

INVITATION FOR BID IFB #14-2032CD 10 MG STORAGE TANK AND INTERCONNECTION AT THE SOUTHEAST WATER RECLAMATION FACILITY

Manatee County, a political subdivision of the State of Florida, (hereinafter "County") will receive sealed Bids from individuals, corporations, partnerships, and other legal entities organized under the laws of the State of Florida or authorized to conduct business in the State of Florida.

NON-MANDATORY INFORMATION CONFERENCE

In order to ensure that all prospective Bidders have sufficient information and understanding of County's needs, an <u>Information Conference</u> will be held at: <u>10:00 AM on July 17, 2014</u> at the **Southeast Water Reclamation Facility, 3331 Lena Road, Bradenton, FL 34202**. Attendance is not mandatory, but is highly encouraged.

DEADLINE FOR CLARIFICATION REQUESTS: 3:00 PM on July 30, 2014

(Reference Bid Article A.05)

TIME AND DATE DUE: 3:00 PM on August 6, 2014

FOR INFORMATION CONTACT:

Chris Daley-CPPB, Contract Specialist (941) 749-3048, Fax (941) 749-3034 <u>Chris.daley@mymanatee.org</u> Manatee County Financial Management Department Purchasing Division

AUTHORIZED FOR RELEASE:

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SECTION A INFORMATION TO BIDDERS

A.01 OPENING LOCATION

Sealed Bids will be <u>publicly opened</u> at the <u>Manatee County Purchasing Division</u>, <u>1112 Manatee Avenue West, Suite 803, Bradenton, Florida 34205</u> in the presence of County officials at the time and date stated, or soon thereafter. All Bidders or their representatives are invited to be present.

Any Bids received after the stated time and date will not be considered. It shall be the sole responsibility of the Bidder to have their Bid <u>delivered to the Manatee County</u> <u>Purchasing Division</u> for receipt on or before the stated time and date. Bidder shall be solely and strictly responsible for its timely delivery to the Purchasing Division. Bids delayed by mail, courier, or Bids delayed for any other reason, shall not be considered, shall not be opened at the public opening, and arrangements shall be made for their return at the Bidder's request and expense.

A.02 SEALED & MARKED

Bids shall be submitted in <u>triplicate, one original (marked Original) and two (2)</u> <u>copies (marked Copy)</u> of your <u>signed Bid</u> shall be submitted in one <u>sealed</u> package, clearly marked on the outside "<u>Sealed Bid #14-2032CD- 10 MG Storage Tank and</u> <u>Interconnection at the Southeast Water Reclamation Facility</u>" along with your company name. For your convenience, a mailing label is provided with this Invitation for Bid package. Or, you may address the package as follows:

Address package to:

Manatee County Purchasing Division 1112 Manatee Avenue West, Suite 803 Bradenton, Florida 34205 Sealed Bid # _____, Title _____

All blank spaces must be filled in as noted with amounts extended and totaled and no changes shall be made in the wording of the forms or in the items mentioned therein. In the event a change is made in your submittal, the Bidder shall write its initials by the change. Any Bid may be rejected which contains any omissions, alterations, irregularities of any kind, or which shall in any manner fail to conform to Bid requirements.

A Bid made by an individual, either in his/her own or proper person or under a trade or firm name, shall be executed under the individual's signature. If made by a partnership, the Bid shall be executed by two or more of the general partners. If made by a corporation, the Bid shall be executed by its President or other legally authorized corporate officer or agent.

A.03 SECURING OF DOCUMENTS

Invitation for Bids (IFB) and related documents are available on <u>http://www.mymanatee.org/purchasing</u> for download in a portable document format (.PDF) file by clicking on "<u>Bids and Proposals</u>" from the Purchasing Division's web page. You may view and print these files using Adobe Reader software. If necessary, you may download a free copy of Adobe Reader from the link provided on the "Bids and Proposals" page.

Additionally, Manatee County collaborates with the Manatee Chamber of Commerce by emailing solicitation opportunities to its members.

Manatee County may also use DemandStar to distribute Bids. On the DemandStar web site, <u>http://www.DemandStar.com</u>, click on the tab titled "My DemandStar" for more information regarding this service. Participation in the DemandStar system is not a requirement for doing business with Manatee County.

Complete copies of the IFB and all related documents are available for public inspection at the Manatee County Purchasing Division, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205, or by calling (941) 749-3014. Appointments are encouraged. Documents are available between the hours of 9:00 AM and 4:00 PM Monday through Friday, with the exception of holidays. A complete set of the IFB documents must be used in preparing Bids. County assumes no responsibility for errors and misinterpretations resulting from the use of incomplete sets of Bid Documents.

A.04 MODIFICATION OF IFB DOCUMENTS

If a Bidder wishes to recommend changes to the IFB documents, the Bidder shall furnish, in writing, data and information necessary to aid County in evaluating the request to modify the Specifications. County is not obligated to make any changes to the IFB documents. Unless an Addendum is issued, the IFB documents shall remain unaltered. **Bidders must fully comply with the IFB documents in their entirety**.

A.05 DEADLINE FOR CLARIFICATION REQUESTS

<u>3:00 PM on July 30, 2014</u> shall be the deadline to submit all inquiries, suggestions, or requests concerning interpretation, clarification or additional information pertaining to this Invitation for Bid to the Manatee County Purchasing Division.

This deadline has been established to maintain fair treatment of all potential Bidders, while maintaining progression of the Project to promote economic stimulus.

A.06 CLARIFICATION & ADDENDA

Each Bidder shall examine all Invitation for Bid Documents and shall judge all matters relating to the adequacy and accuracy of such documents. Any inquiries, suggestions or requests concerning interpretation, clarification or additional information pertaining to this Invitation for Bid shall be made through the Manatee County Purchasing Division. County shall not be responsible for oral interpretations given by any County employee, representative, or others.

The issuance of a written Addendum is the only official method whereby interpretation, clarification or additional information can be given.

If any Addenda are issued to this Invitation for Bid, County will post the documents on the Purchasing Division's web page, which can be accessed at <u>http://www.mymanatee.org/purchasing</u>, and then by clicking on "<u>Bids and Proposals</u>". If the original solicitation was broadcast via DemandStar, the addenda will also be broadcast on the DemandStar distribution system to "Planholders" on this web service.

It shall be the <u>responsibility of each Bidder, prior to submitting their Bid</u>, to contact the Manatee County Purchasing Division (see contact information on the cover page) to <u>determine if any Addenda were issued</u> and to make such Addenda a part of their Bid.

