters "EPDM" factory embossed and/or etched into gasket <u>For contaminated soils:</u> Shall have NBR or FKM rubber gasket Refer to Manatee County Public Works Utility Standards Section 1.4.2.F for gasket material details
		2" - 12"		✓	✓		Krausz	Hymax 2 Coupling (Series 860)	
		4" - 48"		✓	✓		EBAA Iron	Mega-Coupling Series 3800	

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Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Flange Adapters	HDPE AWWA C906 Flange and MJ Adapters			✓	✓	✓	Charter Plastics Products	-	Pressure Class 200, PE4710, Ductile Iron Pipe Size (DIPS), DR 11, AWWA C906 Min. Cell Classification per ASTM D3350 shall be 445574 Fittings shall be fused per manufacturer's recommendations Shall have 316 SS back-up ring **Potable/Reclaimed Water:** For uncontaminated soils: Shall have EPDM rubber gaskets with the letters "EPDM" factory embossed and/or etched into gasket For contaminated soils: Shall have NBR or FKM rubber gasket Refer to Manatee County Public Works Utility Standards Section 1.4.2.F for gasket material details
				✓	✓	✓	Improved Piping Products	-	
				✓	✓	✓	Integrity Fusion Products	-	
				✓	✓	✓	Performance Pipe Products	-	
	Pressurized PVC AWWA C900-16 Flange Adapters	4" - 20"		✓	✓	✓	EBAA Iron	Megaflange Series 2100 (DI, PVC)	**PVC Flange Adapter:** Pipe sizes 4"-36": 235 psi rating **DIP Flange Adapter:** Pipe sizes 2"-16": 350 psi rating Pipe sizes 18" and larger: 250 psi rating For aboveground installations: T-bolts, bolts, tie rods, nuts, and washers shall be 316 SS **Flange adapters shall have the following factory applied high performance coatings:** Star Pipe Products: Starbond System Sigma Corp.: CORRSAFE System EBAA Iron: MEGA-BOND System Ford Meter Box Co.: Armorguard E-Coat System **Potable/Reclaimed Water:** Flange adapters and gaskets for potable water shall be NSF61 certified Shall have EPDM rubber gaskets with the letters "EPDM" factory embossed and/or etched into gasket
		3" - 36"		✓	✓	✓	Sigma Corp.	Sigmaflange SFA Series CP	
		4" - 20"		✓	✓	✓	Star Pipe Products	Super Flange Series 7200 (DI, PVC)	
		3" - 36"		✓	✓	✓		Starflange Series 4200	
	DIP AWWA C110 Flange Adapters	2" - 12"		✓	✓	✓	Ford Meter Box Co.	Series 420	
		3" - 20"		✓	✓	✓	EBAA Iron	Megaflange Series 2100 (DI, PVC)	
				✓	✓	✓	Star Pipe Products	Super Flange Series 7200 (DI, PVC)	
		All sizes except 18"		✓	✓	✓		Starflange Series 3200	
		All sizes except 18"		✓	✓	✓	Sigma Corp.	Sigmaflange SFA Series DP	

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Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Valves	Air Release Valves				✓	✓	✓	GA Industries	Fig-929	Min. inlet size shall be 2" Orifice, float, linkage, and hardware shall be 316 SS The seal shall be made of Buna N elastomer
					✓	✓	✓	H-TEC	Model 986-SS	<u>For waterway and canal crossings only</u> Min. inlet size shall be 2" Body, bolts, nuts, and washers shall be 316 SS The seal shall be made of Buna N elastomer
	Backflow Prevention Assembly	Privately-Owned			✓			-	-	Any privately-owned backflow prevention assembly that is approved by the University of Southern California (USC), with the exception of Wilkins 375XL (3/4" and 1"), Watts LF009QT (3/4" and 1"), and Ames LF4000B (3/4" and 1"), will be accepted by Manatee County County-Owned approved models are also acceptable
		County-Owned	2-1/2" - 12"		✓			Wilkins (Zurn)	350DA	Double Check Valve Assembly w/ Meter
					✓				375DA	Reduced Pressure Zone Assembly w/ Meter
					✓				375DA-OS&Y	Reduced Pressure Zone Assembly w/ Meter (OS&Y)
					✓			Ames	2000SS	Double Check Valve Assembly
					✓				3000SS	Double Check Valve Assembly w/ Meter
					✓				4000SS	Reduced Pressure Zone Assembly
					✓				5000SS	Reduced Pressure Zone Assembly w/ Meter
			1/2" - 2"		✓			Apollo Valves	RPLF-4A Series	Reduced Pressure Zone Assembly
					✓			Wilkins (Zurn)	975XL2	Reduced Pressure Zone Assembly
					✓			Watts	Model LF007 Series	Double Check Valve Assembly
					✓				Model 909 Series	Reduced Pressure Zone Assembly
	Pressure Relief Valves				✓			Apollo Valves	16LF-202	For use with backflow prevention assemblies
	Ball Valves				✓	✓	✓	FNW	Fig. 200A	<u>For use with ARV</u> Body, cap, stem, and ball shall be 316 SS/CF8M Min. Cold-Working Pressure shall be 1000 PSI
					✓	✓	✓	Apollo Valves	Model 76F	
	Automatic Flushing Systems	On Ground Discharge			✓			Mueller	Hydro-Guard HG-1	<u>Shall only be used with prior written approval from Manatee County</u> Design considerations shall minimally include site drainage patterns, cross connection prevention, grounding, dichlorination requirements, and discharge permits
		Pipe Discharge			✓				Hydro-Guard HG-2	

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Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Valves	Corporation Stops	For Copper Pipe and HDPE Tubing	All joints made to CTS size HDPE tubing shall use SS insert stiffeners		✓	✓		Ford Meter Box Co.	FB1000-x-NL	Pack Joint x AWWA Taper Thread (3/4" - 2")
					✓	✓			FB1000-x-G-NL	Grip Joint Compression x AWWA Taper Thread (3/4" - 2")
					✓	✓			FB1000-x-Q-NL	Quick Joint Compression x AWWA Taper Thread (3/4" - 2")
					✓	✓			FB1100-x-NL	Pack Joint x MIP Thread (3/4" - 2")
					✓	✓			FB1100-x-G-NL	Grip Joint Compression x MIP Thread (3/4" - 2")
					✓	✓		A.Y. McDonald	74704B-22	Pack Joint x MIP Thread (3/4" - 2")
					✓	✓			74701B-22	Pack Joint x AWWA Taper Thread (3/4" - 2")
					✓	✓			74701BQ	Quick Joint Compression x AWWA Taper Thread (3/4" -2")
					✓	✓			74704BQ	Quick Joint Compression x MIP Thread (3/4" - 2")
					✓	✓			74701BG	Grip Joint Compression x AWWA Taper Thread (3/4" - 2")
					✓	✓			74704BG	Grip Joint Compression x MIP Thread (3/4" - 2")
		For Copper Pipe Only			✓	✓		Ford Meter Box Co.	FB600-x-NL	Flare x AWWA Taper Thread (3/4" - 2")
					✓	✓			FB700-x-NL	Flare x MIP Thread (3/4" - 2")
					✓	✓		A.Y. McDonald	74704B	Flare x MIP Thread (3/4" - 2")
					✓	✓			74701B	Flare x AWWA Taper Thread (3/4" - 2")
		For Stainless Steel Pipe Only			✓	✓		Ford Meter Box Co.	FB1600-x-NL	FIP Thread x AWWA Taper Thread (3/4" -2")
					✓	✓			FB1700-x-NL	FIP Thread x MIP Thread (3/4" - 2")
					✓	✓		A.Y. McDonald	73149B	FIP Thread x MIP Thread (3/4" - 2")
					✓	✓			73148B	FIP Thread x AWWA Taper Thread (3/4" -2")
	Curb Stops	For Copper Pipe and HDPE Tubing	All joints made to CTS size HDPE tubing shall use SS insert stiffeners		✓	✓		Mueller	P25170N	Pack Joint x FIP Thread (3/4" - 2")
					✓	✓			G25170N	Grip Joint Compression x FIP Thread (3/4" - 2")
					✓	✓		Ford Meter Box Co.	B41-xxxW-NL	Pack Joint x FIP Thread (3/4" - 2")
					✓	✓			B41-xxxW-G-NL	Grip Joint Compression x FIP Thread (3/4" - 2")
					✓	✓		A.Y. McDonald	76100W-22	Compression x Compression (3/4" - 2")
					✓	✓			76100WT	Pack Joint x Pack Joint (3/4" - 2")
					✓	✓			76102WG	Compression x FIP Thread (3/4" - 2")
					✓	✓			76107T	Compression x MIP Thread (3/4" - 2")
					✓	✓			76107-22	Pack Joint x MIP Thread (3/4" - 2")
		For Stainless Steel Pipe Only			✓	✓		Mueller	P25170N	Pack Joint x FIP Thread (1/2" - 2")
					✓	✓			B20200N	FIP Thread x FIP Thread (1/2" - 2")
					✓	✓			B20242N	MIP Thread x FIP Thread (1/2" - 2")
					✓	✓		Ford Meter Box Co.	B51-xxxW-NL	Pack Joint x FIP Thread (1/2" - 2")
					✓	✓			B11-xxxW-NL	FIP Thread x FIP Thread (1/2" - 2")
					✓	✓			B81-xxxW-NL	MIP Thread x FIP Thread (1/2" - 2")
					✓	✓		A.Y. McDonald	76107	FIP Thread x MIP Thread (3/4" - 2")
					✓	✓			76107WP	MIP Thread x MIP Thread (3/4" - 2")
					✓	✓			76102W-44	PVC (DIOD) Compression x FIP Thread (3/4" - 2")
					✓	✓			76101W	FIP Thread x FIP Thread (3/4" - 2")

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Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Valves	Gate Valves	Flange x Flange (NRS)	3" - 54"		✓	✓	✓	American Flow Control	Series 2500 FL x FL	All sizes: min. 250 psi rating Gate Valves larger than 2": Shall be resilient seated valves conforming to AWWA C515 2" Gate Valves: Shall be resilient seated valves conforming to applicable requirements of AWWA C509 or C515 Body and bonnet shall be ductile iron Buried valves shall have external nuts, bolts, and washers be min. 304 SS Buried valves shall have min. 304 SS stems Aboveground valves shall have external nuts, bolts and washers be 316 SS Aboveground valves shall have 316 SS stems Stem nut shall be bronze/copper Wedge shall be ductile iron fully encapsulated in EPDM rubber with the letters "EPDM" factory embossed and/or etched into the wedge Valves shall have factory applied, min. 8 mils DFT fusion bonded epoxy coating on the interior and exterior Holiday-free factory certification per ASTM G62, Method A (Low-Voltage) shall be provided for the interior coating at the point of delivery Valves 16" and larger shall be equipped with manufacturer-standard heavy duty gear type actuators with 2" square AWWA operating nut or handwheel Gearbox shall be externally adjustable, totally enclosed to prevent water infiltration, and conform to ISO 9001 standards Vertical installation shall use spur-type gear Horizontal installation shall use bevel-type gear All horizontally-installed gate valves shall require flush line **Potable/Reclaimed Water:** Aboveground gate valves shall be Outside Stem & Yoke (OS&Y) type **Wastewater:** Valves shall only be installed vertically For Force Mains: Gate valves only allowed for sizes 24" and larger Refer to Plug Valve Section for Force Mains sizes 20" and smaller For Lift Stations: Gate valves allowed for sizes 3" and larger Aboveground valve assembly gate valves shall be Non-Rising Stem (NRS) type **Valves 16" and larger shall come with torque-limiting device with torque trip limits preset at factory:** Kennedy Valves: 16": 250 lb-ft, 18" - 54": 450 lb-ft American Flow Control Valves: 16" - 20": 250 lb-ft, 24": 300 lb-ft, 30" - 54": 500 lb-ft Clow Valves: 16": 250 lb-ft, 18" - 54": 450 lb-ft Mueller Valves: 16" - 24": 100 lb-ft, 30" - 36": 200 lb-ft, 42" - 54": 350 lb-ft
			4" - 54"		✓	✓	✓	Kennedy	Model KS-RW/2638 FL x FL	
			4" - 54"		✓	✓	✓	Mueller	Model A-2361 FL x FL	
			4" - 48"		✓	✓	✓	Clow	Model 2638 FL x FL	
		Flange x Flange (OS & Y)	3" - 54"		✓	✓	✓	American Flow Control	Series 2500 FL x FL (OS & Y)	
			4" - 54"		✓	✓	✓	Kennedy	Model KS-RW/2638 FL x FL (OS & Y)	
			4" - 54"		✓	✓	✓	Mueller	Model A-2361 FL x FL (OS & Y)	
			4" - 24"		✓	✓	✓	Clow	Model 2638 FL x FL (OS & Y)	
		Mechanical Joint x Mechanical Joint	4" - 48"		✓	✓	✓	American Flow Control	Series 2500 MJ x MJ	
					✓	✓	✓	Mueller	Model A-2361 MJ x MJ	
					✓	✓	✓	Kennedy	Model KS-RW/2638 MJ x MJ	
					✓	✓	✓	Clow	Model 2638 MJ x MJ	
		Threaded x Threaded	2"		✓	✓	✓	American Flow Control	Series 2500 FIP x FIP	
					✓	✓	✓	Clow	Model 2639	

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Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Valves	Hydrants			✓	✓		AVK	Series 2780	Shall be nostalgic-style, dry barrel conforming to AWWA C502 and be UL/FM certified Main valve shall be faced or covered with EPDM elastomer with the letters "EPDM" factory embossed and/or etched into the rubber Shall have one 5-inch Storz connection and two 2-1/2 inch hose nozzles All external nuts, bolts, and washers shall be min. 304 SS Upper and lower stem rod shall be min. 304 SS Hydrant Elbow: Shall have a fusion bonded epoxy coating on the interior and exterior Stand Pipe: Shall have std. thickness cement lining on the interior and 1 mil asphaltic coating on the exterior; Alternatively it shall have a fusion bonded epoxy coating on the interior and exterior Aboveground parts shall have an external UV-resistant top coat of min. 4 mils DFT as follows: Kennedy: Ken-Guard TGIC Polyester Mueller: Amercoat 370 AVK: Sherwin Williams Acrolon 218 HS Polyurethane Clow: TGIC Polyester Super Coat American Flow Control: Axalta Imron 3.5 HG+ Polyurethane
				✓	✓		Mueller	Super Centurion 250	
				✓	✓		Kennedy	K81D Guardian	
				✓	✓		Clow	Medallion	
				✓	✓		American Flow Control	Darling B-84-B-5	
	Insertion Valves	4" - 12"		✓	✓		TEAM	InsertValve	Shall be resilient seated valves conforming to AWWA C515 All nuts, bolts, washers, and non-rising stem shall be min. 304 SS Wedge shall be ductile iron fully encapsulated in EPDM rubber with the letters "EPDM" factory embossed and/or etched into the wedge Valves shall have factory applied, min. 8 mils DFT fusion bonded epoxy coating on the interior and exterior
	Check Valves	Flapper Disk 2" - 48"		✓	✓		Valmatic	Series 500ABF	All sizes: min. 250 psi rating Check valve shall be lead free, ductile iron construction conforming to NSF 61 Shall be equipped with min. 17-4 SS seat position indicator and min. 304 SS backflow actuator Disk shall be fully encapsulated in EPDM rubber with the letters "EPDM" factory embossed and/or etchedinto the disk All external bolts, nuts, and washers shall be min. 304 SS Valve shall have factory-applied, min. 8 mils DFT fusion bonded epoxy coating on the interior and exterior Holiday-free factory certification per ASTM G62, Method A (Low-Voltage) shall be provided for the interior coating at the point of delivery
		Flapper Disk 2" - 24"		✓	✓		Pratt	RD Series	
		Flapper Disk 3" - 16"		✓	✓		American Cast Iron Pipe Company	Series 2100	
		Lever & Weight				✓	AVK	Series 41	2" - 12": min. 175 psi rating 14" - 30": min. 150 psi rating Check valve shall be flanged with ductile iron/cast iron body and bronze mounted single disk conforming to AWWA C508 Shall have bronze seat and body rings Hinge pins shall be extended bronze or 316 SS All external bolts, nuts, and washers shall be 316 SS Valves shall have factory applied, min. 12 mils DFT fusion bonded epoxy coating on the interior and exterior Holiday-free factory certification per ASTM G62, Method A (Low-Voltage) shall be provided for the interior coating at the point of delivery
						✓	American Flow Control	Series 52	
						✓	Kennedy	106 LW	
						✓		1106 LW	
						✓	Mueller	Series 8001	
						✓		No. A-2600-6-01	

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Category			Submittal	Potable Water	Redaimed Water	Wastewater	Manufacturer	Model Number	Notes
Valves	Combination Pressure Reducing and Pressure Sustaining			✓	✓		Cla-Val Company	8" Model 52-01	Pressure sustaining and check valve shall be pilot operated diaphragm actuated valve with cast iron body, bronze trim, and 125-lb flanges Pilot system shall consist of two direct acting, adjustable, spring loaded diaphragm valves Pilot control valves shall be cast brass with min. 304 SS trim
				✓	✓		Singer	8" Model A106-RPS	
				✓	✓		Watts	8" Model LFF116-52	
	Plug Valves	2"				✓	Pratt	Series 611A/613A	Plug valves shall be 100% circular port, non-lubricated, eccentric type Shall be installed with the shaft laying horizontally so that the seat rests on the top portion of body when open Shall shut off bubble tight bidirectionally when pressure tested at 175 PSI for 3"-12" and 150 PSI for 14" and larger Valve body, bonnet, and gland shall be ASTM A126 cast iron or ASTM A526 Grade 65-45-12 ductile iron per AWWA C517 Plug shall be ASTM A-526 Grade 65-45-12 ductile iron per AWWA C517 Plug shall be fully vulcanized with nitrile (Buna N) rubber with a min. peel strength of 75 PSI per ASTM D429, method B Top and bottom bearings shall be 316 SS All external nuts, bolts, and washers shall be min. 304 SS Valve shall be equipped with manufacturer-standard worm gear type actuators with 2" square AWWA operating nut Gearbox shall be externally adjustable, totally enclosed to prevent water infiltration, and conform to ISO 9001 standards Gearbox bearings shall be oil impregnated bronze or hardened steel Gearbox worm gear shall be hardened steel or ductile iron ASTM A536 Class 65-45-12 Gearbox shaft shall be hardened steel <u>2":</u> Valve seat shall have an overlay of min. 16 mils DFT high solids epoxy Shall only be allowed at grinder pump stations <u>3" and larger:</u> Valve seat shall have a welded-in overlay of at least 95% pure nickel **<u>Refer to Gate Valve Section for applications larger than 20"</u>** **<u>Valves shall come with torque-limiting device with torque trip limits preset at factory:</u>** 3" - 6": 150 ft-lb 8" - 20": 180 ft-lb All valves shall have internal and external min. 16 mils DFT high solids epoxy coating Holiday-free factory certification per ASTM G62, Method A (Low-Voltage) shall be provided for the interior coating at the point of delivery
		3" - 12"				✓		Series 600FP/601FP	
		2"				✓	Milliken	Series 611A/613A	
		3" - 12"				✓		Series 600F/601F	
		ye				✓	GA Industries	Figure 517-T	
		3" - 20"				✓		Figure 517 Eco-Centric	
	Torque Limiting Device	Trip Torque Limit: 25-250 lb-ft		✓	✓	✓	Aunspach Controls	Model D86-250	Torque limits shall be preset at factory (See gate/plug valve section for torque limits) Permanently mount overtorque protector on the valve operating nut All hardware shall be min. 304 SSS Shall have min. 8 mils DFT fusion bonded epoxy on the interior and exterior Torque set point shall be engraved on the torque limiting device
		Trip Torque Limit: 251-500 lb-ft		✓	✓	✓		Model D86-500	
	Valve Extension Stem			✓	✓	✓	Mueller Co.	-	Extension stems and hardware shall be min. 304 SS
				✓	✓	✓	CS3 Waterworks	-	
				✓	✓	✓	GPM Fab	-	

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Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Valves	Tapping Valves			✓	✓	✓	American Flow Control	Series 2500 FL x MJ	Shall be resilient seated valves conforming to AWWA C515 Shall be furnished with an alignment lip All external nuts, bolts, washers, and non-rising stem shall be min. 304 SS Wedge shall be ductile iron fully encapsulated in EPDM rubber with the letters "EPDM" factory embossed and/or etched into the wedge Valves shall have factory applied min. 8 mils DFT fusion bonded epoxy coating on the interior and exterior Holiday-free factory certification per ASTM G62, Method A (Low-Voltage) shall be provided for the interior coating at the point of delivery Valve 16" and larger shall be equipped with manufacturer-standard heavy duty gear type actuators with 2" square AWWA operating nut Gearbox shall be externally adjustable, totally enclosed to prevent water infiltration, and conform to ISO 9001 standards Vertical installation shall use spur-type gear Horizontal installation shall use bevel-type gear **<u>Wastewater:</u>** Valves shall only be installed vertically **<u>Tapping valves 16" and larger shall come with torque-limiting device with torque trip limits preset at factory:</u>** Refer to Gate Valve section for trip limits
				✓	✓	✓	Kennedy	Model KS-RW/2638 FL x MJ	
				✓	✓	✓	Mueller	Model T-2361 FL X MJ	
				✓	✓	✓	Clow	Series 2638 FL x MJ	
Tapping Sleeves	HDPE	4" - 30"		✓	✓	✓	JCM Industries	Model 6452/6459 (HDPE)	Sleeve and straps shall be 316 SS T-bolts, bolts, tie rods, nuts, and washers shall be 316 SS Shall have 3/4" 316 SS test plug **<u>Potable/Reclaimed Water:</u>** Must hold 180 PSI for one hour Tapping sleeve and gaskets for potable water shall be NSF61 certified <u>For uncontaminated soils:</u> Shall have min. 1/8" thick EPDM full face gasket Shall have EPDM rubber wrap around gasket The letters "EPDM" and company logo shall be factory stamped with white ink on full face gasket The letters "EPDM" and company logo shall be factory stamped with white ink on the wrap around gasket Alternatively, the letters "EPDM" shall be factory embossed and/or etched on the exterior shell of the tapping sleeve if wrap around gasket does not have the EPDM designation <u>For contaminated soils:</u> Shall have NBR or FKM rubber gasket Refer to Manatee County Public Works Utility Standards Section 1.4.2.F for gasket material details **<u>Wastewater:</u>** Must hold 150 PSI for one hour Shall have min. 1/8" thick full face gasket
		4" - 24"				✓	Ford Meter Box Co.	FTSSP-xxx-x-MAN	
		4" - 12"				✓	Romac	STS423-H	
	PVC, Ductile Iron, Steel, AC	6" - 48"				✓		STS420 (316 SS)	
		6" - 12"		✓	✓			STS420 (316 SS)	
		4" - 24"				✓	Ford Meter Box Co.	FTSS-xxxx-x-MAN	
						✓	Cascade Waterworks	Series CST-EX (316 SS)	
						✓	PowerSeal	Series 3490 (316 SS)	
		4" - 30"		✓	✓	✓	JCM Industries	Model 6452/6459	

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Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Service Saddles	HDPE	4" - 12"		✓	✓	✓	Romac	STS423T-H	**Potable/Reclaimed Water:** Must hold 180 PSI for one hour Saddle body shall be made of red brass, alloy 85-5-5-5 or min. 304 SS Saddle strap shall be made of silicon bronze or min. 304 SS T-bolts, bolts, tie rods, nuts, and washers shall be red brass, alloy 85-5-5-5 or min. 304 SS Service saddle and gasket shall be NSF61 certified for potable water For uncontaminated soils: Shall have EPDM rubber gasket The letters "EPDM" and company logo shall be factory stamped with white ink on gasket Alternatively, the letters "EPDM" shall be factory embossed and/or etched on the exterior saddle body For contaminated soils: Shall have NBR or FKM rubber gasket Refer to Manatee County Public Works Utility Standards Section 1.4.2.F for gasket material details **Wastewater:** Must hold 150 PSI for one hour Saddle body and extra wide strap shall be 316 SS T-bolts, bolts, tie rods, nuts, and washers shall be 316 SS
		2" - 12"		✓	✓	✓	Ford Meter Box Co.	FSP313-xxx-TAP-EPDM	
		10" - 18"		✓	✓	✓		FSP323-xxx-TAP-EPDM	
		20" - 34"		✓	✓	✓		FSP333-xxx-TAP-EPDM	
		2" - 3"		✓	✓			FS313W-xxx-TAP-EPDM	
	PVC, Ductile Iron, Steel, AC	4" - 16"		✓	✓		Romac	202BS (Double Bolt)	
		6"- 12"		✓	✓			Model STS420T	
		6" - 42"				✓		Model STS420T (316 SS)	
		3" - 54"		✓	✓	✓	JCM Industries	Model 6438	
		3" - 54"		✓	✓			Model 438	
		2" - 12"		✓	✓			Model 502	
		4" - 12"		✓	✓		Ford Meter Box Co.	202B (DI and AC only)	
		4" - 12"		✓	✓			202BS	
		4" - 30"		✓	✓			202BSD	
		2" - 12"		✓	✓	✓		FS313-xxx-TAP-MAN	
		4" - 18"		✓	✓	✓		FS323-xxx-TAP-MAN	
		20" - 30"		✓	✓	✓		FS333-xxx-TAP-MAN	
		2" - 12"		✓	✓			FS313-xxx-TAP-EPDM	
		4" - 18"		✓	✓			FS323-xxx-TAP-EPDM	
		20" - 30"		✓	✓			FS333-xxx-TAP-EPDM	

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Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Jack and Bore Devices	Casing Spacers	Metallic		✓	✓	✓	BWM Company	Model BWM-SS-8	**Metallic Casing Spacers:** Bolts, nuts, and washers shall be 316 SS Shell/band shall be min. 14 gauge 304 SS Risers shall be min. 10 gauge 304 SS Each shell section shall have a hardness of Durometer "A" 85-90 and be lined with a min. thickness of 0.090" of ribbed PVC extrusion, EPDM, glass reinforced polymer, or ultra high molecular weight polyethylene.
				✓	✓	✓		Model BWM-SS-12	
				✓	✓	✓	Advanced Products & Systems, Inc.	Model SSI8	
				✓	✓	✓		Model SSI12	
				✓	✓	✓	CCI Pipeline Systems	Model CSS-8	
				✓	✓	✓		Model CSS-12	
				✓	✓	✓	Cascade Waterworks	Series CCS 8"	
				✓	✓	✓		Series CCS 12"	
		Non-Metallic		✓	✓	✓	RACI Products	-	**Non-Metallic Casing Spacers:** Shall be constructed of non-metallic virgin polypropylene or HDPE Shall be sized/spaced per manufacturer's recommendations
				✓	✓	✓	GPT Industries	Ranger II	
	End Seals			✓	✓	✓	BWM Company	Model BWM-PO	Shell/band shall be min. 14 gauge 304 SS For buried installations: T-bolts, bolts, tie rods, nuts, and washers shall be High Strength, Low Alloy Steel conforming to AWWA C111/ANSI A21.11-17 or ASTM A242. Hardware referenced above shall be coated with a blue fluoropolymer coating (Xylan 1424, FluoroKote #1, or AFT-PTFE-Blue). Alternatively, hardware shall be 316 SS.
				✓	✓	✓		Model BWM-WR	
				✓	✓	✓	Advanced Products & Systems, Inc.	Model AC	
				✓	✓	✓		Model AM	
				✓	✓	✓		Model AZ	
				✓	✓	✓		Model AW	
				✓	✓	✓	CCI Pipeline Systems	Model ESC	
				✓	✓	✓		Model ESW	
				✓	✓	✓	Cascade Waterworks	Model CCES	
				✓	✓	✓	GPT Industries Products	-	

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Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Asset Protection/Locators	Tracer Wire			✓	✓	✓	Proline Safety	Pro-Trace HF-CSS	To be used for open cut installations Solid #10 gauge, high strength, copper clad steel wire (Min. 448 PSI break load) Min. 30-mils polyethylene insulation Color coded blue for water, purple for reclaimed water, or green for sanitary sewer
				✓	✓	✓	Copperhead Industries	1030-HS	
				✓	✓	✓	Proline Safety	Pro-Trace HDD-CSS	To be used for horizontal directional drilling installations Solid #10 gauge, extra high strength, copper clad steel wire (Min. 1,940 PSI break load) Min. 45-mils polyethylene insulation Color coded blue for water, purple for reclaimed water, or green for sanitary sewer
				✓	✓	✓	Copperhead Industries	1045-EHS	
	Tracer Wire Connection			✓	✓	✓	Dryconn	King 6 Blue	-
				✓	✓	✓		Direct Bury Lug Aqua	
	Tracer Wire Boxes	Non-traffic rated		✓	✓	✓	Copperhead Industries	Model LD14*TP	Shaft size shall be min. 2-1/2" I.D. and 15" length Rim shall be ABS plastic with cast iron lid
				✓	✓	✓	Bingham & Taylor	Model P202CNG	
		Traffic-rated		✓	✓	✓	Copperhead Industries	Model RB14*TP	Tracer wire box shall be encased in a 6" concrete square, 6" in depth Shaft size shall be min. 2-1/2" I.D. and 14-1/2" length Rim and lid shall be cast iron
				✓	✓	✓	Bingham & Taylor	Model P2B202CNGHVY15SPB	
	Path Marking Tape	Electronic		✓	✓	✓	3M	Series 7600XR	All underground pipe shall have electronically detectable path marking tape made of polyethylene, minimum 6" wide and 6 mm thick The tape shall have embedded detectable markers spaced every 8 feet along the warning tape The tape shall be color coded blue for potable water, purple for reclaimed water, or green for sanitary sewer Shall be marked "CAUTION _____ LINE BURIED BELOW"
	Polyethylene Encasement Tubing			✓	✓	✓	T. Christy's Enterprises	-	Shall be min. 8 mil thick, low density polyethylene tubing conforming to AWWA C105 Shall be color coded blue for potable water, purple for reclaimed water, and green for sanitary sewer
				✓	✓	✓	AA Thread	-	
				✓	✓	✓	Trumbull	-	

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Category		Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Valve Boxes	Valve Boxes and Lid Assembly		✓		✓	Pro Select	Series PSVB 461 - 664	Assembly shall be cast iron, screw type boxes & lids Alternatively, HDPE boxes shall be two-piece adjustable, min. 1/4-inch thick wall, w/ cast iron lid Bottom Barrel shall be 5-1/4 inches inside diameter, with a flanged bottom Lids shall have color coded tops with the lettering "WATER" or "SEWER" **Roadway Applications:** Shall use heavy duty, min. 24 lbs cast iron drop-type lid **Reclaimed Water:** Shall have square 9" x 9" lid labeled "Reclaimed Water" Shall be colored purple
			✓		✓	Tyler Union	Series 6500/6850/6860	
			✓		✓	East Jordan Company Products	Series 8550	
			✓				6800045 (Roadway)	
					✓		6800073 (Roadway)	
			✓		✓	Sigma Corp./Russell Pipe Company Products	Series VB261 - VB268	
			✓		✓		Series VB630	
			✓		✓	Star Pipe Products	Series VB-0001/VB-0002	
			✓		✓		Series VB-0005/VB-0006	
				✓			Series VB-0023	
			✓		✓	American Flow Control	Trench Adapter	
	Box Alignment Rings		✓	✓	✓	Boxlok Products	Model 3 & 4	Contractor is responsible for verifying alignment ring model number will properly fit valve model
Air Release Valve Enclosure			✓	✓	✓	Allied Molded Products	ARVC-2439	All enclosures shall comply with Manatee County standard detail for shape and size 24" square by 39" tall fiberglass enclosure with a hasp for a padlock Shall have polyester infused aggregate protective coating color coded per application
Service Lateral Clean Out Lid					✓	US Foundry	USF 7621	Clean out lid shall have the letter "S" engraved and pick holes
Meter Boxes			✓			SIP Industries	6423-WNL	Non-locking, colored blue for potable water
			✓				6423-WL	Locking, colored blue for potable water
				✓			6423-RWNL	Non-locking, colored purple for reclaimed water
				✓			6423-RWL	Locking, colored purple for reclaimed water
Meter Resetters			✓	✓		Ford Meter Box Co.	VB 42-7W (5/8" X 3/4")	Shall conform to AWWA C800 Meter resetters shall have padlock wing on angle ball valve Riser Height shall be 7 inch
			✓	✓			VB 43-7W (3/4")	
			✓	✓			VB 44-7W (1")	
			✓	✓		A.Y. McDonald	718-207WX (5/8" X 3/4")	
			✓	✓		Mueller Co.	B-24118	
Water Sample Stations			✓			Safety Guard	Model B.O.S.S.	Bacteriological sample station with built in flush system Shall be installed with UV-protected enclosure

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Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Manholes	Precast Polymer Concrete Manholes					✓	US Composite Pipe	-	**Manholes shall be made of precast polymer concrete in the following applications:** • Manholes receiving force main flow and the next two (2) downstream manholes •Manholes upstream of a lift station (Refer to Manatee County Public Works Utility Standards detail US-17A) • Manholes that have turbulent opposing flows (Refer to Manatee County Public Works Utility Standards detail US-3) • Manholes with 12-inch and greater gravity sewer pipes • Outside drop manholes Refer to Manatee County Public Works Utility Standards Section 1.13 for details Manholes shall be furnished with an approved heavy duty composite frame & lid Frame & lid shall have min. three (3) 316 SS locking bolts Refer to Frame & Lids section of this Approved Product List for approved manufacturers
						✓	Armorock	-	
	Precast Concrete Manholes					✓	-	-	Precast concrete manholes shall be installed for all applications except where a polymer concrete manhole is required as identified in the Precast Polymer Concrete Manholes section Refer to Manatee County Public Works Utility Standards Section 1.12 for details Only premade O-ring gaskets shall be allowed for joint connection Ramnek or similar products shall not be an acceptable method of joint connection
	Flexible Pipe Connectors	Cast-In Boot (New Construction Only)				✓	A-Lok Products	Z-Lok	Must meet ASTM C923 **Contractor shall grout the annular space between the pipe and wall penetration per manufacturer's recommendations with the following:** Polymer Concrete Manholes: Sauereisen 165/Sikadur 42 Epoxy/ArmorRock Grout Precast Concrete Manholes: Avanti Multi-Grout AV-202/AV-118 **Cast-In Boot:** Shall have external take down clamp and hardware made of 316 SS **Jack-In Boot:** Shall have external take down clamp and hardware made of 316 SS Shall have internal expansion band and hardware made of min. 304 SS
						✓	Trelleborg	Series 706	
						✓	Press-Seal Corp.	Cast-A-Seal Series	
		Jack-In Boot (Existing Construction Only)				✓	Trelleborg	Kor-N-Seal Series 106/206/406	
						✓	Press-Seal Corp.	PSX Direct Drive	
						✓	Hamilton Kent	Tylox MIB Series	
	Rainwater Inserts	Stainless Steel				✓	SSI Sealing Systems	304 SS	Rainwater insert shall be min. 18 gauge 304 SS or 1/8-inch thick thermoplastic polyolefin
						✓	Rowland	InflowShield	
		Plastic				✓	USSI	TPO Inflow Defender Max	

Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Manholes	Frame & Lids	Standard					✓	U.S. Foundry	USF 170-CE-1	Shall be used for precast concrete manholes Lids be marked with the letters: "MANATEE COUNTY", "SANITARY SEWER", AND "YEAR"
		Rim Elevation below Floodplain					✓	U.S. Foundry	USF 170-CE-BWT	Shall be used for precast concrete manholes with lids that are located at less than the flood plain elevations as specified in the Manatee County Public Works Utility Standards Section 1.12.12 Shall have gasketed seals Shall have min. three (3) 316 SS locking bolts
							✓	Pamrex	Pamtight	
		ARV Manholes with < 44" From Top of Pipe to Cover			✓	✓	✓	Pamrex	Pamrex 32"	Shall be used for ARV hinged manholes with less than 44" from top of pipe to cover In roadways, the lid shall open in the direction opposite of incoming traffic
					✓	✓	✓	U.S. Foundry	USF 324-UT-LOC	
		Heavy Duty Composite					✓	Composite Access Products	CAP ONE	Shall be used with all precast polymer concrete manholes Must have "MANATEE COUNTY", "SANITARY SEWER", AND "YEAR" formed/molded Shall have min. three (3) 316 SS locking bolts
							✓	Trumbull	Model 367	
							✓	Aquatechnology Group	ATG-2400	
	Grade Adjustment Ring Adhesives						✓	Henry	Ram-Nek RN101	Butyl rubber sealant strips shall be used to seal grade adjustment rings to manhole cone Min. 3" wide x 1/2" thick
							✓	Martin Asphalt	Evergrip 990	
	External Joint Wrap		Heat Shrink-Wrap				✓	GPT Industries	Riser-Wrap	**To be used on Bell and Spigot or Tongue and Groove Smooth Wall Manhole Joints:** A min. of eighteen (18) inches wide heat shrinkable joint wrap shall be centered over all new manhole joints including chimney to manhole frame section
							✓	CCI Pipeline Systems	WrapidSeal	
			Non-Shrink Wrap				✓	GPT Industries	Boa-Tape	**To be used on all Tongue and Groove Smooth Wall Manhole Joints:** A min. of twelve (12) inches wide elastomeric plastic joint wrap shall be centered over all new and existing manhole joints including chimney to manhole frame section
							✓	Henry	Rubr-Nek RU116	
	Polymer Grout						✓	Armorock	ArmorRock Grout	Non-shrink, polymer grout shall be used for grouting applications in precast polymer concrete manholes including wall penetrations and adjusting benches
							✓	Sauereisen	No. 165	
							✓	Sikadur	No. 42	
	Grout						✓	Avanti	Multi-Grout AV-202/AV-118	Shall be used for grouting applications in precast concrete manholes including wall penetrations and adjusting benches
	Internal Joint Sealants		Bell and Spigot Manhole Joints				✓	Henry	Ram-Nek RN101	Butyl rubber sealant strips shall be applied to the interior of bell and spigot manhole joints per manufacturer's recommendations Min. 3" wide x 1/2" thick
							✓	Martin Asphalt	Evergrip 990	
							✓	ConSeal	CS102	
			Tongue and Groove Smooth Wall Manhole Joints				✓	Chemlink	M-1	A bead of sealant shall be applied to the interior of tongue and groove smooth wall manhole joints per manufacturer's recommendations Min. 3/4" wide x 1/2" thick
							✓	Adeka	UltraSeal P-201	
	Protective Liners (Rehabilitation)						✓	Raven Lining Systems	Raven 405	Liners shall only be used with written approval from Manatee County to rehabilitate existing manhole concrete surfaces Liners shall be installed per manufacturer's recommendations
							✓	GML Coatings	Green Monster	

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Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Lift Stations	Electrical	Site Lighting					✓	Regent	Model EQ300M1	Min. 6000 lumens LED
		Level Switches and Sensors					✓	MDI Products	-	Float switch
							✓	Connery Manufacturing	-	Float switch
							✓	Dylix	Model GXS3-PP300-A49-B49-50-C01-D49	Pressure transmitter mounted inside a stilling well acting as the primary level sensor For pump stations that re-pump sewage flows from other pump stations
		Flow Meters					✓	McCrometer	Ultra Mag Model UM06	Shall be used for lift stations that re-pump sewage flows (directly or indirectly) from other lift stations
	Mechanical	Submersible Pumps	Satellite				✓	ABS	-	Refer to Manatee County Public Works Utility Standards Section 1.14 for details Pumps shall have oil-filled cooling system
							✓	Barnes	-	
							✓	Crane	Sithe Series	
							✓	Hydromatic	-	
			Master				✓	Hydromatic		
							✓	Flygt	-	
		Diesel Backup Pumps	Pumps				✓	Godwin Pumps	-	Refer to Manatee County Public Works Utility Standards Section 1.14.14 for details
			Cooling System Fluid				✓	Prestone Products	-	-
							✓	Zerex Products	-	
			Protective Coating				✓	Carboline	Bitumastic 300M	Pump/Engine enclosures shall have a coal tar epoxy coating, min. 16 mils DFT, for all metal surfaces coming in contact with concrete or grout
							✓	Tnemec	46H-413	Alternatively, a 1/32-inch neoprene gasket between any metal surface and the concrete or masonry shall be used. Gasket shall be installed along the entire perimeter of the metallic surface, not just the fastening hardware.
							✓	Sherwin Williams	SherGlass FF	Fuel tank/skid base shall have haze grey, two coats of min. 12-15 mils DFT on top of a stripe coat over all welds, crevices, edges and sharp angles

Contractor shall check/mark which product is intended to be used in the submittal box. If multiple manufacturers are to be used, each manufacturer shall be marked.