A.07 LOBBYING

After the issuance of any Invitation for Bid prospective Bidders, or any agent, representative or person acting at the request of such Bidder shall not contact, communicate with or discuss any matter relating in any way to the Invitation for Bid with any officer, agent or employee of Manatee County other than the Purchasing Official or as directed in the Invitation for Bid, pursuant to the Manatee County Code. This prohibition includes the act of carbon copying officers, agents or employees of Manatee County on all correspondence, including email correspondence. This requirement begins with the issuance of an Invitation for Bid, and ends upon execution of Contract or when the invitation has been cancelled. Violators of this prohibition shall be subject to sanctions as provided in the Manatee County Code.

A.08 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 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.

A.08 UNBALANCED BIDDING PROHIBITED (Continued)

- 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, etc., which the Bidder obtained and upon which the Bidder relied upon to develop its Bid. County reserves the right to reject as non-responsive any presumptive unbalanced Bids where the Bidder is unable to demonstrate the validity and/or necessity of the unbalanced unit costs.

A.09 FRONT END LOADING OF BID PRICING PROHIBITED

Prices offered for performance and/or acquisition activities to 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 end loaded. Front end 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 end loaded, it will request the opportunity to, and reserves the right to, review all source quotes, bids, price lists, letters of intent, etc., which the Bidder obtained and upon which the Bidder relied upon to develop the pricing or acquisition timing for these Bid items. County reserves the right to reject as non-responsive any presumptive front end loaded Bids where the Bidder is unable to demonstrate the validity and/or necessity of the front end loaded costs.

A.10 WITHDRAWAL OF OFFERS

Bidders may withdraw offers as follows:

- a. Mistakes discovered before the opening of a solicitation may be withdrawn by written notice from the Bidder submitting the Bid. This request must be received in the office designated for receipt of Bids in the solicitation document prior to the time set for delivery and opening of the Bids. A copy of the request shall be retained and the unopened Bid returned to that Bidder; or
- b. After the responses to a solicitation are opened or a selection has been determined, but before a Contract is signed, a Bidder alleging a material mistake of fact may be permitted to withdraw their Bid if:

A.10 WITHDRAWAL OF OFFERS (Continued)

- 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. Request to withdraw a Bid must be in writing and approved by the Purchasing Official.

A.11 IRREVOCABLE OFFER

Any Bid may be withdrawn up until the time and date set for opening of the Bid. Any Bid not so withdrawn shall, upon opening, constitute an <u>irrevocable offer for a period</u> <u>of ninety (90) days</u> to sell to Manatee County the goods or services set forth in the attached IFB until one or more of the Bids have been duly accepted by County.

A.12 BID EXPENSES

All expenses for making Bids to County are to be borne by the Bidder.

A.13 RESERVED RIGHTS

<u>County reserves the right to accept or reject</u> any and/or all Bids, to waive irregularities and 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 <u>lowest</u>, 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 IFB documents or otherwise required by County, and who is fit and capable to perform the Bid as made.

To be <u>responsive</u>, a Bidder shall submit a Bid which conforms in all material respects to the requirements set forth in the Invitation for Bid.

To be a <u>responsible</u> 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.14 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 Contract. Any involvement with the Manatee County Purchasing Division shall be in accordance with the Manatee County Purchasing Ordinance as amended.

A.15 COLLUSION

By submitting a Bid to this Invitation for Bid, the Bidder certifies that it has not divulged, discussed or compared its Bid with any other Bidder, and <u>has not colluded</u> with any other Bidder or parties to this Bid whatsoever. Also, Bidder certifies, and in the case of a joint Bid each party thereto certifies as to their own organization, that in connection with this Bid:

- a. any 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. any 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 the 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, principal or principals is/are named therein and that no person other than therein mentioned has any interest in this Bid or in the resulting Contract to be entered into; and
- e. no person or agency has been employed or retained to solicit or secure the resulting Contract 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.16 CODE OF ETHICS

With respect to this Bid, if any Bidder violates, directly or indirectly, the ethics provisions of the Manatee County Purchasing Ordinance and/or Florida criminal or civil laws related to public procurement, including but not limited to Florida Statutes, Chapter 112, Part III, Code of Ethics for Public Officers and Employees, such Bidder will be disqualified from eligibility to perform the Work described in this Invitation for Bid, and may also be disqualified from furnishing future goods or services to, and from submitting any future Bids to supply goods or services to, Manatee County.

A.16 CODE OF ETHICS (Continued)

By submitting a Bid, the Bidder represents to County that all statements made and materials submitted are truthful, with no relevant facts withheld. If a Bidder is determined to have been untruthful in their Bid or any related presentation, such Bidder will be disqualified from eligibility to perform the Work described in this Invitation for Bid, and may also be disqualified from furnishing future goods or services to, and from submitting any future Bids to supply goods or services to, Manatee County.

A.17 PUBLIC CONTRACTING AND ENVIRONMENTAL CRIMES

A person or affiliate who has been placed on the State's convicted vendor list following a conviction for a public entity crime, as that term is defined in Florida Statute § 287.133, 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 a Contract with any public entity; and may not transact business with any public entity in excess of the threshold amount provided in Florida Statutes § 287.017 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 prohibits the Award of any resulting Contract 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 Purchasing 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 contract 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 included (reference Section 00491 of this document) for this purpose.

A.18 BID FORMS

Bids must be submitted on attached provided forms, although additional pages may be attached. <u>Bidders must fully complete all pages of the Bid Forms. Bid Forms</u> <u>must be executed by an authorized signatory who has the legal authority to</u> <u>make the Bid and bind the company. Bidders must fully comply with all</u> <u>requirements of this IFB in its entirety</u>. Failure to comply shall result in default of the resulting Contract, whereupon, the defaulting Contractor shall be required to pay for any and all re-procurement costs, damages, and attorney fees as incurred by County.

A.19 LEGAL NAME

Bids shall clearly indicate the <u>legal name</u>, <u>address</u> and <u>telephone number</u> of the Bidder on the Bid Form. Bid Forms shall be <u>signed</u> above the <u>typed or printed name</u> and <u>title</u> of the signer. The signer must 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.20 DISCOUNTS

Any and all discounts must be incorporated in the prices contained in the Bid and not shown separately. The prices as shown on the Bid Form shall be the prices used in determining Award.

A.21 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 his Bid for any sales or service taxes. Nothing herein shall affect the Bidder's normal tax liability.

A.22 DESCRIPTIVE INFORMATION

Unless otherwise specifically provided in the IFB documents, all equipment, materials and articles provided shall be new and of the most suitable grade for the purpose intended. Unless otherwise specifically provided in the IFB 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.23 AMERICANS WITH DISABILITIES ACT

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 Bid document at least twenty-four (24) hours in advance of either activity.