Category			Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Lift Stations	Structural	Lift Station Wetwell				✓	US Composite Pipe	-	All lift station wetwells shall be made of precast polymer concrete Refer to Manatee County Public Works Utility Standards Section 1.13 for details
						✓	Armorock	-	
		Drop Bowl				✓	Reliner/Duran Products	-	If required, shall be installed per Manatee County Standard Details
		Wall Penetration Seals				✓	GPT Industries	Link-Seal Model S-316	All hardware shall be 316 SS
						✓	CCI Pipeline Systems	Wrap-IT Link WL-SS Series	
						✓	Proco Products	PenSeal ES Series (Standard)	
		Horizontal Support Channels (For Control Panels Only)				✓	Unistrut Products	-	Min. 1-5/8", 12 gauge solid min. 304 SS channels, attached with 3/8" min. 304 SS all thread rod with min. 304 SS flat washers and nuts Refer to Manatee County Public Works Utility Standards details
						✓	BLine Products	-	
		U-Bolt Clamps				✓	ZSI Inc.	Alpha Series	Riser pipes shall be attached to riser pipe brackets by cushioned 316 stainless steel U-bolt clamps and nylon insert locknuts Thermoplastic cushion shall be resistant to Hydrogen Sulfide gas
		Pump Mounting Systems				✓	Barney's Pumps	-	All systems shall be of the front loading slide rail type BPIU All rail and mounting hardware shall be 316 SS
		Lift Station Towers				✓	Rohn	Series RG-45	For heights above 20 feet
		Aluminum Access Covers				✓	U.S. Foundry Products	-	Shall be aluminum have min. load rating of 300 PSF All hardware, hinges, and locking hasp shall be 316 SS Covers shall be equipped with a locking staple or bar for use with a padlock Shall have 2 coats of bitumastic epoxy, 16 mils DFT **<u>For Duplex Stations:</u>** 4" Base Elbow Wetwell: hatch shall be minimum 36” x 48” 6" Base Elbow Wetwell (8' Dia. Wetwell): hatch shall be minimum 42” x 60”
						✓	Bilco Products	-	
						✓	Halliday Products	-	

Contractor shall check/mark which product is intended to be used in the submittal box. If multiple manufacturers are to be used, each manufacturer shall be marked.

Category				Submittal	Potable Water	Reclaimed Water	Wastewater	Manufacturer	Model Number	Notes
Lift Stations	Surface Protection	Protective Insert Liners					✓	GU Florida	FRP GU Liner	Liners shall only be used with written approval from Manatee County Liners shall be installed per manufacturer's recommendations Sealant, adhesive, and bonding agent products shall be compatible with liner material FRP liners shall be fabricated with premium grade isophthalic polyester resin, fiberglass chopped strand, woven roving and continuous reinforcements Sand filler shall not be permitted in the FRP laminate
							✓	AGRU	HDPE Sure Grip Liner	
		Protective Liners (Rehabilitation)					✓	Raven Lining Systems	Raven 405	Liners shall only be used with prior written approval from Manatee County to rehabilitate existing lift station concrete surfaces Liners shall be installed per manufacturer's recommendations
							✓	GML Coatings	Green Monster	
							✓	CCI Spectrum	SpectraShield	
							✓	Sauereisen Products	210T & 210GL (MC Light Brown Formula)	
		Polymer Grout					✓	Armorock	ArmorRock Grout	Non-shrink, polymer grout shall be used for grouting applications in polymer concrete lift stations including wall penetrations
							✓	Sauereisen	No. 165	
							✓	Sikadur	No. 42	
		Grout Applications					✓	Avanti	Multi-Grout AV-202/AV-118	Shall be used for grouting applications in precast concrete lift stations including wall penetrations
		Coating	Valve Vault Interior				✓	Tnemec	Series 69 Hi-Build Epoxy Coating	Interior surfaces of existing vaults shall have two (2) coats of min. 8 mils DFT each
			Exposed Concrete				✓	FLR Paints, Inc.	H&C Silicone Acrylic Concrete Stain, Patio Green	Exterior surfaces of valve vaults, wetwells, and valve assembly pads exposed above grade shall have at least two (2) coats of min. 8 mils DFT each
			Exposed Valve Assembly				✓	Rustoleum	Series 7538	Aboveground valve assembly & piping shall be painted Hunter Green per manufacturer's recommendations
	Internal Joint Sealants		Bell and Spigot Wetwell Joints				✓	Henry	Ram-Nek RN101	Butyl rubber sealant strips shall be applied to the interior of bell and spigot wetwell joints per manufacturer's recommendations Min. 3" wide x 1/2" thick
							✓	Martin Asphalt	Evergrip 990	
							✓	ConSeal	CS102	
			Tongue and Groove Smooth Wall Wetwell Joints				✓	Chemlink	M-1	A bead of sealant shall be applied to the interior of tongue and groove smooth wall wetwell joints per manufacturer's recommendations Min. 3/4" wide x 1/2" thick
							✓	Adeka	UltraSeal P-201	

Contractor shall check/mark which product is intended to be used in the submittal box. If multiple manufacturers are to be used, each manufacturer shall be marked.

BID ATTACHMENT 7, COUNTY STANDARDS SPECIFICATIONS 911 FOR ROAD BASE MATERIALS

CRUSHED CONCRETE BASE

Crushed Concrete Base shall follow FDOT Standard Specifications 2015. The layer coefficient of 0.18 with LBR minimum150 is allowed to calculate the base thickness.

Only FDOT certified piles are acceptable to this project from FDOT approved sources. The producing process certified by FDOT without the actual pile certified is not considered solid enough for the acceptance of the material. The Engineer of Record shall forward to the County Engineer a copy of the delivery tickets with FDOT certified pile number, pile location, project name and manufactory contact information shown as part of the pre-approval process. The delivery ticket shall be marked "CERTIFIED FOR FDOT".

Additional tests and inspections will be required for the quality control and the contractor will be responsible for the cost. The material will be rejected by the County if the initial test fails. The rejected material shall be completely removed from the project site.

1) Regarding structural number on Crushed Concrete Base, Manatee County to approve SN 0.18 if following criteria is met and maintained:

A) Limerock Bearing Ratio value of 150 or greater.

B) Gradation conforms to FDOT Specifications 2015.

C) Deleterious materials conform to FDOT Specifications 2015.

D) Delivery ticket indicates FDOT approved source, actual lot allocated to a particular project.

E) Piles or lots to be inspected by Manatee County representative prior to acceptance.

2) Regarding Limerock Bearing Ratio value:

A) No Limerock Bearing Ratio value less than 150, with no under tolerance.

3) Regarding source approval:

A) FDOT approved source, allocated lot sufficient to serve project needs, delivery tickets stating FDOT approved source, project name, FDOT preapproved lot or pile number.

4) Regarding deleterious materials:

A) Deleterious material content in addition to the FDOT Specifications 2015 should state that no construction debris such as Styrofoam insulation, telephone wire, lumber, shingles, aluminum window or door frames etc., or household trash ie: bottles, cans, paper goods etc. is acceptable.

5) Material source inspection:

A) Prior to acceptance of base product, a representative of Manatee County will visit the Producer's location and obtain a sample of the proposed base for the specified project. In addition to sampling, the pile will be visually inspected for deleterious materials, substantial segregation, or any other undesirable characteristics. The pile shall have a traceable indentification by pile number or lot number and an accurate quality assessment.

6) Import and placement of base product:

A) During import of base product, a county inspector or duly designated representative of the county will be onsite monitoring incoming loads, making visual assessments of the product and checking load tickets for verification of materials.

7) Import and placement of base product:

A) After spreading out, prior to compacting, samples of the base product will be obtained by contractor's approved testing lab, every 500 LF staggering right, left, center of the roadway for Limerock Bearing Ratio, gradation and deleterious material testing.

8) Rejection of materials:

A) Material not meeting above requirements will subject to rejection and be removed from the project site. Any three (3) concurrent rejections will require immediate shut down of imported material and require review and remedies prior to restart.

9) Compaction of material:

A) In place material shall achieve 98% of AASHTO T-180 compaction.

SECTION 911
BASE AND STABILIZED BASE MATERIALS

911-1 Description.

This Section governs materials to be used in the construction of base and subgrade stabilization including limerock, shell, shell-rock, cemented coquina shell, and recycled concrete aggregate (RCA).

911-2 Materials.

911-2.1 General:

911-2.1.1 Approval of Material: Approval of mineral aggregate sources shall be in accordance with 6-2.3.

911-2.1.2 Deleterious Substances: Materials shall not contain deleterious substances that would result in: prevention of the bituminous prime coat from adhering to the base course; a detriment to the finishing, strength, or performance of the base; or a surface which is susceptible to distortion under construction traffic. Such substances include, but are not limited to: cherty or other extremely hard pieces, lumps, balls or pockets of sand or clay size material, organic matter, loose sand, loose, free shells, corals or skeletal remain of other marine invertebrates retained on the No. 4 sieve, or water sensitive clay minerals.

911-2.3 Limerock Composition: Limerock material shall consist of unconsolidated or partly consolidated limestone of marine origin.

911-2.4 Shell Material: Composition: Shell materials shall consist of naturally occurring deposits formed essentially of broken mollusk shell, corals and the skeletal remains of other marine invertebrates. Live or steamed shell, or man-made deposits as a by-product of the shellfish industry will not be permitted.

911-2.4.1 Bank Run Shell: Shell materials meeting the requirements of this Section which are presently found as “dry land” deposits.

911-2.4.2 Dredged Shell: Shell materials meeting the requirements of this Section which are dredged from ocean, bay or lake deposits.

911-2.5 Shell-Rock Material Composition: Shell-rock materials shall consist of naturally occurring heterogeneous deposits of limestone with interbedded layers or lenses of loose and cemented shell, to include cemented sands (calcitic sandstone). This material shall be mined and processed in a manner that will result in a reasonably homogenous finished product.

911-2.6 Cemented Coquina Shell Material Composition: Cemented coquina shell materials to be used as cemented coquina base or stabilized base, shall be defined as naturally occurring deposits formed essentially of broken mollusk shell, corals and the skeletal remains of other marine invertebrates, which are presently found as “dry land” deposits and which have been cemented together by carbonates or other natural cementing agents.

911-2.7 Recycled Concrete Aggregate (RCA) Composition: RCA shall consist of concrete material derived from the crushing of hard portland cement concrete. In addition to the deleterious materials noted in 911-2.2, RCA shall be asbestos free. The following limits shall not be exceeded:

Bituminous Concrete ..... 1% by weight
Bricks ..... 1% by weight
Glass and Ceramics..... 1% by weight
Wood and other organic substances..... 0.1% by weight
Reinforcing steel and welded wire fabric .... 0.1% by weight
Plaster and gypsum board ..... 0.1% by weight

911-3 Material Requirements.

911-3.1 Limerock Bearing Ratio (LBR): Materials shall meet the requirements in Table 911-1 in accordance with FM 5-515:

Table 911-1 Limerock Bearing Ratio (LBR)	
Material	Requirement
Limerock	Average Results per LOT - 100, minimum Individual Results - 90, minimum
Shell	
Shell-Rock	
Cemented Coquina Shell	
RCA	Average Results per LOT - 150, minimum

911-3.2 Liquid Limit and Plasticity: Materials shall meet the requirements in Table 911-2 in accordance with AASHTO T89 and AASHTO T90:

Table 911-2 Liquid Limit and Plastic Properties			
Material		Liquid Limit	Plastic Properties
Limerock	Base	Not to exceed 35	Non-Plastic (NP)
	Stabilized Base		Plasticity not to exceed 10
Shell		-	NP
Shell-Rock			
Cemented Coquina Shell		-	NP
RCA		-	NP

911-3.3 Carbonates: Materials shall meet the carbonate requirements in Table 911-3 in accordance with FM 5-514:

Table 911-3 Percentage of Carbonates (Calcium and Magnesium)	
Material	Requirement
Limerock	minimum - 70%
Shell	minimum - 50%
Shell-Rock	minimum - 50%
Cemented Coquina Shell	minimum - 50%
RCA	Not Applicable

911-3.4 Gradation and Size Requirements: Materials shall meet the gradation and size requirements in Table 911-4 in accordance with FM 1-T27 and FM 1-T11:

Table 911-4[1]
Gradation Requirements

Material		Requirement	
Limerock	Base	At least 97% shall pass a 3-1/2 inch sieve[2]	
	Stabilized Base	At least 97% shall pass a 1-1/2 inch sieve[2]	
Shell	Dredged shell	Passing 3-1/2 inch sieve - 97% Passing No. 4 sieve - 50%, maximum Passing No. 200 sieve - maximum 7.5% (washed)	
	Bank-run shell	Passing 3-1/2 inch sieve - 97% Passing No. 4 sieve - 80%, maximum Passing No. 200 sieve - 20%, maximum (washed)	
Shell-Rock		Passing 3-1/2 inch sieve - 97%, minimum Passing No. 4 sieve - 70%, maximum Passing No. 200 sieve - 20%, maximum (washed)	
Cemented Coquina Shell			
RCA		Sieve Size	Percent by Weight Passing
		2 inch	100
		3/4 inch	65 to 95
		3/8 inch	40 to 85
		No. 4	25 to 65
		No. 10	20 to 50
		No. 50	5 to 30
		No. 200	0 to 10

(1) The maximum dimension shall not exceed six inches.
(2) The material shall be well graded down to dust. The fine material shall consist entirely of dust of fracture.

911-4 Exceptions, Additions, and Restrictions.

Approved materials shall not be mixed with other approved or non-approved materials.

SECTION D, SAMPLE CONSTRUCTION AGREEMENT WITH GENERAL CONDITIONS OF THE CONSTRUCTION AGREEMENT AND AGREEMENT EXHIBITS

CONSTRUCTION AGREEMENT

for

STIPULATED SUM

between

MANATEE COUNTY (AS OWNER)

and

<CONTRACTOR NAME> (AS CONTRACTOR)

CONSTRUCTION AGREEMENT FOR STIPULATED SUM

[Project Name]

THIS AGREEMENT ("Agreement") is made and entered into by and between Manatee County, a political subdivision of the State of Florida, referred to herein as "Owner", and the firm of _____, incorporated in the State of _____ and registered and licensed to do business in the State of Florida (license # _____), referred to herein as "Contractor."

WHEREAS, the Owner intends to construct [PROJECT DESCRIPTION], the aforementioned improvements being hereinafter referred to and defined as the "Project"; and

WHEREAS, in response to Owner's Invitation for Bid No. _____ (the "IFB"), Contractor has submitted its Bid (the "Contractor's Bid") to provide the aforementioned construction services.

NOW THEREFORE, the Owner and the Contractor, in consideration of the mutual covenants hereinafter set forth, the sufficiency of which is hereby acknowledged, agree as follows:

1. Contract Documents

The Contract Documents consist of this Agreement and attached Exhibits, the attached General Conditions of the Construction Agreement, Supplementary Conditions (if any), Special Conditions (if any), Drawings (the titles of which are attached hereto as Exhibit A), Specifications (the titles of which are attached hereto as Exhibit B), Addenda issued prior to execution of this Agreement, the Invitation for Bid (including any Instructions to Bidders, Scope of Work, Bid Summary, Supplements, and Technical Specifications), any interpretations issued pursuant to the Invitation for Bid, the Contractor's Bid, permits, notice of intent to award, Notice to Proceed, purchase order(s), any other documents listed in this Agreement, and Modifications [to include written Amendment(s), Change Order(s), Work Directive Change(s) and Field Directive(s)] issued after execution of this Agreement. These form the Agreement, and are as fully a part of the Agreement as if attached or repeated herein. This Agreement represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations or agreements, either written or oral. No other documents shall be considered Contract Documents.

2. Work

The Contractor shall fully execute the Work described in the Contract Documents, except to the extent specifically indicated in the Contract Documents to be the responsibility of others.

3. Date of Commencement and Substantial Completion.

A. Date of Commencement. The date of commencement of the Work shall be the date fixed in a Notice to Proceed issued by the Owner.

B. Contract Time. The Contract Time shall be measured from the date of commencement.

C. Substantial Completion. The Contractor shall achieve Substantial Completion of the entire Work not later than days from the date of commencement, or as follows:

Portion of Work	**Substantial Completion Date**

subject to adjustments of this Contract Time as provided in the Contract Documents.

Time is of the essence in the Contract Documents and all obligations thereunder. If the Contractor fails to achieve Substantial Completion of the Work within the Contract Time and as otherwise required by the Contract Documents (to include not only the entire Work but any portion of the Work as set forth above), the Owner shall be entitled to retain or recover from the Contractor, as liquidated damages and not as a penalty, the sum of $_____ per calendar day, commencing upon the first day following expiration of the Contract Time and continuing until the actual date of Substantial Completion. Such liquidated damages are hereby agreed to be a reasonable estimate of damages the Owner will incur because of delayed completion of the Work. The Owner may deduct liquidated damages as described in this paragraph from any unpaid amounts then or thereafter due the Contractor under this Agreement. Any liquidated damages not so deducted from any unpaid amounts due the Contractor shall be payable to the Owner at the demand of the Owner, together with interest from the date of the demand at the maximum allowable rate.

4. Contract Sum

A. Payment. The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be _____ Dollars and _____ Cents ($_____), subject to additions and deductions as provided in the Contract Documents.

B. Alternates. The Contract Sum is based upon the following alternates, if any, which are described in the Contract Documents and are hereby accepted by the Owner.

(State the numbers or other identification of accepted alternates. If decisions on other alternates are to be made by the Owner subsequent to the execution of this Agreement, attach a schedule of such other alternates showing the amount for each and the date when that amount expires.)

C. Unit Prices. Unit prices, if any, are reflected in the Contractor's Bid.

5. Payments

A. Progress Payments

(1) Based upon Applications for Payment submitted to the Architect/Engineer by the Contractor and Certificates for Payment issued by the Architect/Engineer, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

(2) The period covered by each Application for Payment shall be one calendar month ending on the last day of the month.

(3) Payments shall be made by Owner in accordance with the requirements of Section 218.735, Florida Statutes.

(4) Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form and supported by such data to substantiate its accuracy as the Architect/Engineer may require. This schedule, unless objected to by the Owner or Architect/Engineer, shall be used as a basis for reviewing the Contractor's Applications for Payment.

(5) Applications for Payment shall indicate the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

(6) Subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

i. Take that portion of the Contract Sum properly allocable to completed Work as determined by multiplying the percentage completion of each portion of the Work by the share of the Contract Sum allocated to that portion of the Work in the schedule of values, less retainage of ten percent (10.00%). Pending final determination of cost to the Owner of changes in the Work, amounts not in dispute shall be included as provided in Section 3.3.B. of the General Conditions;
ii. Add that portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction (or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing), supported by paid receipts, less retainage of ten percent (10.00%);
iii. Subtract the aggregate of previous payments made by the Owner; and
iv. Subtract amounts, if any, for which the Architect/Engineer has withheld or nullified an Application for Payment, in whole or in part as provided in Section 3.3.C. of the General Conditions.

(7) The progress payment amount determined in accordance with Section 5.A(6) shall be further modified under the following circumstances:

i. Add, upon Substantial Completion of the Work, a sum sufficient to increase the total payments to the full amount of the Contract Sum, less such amounts as the Architect/Engineer shall determine for incomplete Work, retainage applicable to such work and unsettled claims.

ii. Add, if final completion of the Work is thereafter materially delayed through no fault of the Contractor, any additional amounts payable in accordance with Section 3.2.B. of the General Conditions.

(8) Reduction or limitation of retainage, if any, shall be as follows:

Notwithstanding the foregoing, upon completion of at least 50% of the Work, as determined by the Architect/Engineer and Owner, the Owner shall reduce to five percent (5%) the amount of retainage withheld from each subsequent progress payment.

(9) Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

B. Final Payment. Final Payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when:

(1) The Contractor has fully performed the Work except for the Contractor's responsibility to correct Work as provided in Section 2.4.C. of the General Conditions, and to satisfy other requirements, if any, which extend beyond final payment; and

(2) A final Application for Payment has been approved by the Architect/Engineer.

6. Termination or Suspension.

A. Termination. The Agreement may be terminated by the Owner or the Contractor as provided in Article XIV of the General Conditions.

B. Suspension by Owner. The Work may be suspended by the Owner as provided in Article XIV of the General Conditions.

7. Other Provisions.

A. Substantial Completion Defined. Substantial Completion shall be defined as provided in Article I of the General Conditions. In the event a temporary certificate of occupancy or completion is issued establishing Substantial Completion, the Contractor shall diligently pursue the issuance of a permanent certificate of occupancy or completion.

B. Project Meetings. There shall be a project meeting, at the jobsite or other location acceptable to the parties, on a regularly scheduled basis. The meeting will be attended by a representative of the Contractor, Architect/Engineer and Owner. These representatives shall be authorized to make decisions that are not otherwise contrary to the requirements of this Agreement.

C. Weather. Any rainfall, temperatures below 32 degrees Fahrenheit or winds greater than 25 m.p.h. which actually prevents Work on a given day, shall be considered lost time and an additional day added to the Contract Time, provided no work could be done on site, and provided written notice has been submitted to the Owner by the Contractor documenting same.

D. Shop Drawings; Critical Submittals. In consideration of the impact of timely review of submittals and shop drawings on the overall progress of the Work, it is hereby agreed that the Owner shall cause his agents and design professionals to accomplish the review of any particular “critical” submittals and/or shop drawings and return same to the Contractor within fourteen (14) days.

E. Applications for Payment. Applications for Payment shall be submitted once monthly at regular intervals and shall include detailed documentation of all costs incurred.

F. Punch List. Within 30 days after obtainment of Substantial Completion, the Owner shall generate a “punch list” of all work items requiring remedial attention by the Contractor. Within 5 days thereafter the Architect/Engineer shall assign a fair value to the punch list items, which sum shall be deducted from the next scheduled progress payment to the Contractor. Upon satisfactory completion of the punch list items, as certified by the Architect/Engineer, the previously deducted sum shall be paid to the Contractor.

G. Closeout documentation. Within 30 days after obtainment of Substantial Completion and before final payment, Contractor shall gather and deliver to Owner all warranty documentation, all manufacturer’s product and warranty literature, all manuals (including parts and technical manuals), all schematics and handbooks, and all as-built drawings.

H. Governing Provisions; Conflicts. In the event of a conflict between this Agreement and the Specifications or as between the General Conditions and the Specifications, the Specifications shall govern.

I. E-Verify. The Contractor’s employment of unauthorized aliens is a violation of Section 274(e) of the Federal Immigration and Employment Act. The Contractor shall utilize the U.S. Department of Homeland Security E-Verify system to verify the employment eligibility of all new employees hired during the term of this Agreement, and shall require the same verification procedure of all Subcontractors.

8. Insurance and Bonding

If and to the extent required by the Invitation for Bid documents, the Contractor shall furnish insurance coverage for (but not necessarily limited to) workers' compensation, commercial general liability, auto liability, excess liability, and builder's risk. The Contractor shall furnish to the Owner all appropriate policies and Certificate(s) of Insurance. The Contractor shall also post a Payment and Performance Bond for the Contract Sum, within ten (10) days following notification of intent to award, and otherwise in accordance with the Invitation for Bid documents.

9. Independent Contractor

The Contractor acknowledges that it is functioning as an independent contractor in performing under the terms of this Agreement, and it is not acting as an employee of the Owner.

10. Entire Agreement

This Agreement (inclusive of the Contract Documents incorporated herein by reference) represents the full agreement of the parties.

11. Amendments; Waivers; Assignment

A. Amendments. This Agreement may be amended only pursuant to an instrument in writing that has been jointly executed by authorized representatives of the parties hereto.

B. Waivers. Neither this Agreement nor any portion of it may be modified or waived orally. However, each party (through its governing body or properly authorized officer) shall have the right, but not the obligation, to waive, on a case-by-case basis, any right or condition herein reserved or intended for the benefit or protection of such party without being deemed or considered to have waived such right or condition for any other case, situation, or circumstance and without being deemed or considered to have waived any other right or condition. No such waiver shall be effective unless made in writing with an express and specific statement of the intent of such governing body or officer to provide such waiver.

C. Assignment. The rights and obligations of either party to this Agreement may be assigned to a third party only pursuant to a written amendment hereto.

12. Validity

Each of the Owner and Contractor represents and warrants to the other its respective authority to enter into this Agreement.

13. Covenant To Defend

Neither the validity of this Agreement nor the validity of any portion hereof may be challenged by any party hereto, and each party hereto hereby waives any right to initiate any such challenge. Furthermore, if this Agreement or any portion hereof is challenged by a third party in any judicial, administrative, or appellate proceeding (each

party hereby covenanting with the other party not to initiate, encourage, foster, promote, cooperate with, or acquiesce to such challenge), the parties hereto collectively and individually agree, at their individual sole cost and expense, to defend in good faith its validity through a final judicial determination or other resolution, unless all parties mutually agree in writing not to defend such challenge or not to appeal any decision invalidating this Agreement or any portion thereof.

14. Disclaimer of Third-Party Beneficiaries; Successors and Assigns

This Agreement is solely for the benefit of the parties hereto, and no right, privilege, or cause of action shall by reason hereof accrue upon, to, or for the benefit of any third party. Nothing in this Agreement is intended or shall be construed to confer upon or give any person, corporation, partnership, trust, private entity, agency, or other governmental entity any right, privilege, remedy, or claim under or by reason of this Agreement or any provisions or conditions hereof. This Agreement shall be binding upon, and its benefits and advantages shall inure to, the successors and assigns of the parties hereto.

15. Construction

A. Headings and Captions. The headings and captions of articles, sections, and paragraphs used in this Agreement are for convenience of reference only and are not intended to define or limit their contents, nor are they to affect the construction of or be taken into consideration in interpreting this Agreement.

B. Legal References. All references to statutory sections or chapters shall be construed to include subsequent amendments to such provisions, and to refer to the successor provision of any such provision. References to “applicable law” and “general law” shall be construed to include provisions of local, state and federal law, whether established by legislative action, administrative rule or regulation, or judicial decision.

16. Severability

The provisions of this Agreement are declared by the parties hereto to be severable. In the event any term or provision of this Agreement shall be held invalid by a court of competent jurisdiction, such invalid term or provision should not affect the validity of any other term or provision hereof; and all such terms and provisions hereof shall be enforceable to the fullest extent permitted by law as if such invalid term or provision had never been part of this Agreement; provided, however, if any term or provision of this Agreement is held to be invalid due to the scope or extent thereof, then, to the extent permitted by law, such term or provision shall be automatically deemed modified in order that it may be enforced to the maximum scope and extent permitted by law.

17. Governing Law; Venue

This Agreement shall be governed by the laws of the State of Florida. Venue for any petition for writ of certiorari or other court action allowed by this Agreement shall be in the Circuit Court of the Twelfth Judicial Circuit in and for Manatee County, Florida.

18. Attorney's Fees and Costs

In any claim dispute procedure or litigation arising from this Agreement, each party hereto shall be solely responsible for paying its attorney's fees and costs.

19. Notices

All notices, comments, consents, objections, approvals, waivers, and elections under this Agreement shall be in writing and shall be given only by hand delivery for which a receipt is obtained, or certified mail, prepaid with confirmation of delivery requested, or by electronic mail with delivery confirmation. All such communications shall be addressed to the applicable addressees set forth below or as any party may otherwise designate in the manner prescribed herein.

To the Owner:
Manatee County,
Attn:
Address
City/State/Zip
Email:

To the Contractor:
Name.
Attn:
Address
City/State/Zip
Email:

Notices, comments, consents, objections, approvals, waivers, and elections shall be deemed given when received by the party for whom such communication is intended at such party's address herein specified, or such other physical address or email address as such party may have substituted by notice to the other.

20. Public Records Law

The Contractor shall comply with the Florida Public Records Act (Chapter 119, Florida Statutes), and shall:

A. Keep and maintain public records required by the Owner to perform the services called for in this Agreement.
B. Upon request from the Owner's custodian of public records, provide the Owner with a copy of the requested records or allow the records to be inspected or copied within a reasonable time at a cost that does not exceed the cost provided in Chapter 119, Florida Statutes or as otherwise provided by law.
C. Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law for the duration of this Agreement and following completion of this Agreement if the Contractor does not transfer the records to the Owner.

D. Upon completion of this Agreement, transfer, at no cost, to the Owner all public records in possession of the Contractor or keep and maintain such public records. If the Contractor transfers all public records to the Owner upon completion of the Agreement, the Contractor shall destroy any duplicate public records that are exempt or confidential and exempt from public records disclosure requirements. If the Contractor keeps and maintains public records upon completion of the Agreement, the Contractor shall meet all applicable requirements for retaining public records. All records stored electronically must be provided to the Owner, upon request from the Owner's custodian of public records, in a format that is compatible with the information technology systems of the Owner.

IF THE CONTRACTOR HAS QUESTIONS REGARDING THE APPLICATION OF CHAPTER 119, FLORIDA STATUTES, TO THE CONTRACTOR'S DUTY TO PROVIDE PUBLIC RECORDS RELATING TO THIS AGREEMENT, CONTACT THE OWNER'S CUSTODIAN OF PUBLIC RECORDS AT 941-748-4501, EXT. 5845; DEBBIE.SCACCIANOCE@MYMANATEE.ORG; POST OFFICE BOX 1000, BRADENTON, FLORIDA 34206.

21. Exhibits. Exhibits to this Agreement are as follows:

Exhibit A—Title(s) of Drawings

Exhibit B—Title(s) of Specifications

Exhibit C—Affidavit of No Conflict

Exhibit D—Certificate(s) of Insurance

Exhibit E—Payment and Performance Bond

Exhibit F—Standard Forms

1. Application for Payment
2. Certificate of Substantial Completion
3. Final Reconciliation / Warranty / Affidavit
4. Change Order

WHEREFORE, the parties hereto have executed this Agreement as of the date last executed below.

NAME OF CONTRACTOR

By: _____

Printed Name: _____

Title: _____

Date: _____

MANATEE COUNTY, a political subdivision
of the State of Florida

By: _____

Printed Name:

Title:

Date: _____

GENERAL CONDITIONS

of the

CONSTRUCTION AGREEMENT

GENERAL CONDITIONS OF THE CONSTRUCTION AGREEMENT

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ARTICLE I, DEFINITIONS

1.1 Definitions

For purposes of the Contract Documents, the following terms shall have the following meanings.

A. Acceptance: The acceptance of the Project into the Owner's operating public infrastructure.

B. Application for Payment: The form approved and accepted by the Owner, which is to be used by Contractor in requesting progress payments or final payment and which is to include such supporting documentation as is required by the Contract Documents.

C. Architect/Engineer: <Name>, a corporation/company/limited liability corportation, registered and licensed to do business in the State of Florida with _____ as the primary qualifying agent OR an employee of Manatee County Government

D. Change Order: A written order signed by the Owner, the Architect/Engineer and the Contractor authorizing a change in the Project Plans and/or Specifications and, if necessary, a corresponding adjustment in the Contract Sum and/or Contract Time, pursuant to Article V.

E. Compensable Delay: Any delay beyond the control and without the fault or negligence of the Contractor resulting from Owner-caused changes in the Work, differing site conditions, suspensions of the Work, or termination for convenience by Owner.

F. Contractor's Personnel: The Contractor's key personnel designated by Contractor.

G. Construction Services: The Construction Services to be provided by Contractor pursuant to Section 2.4, in accordance with the terms and provisions of the Contract Documents.

H. Contract Sum: The total compensation to be paid to the Contractor for Construction Services rendered pursuant to the Contract Documents, as set forth in Contractor's Bid (or Guaranteed Maximum Price Addendum), unless adjusted in accordance with the terms of the Contract Documents.

I. Construction Team: The working team established pursuant to Section 2.1.B.

J. Contract Time: The time period during which all Construction Services are to be completed pursuant to the Contract Documents, to be set forth in the Project Schedule.

K. Days: Calendar days except when specified differently. When time is referred to in the Contract Documents by days, it will be computed to exclude the first and include the last day of such period. If the last day of any such period falls on a Saturday or Sunday or legal holiday, such day will be omitted from the computation.

L. Defective: When modifying the term "Work", referring to Work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or that does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or that has been damaged prior to Owner's approval of final payment (unless responsibility for the protection thereof has been assumed by Owner).

M. Excusable Delay: Any delay beyond the control and without the negligence of the Contractor, the Owner, or any other contractor caused by events or circumstances such as, but not limited to, acts of God or of a public enemy, fires, floods, freight embargoes, acts of government other than Owner or epidemics. Labor disputes and above average rainfall shall give rise only to excusable delays.

N. Field Directive: A written order issued by Owner which orders minor changes in the Work not involving a change in Contract Time, to be paid from the Owner's contingency funds.

O. Final Completion Date: The date upon which the Project is fully constructed and all Work required on the Project and Project Site is fully performed as verified in writing by the Owner.

P. Float or Slack Time: The time available in the Project Schedule during which an unexpected activity can be completed without delaying substantial completion of the Work.

Q. Force Majeure: Those conditions constituting excuse from performance as described in and subject to the conditions described in Article XII.

R. Inexcusable Delay: Any delay caused by events or circumstances within the control of the Contractor, such as inadequate crewing, slow submittals, etc., which might have been avoided by the exercise of care, prudence, foresight or diligence on the part of the Contractor.

S. Non-prejudicial Delay: Any delay impacting a portion of the Work within the available total Float or Slack Time and not necessarily preventing Substantial Completion of the Work within the Contract Time.

T. Notice to Proceed: Written notice by Owner (after execution of Contract) to Contractor fixing the date on which the Contract Time will commence to run and on which Contractor shall start to perform the Work.

U. Owner: Manatee County, a political subdivision of the State of Florida.

V. Owner's Project Representative: The individual designated by Owner to perform those functions set forth in Section 7.8.

W. Payment and Performance Bond: The Payment and Performance Bond security posted pursuant to Section 2.4.Y to guarantee payment and performance by the Contractor of its obligations hereunder.

X. Permitting Authority: Any applicable governmental authority acting in its governmental and regulatory capacity which is required to issue or grant any permit, certificate, license or other approval which is required as a condition precedent to the commencement or approved of the Work, or any part thereof, including the building permit.

Y. Prejudicial Delay: Any excusable or compensable delay impacting the Work and exceeding the total float available in the Project Schedule, thus preventing completion of the Work within the Contract Time unless the Work is accelerated.

Z. Pre-operation Testing: All field inspections, installation checks, water tests, performance tests and necessary corrections required of Contractor to demonstrate that individual components of the Work have been properly constructed and do operate in accordance with the Contract Documents for their intended purposes.

AA. Procurement Ordinance: The Manatee County Procurement Code, Chapter 2-26 of the Manatee County Code of Laws, as amended from time to time.

BB. Progress Report: A report to Owner that includes all information required pursuant to the Contract Documents and submitted in accordance with Section 2.4.EE, hereof.

CC. Project: The total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by Owner and by separate contractors. For the purposes of the Contract Documents, the term Project shall include all areas of proposed improvements and all areas which may reasonably be judged to have an impact on the Project.

DD. Project Costs: The costs incurred by the Contractor to plan, construct and equip the Project and included within, and paid as a component of, the Contract Sum.

EE. Project Manager: Subject to the prior written consent of Owner, the individual designated to receive notices on behalf of the Contractor, or such other individual designated by the Contractor, from time to time, pursuant to written notice in accordance with the Contract Documents.

FF. Project Plans and Specifications: The one hundred percent (100%) construction drawings and specifications prepared by the Architect/Engineer, and any changes, supplements, amendments or additions thereto approved by the Owner, which shall also include any construction drawings and final specifications required for the repair or construction of the Project, as provided herein.

GG. Project Schedule: The schedule and sequence of events for the commencement, progression and completion of the Project, developed pursuant to Section 2.3., as such schedule may be amended as provided herein.

HH. Project Site: The site depicted in the Project Plans and Specifications, inclusive of all rights of way, temporary construction easements or licensed or leased sovereign lands.

II. Punch List Completion Date: The date upon which all previously incomplete or unsatisfactory items, as identified by the Contractor, the Architect/Engineer and/or the Owner are completed in a competent and workmanlike manner, consistent with standards for Work of this type and with good building practices in the State of Florida.

JJ. Subcontractor: Any individual (other than a direct employee of the Contractor) or organization retained by Contractor to plan, construct or equip the Project pursuant to Article IV.

KK. Substantial Completion and Substantially Complete: The stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use; provided, however, that as a condition precedent to Substantial Completion, the Owner has received all certificates of occupancy or completion and other permits, approvals, licenses, and other documents from any governmental authority which are necessary for the beneficial occupancy of the Project or any designated portion thereof.

LL. Substantial Completion Date: The date on which the Project or designated portion thereof is deemed to be Substantially Complete, as evidenced by receipt of (i) the Architect/Engineer's certificate of Substantial Completion, (ii) written

Acceptance of the Project by the Owner, and (iii) approvals of any other authority as may be necessary or otherwise required.

MM. Substitute: Materials or equipment offered by the Contractor as an alternative to that set forth in the Project Plans and Specifications, where (i) the Project Plans and Specifications do not authorize an "approved equal", or (ii) the Owner, in its reasonable discretion, determines that a pre-authorized "approved equal" will result in a substantial change to the Work because of cost, quality or other difference in comparison to the materials or equipment specified.

NN. Unit Price Work: Work to be paid for on the basis of unit prices.

OO. Work: The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all labor, materials, equipment and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

PP. Work Directive Change: A written directive to Contractor, issued on or after the effective date of the Agreement pursuant to Section 5.8 and signed by Owner's Project Representative, ordering an addition, deletion or revision in the Work, or responding to differing or unforeseen physical conditions under which the Work is to be performed or responding to emergencies.

ARTICLE II , RELATIONSHIP AND RESPONSIBILITIES

2.1 Relationship between Contractor and Owner

The Contractor accepts the relationship of trust and confidence established with Owner pursuant to the Contract Documents. The Contractor shall furnish its best skill and judgment and cooperate with Owner and Owner's Project Representative in furthering the interests of the Owner. The Contractor agrees to provide the professional services required to complete the Project consistent with the Owner's direction and the terms of the Contract Documents. All services provided hereunder by Contractor, either directly or through Subcontractors, shall be provided in accordance with sound construction practices and applicable professional construction standards.

A. Purpose. The purpose of the Contract Documents is to provide for the provision of construction services for the Project on the Project Site by the Contractor, and construction of the Project by the Contractor in accordance with the Project Plans and Specifications. The further purpose of the Contract Documents is to define and delineate the responsibilities and obligations of the parties to the Contract Documents and to express the desire of all such parties to cooperate to accomplish the purposes and expectations of the Contract Documents.

B. Construction Team. The Contractor, Owner and Architect/Engineer shall be called the "Construction Team" and shall work together as a team commencing upon full execution of the Contract Documents through Substantial Completion.

As provided in Section 2.2, the Contractor and Architect/Engineer shall work jointly through completion and shall be available thereafter should additional services be required. The Contractor shall provide leadership to the Construction Team on all matters relating to construction. The Contractor understands, acknowledges and agrees that the Architect/Engineer shall provide leadership to the Construction Team on all matters relating to design.

C. Owner's Reliance on Bid (or Guaranteed Maximum Price Addendum). The Contractor acknowledges that the representations, statements, information and pricing contained in its Bid (or Guaranteed Maximum Price Addendum) have been relied upon by the Owner and have resulted in the award of this Project to the Contractor.

2.2 General Contractor Responsibilities

In addition to the other responsibilities set forth herein, the Contractor shall have the following responsibilities pursuant to the Contract Documents:

A. Personnel. The Contractor represents that it has secured, or shall secure, all personnel necessary to perform the Work, none of whom shall be employees of the Owner. Primary liaison between the Contractor and the Owner shall be through the Owner's Project Representative and Contractor's Project Manager. All of the services required herein shall be performed by the Contractor or under the Contractor's supervision, and all personnel engaged in the Work shall be fully qualified and shall be authorized or permitted under law to perform such services.

B. Cooperation with Architect/Engineer. The Contractor's services shall be provided in conjunction with the services of the Architect/Engineer. In the performance of professional services, the Contractor acknowledges that time is critical for Project delivery. The Contractor acknowledges that timely construction utilizing the services of an Architect/Engineer and a Contractor requires maximum cooperation between all parties.

C. Timely Performance. The Contractor shall perform all services as expeditiously as is consistent with professional skill and care and the orderly progress of the Work, in accordance with the Project Schedule. Verification of estimated Project Schedule goals will be made as requested by the Owner.

D. Duty to Defend Work. In the event of any dispute between the Owner and any Permitting Authority that relates to the quality, completeness or professional workmanship of the Contractor's services or Work, the Contractor shall, at its sole cost and expense, cooperate with the Owner to defend the quality and workmanship of the Contractor's services and Work.

E. Trade and Industry Terminology. It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result will be supplied whether or not specifically called

for. When words which have a well-known technical or trade meaning are used to describe Work, materials, or equipment, such words shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals or codes of any technical society, organization or association, or to the laws or regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code or laws or regulations in effect at the time of opening of Bids (or at the time of execution of the Guaranteed Maximum Price Addendum), except as may be otherwise specifically stated. However, no provision of any referenced standard specification, manual or code (whether or not specifically incorporated by reference in the Contract Documents) shall be effective to change the duties and responsibilities of Owner or Contractor, or any of their agents or employees from those set forth in the Contract Documents. Computed dimensions shall govern over scaled dimensions.

2.3 Project Schedule

A. The Contractor, within ten (10) days after being awarded the Agreement, shall prepare and submit for the Owner's and Architect/Engineer's information a Contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of Work.

B. The Project Schedule shall show a breakdown of all tasks to be performed, and their relationship in achieving the completion of each phase of Work, subject to review of Owner and Architect/Engineer and approval or rejection by Owner. The Project Schedule shall show, at a minimum, the approximate dates on which each segment of the Work is expected to be started and finished, the proposed traffic flows during each month, the anticipated earnings by the Contractor for each month and the approximate number of crews and equipment to be used. The Project Schedule shall include all phases of procurement, approval of shop drawings, proposed Change Orders in progress, schedules for Change Orders, and performance testing requirements. The Project Schedule shall include a construction commencement date and Project Substantial Completion Date, which dates shall accommodate known or reasonably anticipated geographic, atmospheric and weather conditions.

C. The Project Schedule shall serve as the framework for the subsequent development of all detailed schedules. The Project Schedule shall be used to verify Contractor performance and to allow the Owner's Project Representative to monitor the Contractor's efforts.