A.24 EQUAL EMPLOYMENT OPPORTUNITY CLAUSE

In accordance with the provisions of Title VI of the Civil Rights Act of 1964 and Title 15, Part 8 of the Code of Federal Regulations, County hereby notifies all prospective Bidders that they will affirmatively ensure minority business enterprises will be afforded full opportunity to participate in response to this advertisement and will not be discriminated against on the grounds of race, color or national origin in consideration for Bid Award.

A.25 MBE/DBE

The State of Florida, Office of Supplier Diversity provides the certification process and the database for identifying certified MBE/DBE firms. This service may be directly accessed at: <u>http://www.osd.dms.state.fl.us/iframe.htm</u>

If you have any questions regarding this State service, please contact their office at (850) 487-0915.

A.26 MATHEMATICAL ERRORS

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. All Bids shall be reviewed mathematically and corrected, if necessary, using these standards, prior to additional evaluation.

A.27 DISCLOSURE

Upon receipt, all inquiries and responses to inquiries related to this Invitation for Bid 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 Bid 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 and any amount presented as a total offer without any verification of the mathematics or the completeness of the Bid.

A.27 DISCLOSURE (Continued)

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 County, Successful Bidder must:

- a. Keep and maintain public records that ordinarily and necessarily would be required by County in order to perform the service;
- b. Provide the public with access to public records on the same terms and conditions that County would provide and at a cost that does not exceed the cost provided in Florida Statutes, Chapter 119, or as otherwise provided by law;
- Ensure that public records that are exempt or confidential and exempt from public records disclosure requirements are not disclosed except as authorized by law, and;
- d. Meet all requirements for retaining public records and transfer, at no cost, to County all public records in possession of Successful Bidder upon termination of the awarded Contract and/or PO and destroy any duplicate public records that are exempt or confidential from public records disclosure requirements. All records stored electronically must be provided to County in a format that is compatible with County's information technology systems.

A.28 LOCAL PREFERENCE

- a. Local business is defined as a business legally authorized to engage in the sale of the goods and/or services to be procured, and which certifies within its Bid that for at least six (6) months prior to the announcement of the solicitation of Bids 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.
- b. Local preference shall not apply to the following categories of Contracts:
 - 1. Purchases or Contracts which are funded, in whole or in part, by a governmental or other funding entity, where the terms and conditions of receipt of the funds prohibit the preference;

A.28 LOCAL PREFERENCE (Continued)

- 2. Any Bid announcement which specifically provides that the general local preference policies set forth in this section are 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.
- c. 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 <u>www.mymanatee.org/vendor</u>. Click on "Affidavit for Local Business" to access and print the form. Complete, notarize, and <u>mail the notarized</u> <u>original</u> to the following address: Manatee County Purchasing Division, 1112 Manatee Avenue West, Suite 803, Bradenton, FL 34205.

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. Bidder attests that it:

- 1. Has not within the five (5) years prior to the Bid announcement admitted guilt or been found guilty by any court or state or federal regulatory enforcement agency of violation of any criminal law, or a law or administrative regulation regarding fraud;
- 2. Is not currently subject to an unresolved citation or notice of violation of any Manatee County Code provision, except citations or notices which are the subject of a current legal appeal, as of the date of the Bid announcement;
- 3. Is not delinquent in the payment of any fines, liens, assessments, fees or taxes to any governmental unit or taxing authority within Manatee County, except any such sums which are the subject of a current legal appeal.

A.29 VENDOR REGISTRATION

All vendors are encouraged to register with Manatee County using the on-line "Vendor Registration" web page on <u>www.mymanatee.org/purchasing</u>.

Your cooperation in registering your business with Manatee County will enhance our opportunities to identify sources for goods and services, plus identify local businesses. This information is used for soliciting quotations up to \$250,000.00 and for competitive solicitations of larger purchases.

You will note that Manatee County collaborates with the Manatee Chamber of Commerce (<u>www.manateechamber.com</u>) by emailing solicitation opportunities to its members.

Our staff can assist you with your registration as needed. Our office hours are 8:00 A.M. to 5:00 P.M., Monday through Friday on regular business days. Please call (941) 749-3014 if you wish to have a Purchasing staff member assist you.

A.29 VENDOR REGISTRATION (Continued)

Quick steps to registration: www.mymanatee.org/purchasing

A link to Vendor Registration is listed on the Purchasing Division's web page under "Register as a Vendor".

Click on "Vendor Registration Form" for on-line input.

Thank you for reviewing this information and considering registering your business with Manatee County. Registration is not mandatory; however, by taking the time to register, you are helping County to provide timely notifications of Quotation, Bid and Proposal opportunities to your business.

A.30 ePAYABLES

Manatee County and Clerk of the Circuit Court have partnered to offer the ePayables program, which allows payments to be made to vendors via credit cards. County will issue a unique credit card number to each vendor; the card has a zero balance until payments have been authorized.

After goods are delivered or services rendered, vendors submit invoices to the remit to address on the purchase order according to the current process. 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. Once the vendor receives the email, the credit card has been authorized to be charged for the amount listed in the email. When the vendor charges the full amount authorized in the email, the card will return to a zero balance until the next payment is authorized.

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 you are interested in participating in this program, please complete Form E, ePayables application and return the completed form via email to <u>lori.bryan@manateeclerk.com</u>.

NOTE: ANY OR ALL STATEMENTS CONTAINED IN THE FOLLOWING SECTIONS: MIMIMUM QUALIFICATIONS & BASIS OF AWARD, GENERAL TERMS AND CONDITIONS, OR SPECIFICATIONS, WHICH VARY FROM THE INFORMATION TO BIDDERS, SHALL HAVE PRECEDENCE.

END OF SECTION A

SECTION B BID SUMMARY

B.01 THE WORK

The Work included in this Bid consists of furnishing all labor, materials, and equipment necessary to provide improvements for the 10 MG storage tank and interconnections at the Manatee County Southeast Water Reclamation Facility located at 3331 Lena Road in Bradenton, Florida as required by the specifications and drawings included with this Invitation for Bids.

The 10MG storage tank and interconnection improvements consists of the following:

- Convert the existing High Service Effluent Pump Station to the Low Service Pump Station. Remove and replace the existing high service pumps and VFDs.
- Construct a new High Service Pump Station for the proposed 10 MG Ground Storage Tank, complete with turbine pumps, VFD, intake pipe, discharge pipe, and flow meter.
- Construction of low service and high service reclaimed water pipelines.
- Relocation of Storage Pond Return Reclaimed Water Pipeline.
- Construct a 10 MG Storage Tank with inner diameter of 200 feet and a side wall height of 42.5 feet.
- Construct Overflow, Effluent, and Interconnection Pipelines
- Provide and install electric power, instrumentation and SCADA equipment, cables, control panels, etc., for the operation, control and monitoring of the proposed pumping stations, storage tank, flow meters, and any additional requirements covered in the specifications and drawings.