D. The Project Schedule may be adjusted by the Contractor pursuant to Article V. The Owner shall have the right to reschedule Work provided such rescheduling is in accord with the remainder of terms of the Contract Documents.

E. The Contractor shall prepare a submittal schedule, promptly after being awarded the Agreement and thereafter as necessary to maintain a current submittal

schedule, and shall submit the schedule(s) for the Architect/Engineer's approval. The Architect/Engineer's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect/Engineer reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

F. The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect/Engineer.

2.4 Construction Services.

The Contractor shall provide the following Construction Services:

A. Construction of Project. The Contractor shall work from the receipt of a Notice to Proceed through the Substantial Completion of the Project in accordance with the terms of the Contract Documents to manage the construction of the Project. The Construction Services provided by the Contractor to construct the Project shall include without limitation (1) all services necessary and commensurate with established construction standards, and (2) all services described in the Invitation for Bid (or Request for Proposal) and the Bid (or Guaranteed Maximum Price Addendum).

B. Notice to Proceed. A Notice to Proceed may be given at any time within thirty (30) days after the effective date of the Agreement. Contractor shall start to perform the Work on the date specified in the Notice to Proceed, but no Work shall be done at the site prior to the issuance of the Notice to Proceed.

C. Quality of Work. If at any time the labor used or to be used appears to the Owner as insufficient or improper for securing the quality of Work required or the required rate of progress, the Owner may order the Contractor to increase its efficiency or to improve the character of its Work, and the Contractor shall conform to such an order. Any such order shall not entitle Contractor to any additional compensation or any increase in Contract Time. The failure of the Owner to demand any increase of such efficiency or any improvement shall not release the Contractor from its obligation to secure the quality of Work or the rate of progress necessary to complete the Work within the limits imposed by the Contract Documents. The Owner may require the Contractor to remove such personnel as the Owner deems incompetent, careless, insubordinate or otherwise objectionable, or whose continued employment on the Project is deemed to be contrary to the Owner's interest. The Contractor shall provide good quality workmanship and shall promptly correct construction defects without additional compensation. Acceptance of the Work by the Owner shall not relieve the Contractor of the responsibility for subsequent correction of any construction defects.

D. Materials. All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by Architect/Engineer, Contractor shall furnish satisfactory evidence (including

reports of required tests) as to the kind and quality of materials and equipment. All materials and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned in accordance with the instruction of the applicable supplier except as otherwise provided in the Contract Documents.

E. Accountability for Work. The Contractor shall be solely accountable for its Work, including plans review and complete submittals. The Contractor shall be solely responsible for means, methods, techniques, sequences and procedures of construction. If a specific means, method, technique, sequence or procedure of construction is required by the Contract Documents, the Contractor may utilize an alternative means, method, technique, sequence or procedure acceptable to the Architect/Engineer if the Contractor submits sufficient information to allow the Architect/Engineer to determine that the alternative is equivalent to that required by the Contract Documents.

F. Contract Sum. The Contractor shall construct the Project so that the Project can be built for a cost not to exceed the Contract Sum.

G. Governing Specifications. The Project shall be constructed in accordance with applicable Owner design standards and guidelines. In the absence of specified Owner design standards or guidelines, the Architect/Engineer shall use, and the Contractor shall comply with, the most recent version of the applicable FDOT or AASHTO design standards. In general, the Project shall be constructed by the Contractor in accordance with applicable industry standards. The Contractor shall be responsible for utilizing and maintaining current knowledge of any laws, ordinances, codes, rules, regulations, standards, guidelines, special conditions, specifications or other mandates relevant to the Project or the services to be performed.

H. Adherence to Project Schedule. The development and equipping of the Project shall be undertaken and completed in accordance with the Project Schedule, and within the Contract Time described therein.

I. Superintendent. The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project Site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

(1) The Contractor, as soon as practicable after award of the Agreement, shall furnish in writing to the Owner through the Architect/Engineer the name and qualifications of the proposed superintendent. The Architect/Engineer may reply within 14 days to the Contractor in writing stating (i) whether the Owner or the Architect/Engineer has reasonable objection to the proposed superintendent or (ii) that the Architect/Engineer requires additional time to review. Failure of the Architect/Engineer to reply within 14 days shall constitute notice of no reasonable objection.
(2) The Contractor shall not employ a proposed superintendent to whom the Owner or Architect/Engineer has made reasonable and timely objection. The

Contractor shall not change the superintendent without the Owner's consent, which shall not be unreasonably withheld or delayed.

J. Work Hours. Contractor shall provide competent, suitable qualified personnel to survey and lay out the Work and perform construction as required by the Contract Documents. Contractor shall at all times maintain good discipline and order at the site. Except in connection with the safety or protection of persons or the Work or property at the site or adjacent thereto and except as otherwise indicated in the Contract Documents, all Work at the site shall be performed during regular working hours, and Contractor shall not permit overtime work or the performance of Work on a Saturday, Sunday or legal holiday without Owner's written consent given after prior notice to Architect/Engineer (at least seventy-two (72) hours in advance).

K. Overtime-Related Costs. Contractor shall pay for all additional Architect/Engineering charges, inspection costs and Owner staff time for any overtime work which may be authorized. Such additional charges shall be a subsidiary obligation of Contractor and no extra payment shall be made by Owner because such overtime work. At Owner's option, such overtime costs may be deducted from Contractor's monthly payment request or Contractor's retainage prior to release of final payment.

L. Insurance, Overhead and Utilities. Unless otherwise specified, Contractor shall furnish and assume full responsibility for all bonds, insurance, materials, equipment, labor, transportation, construction equipment and machinery, tools, appliances, fuel, power, light, heat, telephone, water, sanitary facilities, temporary facilities and all other facilities and incidentals necessary for the furnishing, performance, testing, start-up and completion of the Work.

M. Cleanliness. The Contractor shall keep the premises and surrounding area free from accumulation of waste materials or rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery and surplus materials from and about the Project Site. Contractor shall restore to original conditions all property not designated for alteration by the Contract Documents If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and Owner shall be entitled to reimbursement from Contractor.

N. Loading. Contractor shall not load nor permit any part of any structure to be loaded in any manner that will endanger the structure, nor shall Contractor subject any part of the Work or adjacent property to stresses or pressures that will endanger it.

O. Safety and Protection. Contractor shall comply with the Florida Department of Commerce Safety Regulations and any local safety regulations. Contractor shall be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the Work. Contractor shall take all necessary

precautions for the safety of and shall provide the necessary protection to prevent damage, injury or loss to:

(1) All employees on the Work and other persons and organizations who may be affected thereby;

(2) All the Work and materials and equipment to be incorporated therein, whether in storage on or off the Project Site; and

(3) Other property at the Project Site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and underground facilities not designated for removal, relocation or replacement during construction.

Contractor shall comply with all applicable laws and regulations of any public body having jurisdiction for the safety of persons or property or to protect them from damage, injury or loss, and shall erect and maintain all necessary safeguards for such safety and protection. Contractor shall provide and maintain all passageways, guard fences, lights and other facilities for the protection required by public authority or local conditions. Contractor shall provide reasonable maintenance of traffic for the public and preservation of the Owner's business, taking into full consideration all local conditions. Contractor's duties and responsibilities for safety and protection with regard to the Work shall continue until such time as all the Work is completed.

P. Emergencies. In emergencies affecting the safety or protection of persons or the Work or property at the Project Site or adjacent thereto, Contractor, without special instruction or authorization from Architect/Engineer or Owner, shall act to prevent threatened damage, injury or loss. Contractor shall give Owner prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If Owner determines that a change in the Project is required because of the action taken in response to an emergency, a Work Directive Change or Change Order will be issued to document the consequences of the changes or variation.

Q. Substitutes. For Substitutes not included with the Bid (or Guaranteed Maximum Price Addendum), but submitted after the effective date of the Agreement (or Guaranteed Maximum Price Addendum), Contractor shall make written application to Architect/Engineer for acceptance thereof, certifying that the proposed Substitute will perform adequately the functions and achieve the results called for by the general design, be similar and of equal substance to that specified and be suited to the same use as that specified. The application will also contain an itemized estimate of all costs and delays or schedule impacts that will result directly or indirectly from review, acceptance and provision of such Substitute, including costs of redesign and claims of other contractors affected by the resulting change, all of which will be considered by the Architect/Engineer in evaluating the proposed Substitute. Architect/Engineer may require Contractor to furnish at Contractor's expense, additional data about the proposed Substitute. In rendering a decision, Owner, Architect/Engineer and Contractor

shall have access to any available Float Time in the Project Schedule. If Substitute materials or equipment not included as part of the Bid (or Guaranteed Maximum Price Addendum), but proposed after the effective date of the Agreement, are accepted and are less costly than the originally specified materials or equipment, then the net difference in cost shall be credited to the Owner and an appropriate Change Order executed to adjust the Contract Sum.

(1) Architect/Engineer will be allowed a reasonable time within which to evaluate each proposed Substitute. Architect/Engineer will be the sole judge of acceptability and no Substitute will be ordered, installed or utilized without Architect/Engineer's prior written acceptance which will be evidenced by either a Change Order or an approved shop drawing. Owner may require Contractor to furnish at Contractor's expense a special performance guarantee or other surety with respect to any Substitute.

(2) Contractor shall reimburse Owner for the charges of Architect/Engineer and Architect/Engineer's Consultants for evaluating each proposed Substitute submitted after the effective date of the Agreement and all costs resulting from any delays in the Work while the Substitute was undergoing review.

R. Surveys and Stakes. The Contractor shall furnish, free of charge, all labor, stakes, surveys, batter boards for structures, grade lines and other materials and supplies and shall set construction stakes and batter boards for establishing lines, position of structures, slopes and other controlling points necessary for the proper prosecution of the Work. Where rights-of-way, easements, property lines or any other conditions which make the lay-out of the Project or parts of the Project critical are involved, the Contractor shall employ a competent surveyor who is registered in the State of Florida for lay-out and staking. These stakes and marks shall constitute the field control by and in accord with which the Contractor shall govern and execute the Work. The Contractor shall be held responsible for the preservation of all stakes and marks and if for any reason any of the stakes or marks or batter boards become destroyed or disturbed, they shall be immediately and accurately replaced by the Contractor.

S. Suitability of Project Site. The Contractor has, by careful examination, satisfied itself as to the nature and location of the Work and all other matters which can in any way affect the Work, including, but not limited to details pertaining to borings, as shown on the drawings. Such boring information is not guaranteed to be more than a general indication of the materials likely to be found adjacent to holes bored at the Project Site, approximately at the locations indicated. The Contractor has examined boring data, where available, made its own interpretation of the subsurface conditions and other preliminary data, and has based its Bid (or Guaranteed Maximum Price Addendum) on its own opinion of the conditions likely to be encountered. Except as specifically provided in Sections 2.4.U., 5.4 and 5.5, no extra compensation or extension of time will be considered for any Project Site conditions that existed at the time of bidding (or at the time of execution of the Guaranteed Maximum Price Addendum). No verbal agreement or conversation with any officer, agent or employee of the

Owner, before or after the execution of the Agreement, shall affect or modify any of the terms or obligations herein contained.

T. Project Specification Errors. If the Contractor, during the Work, finds that the drawings, specifications or other Contract Documents cannot be followed, the Contractor shall immediately inform the Owner in writing, and the Owner shall promptly check the accuracy of the information. Any Work done after such discovery, until any necessary changes are authorized, will be done at the Contractor's sole risk of non-payment and delay.

U. Remediation of Contamination. Owner and Contractor recognize that remediation of subsurface conditions may be necessary due to potential hazardous materials contamination. Because the presence or extent of any contamination is not known, Contractor shall include no cost in the Contract Sum, and no time in the Project Schedule, for cost or delays that might result from any necessary remediation. The Project Schedule will provide a period of time between demolition activities and the start of the next activity to commence any remediation if needed. Contractor shall use all reasonable efforts in scheduling the Project to minimize the likelihood that remediation delays construction. Any hazardous materials remediation Work which Contractor agrees to perform shall be done pursuant to a Change Order or amendment consistent with the following:

(1) The dates of Substantial Completion shall be equitably adjusted based on delays, if any, incurred in connection with remediation efforts.

(2) Contractor, and any Subcontractors which have mobilized on the Project Site, shall be paid for demonstrated costs of overhead operations at the Project Site during any period of delay of more than seven (7) days, except to the extent that Work proceeds concurrently with remediation. The categories of costs to be reimbursed are limited to those reasonably incurred at the jobsite during the delay period (such as trailers or offices, telephones, faxes, and the like); equipment dedicated to the Project and located at the Project Site; salaries and associated costs of personnel dedicated to the Project to the extent that they do not perform work on other projects; and other jobsite costs that are reasonable and which are incurred during the delay period. Subcontractors and suppliers which have not mobilized are limited to the costs set forth in Section 2.4.U(3).

(3) Contractor and any Subcontractor or supplier on the Project who is eligible for compensation shall be paid any demonstrated costs of escalation in materials or labor, and reasonable costs of off-site storage of materials identified to the Project, arising because of any delay of more than seven (7) days. Such Contractor, Subcontractors and suppliers are obligated to take all reasonable steps to mitigate escalation costs, such as through early purchase of materials.

(4) Contractor, for itself and all Subcontractors and suppliers on the Project, hereby agrees that the extension of time for delays under Section 2.4.U(1),

and payment of the costs identified in Sections 2.4.U(2) and/or Section 2.4.U(3), are the sole remedies for costs and delays described in this Section, and waives all claims and demands for extended home office overhead (including, but not limited to, “Eichleay” claims), lost profit or lost opportunities, and any special, indirect, or consequential damages arising as a result of delays described in this Section. The Contract Sum shall be adjusted to reflect payment of allowable costs.

(5) If any delay described in this section causes the time or cost for the Project to exceed the Contract Time or the Contact Sum, then the Owner may terminate the Agreement pursuant to Section 14.2.

(6) Contractor and any Subcontractor or supplier seeking additional costs under this Section 2.4.U. shall promptly submit estimates or any costs as requested by Owner, and detailed back-up for all costs when payment is sought or whenever reasonably requested by Owner. All costs are auditable, at Owner’s discretion. Bid, estimate and pricing information reasonably related to any request for additional compensation will be provided promptly upon request.

(7) Contractor shall include provisions in its subcontracts and purchase orders consistent with this Section.

V. Interfacing.

(1) The Contractor shall take such measures as are necessary to ensure proper construction and delivery of the Project, including but not limited to providing that all procurement of long-lead items, the separate construction Subcontractors, and the general conditions items are performed without duplication or overlap to maintain completion of all Work on schedule. Particular attention shall be given to provide that each Subcontractor bid package clearly identifies the Work included in that particular separate subcontract, its scheduling for start and completion, and its relationship to other separate contractors.

(2) Without assuming any design responsibilities of the Architect/Engineer, the Contractor shall include in the Progress Reports required under this Section 2.4 comments on overlap with any other separate subcontracts, omissions, lack of correlation between drawings, and any other deficiencies noted, in order that the Architect/Engineer may arrange for necessary corrections.

W. Job Site Facilities. The Contractor shall arrange for all job site facilities required and necessary to enable the Contractor and Architect/Engineer to perform their respective duties and to accommodate any representatives of the Owner which the Owner may choose to have present on the Project Site.

X. Weather Protection. The Contractor shall provide temporary enclosures of building areas to assure orderly progress of the Work during periods when extreme weather conditions are likely to be experienced. The Contractor shall

also be responsible for providing weather protection for Work in progress and for materials stored on the Project Site. A contingency plan shall be prepared upon request of the Owner for weather conditions that may affect the construction.

Y. Payment and Performance Bond. Prior to the construction commencement date, the Contractor shall obtain, for the benefit of and directed to the Owner, a Payment and Performance Bond satisfying the requirements of Section 255.05, Florida Statutes, covering the faithful performance by the Contractor of its obligations under the Contract Documents, including but not limited to the construction of the Project on the Project Site and the payment of all obligations arising thereunder, including all payments to Subcontractors, laborers, and materialmen. The surety selected by the Contractor to provide the Payment and Performance Bond shall be approved by the Owner prior to the issuance of such Bond, which approval shall not be unreasonably withheld or delayed provided that the surety is rated A or better by Best's Key Guide, latest edition. For Changes in the Work that result in an increase in the Contract Sum, Owner reserves the right to require the Contractor to secure and deliver additive riders to the Payment and Performance Bond.

Z. Construction Phase; Building Permit; Code Inspections. Unless otherwise provided, Contractor shall obtain and pay for all construction permits and licenses. Owner shall assist Contractor, when necessary, in obtaining such permits and licenses. Contractor shall pay all governmental charges and inspection fees necessary for the prosecution of the Work.

(1) Building Permit. The Owner and Architect/Engineer shall provide such information to any Permitting Authority as is necessary to obtain approval from the Permitting Authority to commence construction prior to beginning construction. The Contractor shall pull any required building permit, and shall be responsible for delivering and posting the building permit at the Project Site prior to the commencement of construction. The cost of the building permit is included in the Contract Sum. The Owner and Architect/Engineer shall fully cooperate with the Contractor when and where necessary.

(2) Code Inspections. The Project requires detailed code compliance inspection during construction in disciplines determined by any Permitting Authority. These disciplines normally include, but are not necessarily limited to, structural, mechanical, electrical, plumbing, general building and fire. The Contractor shall notify the appropriate inspector(s) and the Architect/Engineer, no less than 24 hours in advance, when the Work is ready for inspection and before the Work is covered up. All inspections shall be made for conformance with the applicable ordinances and building codes. Costs for all re-inspections of Work found defective and subsequently repaired shall not be included as Project Costs and shall be borne by the Contractor or as provided in the contract between Contractor and Subcontractor.

(3) Contractor's Personnel. The Contractor shall maintain sufficient off-site support staff and competent full-time staff at the Project Site authorized to act on behalf of the Contractor to coordinate, inspect, and provide general direction of the Work and progress of the Subcontractors. At all times during the performance of the Work, the Owner shall have the right to demand replacement of Contractor Personnel to whom the Owner has reasonable objection, without liability to the Contractor.

(4) Lines of Authority. To provide general direction of the Work, the Contractor shall establish and maintain lines of authority for its personnel and shall provide this information to the Owner and all other affected parties, such as the code inspectors of any Permitting Authority, the Subcontractors, and the Architect/Engineer. The Owner and Architect/Engineer may attend meetings between the Contractor and his Subcontractors; however, such attendance is optional and shall not diminish either the authority or responsibility of the Contractor to administer the subcontracts.

AA. Quality Control. The Contractor shall develop and maintain a program, acceptable to the Owner and Architect/Engineer, to assure quality control of the construction. The Contractor shall be responsible for and supervise the Work of all Subcontractors, providing instructions to each when their Work does not conform to the requirements of the Project Plans and Specifications, and the Contractor shall continue to coordinate the Work of each Subcontractor to ensure that corrections are made in a timely manner so as to not affect the efficient progress of the Work. Should a disagreement occur between the Contractor and the Architect/Engineer over the acceptability of the Work, the Owner, at its sole discretion and in addition to any other remedies provided herein, shall have the right to determine the acceptability, provided that such determination is consistent with standards for construction projects of this type and generally accepted industry standards for workmanship in the State of Florida.

BB. Management of Subcontractors. All Subcontractors shall be compensated in accordance with Article IV. The Contractor shall solely control the Subcontractors. The Contractor shall negotiate all Change Orders and Field Orders with all affected Subcontractors and shall review the costs and advise the Owner and Architect/Engineer of their validity and reasonableness, acting in the Owner's best interest. When there is an imminent threat to health and safety, and Owner's Project Representative concurrence is impractical, the Contractor shall act immediately to remove the threats to health and safety and shall subsequently fully inform Owner of all such action taken. The Contractor shall also carefully review all shop drawings and then forward the same to the Architect/Engineer for review and actions. The Architect/Engineer will transmit them back to the Contractor, who will then issue the shop drawings to the affected Subcontractor for fabrication or revision. The Contractor shall maintain a suspense control system to promote expeditious handling. The Contractor shall request the Architect/Engineer to make interpretations of the drawings or specifications requested of him by the Subcontractors and shall maintain a

business system to promote timely response. The Contractor shall inform the Architect/Engineer which shop drawings or requests for clarification have the greatest urgency, to enable the Architect/Engineer to prioritize requests coming from the Contractor. The Contractor shall advise the Owner and Architect/Engineer when timely response is not occurring on any of the above.

CC. Job Requirements.

(1) The Contractor shall provide each of the following as a part of its services hereunder:

(a) Maintain a log of daily activities, including manpower records, equipment on site, weather, delays, major decisions, etc;

(b) Maintain a roster of companies on the Project with names and telephone numbers of key personnel;

(c) Establish and enforce job rules governing parking, clean-up, use of facilities, and worker discipline;

(d) Provide labor relations management and equal opportunity employment for a harmonious, productive Project;

(e) Provide and administer a safety program for the Project and monitor for subcontractor compliance without relieving them of responsibilities to perform Work in accordance with best acceptable practice;

(f) Provide a quality control program as provided under Section 2.4.C above;

(g) Provide miscellaneous office supplies that support the construction efforts which are consumed by its own forces;

(h) Provide for travel to and from its home office to the Project Site and to those other places within Manatee County as required by the Project;

(i) Verify that tests, equipment, and system start-ups and operating and maintenance instructions are conducted as required and in the presence of the required personnel and provide adequate records of same to the Architect/Engineer;

(j) Maintain at the job site orderly files for correspondence, reports of job conferences, shop drawings and sample submissions, reproductions of original Contract Documents including all addenda, change orders, field orders, additional drawings issued after execution of the Agreement, Owner/Architect/Engineer's clarifications and interpretations of the Contract Documents, progress reports, as-built drawings, and other project related documents;

(k) Keep a diary or log book, recording hours on the job site, weather conditions, data relative to questions of extras or deductions; list of visiting officials and representatives or manufacturers, fabricators, suppliers and distributors; daily activities, decisions, observations in general and specific observations in more detail as in the case of observing test procedures, and provide copies of same to Owner/Architect/Engineer;

(l) Record names, addresses and telephone numbers of all Contractors, Subcontractors and major suppliers of materials and equipment;

(m) Furnish Owner/Architect/Engineer periodic reports, as required, of progress of the Work and Contractor's compliance with the approved progress schedule and schedule of shop drawing submissions;

(n) Consult with Owner/Architect/Engineer in advance of scheduling major tests, inspections or start of important phases of the Work;

(o) Verify, during the course of the Work, that certificates, maintenance and operations manuals and other data required to be assembled and furnished are applicable to the items actually installed, and deliver same to Owner/Architect/Engineer for review prior to final Acceptance of the Work; and

(p) Cooperate with Owner in the administration of grants.

(2) The Contractor shall provide personnel and equipment, or shall arrange for separate Subcontractors to provide each of the following as a Project Cost:

a. Services of independent testing laboratories, and provide the necessary testing of materials to ensure conformance to contract requirements; and

b. Printing and distribution of all required bidding documents and shop drawings, including the sets required by Permitting Authority inspectors.

DD. As-Built Drawings. The Contractor shall continuously review as-built drawings and mark up progress prints to provide as much accuracy as possible. Prior to, and as a requirement for authorizing final payment to the Contractor due hereunder, the Contractor shall provide to the Owner an original set of marked-up, as-built Project Plans and Specifications and an electronic format of those records showing the location and dimensions of the Project as constructed, which documents shall be certified as being correct by the Contractor and the Architect/Engineer. Final as-built drawings shall be signed and sealed by a registered Florida surveyor.

EE. Progress Reports. The Contractor shall forward to the Owner, as soon as practicable after the first day of each month, a summary report of the progress of the various parts of the Work, to include those parts of the Work in fabrication and in the field, stating the existing status, estimated time of completion and cause of delay, if any. Together with the summary report, the Contractor shall

submit any necessary revisions to the original schedule for the Owner's review and approval. In addition, more detailed schedules may be required by the Owner for daily traffic control.

FF. Contractor's Warranty. The Contractor warrants to the Owner and Architect/Engineer that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements will be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect/Engineer, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

(1) Contractor shall use its best efforts and due diligence to ensure that during the warranty period, those entities or individuals who have provided direct warranties to the Owner as required by the Contract Documents perform all required warranty Work in a timely manner and at the sole cost and expense of such warranty providers. Any such cost or expense not paid by the warranty providers shall be paid by the Contractor, to include any costs and attorney's fees incurred in warranty-related litigation between Contractor and any Subcontractors.

(2) The Contractor shall secure guarantees and warranties of Subcontractors, equipment suppliers and materialmen, and assemble and deliver same to the Owner in a manner that will facilitate their maximum enforcement and assure their meaningful implementation. The Contractor shall collect and deliver to the Owner any specific written guaranties or warranties given by others as required by subcontracts.

(3) At the Owner's request, the Contractor shall conduct, jointly with the Owner and the Architect/Engineer, no more than two (2) warranty inspections within three (3) years after the Substantial Completion Date.

GG. Apprentices. If Contractor employs apprentices, their performance of Work shall be governed by and shall comply with the provisions of Chapter 446, Florida Statutes.

HH. Schedule of Values. Unit prices shall be established for this Agreement by the submission of a schedule of values within ten (10) days of receipt of the Notice to Proceed. The schedule shall include quantities and prices of items equaling the Contract Sum and will subdivide the Work into components in sufficient detail to serve as the basis for progress payments during construction. Such prices shall include an appropriate amount of overhead and profit applicable to each

item of Work. Upon request of the County, the Contractor shall support the values with data which will substantiate their correctness.

II. Other Contracts. The Owner reserves the right to let other contracts in connection with this Work. The Contractor shall afford other contractors reasonable opportunity for the introduction and storage of their materials and execution of their work, and promptly connect and coordinate the Work with theirs.

ARTICLE III, COMPENSATION

3.1 Compensation

The Contract Sum constitutes the total compensation (subject to authorized adjustments) payable to Contractor for performing the Work. All duties, responsibilities and obligations assigned to or undertaken by Contractor shall be at Contractor's expense without change in the Contract Sum.

A. Adjustments. The Contract Sum may only be changed by Change Order or by a written amendment. Any claim for an increase or decrease in the Contract Sum shall be based on written notice delivered by the party making the claim to the other party. Notice of the amount of the claim with supporting data shall be delivered within fifteen (15) days from the beginning of such occurrence and shall be accompanied by claimant's written statement that the amount claimed covers all amounts to which the claimant is entitled as a result of the occurrence of said event. Failure to deliver a claim within the requisite 15-day period shall constitute a waiver of the right to pursue said claim.

B. Valuation. The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Sum shall be determined in one of the following ways (at Owner's discretion):

(1) In the case of Unit Price Work, in accordance with Section 3.1.C, below; or

(2) By mutual acceptance of a lump sum; or

(3) On the basis of the cost of the Work, plus a negotiated Contractor's fee for overhead and profit. Contractor shall submit an itemized cost breakdown together with supporting data.

C. Unit Price Work. The unit price of an item of Unit Price Work shall be subject to re-evaluation and adjustment pursuant to a requested Change Order under the following conditions:

(1) If the total cost of a particular item of Unit Price Work amounts to 5% or more of the Contract Sum and the variation in the quantity of the particular item of Unit Price Work performed by Contractor differs by more than 15% from the estimated quantity of such item indicated in the Agreement; and

(2) If there is no corresponding adjustment with respect to any other item of Work; and

i. If Contractor believes that it has incurred additional expense as a result thereof; or

ii. If Owner believes that the quantity variation entitles it to an adjustment in the unit price; or

iii. If the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

3.2 Schedule of Compensation

All payments for services and material under the Contract Documents shall be made in accordance with the following provisions.

A. Periodic Payments for Services. The Contractor shall be entitled to receive payment for Construction Services rendered pursuant to Section 2.4 in periodic payments which shall reflect a fair apportionment of cost and schedule of values of services furnished prior to payment, subject to the provisions of this Section.

B. Payment for Materials and Equipment. In addition to the periodic payments authorized hereunder, payments may be made for material and equipment not incorporated in the Work but delivered and suitably stored at the Project Site, or another location, subject to prior approval and acceptance by the Owner on each occasion.

C. Credit toward Contract Sum. All payments for Construction Services made hereunder shall be credited toward the payment of the Contract Sum as Contractor's sole compensation for the construction of the Project.

3.3 Invoice and Payment.

All payments for services and materials under the Contract Documents shall be invoiced and paid in accordance with the following provisions.

A. Invoices. The Contractor shall submit to the Owner periodic invoices for payment, in a form acceptable to the Owner, which shall include a sworn statement certifying that, to the best of the Contractor's knowledge, information and belief, the construction has progressed to the point indicated, the quality and the Work covered by the invoice is in accord with the Project Plans and Specifications, and the Contractor is entitled to payment in the amount requested, along with the cost reports required pursuant to Article II, showing in detail all monies paid out, Project Costs accumulated, or Project Cost incurred during the previous period. This data shall be attached to the invoice.

B. Additional Information; Processing of Invoices. Should an invoiced amount appear to exceed the Work effort believed to be completed, the Owner may, prior to processing of the invoice for payment, require the Contractor to submit

satisfactory evidence to support the invoice. All progress reports and invoices shall be delivered to the attention of the Owner's Project Representative. Invoices not properly prepared (mathematical errors, billing not reflecting actual Work done, no signature, etc.) shall be returned to the Contractor for correction.

C. Architect/Engineer's Approval. Payment for Work completed shall be subject to the Architect/Engineer approving the payment requested by the Contractor and certifying the amount thereof that has been properly incurred and is then due and payable to the Contractor, and identifying with specificity any amount that has not been properly incurred and that should not be paid.

D. Warrants of Contractor with Respect to Payments. The Contractor warrants that (1) upon payment of any retainage, materials and equipment covered by a partial payment request will pass to Owner either by incorporation in construction or upon receipt of payment by the Contractor, whichever occurs first; (2) Work, materials and equipment covered by previous partial payment requests shall be free and clear of liens, claims, security interests, or encumbrances; and (3) no Work, materials or equipment covered by a partial payment request which has been acquired by the Contractor or any other person performing Work at the Project Site, or furnishing materials or equipment for the Project, shall be subject to an agreement under which an interest therein or an encumbrance thereon is retained by the seller or otherwise imposed by the Contractor or any other person.

E. All Compensation Included. Contractor's compensation includes full payment for services set forth in the Contract Documents, including but not limited to overhead, profit, salaries or other compensation of Contractor's officers, partners and/or employees, general operating expenses incurred by Contractor and relating to this Project, including the cost of management, supervision and data processing staff, job office equipment and supplies, and other similar items.

ARTICLE IV, SUBCONTRACTORS

4.1 Subcontracts

At the Owner's request, the Contractor shall provide Owner's Project Representative with copies of all proposed and final subcontracts, including the general and supplementary conditions thereof.

A. Subcontracts Generally. All subcontracts shall: (i) require each Subcontractor to be bound to Contractor to the same extent Contractor is bound to Owner by the terms of the Contract Documents, as those terms may apply to the portion of the Work to be performed by the Subcontractor, (ii) provide for the assignment of the subcontracts from Contractor to Owner at the election of Owner, upon termination of Contractor, (iii) provide that Owner will be an additional indemnified party of the subcontract, (iv) provide that Owner will be an additional insured on all insurance policies required to be provided by the Subcontractor, except workers' compensation, (v) assign all warranties directly to Owner, and (vi) identify Owner as an intended third-party beneficiary of the subcontract.

(1) A Subcontractor is a person or entity who has a direct contract with Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a separate contractor or subcontractors of a separate contractor.

(2) A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

B. No Damages for Delay. Except when otherwise expressly agreed to by Owner in writing, all subcontracts shall provide:

"LIMITATION OF REMEDIES – NO DAMAGES FOR DELAY. The Subcontractor's exclusive remedy for delays in the performance of the contract caused by events beyond its control, including delays claimed to be caused by the Owner or Architect/Engineer or attributable to the Owner or Architect/Engineer and including claims based on breach of contract or negligence, shall be an extension of its contract time and shall in no way involve any monetary claim."

Each subcontract shall require that any claims by the Subcontractor for delay must be submitted to the Contractor within the time and in the manner in which the Contractor must submit such claims to the Owner, and that failure to comply with the conditions for giving notice and submitting claims shall result in the waiver of such claims.

C. Subcontractual Relations. The Contractor shall require each Subcontractor to assume all the obligations and responsibilities which the Contractor owes the Owner pursuant to the Contract Documents, by the parties to the extent of the Work to be performed by the Subcontractor. Said obligations shall be made in writing and shall preserve and protect the rights of the Owner and Architect/Engineer, with respect to the Work to be performed by the Subcontractor, so that the subcontracting thereof will not prejudice such rights. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with its sub-subcontractors.

D. Insurance; Acts and Omissions. Insurance requirements for Subcontractors shall be no more stringent than those requirements imposed on the Contractor by the Owner. The Contractor shall be responsible to the Owner for the acts and omissions of its employees, agents, Subcontractors, their agents and employees, and all other persons performing any of the Work or supplying materials under a contract to the Contractor.

4.2 Relationship and Responsibilities

Except as specifically set forth herein with respect to direct materials acquisitions by Owner, nothing contained in the Contract Documents or in any Contract Document does or shall create any contractual relation between the Owner or Architect/Engineer and any Subcontractor. Specifically, the Contractor is not acting as an agent of the Owner with respect to any Subcontractor. The utilization of any Subcontractor shall not relieve Contractor from any liability or responsibility to Owner, or obligate Owner to the payment of any compensation to the Subcontractor or additional compensation to the Contractor.

4.3 Payments to Subcontractors; Monthly Statements

The Contractor shall be responsible for paying all Subcontractors from the payments made by the Owner to Contractor pursuant to Article III, subject to the following provisions:

A. Payment. The Contractor shall, no later than ten (10) days after receipt of payment from the Owner, out of the amount paid to the Contractor on account of such Subcontractor's Work, pay to each Subcontractor the amount to which the Subcontractor is entitled in accordance with the terms of the Contractor's contract with such Subcontractor. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to sub-Subcontractors in a similar manner. After receipt of payment from Owner, if the need should arise to withhold payments to Subcontractors for any reason, as solely determined by Contractor, the Contractor shall promptly restore such monies to the Owner, adjusting subsequent pay requests and Project bookkeeping as required.

B. Final Payment of Subcontractors. The final payment of retainage to Subcontractors shall not be made until the Project has been inspected by the Architect/Engineer or other person designated by the Owner for that purpose, and until both the Architect/Engineer and the Contractor have issued a written certificate that the Project has been constructed in accordance with the Project Plans and Specifications and approved Change Orders. Before issuance of final payment to any Subcontractor without any retainage, the Subcontractor shall submit satisfactory evidence that all payrolls, material bills, and other indebtedness connected with the Project have been paid or otherwise satisfied, warranty information is complete, as-built markups have been submitted, and instruction for the Owner's operating and maintenance personnel is complete. Final payment may be made to certain select Subcontractors whose Work is satisfactorily completed prior to the completion of the Project, but only upon approval of the Owner's Project Representative.

4.4 Responsibility for Subcontractors

As provided in Section 2.4.BB, Contractor shall be fully responsible to Owner for all acts and omissions of the Subcontractors, suppliers and other persons and organizations performing or furnishing any of the Work under a direct or indirect Contract with Contractor just as Contractor is responsible for Contractor's own acts and omissions.

4.5 Contingent Assignment of Subcontracts

Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that:

(1) Assignment is effective only after termination of the Contract by the Owner for cause pursuant to Article XIV and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor in writing; and

(2) Assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Agreement.

When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract. Upon such assignment, if the Work has been suspended for more than thirty (30) days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension. Upon such assignment to the Owner, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE V, CHANGES IN WORK

5.1 General

Changes in the Work may be accomplished after execution of the Agreement, and without invalidating the Agreement, by Change Order, Work Directive Change or order for a minor change in the Work, subject to the limitations stated in this Article V and elsewhere in the Contract Documents. A Change Order shall be based upon agreement among the Owner, Contractor and Architect/Engineer; a Work Directive Change requires agreement by the Owner and Architect/Engineer and may or may not be agreed to by the Contractor; an order for a minor change in the Work may be issued by the Architect/Engineer alone. Changes in the Work shall be performed under applicable provisions of the Contract Documents, and the Contractor shall proceed promptly, unless otherwise provided in the Change Order, Work Directive Change or order for a minor change in the Work.

5.2 Minor Changes in the Work

The Owner or Architect/Engineer shall have authority to order minor changes in the Work not involving adjustment in the Contract Sum or extension of the Contract Time and not inconsistent with the intent of the Contract Documents. Such change will be effected by written order signed by the Architect/Engineer and shall be binding on the Owner and Contractor. The Contractor shall abide by and perform such minor changes. Such changes shall be effected by a Field Directive or a Work Directive Change. Documentation of changes shall be determined by the Construction Team, and displayed monthly in the Progress Reports. Because such changes shall not affect the Contract Sum to be paid to the Contractor, they shall not require a Change Order pursuant to Section 5.6.

5.3 Emergencies

In any emergency affecting the safety of persons or property, the Contractor shall act at its discretion to prevent threatened damage, injury, or loss. Any increase in the Contract Sum or extension of time claimed by the Contractor because of emergency Work shall be determined as provided in Section 5.6. However, whenever practicable, the Contractor shall obtain verbal concurrence of the Owner's Project Representative and Architect/Engineer where the act will or may affect the Contract Sum or Contract Time.

5.4 Concealed Conditions

If the Contractor encounters conditions at the site that are (i) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (ii) unknown physical conditions of an unusual nature, that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect/Engineer before conditions are disturbed and in no event later than ten (10) days after first observance of the conditions. The Architect/Engineer will promptly investigate such conditions and, if the Architect/Engineer determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend an equitable adjustment in the Contract Sum or Contract Time, or both. If the Architect/Engineer determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect/Engineer shall promptly notify the Owner and Contractor in writing, stating the reasons. If the Contractor disputes the Architect/Engineer's determination or recommendation, the Contractor may proceed as provided in Article VIII. If the Owner disputes the Architect/Engineer's determination or recommendation, the Owner may appeal directly to the Purchasing Official and shall thereafter follow the process set forth in Section 8.5.

5.5 Hazardous Materials

In the event the Contractor encounters on the Project Site material reasonably believed to be hazardous, petroleum or petroleum related products, or other hazardous or toxic substances, except as provided in Section 2.4.U, the Contractor shall immediately stop Work in the area affected and report the condition to the Owner and the Architect/Engineer in writing. The Work in the affected area shall not thereafter be resumed except by Change Order or written amendment, if in fact the material or substance has not been rendered harmless. The Work in the affected area shall be resumed when the Project Site has been rendered harmless, in accordance with the final determination by the Architect/Engineer or other appropriate professional employed by Owner. The Contractor shall not be required to perform without its consent any Work relating to hazardous materials, petroleum or petroleum related products, or other hazardous or toxic substances. In the event the Contractor encounters on the Project Site materials believed in good faith to be hazardous or contaminated material, and the presence of such hazardous or contaminated material was not known and planned for at the time the Contractor submitted its Bid (or Guaranteed Maximum Price proposal), and it is necessary for the Contractor to stop Work in the area affected and delays Work for more than a seven (7) day period, adjustments to the Contract Sum and/or Contract Time shall be made in accordance with this Article V.

5.6 Change Orders; Adjustments to Contract Sum

A. Change Orders Generally

The increase or decrease in the Contract Sum resulting from a change authorized pursuant to the Contract Documents shall be determined:

(1) By mutual acceptance of a lump sum amount properly itemized and supported by sufficient substantiating data, to permit evaluation by the Architect/Engineer and Owner; or

(2) By unit prices stated in the Agreement or subsequently agreed upon; or

(3) By any other method mutually agreeable to Owner and Contractor.

If Owner and Contractor are unable to agree upon increases or decreases in the Contract Sum and the Architect/Engineer certifies that the work needs to be commenced prior to any such agreement, the Contractor, provided it receives a written Change Order signed by or on behalf of the Owner, shall promptly proceed with the Work involved. The cost of such Work shall then be determined on the basis of the reasonable expenditures of those performing the Work attributed to the change. However, in the event a Change Order is issued under these conditions, the Owner, through the Architect/Engineer, will establish an estimated cost of the Work and the Contractor shall not perform any Work whose cost exceeds that estimated without prior written approval by the Owner. In such case, the Contractor shall keep and present in such form as the Owner may prescribe an itemized accounting, together with appropriate supporting data of the increase in overall costs of the Project. The amount of any decrease in the Contract Sum to be allowed by the Contractor to the Owner for any deletion or change which results in a net decrease in costs will be the amount of the actual net decrease.

5.7 Owner-Initiated Changes

Without invalidating the Agreement and without notice to any Surety, Owner may, at any time, order additions, deletions or revisions in the Work. These will be authorized by a written amendment, a Field Directive, a Change Order, or a Work Directive Change, as the case may be. Upon receipt of any such document, Contractor shall promptly proceed with the Work involved which will be performed under the applicable conditions of the Contract Documents (except as otherwise specifically provided). A Work Directive Change may not change the Contract Sum or the Contract Time; but is evidence that the parties expect that the change directed or documented by a Work Directive Change will be incorporated in a subsequently issued Change Order following negotiations by the parties as to its effect, if any, on the Contract Sum or Contract Time.

5.8 Unauthorized Work

Contractor shall not be entitled to an increase in the Contract Sum or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents.

5.9 Defective Work

Owner and Contractor shall execute appropriate Change Orders (or written amendments) covering changes in the Work which are ordered by Owner, or which may be required because of acceptance of defective Work, without adjustment to the Contract Sum.