The successful Bidder shall furnish all Shop Drawings, working drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all Work required by these Bid Documents.

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 County.

The successful Bidder 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 Bid Documents or not.

B.02 EXAMINATION OF BID DOCUMENTS AND SITE(S)

It is the responsibility of each Bidder before submitting a Bid, to (a) examine the Bid Documents thoroughly; (b) visit the 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 Bid Documents; and (e) notify County of all conflicts, errors, or discrepancies in the Bid Documents.

B.02 EXAMINATION OF BID DOCUMENTS AND SITE(s) (Continued)

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 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 Bid 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 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 Contractor in performing the Work are identified in the Bid Documents.

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

Inspection of the site(s) is **a requirement** to be considered for Award of this Bid. Prior to submitting a Bid, each Bidder shall examine the site(s) and all conditions thereon fully familiarizing themselves with the full scope of the project. Failure to become familiar with 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 plans and specifications. Bidder shall acknowledge inspection of the project site(s) on his/her signed, submitted Bid Form.

The informational conference will be held on site with construction site inspection immediately following. After the date of the informational conference has passed, any potential Bidder wishing to conduct a site visit shall contact Anthony Benitez at 941-708-7450 ext 7333 for coordination of the site visit.

END OF SECTION B

SECTION C BASIS OF AWARD & MINIMUM QUALIFICATIONS

C.01 BASIS OF AWARD

Award shall be to the lowest, responsive, responsible Bidder meeting Specifications and having the lowest total offer for the requirements listed on the Bid Form for the Work as set forth in this Invitation for Bid. Bid prices shall include costs for furnishing all labor, equipment and/or materials for the completion of the Work in accordance with and in the manner set forth and described in the Bid Documents to County's satisfaction within the prescribed time.

Only one schedule for Completion of the Work shall be considered. <u>Only one</u> <u>Award shall be made.</u>

NOTE: Inspection of the site is a pre-requisite to be considered for Award of this Bid.

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 Bids are equal with respect to price, the Award shall be determined by a chance drawing, coin toss, or similar tie-breaking method conducted by the Purchasing Division and open to the public.

C.02 MINIMUM QUALIFICATIONS OF BIDDERS

No person who is not certified or registered as a General Contractor pursuant to Florida Statutes, Chapter 489 on the day the Bid is submitted, and who has continuously held that certification or registration for a period of at least five (5) consecutive years immediately prior to the day the Bid is submitted, may be qualified to bid on this Project. In the event that a Bidder is a business organization, including a partnership, corporation, business trust or other legal entity as set forth in Florida Statutes § 489.119(2), then the Bidder shall only be qualified to bid on this Project if: 1) the Bidder (the business organization) is on the day the Bid is submitted, and for at least three (3) consecutive years immediately prior to the day the Bid is submitted has been, in continuous existence, properly licensed and registered as required by Florida law; and 2) the Bidder, on the day the Bid is submitted, has a certified or registered Qualifying Agent, as required by Florida Statutes § 489.119, and that Qualifying Agent has been the same Qualifying Agent of the Bidder for a period of at least five (5) consecutive years immediately prior to the day the Bid is submitted.

END OF SECTION C

SECTION D GENERAL TERMS & CONDITIONS

D.01 CONTRACT FORMS

The Contract resulting from the acceptance of a Bid shall be in the form of the Contract stated in this Bid (reference Section F of this document).

A written notice confirming Award or recommendation thereof will be forwarded to the Successful Bidder accompanied by the required number of unsigned counterparts of the Contract. <u>Within ten (10) days thereafter</u>, Successful Bidder shall sign and deliver the required number of counterparts of the Contract with any other required documents to County. (Note: Contract must be approved in accordance with Chapter 2-26 of the Manatee County Code, and the Administrative Standards and Procedures Manual approved by the County Administrator).

D.02 ASSIGNMENT OF CONTRACT

Contractor shall not assign, transfer, convey, sublet or otherwise dispose of the resulting Contract or of his right, title, or interest therein, or his power to execute such Contract, or to assign any monies due or to become due there under to any other person, firm or corporation unless first obtaining the written consent of County. The giving of such consent to a particular Subcontractor assignment shall not dispense with the necessity of such consent to any further or other assignment.

D.03 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. Only one Bid shall be considered based on <u>540 calendar days</u>. <u>Only one Award shall be made</u>.

D.04 LIQUIDATED DAMAGES

If the Contractor refuses or fails to prosecute the Work, or any separable part thereof, with such diligence as will hinder its completion within the time specified, County may seek damages. The actual damages for delay will be impossible to determine and in lieu thereof, the Contractor shall pay to County the sum of **\$3,770** as fixed, agreed, and liquidated damages for each calendar day of the delay until the Work is finally accepted by County and the Contractor and his Surety shall be liable for the amount thereof.

D.05 PAYMENT

Contractor may apply for partial payment on monthly estimates, based on the amount of the Work done or completed in compliance with the provisions of the resulting Contract. Contractor shall submit an application, on a standard pay application form provided or approved by County, of an approximate estimate of the proportionate value of the Work done, items and locations of the Work performed up to and including the last day of the period then ending.

D.05 PAYMENT (Continued)

County will then review said estimate and make any necessary revisions so that the estimate can receive approval for payment. If the Contractor and County do not agree on the approximate estimate of the proportionate value of the Work done for any pay period, the determination of County will be binding. The amount of said estimate after deducting any required Retainage and all previous payments shall be due and payable to the Contractor, twenty (20) business days if County is its own Engineer of Record (EOR) or twenty-five (25) business days if outside agent approval is required after the pay estimate has been approved by the agent for County.

In accordance with the Prompt Payment Act, Florida Statutes § 218.735(7), a Punch List shall be formulated.

Time allowed for development of Punch List:

- a. Awarded Contracts with an estimated cost of less than \$10 million will be within thirty (30) calendar days after reaching Substantial Completion.
- Awarded Contracts with a cost of \$10 million dollars or more will be within thirty (30) calendar days OR if extended by Contract, up to sixty (60) calendar days after reaching Substantial Completion.

The Final Completion date of the resulting Contract must be at least thirty (30) days after delivery of the list of items. If the list is not provided to the awarded Contractor by the agreed upon date, the Contract completion time must be extended by the number of days County exceeds the delivery date.

It is the Contractor's responsibility for the care of the materials. Any damage to or loss of said materials is the full responsibility of the Contractor. Any periodical pay estimate signed by the Contractor shall be final as to the Contractor for any or all Work covered by the periodical pay estimate.

Any requests for payment of materials stored on site must be accompanied with a paid receipt. The Contractor warrants and guarantees that title to all Work, materials and equipment covered by any Application for Payment, whether incorporated in the Project or not, will pass to County at the time of payment free and clear of all liens, claims, security interests and encumbrances (hereafter referred to as "Liens").

The Contractor agrees to furnish an affidavit stating that all laborers, material men, and Subcontractors have been paid on the Project for Work covered by the Application for Payment and that a partial or complete release of lien, as may be necessary, be properly executed by the material men, laborers, Subcontractors on the Project for Work covered by the Application for Payment, sufficient to secure County from any claim whatsoever arising out of the aforesaid Work. When the Contractor has completed the Work in compliance with the terms of the Contract Documents, he shall notify County in writing that the Project is ready for final inspection.

D.05 PAYMENT (Continued)

County will then advise the Contractor as to the arrangements for final inspection and what Work, if any, is required to prepare the Project or a portion thereof for final inspection. When County determines the Project or portion thereof is ready for final inspection, County shall perform same. Upon completion of final inspection, County will notify Contractor of all particulars in which this inspection reveals that the Work is incomplete or defective. Contractor shall immediately take such measures as are necessary to complete such Work or remedy such deficiencies. When all such errors have been corrected, a final re-inspection will be made.

The process will be repeated until, in the opinion of County, the Project has been completed in compliance with the terms of the Contract Documents.

When final acceptance has been made by County, County will make final payment of the resulting Contract amount, plus all approved additions, less approved deductions and previous payments made. The resulting Contract will be considered complete when all Work has been finished, the final inspection made, approved as-builts received, and the Project finally accepted in writing by County. The Contractor's responsibility shall then terminate except as otherwise stated.

D.06 CONTRACT CONTINGENCY WORK

This Bid item entails a monetary allowance which is used at County's discretion to handle unexpected conditions as required to satisfactorily complete the Project in accordance with the plans and Specifications. 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. Vendor shall enter the amount for Contract Contingency based on the percentage of their Total Base Bid. The total Contract Award will include the Contract Contingency funds.

Appropriate uses of Contract Contingency funds include increases to existing Bid item quantities that do not change the initial Scope of Work, which may be directed by staff; modification items not originally bid which were unforeseen yet necessary during the construction 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 funds include anything that changes the initial Scope of Work, including the Contract Price and Contract Time, and adding Bid items not previously contemplated that change the initial Scope of Work.

D.07 RETAINAGE

A Retainage of 10% of the total Work in place shall be withheld until 50% complete. After 50% completion, the Retainage shall be reduced to 5% of the total Work in place until Final Completion and acceptance of the Work by County. Upon final acceptance, the remaining Retainage shall be included in the final payment.

D.08 PROGRESS REQUIREMENTS

All Work done under the resulting Contract shall be done with a minimum of inconvenience to the private property owners in the area. The Contractor shall coordinate his Work with private property owners such that existing utility services are maintained and they have access to their property at all times.

D.09 WARRANTY AND GUARANTEE PROVISIONS

All Work, materials, and equipment furnished as defined herein shall be guaranteed and warranted by the Contractor for a minimum period of three (3) years, unless otherwise specified, from final acceptance by County to be free from defects due either to faulty materials or equipment or faulty workmanship.

All materials, equipment, and workmanship furnished and installed by the Contractor is warranted and guaranteed by the Contractor to meet the required standards and to accomplish the purposes and functions of the Project as defined, detailed, and specified herein.

County shall, following discovery thereof, promptly give written notice to the Contractor of faulty materials, equipment, or workmanship within the period of the guarantee and the Contractor shall promptly replace any part of the faulty equipment, material, or workmanship at his own cost. These warranty and guarantee provisions create no limitations on County as to any claims or actions for breach of guaranty or breach of warranty that County might have against parties other than the Contractor, and do not constitute exclusive remedies of County against the Contractor.

D.10 MATERIALS AND WORKMANSHIP

All materials and apparatus required for this Work, except as specified otherwise, shall be new, of first class quality, and shall be furnished, delivered, connected and finished in every detail. Construction shall be prescribed by good industry practice and in accordance with manufacturer's recommendations for the type being installed.

Use skilled workman trained and experienced in the necessary trades and who are completely familiar with the specified requirements and the methods needed for proper performance of the Work of this section.

D.11 PROJECT CLOSE-OUT

Clean construction site and remove any and all excess materials. Correct any damages to property that may have occurred as a result of installation and/or delivery. Repair and patch all surfaces cut for installation. The Contractor shall remedy any deficiencies promptly should County determine any Work is incomplete or defective.

D.11 PROJECT CLOSE-OUT (Continued)

When County determines the Work is acceptable in accordance with this Invitation for Bid, the Contractor shall provide the close out submittals, including but not necessarily limited to the following:

- 1 set Certificate of Warranties 1 set Manufacturer's Product Literature
 - (when applicable)
- 1 set Project Record Drawings
- 1 set Subcontractor Information (when applicable)

D.12 ROYALTIES AND PATENTS

The Contractor shall pay all royalties and license fees for equipment or processes in conjunction with the equipment and/or services being furnished. Contractor 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.

D.13 AUTHORIZED PRODUCT REPRESENTATION

The 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 perform accordingly may, in County's sole discretion, be deemed a Material Breach of the resulting Contract, and shall constitute grounds for County's immediate termination of the resulting Contract.

D.14 REGULATIONS

It shall be the responsibility of the Contractor to assure compliance with any OSHA, EPA and/or other federal or State of Florida rules, regulations or other requirements, as each may apply.

D.15 CANCELLATION

Any failure of the Contractor to furnish or perform the Work (including, but not limited to, commencement of the Work, failure to supply sufficient skilled workers or suitable materials or equipment) in accordance with the resulting Contract, County may order the stop of the Work, or any portion thereof, until the cause for such order has been eliminated. If the Contractor persistently fails to perform the Work in accordance with the resulting Contract, County reserves the right to terminate the resulting Contract and select the next qualified Bidder or re-advertise this procurement in part or in whole. County reserves the right to cancel all or any undelivered or unexecuted portion of the resulting Contract with or without cause.