5.10 Estimates for Changes

At any time Architect/Engineer may request a quotation from Contractor for a proposed change in the Work. Within twenty-one (21) calendar days after receipt, Contractor shall submit a written and detailed proposal for an increase or decrease in the Contract Sum or Contract Time for the proposed change. Architect/Engineer shall have twenty-one (21) calendar days after receipt of the detailed proposal to respond in writing. The proposal shall include an itemized estimate of all costs and time for performance that will result directly or indirectly from the proposed change. Unless otherwise directed, itemized estimates shall be in sufficient detail to reasonably permit an analysis by Architect/Engineer of all material, labor, equipment, subcontracts, overhead costs and fees, and shall cover all Work involved in the change, whether such Work was deleted, added, changed or impacted. Notwithstanding the request for quotation, Contractor shall carry on the Work and maintain the progress schedule. Delays in the submittal of the written and detailed proposal will be considered non-prejudicial.

5.11 Form of Proposed Changes

The form of all submittals, notices, Change Orders and other documents permitted or required to be used or transmitted under the Contract Documents shall be determined by the Owner. Standard Owner forms shall be utilized.

5.12. Changes to Contract Time

The Contract Time may only be changed pursuant to a Change Order or a written amendment to the Contract Documents. Any claim for an extension or shortening of the Contract Time shall be based on written notice delivered by the party making the claim to the other party. Notice of the extent of the claim with supporting data shall be delivered within fifteen (15) days from detection or beginning of such occurrence and shall be accompanied by the claimant's written statement that the adjustment claimed is the entire adjustment to which the claimant has reason to believe it is entitled to because of the occurrence of said event. The Contract time will be extended in an amount equal to time lost due to delays beyond the control of Contractor. Such delays shall include, but not be limited to, acts or neglect by Owner or others performing additional Work; or to fires, floods, epidemics, abnormal weather conditions or acts of God. Failure to deliver a written notice of claim within the requisite 15-day period shall constitute a waiver of the right to pursue said claim.

ARTICLE VI, ROLE OF ARCHITECT/ENGINEER

6.1 General

A. Retaining. The Owner shall retain an Architect/Engineer (whether an individual or an entity) lawfully licensed to practice in Florida. That person or entity is

identified as the Architect/Engineer in the Agreement and is referred to throughout the Contract Documents as if singular in number.

B. Duties. Duties, responsibilities and limitations of authority of the Architect/Engineer as set forth in the Contract Documents shall not be restricted, modified or extended without written consent of the Owner and Architect/Engineer. Consent shall not be unreasonably withheld.

C. Termination. If the employment of the Architect/Engineer is terminated, the Owner shall employ a successor Architect/Engineer as to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect/Engineer.

6.2 Administration

The Architect/Engineer will provide administration of the Agreement as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect/Engineer approves the final Application for Payment. The Architect/Engineer will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

A. Site Visits. The Architect/Engineer will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work complete, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. Unless specifically instructed by Owner, the Architect/Engineer will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect/Engineer will not have control over, charge of, or responsibility for, the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents

B. Reporting. Based on the site visits, the Architect/Engineer will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and report to the Owner (i) known deviations from the Contract Documents and from the most recent construction schedule submitted by the Contractor, and (ii) defects and deficiencies observed in the Work. The Architect/Engineer will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect/Engineer will not have control over or charge of and will not be responsible for acts or omissions of the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

6.3 Interpretation of Project Plans and Specifications

The Architect/Engineer will be the interpreter of the requirements of the Project Plans and Specifications. Upon receipt of comments or objections by Contractor or Owner,

the Architect/Engineer will make decisions on all claims, disputes, or other matters pertaining to the interpretation of the Project Plans and Specifications.

6.4 Rejection of Non-Conforming Work

Upon consultation with Owner, the Architect/Engineer shall have the authority to reject Work which does not conform to the Project Plans and Specifications.

6.5 Correction of Work

The Contractor shall promptly correct all Work rejected by the Architect/Engineer for being defective or as failing to conform to the Project Plans and Specifications, whether observed before or after the Substantial Completion Date and whether or not fabricated, installed, or completed. The Contractor shall bear all costs of correcting such rejected Work, including compensation for Architect/Engineer's additional services made necessary thereby.

6.6 Timely Performance of Architect/Engineer

The Contractor shall identify which requests for information or response from the Architect/Engineer have the greatest urgency and those items which require prioritizing in response by the Architect/Engineer. The Contractor shall also identify the preferred time period for response and shall request a response time which is reasonably and demonstrably related to the needs of the Project and Contractor. If Architect/Engineer claims that Contractor's expectations for a response are unreasonable, Owner shall require Architect/Engineer to communicate such claim to Contractor in writing together with the specific time necessary to respond and the date upon which such response will be made. If Contractor believes that Architect/Engineer is not providing timely services or responses, Contractor shall notify Owner of same in writing not less than two (2) weeks before Contractor believes performance or response time from Architect/Engineer is required without risk of delaying the Project.

ARTICLE VII, OWNER'S RIGHTS AND RESPONSIBILITIES

7.1 Project Site; Title

The Owner shall provide the lands upon which the Work under the Contract Documents is to be done, except that the Contractor shall provide all necessary additional land required for the erection of temporary construction facilities and storage of his materials, together with right of access to same. The Owner hereby represents to the Contractor that it currently has and will maintain up through and including the Substantial Completion Date, good title to all of the real property constituting the Project Site. Owner agrees to resolve, at its expense, any disputes relating to the ownership and use of the Project Site which might arise during construction.

7.2 Project Plans and Specifications; Architect/Engineer

The parties hereto acknowledge and agree that Owner has previously entered into an agreement with Architect/Engineer. Pursuant to the terms of such agreement, the Architect/Engineer, as an agent and representative of Owner, is responsible for the preparation of Project Plans and Specifications which consist of drawings, specifications, and other documents setting forth in detail the requirements for the

construction of the Project. All such Project Plans and Specifications shall be provided either by Owner or the Architect/Engineer, and Contractor shall be under no obligation to provide same and shall be entitled to rely upon the accuracy and completeness of the Project Plans and Specifications provided by the Architect/Engineer and all preliminary drawings prepared in connection therewith. The Contractor will be furnished a reproducible set of all drawings and specifications reasonably necessary for the performance of Contractor's services hereunder and otherwise ready for printing. The Contractor shall be notified of any written modification in the agreement between Owner and Architect/Engineer.

7.3 Surveys; Soil Tests and Other Project Site Information

Owner shall be responsible for providing a legal description and certified land survey of the Project Site in a form and content and with such specificity as may be required by the Architect/Engineer and Contractor to perform their services. To the extent deemed necessary by Owner and Architect/Engineer, and solely at Owner's expense, Owner may engage the services of a geotechnical consultant to perform test borings and other underground soils testing as may be deemed necessary by the Architect/Engineer or the Contractor. Contractor shall not be obligated to provide such surveys or soil tests and shall be entitled to rely upon the accuracy and completeness of the information provided; subject, however, to the provisions of Section 2.4.S hereof. Owner shall provide Contractor, as soon as reasonably possible following the execution of the Contract Documents, all surveys or other survey information in its possession describing the physical characteristics of the Project Site, together with soils reports, subsurface investigations, utility locations, deed restrictions, easements, and legal descriptions then in its possession or control. Upon receipt of all surveys, soils tests, and other Project Site information, Contractor shall promptly advise Owner of any inadequacies in such information and of the need for any additional surveys, soils or subsoil tests. In performing this Work, Contractor shall use the standard of care of experienced contractors and will use its best efforts timely to identify all problems or omissions. Owner shall not be responsible for any delay or damages to the Contractor for any visible or disclosed site conditions or disclosed deficiencies in the Project Site which should have been identified by Contractor and corrected by Owner prior to the execution of the Contract Documents.

7.4 Information; Communication; Coordination

The Owner's Project Representative shall examine any documents or requests for information submitted by the Contractor and shall advise Contractor of Owner's decisions pertaining thereto within a reasonable period of time to avoid unreasonable delay in the progress of the Contractor's services. Contractor shall indicate if any such documents or requests warrant priority consideration. However, decisions pertaining to approval of the Project Schedule as it relates to the date of Substantial Completion, the Project Cost, Contractor's compensation, approving or changing the Contract Sum shall only be effective when approved by Owner in the form of a written Change Order or amendment to the Contract Documents. Owner reserves the right to designate a different Owner's Project Representative provided Contractor is notified in writing of any such change. Owner and Architect/Engineer may communicate with Subcontractors, materialmen, laborers, or suppliers engaged to perform services on the Project, but only for informational purposes. Neither the Owner nor the Architect/Engineer shall attempt

to direct the Work of or otherwise interfere with any Subcontractor, materialman, laborer, or supplier, or otherwise interfere with the Work of the Contractor. Owner shall furnish the data required of Owner under the Contract Documents promptly.

7.5 Governmental Body

The Contractor recognizes that the Owner is a governmental body with certain procedural requirements to be satisfied. The Contractor has and will make reasonable allowance in its performance of services for such additional time as may be required for approvals and decisions by the Owner and any other necessary government agency.

7.6 Pre-Completion Acceptance

The Owner shall have the right to take possession of and use any completed portions of the Work, although the time for completing the entire Work or such portions may not have expired, but such taking possession and use shall not be deemed an acceptance of any Work not completed in accordance with the Contract Documents.

7.7 Ownership and Use of Drawings, Specifications and Other Instruments of Service

A. The Architect/Engineer and the Architect/Engineer's consultants shall be deemed the authors and owners of their respective instruments of service, including the Project Plans and Specifications, and will retain all common law, statutory and other reserved rights, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers shall not own or claim a copyright in the instruments of service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with this Project is not to be constructed as publication in derogation of the Architect/Engineer's or Architect/Engineer's consultants' reserved rights.

B. The Contractor, Subcontractors, Sub-subcontractors and material or equipment suppliers are authorized to use and reproduce the drawings and specifications provided to them solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Project Plans and Specifications or other instruments of service. The Contractor, Subcontractors, Sub-subcontractors, and material or equipment suppliers may not use the drawings or specifications on other projects or for additions to this Project outside the scope of the Work without the specific written consent of the Owner, Architect/Engineer and the Architect/Engineer's consultants.

7.8 Owner's Project Representative

Owner's Project Representative is Owner's Agent, who will act as directed by and under the supervision of the Owner, and who will confer with Owner/Architect/Engineer regarding his actions. The Owner's Project Representative's dealings in matters pertaining to the on-site Work shall, in general, be only with the Owner/Architect/Engineer and Contractor and dealings with Subcontractors shall only be through or with the full knowledge of Contractor.

A. Responsibilities. Except as otherwise instructed in writing by Owner, the Owner's Project Representative will:

(1) Attend preconstruction conferences; arrange a schedule of progress meetings and other job conferences as required in consultation with Owner/Architect/Engineer and notify those expected to attend in advance; and attend meetings and maintain and circulate copies of minutes thereof;

(2) Serve as Owner/Architect/Engineer's liaison with Contractor, working principally through Contractor's superintendent, to assist in understanding the intent of the Contract Documents. As requested by Owner/Architect/Engineer, assist in obtaining additional details or information when required at the job site for proper execution of the Work;

(3) Report to Owner/Architect/Engineer whenever he believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents;

(4) Accompany visiting inspectors representing public or other agencies having jurisdiction over the project; record the outcome of these inspections and report to Owner/Architect/Engineer;

(5) Review applications for payment with Contractor for compliance with the established procedure for their submission and forward them with recommendations to Owner/Architect/Engineer; and

(6) Perform those duties as set forth elsewhere within the Contract Documents.

B. Limitations. Except upon written instructions of Owner, Owner's Project Representative shall not:

(1) Authorize any deviation from the Contract Documents or approve any substitute materials or equipment;

(2) Exceed limitations on Owner/Architect/Engineer's authority as set forth in the Contract Documents;

(3) Undertake any of the responsibilities of Contractor, Subcontractors or Contractor's superintendent, or expedite the Work;

(4) Advise on or issue directions relative to any aspect of the means, methods, techniques, sequences or procedures of construction unless such is specifically called for in the Contract Documents;

(5) Advise on or issue directions as to safety precautions and programs in connection with the Work;

(6) Authorize Owner to occupy the project in whole or in part; or

(7) Participate in specialized field or laboratory tests.

ARTICLE VIII, RESOLUTION OF DISAGREEMENTS; CLAIMS FOR COMPENSATION

8.1 Owner to Decide Disputes

The Owner shall reasonably decide all questions and disputes (with the exception of matters pertaining to the interpretation of the Project Plans and Specifications which shall be resolved by the Architect/Engineer pursuant to Section 6.3) that may arise in the execution and fulfillment of the services provided for under the Contract Documents, in accordance with the Procurement Ordinance.

8.2 Finality

The decision of the Owner upon all claims, questions, disputes and conflicts shall be final and conclusive, and shall be binding upon all parties to the Contract Documents, subject to judicial review as provided in Section 8.5 below.

8.3 No Damages for Delay

If at any time Contractor is delayed in the performance of Contractor's responsibilities under the Contract Documents as the result of a default or failure to perform in a timely manner by Owner or Owner's agents or employees, Contractor shall not be entitled to any damages except for compensation specifically authorized in Article III. Contractor's sole remedy will be a right to extend the time for performance. Nothing herein shall preclude Contractor from any available remedy against any responsible party other than Owner. Contractor shall be responsible for liquidated damages for delay if otherwise provided for in the Contract Documents.

8.4 Permitted Claims Procedure

Where authorized or permitted under the Contract Documents, all claims for additional compensation by Contractor, extensions of time affecting the Substantial Completion Date, for payment by the Owner of costs, damages or losses due to casualty, Force Majeure, Project Site conditions or otherwise, shall be governed by the following:

(1) All claims must be submitted as a request for Change Order in the manner as provided in Article V.

(2) The Contractor must submit a notice of claim to Owner's Project Representative and to the Architect/Engineer within fifteen (15) days of when the Contractor was or should have been aware of the fact that an occurrence was likely to cause delay or increased costs. Failure to submit a claim within the requisite 15-day period shall constitute a waiver of the right to pursue said claim.

(3) Within twenty (20) days of submitting its notice of claim, the Contractor shall submit to the Owner's Project Representative its request for Change Order, which shall include a written statement of all details of the claim, including a description of the Work affected.

(4) After receipt of a request for Change Order, the Owner's Project Representative, in consultation with the Architect/Engineer, shall deliver to the Contractor, within twenty (20) days after receipt of request, its written response to the claim.

(5) In the event the Owner and Contractor are unable to agree on the terms of a Change Order, the Owner shall have the option to instruct the Contractor to proceed with the Work. In that event, the Owner shall pay for those parts of the Work, the scope and price of which are not in dispute. The balance of the disputed items in the order to proceed will be resolved after completion of the Work, based upon completed actual cost.

(6) The rendering of a decision by Owner with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment) will be a condition precedent to any exercise by Owner or Contractor of such right or remedies as either may otherwise have under the Contract Documents or by laws or regulations in respect of any such claim, dispute or other matter.

8.5 Contract Claims and Disputes

After completion of the process set forth in Section 8.4 above, any unresolved dispute under this Agreement shall be decided by the Purchasing Official in accordance with Section 2-26-63 of the Manatee County Code of Laws, subject to an administrative hearing process as provided in Section 2-26-64. The decision of the Board of County Commissioners in accordance with Section 2-26-64 of the Manatee County Code of Laws shall be the final and conclusive County decision subject to exclusive judicial review in circuit court by a petition for certiorari.

8.6 Claims for Consequential Damages

The Contractor and Owner waive claims against each other for consequential damages arising out of or relating to this Agreement. This mutual waiver includes:

(1) Damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons, unless any of such damages or losses are covered by insurance placed by the Contractor; and

(2) Damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article XIV. Nothing contained in this Section 8.6 shall be deemed to preclude assessment of liquidated direct damages, when applicable, in accordance with the requirements of the Contract Documents.

ARTICLE IX, INDEMNITY

9.1 Indemnity

A. Indemnification Generally. To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect/Engineer, Architect/Engineer's consultants, and agents and employees of any of them from and against claims, damages, losses and expenses, including but not limited to attorney's fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor or anyone directly or indirectly employed by them or anyone for whose acts they may be liable, regardless of whether such claim, damage, loss or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity which would otherwise exist as to a party or person described in this Section 9.1.

B. Claims by Employees. In claims against any person or entity indemnified under this Section 9.1 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them or anyone for whose acts they may be liable, the indemnification obligation under Section 9.1.A. shall not be limited by a limitation on amount or type of damages, compensation or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts or other employee benefit acts.

9.2 Duty to Defend

The Contractor shall defend the Owner in any action, lawsuit mediation or arbitration arising from the alleged negligence, recklessness or intentionally wrongful conduct of the Contractor and other persons employed or utilized by the Contractor in the performance of the Work. So long as Contractor, through its own counsel, performs its obligation to defend the Owner pursuant to this Section, Contractor shall not be required to pay the Owner's costs associated with the Owner's participation in the defense.

ARTICLE X, ACCOUNTING RECORDS; OWNERSHIP OF DOCUMENTS

10.1 Accounting Records

Records of expenses pertaining to all services performed shall be kept in accordance with generally accepted accounting principles and procedures.

10.2 Inspection and Audit

The Contractor's records shall be open to inspection and subject to examination, audit, and/or reproduction during normal working hours by the Owner's agent or authorized representative to the extent necessary to adequately permit evaluation and verification of any invoices, payments or claims submitted by the Contractor or any of its payees

during the performance of the Work. These records shall include, but not be limited to, accounting records, written policies and procedures, Subcontractor files (including proposals of successful and unsuccessful bidders), original estimates, estimating worksheets, correspondence, Change Order files (including documentation covering negotiated settlements), and any other supporting evidence necessary to substantiate charges related to the Contract Documents. They shall also include, but not be limited to, those records necessary to evaluate and verify direct and indirect costs (including overhead allocations) as they may apply to costs associated with the Contract Documents. For such audits, inspections, examinations and evaluations, the Owner's agent or authorized representative shall have access to said records from the effective date of the Contract Documents, for the duration of Work, and until three (3) years after the date of final payment by the Owner to the Contractor pursuant to the Contract Documents.

10.3 Access

The Owner's agent or authorized representative shall have access to the Contractor's facilities and all necessary records to conduct audits in compliance with this Article. The Owner's agent or authorized representative shall give the Contractor reasonable advance notice of intended inspections, examinations, and/or audits.

10.4 Ownership of Document

Upon obtainment of Substantial Completion or termination of the Agreement, all records, documents, tracings, plans, specifications, maps, evaluations, reports, transcripts and other technical data, other than working papers, prepared or developed by the Contractor shall be delivered to and become the property of the Owner. The Contractor at its own expense may retain copies for its files and internal use.

ARTICLE XI, PUBLIC CONTRACT LAWS

11.1 Equal Opportunity Employment

A. Employment. The Contractor shall not discriminate against any employee or applicant for employment because of race, creed, sex, color, national origin, disability or age, and will take affirmative action to ensure that all employees and applicants are afforded equal employment opportunities without discrimination because of race, creed, sex, color, national origin, disability or age. Such action will be taken with reference to, but shall not be limited to, recruitment, employment, job assignment, promotion, upgrading, demotion, transfer, layoff or termination, rates of training or retraining, including apprenticeship and on-the-job training.

B. Participation. No person shall, on the grounds of race, creed, sex, color, national origin, disability or age, be excluded from participation in, be denied the proceeds of, or be subject to discrimination in the performance of the Agreement.

11.2 Immigration Reform and Control Act of 1986

Contractor acknowledges that it is responsible for complying with the provisions of the Immigration Reform and Control Act of 1986, located at 8 U.S.C. Section 1324, et seq., and regulations relating thereto. Failure to comply with the above statutory provisions shall be considered a material breach and shall be grounds for immediate termination of this Agreement.

11.3 No Conflict of Interest

The Contractor warrants that it has not employed or retained any company or person, other than a bona fide employee working solely for the Contractor to solicit or secure this Agreement, and that it has not paid or agreed to pay any person, company, corporation, individual, or firm other than a bona fide employee working solely for the Contractor, any fee, commission, percentage, gift or any other consideration, contingent upon or resulting from the award or making of this Agreement.

A. No Interest in Business Activity. By accepting award of this Agreement, the Contractor, which shall include its directors, officers and employees, represents that it presently has no interest in and shall acquire no interest in any business or activity which would conflict in any manner with the performance of services required hereunder, including without limitation as described in the Contractor's own professional ethical requirements. An interest in a business or activity which shall be deemed a conflict includes but is not limited to direct financial interest in any of the material and equipment manufacturers, suppliers, distributors, or contractors who will be eligible to supply material and equipment for the Project for which the Contractor is furnishing its services required hereunder.