D.16 INDEMNIFICATION

The Contractor covenants and agrees to <u>indemnify and save harmless</u> County, its agents and employees, from and against all claims, suits, actions, damages, causes of action, or judgments arising out of the terms of the resulting Contract for any personal injury, loss of life, or damage to the property sustained as a result of the performance or non-performance of services or delivery of goods; from and against any orders, judgments, or decrees, which may be entered against County, its agents or employees; and from and against all costs, attorney's fees, expenses and other liabilities incurred in the defense of any such claim, suit or action, and the investigation thereof. Nothing in the resulting Award, Contract or Purchase Order shall be deemed to affect the rights, privileges and immunities of County as set forth in Florida Statutes § 768.28.

D.17 SUBCONTRACTORS, SUPPLIERS AND OTHERS

The identity of Subcontractors, Suppliers, and other persons and organizations (including those who are to furnish the principal items of material and equipment) may be requested by County for each Bid item from any of the Bidders; and the Bidder shall respond within five (5) days after the date of such request. Such list shall be accompanied by an experience statement with pertinent information regarding similar projects and other evidence of qualification for each such Subcontractor, Supplier, persons or organization if requested by County. If County, after due investigation, has reasonable objection to any proposed Subcontractor, Supplier, other person or organization, County may, before the Notice of Intent to Award is given, request the apparent Successful Bidder to submit an acceptable substitute without an increase in Contract Price or Contract Time.

If apparent Successful Bidder declines to make any such substitution, County may Award the resulting Contract to the next lowest qualified Bidder that proposes to use acceptable Subcontractors, Suppliers, and other persons who County does not make written objection to. Contractor shall not be required to employ any Subcontractor, Supplier, other person or organization who Contractor has reasonable objection to.

Subcontractors shall be bound by the terms and conditions of the resulting Contract insofar as it applies to their work, but this shall not relieve the prime Contractor from the full responsibility to County for the proper completion of all Work to be executed under the resulting Contract.

The employment of unauthorized aliens by any Contractor is considered a violation of Section 274 (e) of the Immigration and Employment Act. If the Contractor knowingly employs unauthorized aliens, such violation shall be cause for unilateral cancellation of the resulting Contract.

A complete list of all Subcontractors proposed for any portion of the Work may be requested of any Bidder deemed necessary by County. Subcontracts shall be awarded only to those Subcontractors considered satisfactory by County.

D.18 MANUALS, SCHEMATICS, HANDBOOKS (IF APPLICABLE)

All manuals, schematics and handbooks shall be provided which are applicable to the equipment delivered. An operators manual, parts manual and technician manual must also be provided. Parts lists (manuals) must include OEM part numbers for items not manufactured by the Contractor. Contractor shall furnish two (2) copies of each.

D.19 INSURANCE

The Contractor will not commence Work under the resulting Contract until <u>all</u> <u>insurance</u> under this section and such insurance coverage as might be required by County has been obtained. The Contractor shall obtain, and submit to the Purchasing Division <u>within ten (10) calendar days</u> from the date of Notice of Intent to Award, at his expense, the following minimum amounts of insurance (inclusive of any amounts provided by an umbrella or excess policy):

a. <u>Workers' Compensation/Employers' Liability</u>

<u>Part One</u> - There shall be no maximum limit (other than as limited by the applicable statute) for liability imposed by Florida Workers' Compensation Act or any other coverage required by the resulting Contract Documents which are customarily insured under Part One of the standard Workers' Compensation Policy.

<u>Part Two</u> - The minimum amount of coverage required by the resulting Contract Documents which are customarily insured under Part Two of the standard Workers' Compensation Policy shall be:

(Each Accident)	<u>\$100,000</u>
(Disease-Policy Limit)	<u>\$500,000</u>
(Disease-Each Employee)	<u>\$100,000</u>

b. <u>Commercial General Liability</u>

The limits are to be applicable only to Work performed under the resulting Contract and shall be those that would be provided with the attachment of the Amendment of Limits of Insurance (Designated Project or Premises) endorsement (ISO Form CG 25 03) a Commercial General Liability Policy with the following minimum limits.

<u>\$2,000,000</u>
<u>\$1,000,000</u>
<u>\$1,000,000</u>
<u>\$Nil</u>
<u>\$Nil</u>

ADDITIONAL INSURED: Manatee County, a political subdivision of the State of Florida, shall be specifically named as additional insured on the Commercial General Liability Policy.

D.19 INSURANCE (Continued)

c. <u>Business Auto Policy</u> Each Occurrence Bodily Injury and Property Damage Liability Combined Annual Aggregate (if applicable)

<u>\$300,000</u> \$1,000,000

ADDITIONAL INSURED: Manatee County, a political subdivision of the State of Florida, shall be specifically named as additional insured on the Business Auto Policy.

d. Property Insurance

If the resulting Contract includes construction of or additions to above ground buildings or structures, Contractor shall provide "Builder's Risk" insurance with the minimum amount of insurance to be 100% of the value of such addition(s), building(s), or structure(s).

e. Installation Floater

If the resulting Contract does not include construction of or additions to above ground building or structures, but does involve the installation of machinery or equipment, Contractor shall provide an "Installation Floater" with the minimum amount of insurance to be 100% of the value of such addition(s), building(s), or structure(s).

f. Certificates of Insurance and Copies of Policies

Certificates of Insurance in triplicate evidencing the insurance coverage specified herein shall be filed with the Purchasing Official <u>before operations are begun</u>. The required certificates of insurance shall name the types of policy, policy number, date of expiration, amount of coverage, companies affording coverage, and also <u>shall refer specifically to the Bid number and title of the Project</u>. All insurance policies required herein shall be issued by companies that are authorized to do business under the laws of the State of Florida and hold an A.M. Best rating of A-or better. Insurance, as specified herein, shall remain in force and effect for the duration of the Project including any warranty periods.

g. <u>Complete Policies</u>: The entire and complete insurance policies required herein shall be provided to County on request.

Nothing herein shall in any manner create any liability of County in connection with any claim against the Contractor for labor, services, or materials, or of Subcontractors; and nothing herein shall limit the liability of the Contractor or Contractor's Sureties to County or to any Workers, Suppliers, material men or employees in relation to the resulting Contract.

D.19 INSURANCE (Continued)

- h. By way of its submission of a Bid hereto, Bidder:
 - 1. Represents that Bidder maintains, and will maintain during the term of any Contract arising from this solicitation, insurance coverage from responsible companies duly authorized to do business in the State of Florida and deemed acceptable to County, as set forth in this solicitation; and
 - 2. Agrees that, insurance should not be cancelled without thirty (30) days notice to County and must be endorsed to provide same. Failure of Bidder to obtain and maintain proper amounts of insurance at all times as called for herein shall constitute a Material Breach of the resulting Contract, which may result in immediate termination.
- <u>Certification Requirements</u> In order for the certificate of insurance to be accepted it <u>must</u> comply with the following:

 The certificate holder shall be: Manatee County Board of Commissioners, A political subdivision of the State of Florida P.O. Box 1000 Bradenton, FL 34206-1000 IFB# 14-2032CD, 10 MG Storage Tank and Interconnections at the Southeast Water Reclamation Facility

 Certificate shall be mailed to: Manatee County Purchasing Division 1112 Manatee Avenue West, Suite 803 Bradenton, FL 34205 Attn: Chris Daley-CPPB, Contract Specialist

D.20 BID BOND/CERTIFIED CHECK

By submitting a Bid to this Invitation for Bid, the Bidder agrees should the Bidder's Bid be accepted, to execute the form of Contract and present the same to Manatee County for approval within ten (10) calendar days after Notice of Intent to Award. The Bidder further agrees that failure to execute and deliver said form of Contract within ten (10) calendar days will result in damages to Manatee County and as guarantee of payment of same a <u>Bid Bond/certified check</u> shall be enclosed within the submitted sealed Bid in the amount of five (5%) percent of the total amount of the Bid. The Bidder further agrees that in case the Bidder fails to enter into a Contract, as prescribed by Manatee County, the Bid Bond/certified check accompanying the Bid shall be forfeited to Manatee County as agreed liquidated damages. If County enters into a Contract with a Bidder, or if County rejects any and/or all Bids, accompanying bond will be promptly returned.

D.21 PERFORMANCE AND PAYMENT BONDS

The Successful Bidder shall furnish Surety bonds using the Public Construction Bond form prescribed in Florida Statutes § 255.05, which is provided herein, as security for faithful performance of the Contract awarded as a result of this Bid and for the payment of all persons performing labor and/or furnishing material in connection therewith. Failure to provide the required bonds on the prescribed form may result in Successful Bidder being deemed nonresponsive. Bonds must be in the form prescribed in Florida Statutes § 255.05, and must not contain notice, demand or other terms and conditions, including informal pre-claim meetings, not provided for in Florida Statutes § 255.05.

Surety of such bonds shall be in an amount equal to 100% of the Contract Award issued by a duly authorized and nationally recognized Surety company, authorized to do business in the State of Florida, satisfactory to this County. Surety shall be rated as "A-" or better as to general policy holders rating and Class V or higher rating as to financial size category and the amount required shall not exceed 5% of the reported policy holders' surplus, all as reported in the most current Best Key Rating Guide, published by A.M. Best Company, Inc. of 75 Fulton Street, New York, New York, 10038. The attorney-in-fact who signs the bonds must file with the bonds, a certificate and effective dated copy of power-of-attorney. Performance and Payment Bonds shall be issued to Manatee County, a political subdivision of the State of Florida, within ten (10) calendar days after Notice of Intent to Award.

In addition, pursuant to Florida Statutes § 255.05(1)(b), prior to commencing Work, the Contractor shall be responsible and bear all costs associated to record the Performance and Payment Bond with the Manatee County Clerk of the Circuit Court. A certified copy of said recording shall be furnished to the Purchasing Division upon filing. Pursuant to Florida Statutes § 255.05(1)(b), County will make no payment to the Contractor until the Contractor has complied with this paragraph.

Furnishing Performance and Payment Bonds shall be requisite to execution of a Contract with County. Said Performance and Payment Bonds will remain in force for the duration of the Contract with the premiums paid by the Contractor. Failure of the Successful Bidder to execute such Contract and to supply the required bonds shall be just cause for cancellation of the Award. County may then contract with another acceptable Bidder or re-advertise this Invitation for Bid. If another Bidder is accepted, and notice given within ninety (90) days after the opening of the Bids, this acceptance shall bind the Bidder as though they were originally the Successful Bidder.

Failure of County at any time to require performance by the Contractor of any provisions set out in the resulting Contract will in no way affect the right of County, thereafter, to enforce those provisions.

When activity occurs within the resulting Contract that increases the amount of the Contract by either an approved Administrative Contract Adjustment (ACA) or an approved Change Order, a recorded Bond Rider shall be provided before the additional Work can proceed. All premiums shall be paid by the Contractor.

D.22 NO DAMAGES FOR DELAY

No claim for damages or any claim other than for an extension of time shall be made or asserted against County by reason of any delays. The Contractor shall not be entitled to an increase in the total Contract Price or payment or compensation of any kind from County or direct, indirect, consequential impact or other costs, expenses for damages, including but not limited to costs of acceleration or inefficiency arising because of delay, disruption, interference or hindrance from any cause whatsoever; provided, however, that this provision shall not preclude recovery or damages by the Contractor for hindrance or delays due solely to fraud, bad faith, or active interference on part of County or its agents. Otherwise, the Contractor shall only be entitled to extensions of the Contract Time as the sole and exclusive remedy for such resulting delay, in accordance with and to the extent specifically provided above.

D.23 NO INTEREST

Any monies not paid by County when claimed to be due to the Contractor under this Contract shall not be subject to interest including prejudgment interest. Any monies not paid by County when claimed to be due to the Contractor for damages awarded in the case of construction delays shall not be subject to prejudgment interest.

D.24 CONSTRUCTION OF CONTRACT

The resulting Contract and the rights and responsibilities hereunder shall not be construed more strongly against either party, regardless of the extent to which such party may have participated in the preparation hereof.

D.25 BE GREEN

All Contractors are encouraged to use as many **environmentally preferable** "green" products, materials, supplies, etc. as possible in order to promote a safe and healthy environment. **Environmentally preferable are products or services that have a reduced adverse effect on the environment**. Provide detail of your organization's initiative and its ability to meet the goal of environmental sustainability.

END OF SECTION D

SECTION E GENERAL CONDITIONS

ARTICLE 1. DEFINITIONS

Whenever used in the Contract Documents, the following terms have the meaning indicated which are applicable to both the singular and plural thereof:

<u>Addendum</u> - Written or graphic instruments issued prior to the opening of Bids which clarify or change the Bid Documents.

<u>Administrative Contract Adjustment (ACA)</u> – A minor change to a Contract, which is less than 10% of the Contract Price or less than 20% of the Contract Time, and does not require Board approval. (Reference Resolution R-07-189)

<u>Application for Payment</u> - The form accepted by the Project Representative which is to be used by Contractor in requesting progress or final payments and which is to include such supporting documentation as is required by the Contract Documents.

<u>Award</u> - Acceptance of the Bid from the person, firm, or corporation which in the County's sole and absolute judgment will under all circumstances best serve the public interest. Award shall be made in accordance with Chapter 2-26 of the Manatee County Code.

<u>Bid</u> - The Offer of the Bidder submitted on the prescribed form setting forth the prices for the Work to be performed.