B. No Appearance of Conflict. The Contractor shall not knowingly engage in any contractual or professional obligations that create an appearance of a conflict of interest with respect to the services provided pursuant to the Agreement. The Contractor has provided the Affidavit of No Conflict, incorporated into the Contract Documents as Exhibit "C", as a material inducement for Owner entering the Agreement. If, in the sole discretion of the County Administrator or designee, a conflict of interest is deemed to exist or arise during the term of this Agreement, the County Administrator or designee may cancel this Agreement, effective upon the date so stated in a written notice of cancellation, without penalty to the Owner.

11.4 Truth in Negotiations

By execution of the Contract Documents, the Contractor certifies to truth-in-negotiations and that wage rates and other factual unit costs supporting the compensation are accurate, complete and current at the time of contracting. Further, the original Contract Sum and any additions thereto shall be adjusted to exclude any significant sums where the Owner determines the Contract Sum was increased due to inaccurate, incomplete or non-current wage rates and other factual unit costs. Such adjustments must be made within one (1) year after final payment to the Contractor.

11.5 Public Entity Crimes

The Contractor is directed to the Florida Public Entity Crimes Act, Section 287.133, Florida Statutes, specifically section 2(a), and the Owner's requirement that the Contractor comply with it in all respects prior to and during the term of the Agreement.

ARTICLE XII, FORCE MAJEURE, FIRE OR OTHER CASUALTY

12.1 Force Majeure.

A. Unavoidable Delays. Delays in any performance by any party contemplated or required hereunder due to fire, flood, sinkhole, earthquake or hurricane, acts of God, unavailability of materials, equipment or fuel, war, declaration of hostilities, revolt, civil strife, altercation or commotion, strike, labor dispute, or epidemic, archaeological excavation, lack of or failure of transportation facilities, or any law, order, proclamation, regulation, or ordinance of any government or any subdivision thereof, or for any other similar cause to those enumerated, beyond the reasonable control and which with due diligence could not have been reasonably anticipated, shall be deemed to be events of Force Majeure and any such delays shall be excused. In the event such party is delayed in the performance of any Work or obligation pursuant to the Contract Documents for any of the events of Force Majeure stated in this Section 12.1, the date for performance required or contemplated by the Contract Documents shall be extended by the number of calendar days such party is actually delayed.

B. Concurrent Contractor Delays. If a delay is caused for any reason provided in 12.1.A. or because of an extension of time provided by Change Order, and during the same time period a delay is caused by Contractor, the date for performance shall be extended as provided in 12.1.A. but only to the extent the time is or was concurrent.

C. Notice; Mitigation. The party seeking excuse for nonperformance based on Force Majeure shall give written notice to the Owner, if with respect to the Contractor, or to the Contractor if with respect to the Owner, specifying its actual or anticipated duration. Each party seeking excuse from nonperformance based on Force Majeure shall use its best efforts to rectify any condition causing a delay and will cooperate with the other party, except that neither party shall be obligated to incur any unreasonable additional costs and expenses to overcome any loss of time that has resulted.

12.2 Casualty; Actions by Owner and Contractor

During the construction period, if the Project or any part thereof shall have been damaged or destroyed, in whole or in part, the Contractor shall promptly make proof of loss; and Owner and Contractor shall proceed promptly to collect, or cause to be collected, all valid claims which may have arisen against insurers or others based upon such damage or destruction. The Contractor shall diligently assess the damages or destruction and shall prepare an estimate of the cost, expenses, and other charges, including normal and ordinary compensation to the Contractor, necessary for reconstruction of the Project substantially in accordance with the Project Plans and Specifications. Within fifteen (15) days following satisfaction of the express conditions

described in subsections (1), (2) and (3) below, the Contractor covenants and agrees diligently to commence reconstruction and to complete the reconstruction or repair of any loss or damage by fire or other casualty to the Project to substantially the same size, floor area, cubic content, and general appearance as prior to such loss or damage:

(1) Receipt by the Owner or the trustee of the proceeds derived from collection of all valid claims against insurers or others based upon such damage or destruction, and receipt of other sums from any source such that the funds necessary to pay the Project Cost and any additions to the Project Cost necessitated for repair or reconstruction are available;

(2) Written agreement executed by the Contractor and the Owner, by amendment to the Contract Documents or otherwise, authorizing and approving the repair or reconstruction and any additions to the Project Cost necessitated thereby, including any required adjustment to the Contract Sum; and

(3) Final approval by the Owner of the Project Plans and Specifications for such repair or reconstruction and issuance of any required building permit.

12.3 Approval of Plans and Specifications

The Owner agrees to approve the plans and specifications for such reconstruction or repair if the reconstruction or repair contemplated by such plans and specifications is economically feasible, and will restore the Project, or the damaged portion thereof, to substantially the same condition as prior to such loss or damage, and such plans and specifications conform to the applicable laws, ordinances, codes, and regulations. The Owner agrees that all proceeds of any applicable insurance or other proceeds received by the Owner or the Contractor as a result of such loss or damage shall be used for payment of the costs, expenses, and other charges of the reconstruction or repair of the Project.

12.4 Notice of Loss or Damage

The Contractor shall promptly give the Owner written notice of any significant damage or destruction to the Project, defined as loss or damage which it is contemplated by Contractor will increase the Contract Sum or extend the Substantial Completion Date, stating the date on which such damage or destruction occurred, the then expectations of Contractor as to the effect of such damage or destruction on the use of the Project, and the then proposed schedule, if any, for repair or reconstruction of the Project. Loss or damage which the Contractor determines will not affect the Contract Sum or Substantial Completion Date will be reported to Owner and Architect/Engineer immediately, and associated corrective actions will be undertaken without delay.

ARTICLE XIII, REPRESENTATIONS, WARRANTIES AND COVENANTS

13.1 Representations and Warranties of Contractor

The Contractor represents and warrants to the Owner each of the following.

A. The Contractor is a construction company, organized under the laws of the State of , authorized to transact business in the State of Florida, with as the primary qualifying agent. Contractor has all requisite power and authority to carry on its business as now conducted, to own or hold its properties, and to enter into and perform its obligations hereunder and under each instrument to which it is or will be a party, and is in good standing in the State of Florida.

B. Each Contract Document to which the Contractor is or will be a party constitutes, or when entered into will constitute, a legal, valid, and binding obligation of the Contractor enforceable against the Contractor in accordance with the terms thereof, except as such enforceability may be limited by applicable bankruptcy, insolvency, or similar laws from time to time in effect which affect creditors' rights generally and subject to usual equitable principles in the event that equitable remedies are involved.

C. There are no pending or, to the knowledge of the Contractor, threatened actions or proceedings before any court or administrative agency, within or without the State of Florida, against the Contractor or any partner, officer, or agent of the Contractor which question the validity of any document contemplated hereunder, or which are likely in any case, or in the aggregate, to materially adversely affect the consummation of the transactions contemplated hereunder, or materially adversely affect the financial condition of the Contractor.

D. The Contractor has filed or caused to be filed all federal, state, local, or foreign tax returns, if any, which were required to be filed by the Contractor, and has paid, or caused to be paid, all taxes shown to be due and payable on such returns or on any assessments levied against the Contractor.

E. Neither Contractor nor any agent or person employed or retained by Contractor has acted fraudulently or in bad faith or in violation of any statute or law in the procurement of this Agreement.

F. The Contractor shall timely fulfill or cause to be fulfilled all of the terms and conditions expressed herein which are within the control of the Contractor or which are the responsibility of the Contractor to fulfill. The Contractor shall be solely responsible for the means and methods of construction.

G. It is recognized that neither the Architect/Engineer, the Contractor, nor the Owner has control over the cost of labor, materials, or equipment, over a Subcontractor's methods of determining bid prices, or over competitive bidding, market, or negotiating conditions.

H. During the term of the Contract Documents, and the period of time that the obligations of the Contractor under the Contract Documents shall be in effect, the Contractor shall cause to occur and to continue to be in effect those instruments, documents, certificates, and events contemplated by the Contract Documents that are applicable to, and the responsibility of, the Contractor.

I. The Contractor shall assist and cooperate with the Owner and shall accomplish the construction of the Project in accordance with the Contract Documents and the Project Plans and Specifications, and will not knowingly violate any laws, ordinances, rules, regulations, or orders that are or will be applicable thereto.

J. Contractor warrants and guarantees to Owner that all Work will be in accordance with the Contract Documents and will not be defective, and that Owner, representatives of Owner, and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. Contractor shall give Architect/Engineer timely notice of readiness of the Work for all required approvals and shall assume full responsibility, including costs, in obtaining required tests, inspections, and approval certifications and/or acceptance, unless otherwise stated by Owner.

K. If any Work (including Work of others) that is to be inspected, tested, or approved is covered without written concurrence of Architect/Engineer, it must, if requested by Architect/Engineer, be uncovered for observation. Such uncovering shall be at Contractor's expense unless Contractor has given Architect/Engineer timely notice of Contractor's intention to cover the same and Architect/Engineer has not acted with reasonable promptness in response to such notice. Neither observations by Architect/Engineer nor inspections, tests, or approvals by others shall relieve Contractor from Contractor's obligations to perform the Work in accordance with the Contract Documents.

L. If the Work is defective, or Contractor fails to supply sufficient skilled workers, or suitable materials or equipment, or fails to furnish or perform the Work in such a way that the completed Work will conform to the Contract Documents, Owner may order Contractor to stop the Work, or any portion thereof and terminate payments to the Contractor until the cause for such order has been eliminated. Contractor shall bear all direct, indirect and consequential costs for satisfactory reconstruction or removal and replacement with non-defective Work, including, but not limited to fees and charges of Architect/Engineers, attorneys and other professionals and any additional expenses experienced by Owner due to delays to other Contractors performing additional Work and an appropriate deductive change order shall be issued. Contractor shall further bear the responsibility for maintaining the schedule and shall not be entitled to an extension of the Contract Time or the recovery of delay damages due to correcting or removing defective Work.

M. If Contractor fails within seven (7) days after written notice to correct defective Work, or fails to perform the Work in accordance with the Contract Documents, or fails to comply with any other provision of the Contract Documents, Owner may correct and remedy any such deficiency to the extent necessary to complete

corrective and remedial action. Owner may exclude Contractor from all or part of the site, take possession of all or part of the Work, Contractor's tools, construction equipment and machinery at the site or for which Owner has paid Contractor but which are stored elsewhere. All direct and indirect costs of Owner in exercising such rights and remedies will be charged against Contractor in an amount approved as to reasonableness by Architect/Engineer and a Change Order will be issued incorporating the necessary revisions.

N. If within three (3) years after the Substantial Completion Date or such longer period of time as may be prescribed by laws or regulations or by the terms of any applicable special guarantee required by the Contract Documents, any Work is found to be defective, Contractor shall promptly, without cost to Owner and in accordance with Owner's written instructions, either correct such defective Work or if it has been rejected by Owner, remove it from the site and replace it with non-defective Work. If Contractor does not promptly comply with the terms of such instruction, Owner may have the defective Work corrected/removed and all direct, indirect and consequential costs of such removal and replacement will be paid by Contractor. Failing payment by the Contractor and notwithstanding any other provisions of the Contract Documents to the contrary, Owner shall have the right to bring a direct action in the Circuit Court to recover such costs.

13.2 Representations of the Owner

To the extent permitted by law, the Owner represents to the Contractor that each of the following statements is presently true and accurate:

A. The Owner is a validly existing political subdivision of the State of Florida

B. The Owner has all requisite corporate or governmental power and authority to carry on its business as now conducted and to perform its obligations under the Contract Documents and each Contract Document contemplated hereunder to which it is or will be a party.

C. The Contract Documents and each Contract Document contemplated hereby to which the Owner is or will be a party has been duly authorized by all necessary action on the part of, and has been or will be duly executed and delivered by, the Owner, and neither the execution and delivery thereof nor compliance with the terms and provisions thereof or hereof: (a) requires the approval and consent of any other person or party, except such as have been duly obtained or as are specifically noted herein; (b) contravenes any existing law, judgment, governmental rule, regulation or order applicable to or binding on the Owner; or (c) contravenes or results in any breach of, default under, or result in the creation of any lien or encumbrance upon the Owner under any indenture, mortgage, deed of trust, bank loan, or credit agreement, the charter, ordinances, resolutions, or any other agreement or instrument to which the Owner is a party, specifically including any covenants of any bonds, notes, or other forms of indebtedness of the Owner outstanding on the date of the Contract Documents.

D. The Contract Documents and each document contemplated hereby to which the Owner is or will be a party constitutes, or when entered into will constitute, a

legal, valid, and binding obligation of the Owner enforceable against the Owner in accordance with the terms thereof, except as such enforceability may be limited by applicable bankruptcy, insolvency, or similar laws from time to time in effect which affect creditors' rights generally, and subject to usual equitable principles in the event that equitable remedies are involved.

E. There are no pending or, to the knowledge of the Owner, threatened actions or proceedings before any court or administrative agency against the Owner which question the validity of the Contract Documents or any document contemplated hereunder, or which are likely in any case or in the aggregate to materially adversely affect the consummation of the transactions contemplated hereunder or the financial or corporate condition of the Owner.

F. The Owner shall use due diligence to timely fulfill or cause to be fulfilled all of the conditions expressed in the Contract Documents which are within the control of the Owner or which are the responsibility of the Owner to fulfill.

G. During the pendency of the Work and while the obligations of the Owner under the Contract Documents shall be in effect, the Owner shall cause to occur and to continue to be in effect and take such action as may be necessary to enforce those instruments, documents, certificates and events contemplated by the Contract Documents that are applicable to and the responsibility of the Owner.

H. The Owner shall assist and cooperate with the Contractor in accomplishing the construction of the Project in accordance with the Contract Documents and the Project Plans and Specifications, and will not knowingly violate any laws, ordinances, rules, regulations, orders, contracts, or agreements that are or will be applicable thereto or, to the extent permitted by law, enact or adopt any resolution, rule, regulation, or order, or approve or enter into any contract or agreement, including issuing any bonds, notes, or other forms of indebtedness, that will result in the Contract Documents or any part thereof, or any other instrument contemplated by and material to the timely and effective performance of a party's obligations hereunder, to be in violation thereof.

ARTICLE XIV, TERMINATION AND SUSPENSION

14.1 Termination for Cause by Owner

This Agreement may be terminated by Owner upon written notice to the Contractor should Contractor fail substantially to perform a material obligation in accordance with the terms of the Contract Documents through no fault of the Owner. In the event Owner terminates for cause and it is later determined by a court of competent jurisdiction that such termination for cause was not justified, then in such event such termination for cause shall automatically be converted to a termination without cause pursuant to Section 14.2.

A. Nonperformance. If the Contractor fails to timely perform any of its obligations under the Contract Documents, including any obligation the Contractor assumes to perform Work with its own forces, or if it persistently or repeatedly refuses or

fails, except in case for which extension of time is provided, to supply enough properly skilled workmen or proper materials, or fails, without being excused, to maintain an established schedule (failure to maintain schedule shall be defined as any activity that falls thirty (30) days or more behind schedule) which has been adopted by the Construction Team, or it fails to make prompt payment to Subcontractors for materials or labor, or disregards laws, rules, ordinances, regulations, or orders of any public authority having jurisdiction, or otherwise is guilty of substantial violations of the Agreement the Owner may, after seven (7) days written notice, during which period the Contractor fails to perform such obligation, make good such deficiencies and perform such actions. The Contract Sum shall be reduced by the cost to the Owner of making good such deficiencies, and the Contractor's compensation shall be reduced by an amount required to manage the making good of such deficiencies. Provided, however, nothing contained herein shall limit or preclude Owner from pursuing additional damages from Contractor because of its breach.

B. Insolvency. If the Contractor is adjudged bankrupt, or if it makes a general assignment for the benefit of its creditors, or if a receiver is appointed because its insolvency, then the Owner may, without prejudice to any other right or remedy, and after giving the Contractor and its surety, if any, fourteen (14) days written notice, and during which period the Contractor fails to cure the violation, terminate the Agreement. In such case, the Contractor shall not be entitled to receive any further payment. Owner shall be entitled to recover all costs and damages arising because of failure of Contractor to perform as provided in the Contract Documents, as well as reasonable termination expenses, and costs and damages incurred by the Owner may be deducted from any payments left owing the Contractor.

C. Illegality. Owner may terminate the Agreement if Contractor disregards laws or regulations of any public body having jurisdiction.

D. Rights of Owner. The Owner may, after giving Contractor (and the Surety, if there is one) seven (7) days written notice, terminate the services of Contractor for cause; exclude Contractor from the Project Site and take possession of the Work and of all Contractor's tools, construction equipment and machinery at the Project Site and use the same to the full extent they could be used (without liability to Contractor for trespass or conversion); incorporate in the Work all materials and equipment stored at the Project Site or for which Owner has paid Contractor but which are stored elsewhere, and finish the Work as Owner may deem expedient. In such case, Contractor shall not be entitled to receive any further payment beyond an amount equal to the value of material and equipment not incorporated in the Work, but delivered and suitably stored, less the aggregate of payments previously made. If the direct and indirect costs of completing the Work exceed the unpaid balance of the Contract Sum, Contractor shall pay the difference to Owner. Such costs incurred by Owner shall be verified by Owner in writing; but in finishing the Work, Owner shall not be required to obtain the lowest quote for the Work performed. Contractor's obligations to pay the difference between such costs and such unpaid balance shall survive termination of the Agreement. In such event and notwithstanding any other

provisions of the Contract Documents to the contrary, Owner shall be entitled to bring a direct action in the Circuit Court to recover such costs.

14.2 Termination without Cause by Owner

The Owner, through its County Administrator or designee, shall have the right to terminate the Agreement, in whole or in part, without cause upon sixty (60) calendar days' written notice to the Contractor. In the event of such termination for convenience, the Owner shall compensate Contractor for payments due through the date of termination, and one subsequent payment to cover costs of Work performed through the date of termination, subject to the terms and conditions of Section 3.1. The Contractor shall not be entitled to any other further recovery against the Owner, including, but not limited to, anticipated fees or profit on Work not required to be performed, or consequential damages or costs resulting from such termination.

A. Release of Contractor. As a condition of Owner's termination rights provided for in this subsection, Contractor shall be released and discharged from all obligations arising by, through, or under the terms of the Contract Documents, and the Payment and Performance Bond shall be released. Owner shall assume and become responsible for the reasonable value of Work performed by Subcontractors prior to termination plus reasonable direct close-out costs, but in no event shall Subcontractors be entitled to unabsorbed overhead, anticipatory profits, or damages for early termination.

B. Waiver of Protest. Contractor hereby waives any right to protest the exercise by Owner of its rights under this Section that may apply under the Procurement Ordinance.

14.3 Suspension without Cause

Owner may, at any time and without cause, suspend the Work or any portion thereof for a period of not more than ninety (90) days by written notice to Contractor, which will fix the date on which Work will be resumed. Contractor shall be allowed an increase in the Contract Sum or an extension of the Contract Time, or both, directly attributable to any suspension if Contractor makes an approved claim therefor.

14.4 Termination Based Upon Abandonment, Casualty or Force Majeure

If, after the construction commencement date (i) Contractor abandons the Project (which for purposes of this paragraph shall mean the cessation of all construction and other activities relating to the Project, excluding those which are necessary to wind down or otherwise terminate all outstanding obligations with respect to the Project, and no recommencement of same within one hundred twenty (120) days following the date of cessation), or (ii) the Project is stopped for a period of thirty (30) consecutive days due to an instance of Force Majeure or the result of a casualty resulting in a loss that cannot be corrected or restored within one hundred twenty (120) days (excluding the time required to assess the damage and complete the steps contemplated under Section 12.2), the Owner shall have the right to terminate the Agreement and pay the Contractor its compensation earned or accrued to date.

14.5 Vacation of Project Site; Delivery of Documents

Upon termination by Owner pursuant to Section 14.2 or 14.4, Contractor shall withdraw its employees and its equipment, if any, from the Project Site on the effective date of the termination as specified in the notice of termination (which effective date shall not be less than two (2) working days after the date of delivery of the notice), regardless of any claim the Contractor may or may not have against the Owner. Upon termination, the Contractor shall deliver to the Owner all original papers, records, documents, drawings, models and other material set forth and described in the Contract Documents.

14.6 Termination by the Contractor

If, through no act or fault of Contractor, the Work is suspended for a period of more than ninety (90) consecutive days by Owner or under an order of court or other public authority, or Owner fails to act on any Application for Payment or fails to pay Contractor any sum finally determined to be due; then Contractor may, upon fourteen (14) days written notice to Owner terminate the Agreement and recover from Owner payment for all Work executed, any expense sustained plus reasonable termination expenses. In lieu of terminating the Agreement, if Owner has failed to act on any Application for Payment or Owner has failed to make any payment as aforesaid, Contractor may upon fourteen (14) days written notice to Owner stop the Work until payment of all amounts then due.

Exhibit A, Title(s) of Drawings

Exhibit B, Title(s) of Specifications

Exhibit C, Affidavit of No Conflict

Exhibit D, Contractor's Certificate(s) of Insurance

Exhibit E Contractor's Payment and Performance Bond

Exhibit F Standard Forms