<u>Bid Bond</u> – An insurance agreement, accompanied by a monetary commitment, by which a third party (the Surety) accepts liability and guarantees that the Bidder will not withdraw the Bid.

<u>Bidder</u> - One who submits a Bid directly to the County, as distinct from a Sub-bidder, who submits a Bid to a Bidder.

<u>Bid Documents</u> - Consists of the Invitation for Bid, which includes but is not limited to the Bid Form, drawings, technical Specifications, terms and conditions, and the proposed Contract Documents (including all Addenda issued prior to receipt of Bids); and becomes a part of the resulting Contract.

<u>Bid Summary</u> – Specifications or scope of Work that specifically describes the Work to be done for this Project.

<u>Bond Rider</u> – A Bond Rider increases the Performance Bond coverage to ensure responsibility of the Contractor in executing the Work for the County in consideration of the increased value resulting from an approved change in the Contract amount.

<u>Change Order</u> - A document recommended by the Project Representative which is signed by Contractor and County and authorizes an addition, deletion, or revision in the Work or an adjustment in the Contract Price or the Contract Time, issued on or after the Effective Date of the Contract.

<u>Compensable Delay</u> - Any delay beyond the control and without the fault or negligence of the Contractor resulting from County-caused changes in the Work, differing site conditions, suspensions of the Work, or termination for convenience by County.

<u>Contract</u> - The written Contract between County and Contractor covering the Work to be performed; other Contract Documents are attached to the Contract and made a part thereof as provided therein.

<u>Contract Contingency</u> - A monetary allowance used at the County's discretion, which is part of the total sum of the Contract that allows for minor changes in the Contract that do not change the initial Scope of Work, including Contract Price and Contract Time.

<u>Contract Documents</u> - The Contract, Invitation for Bid in its entirety, Public Construction Bond Form and Insurance Certificate(s), Drawings/Plans, Addenda (which pertain to the Bid Documents), Contractor's Bid Form (including documentation accompanying the Bid and any post-Bid documentation submitted prior to the Notice of Award), and Reports, together with all written Change Orders and other documents amending, modifying or supplementing the Contract Documents issued on or after the Effective Date of the Contract.

<u>Contract Price</u> - The monies payable by County to Contractor under the Contract Documents as stated in the Contract.

<u>Contract Time</u> - The number of days or the date stated in the Notice to Proceed for the completion of the Work.

<u>Contractor</u> - The person, firm or corporation with whom County has entered into a Contract.

<u>Days</u> - All references to days are to be considered calendar days except as specified differently.

<u>Defective</u> - An adjective which when modifying the Work refers to work that is unsatisfactory, faulty or deficient, or does not conform to the Contract Documents, or does not meet the requirements of any inspection, reference standard, test or approval referred to in the Contract Documents, or has been damaged prior to Project Representative's recommendation of final payment (unless responsibility for the protection thereof has been assumed by County). <u>Drawings</u> - The drawings which show the character and Scope of Work to be performed and which have been prepared or approved by Engineer and are referred to in the Bid and Contract Documents.

<u>Effective Date of the Contract</u> - The date indicated in the Contract on which it becomes effective (date of execution).

<u>Engineer</u> – Licensed professional who is responsible for the preparation, signing, dating, sealing and issuing of any engineering document(s) for any engineering service or Work.

<u>Excusable Delay</u> - Any delay beyond the control and without the negligence of the Contractor, the County, or any other Contractor caused by events or circumstances such as, but not limited to, acts of God or of the public enemy, fires, floods, freight embargoes, acts of government other than County or epidemics. Labor disputes and above average rainfall shall give rise only to Excusable Delays.

<u>Field Directive</u> - A written order issued by an authorized County Representative which approves changes in the Work, but does not involve a change in the initial Scope of Work, including the Contract Price and the Contract Time. A Field Directive must be issued by an authorized County Representative to authorize use of Contract Contingency funds.

<u>Final Completion</u> – The Work (including items defined on the Punch List) has been completed, accepted in writing by the County, approved as-builts have been received, and is ready for final payment.

<u>Float or Slack Time</u> - The time available in the progress schedule during which an unexpected activity can be completed without delaying Substantial Completion of the Work.

<u>Inexcusable Delay</u> - 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.

<u>Information (Pre-Bid) Conference</u> – A meeting held by the Purchasing Division with potential Bidders, prior to the opening of the solicitation, for the purpose of answering questions, clarifying ambiguities, and responding to general issues in order to establish a common basis for understanding all of the requirements of the solicitation; may result in the issuance of an Addendum.

<u>Material Breach</u> – A substantial failure in the performance of the Contract, as to give the affected party the right to remedies available in the Contract.

<u>Non-prejudicial Delay</u> - Any delay impacting a portion of the Work within the available total Float or Slack Time and not necessarily preventing completion of the Work within the Contract Time.

<u>Notice of Award</u> - The written notice to the Successful Bidder stating Award has been approved by the Board of County Commissioners; or by the Purchasing Official in accordance with Chapter 2-26 of the Manatee County Code.

<u>Notice of Intent to Award</u> - The written notice to the apparent Successful Bidder stating Award has been recommended with final Award to be authorized by the Purchasing Official or Board of County Commissioners, as appropriate.

<u>Notice to Proceed</u> - Written notice by County (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 (ten (10) days from date of such notice) Contractor's obligations under the Contract Documents.

<u>Payment Bond</u> – An instrument, issued by a Surety that guarantees that Subcontractors will be paid for labor expended on the Contract.

<u>Performance Bond</u> – An instrument executed subsequent to Award by the successful Contractor that protects the County from loss due to Contractor's inability to complete the Contract as agreed.

<u>Preconstruction Conference</u> - Prior to starting the Work, a meeting scheduled by County with Contractor to review the Work schedules, to establish procedures for handling Shop Drawings and other submissions, for processing periodical pay estimates, and such other matters as may be pertinent to the project.

<u>Prejudicial Delay</u> - Any excusable or Compensable Delay impacting the Work and exceeding the total float time available in the progress schedule, thus preventing completion of the Work within the Contract Time unless the Work is accelerated.

<u>Pre-operation Testing</u> - 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.

<u>Project</u> - The total construction of which the Work to be provided under the Contract Documents (may be the whole or a part as indicated elsewhere in the Contract Documents).

<u>Project Representative</u> - The authorized representative of Manatee County who is assigned to the project or any part thereof.

<u>Punch List</u> – A list of minor deficiencies or additional Work that does not prohibit achieving Substantial Completion yet must be completed before Final Completion of the Contract can be achieved.

<u>Retainage</u> – A certain percentage, identified in the solicitation document, is withheld from payment due to the Contractor until the Work is fully completed and accepted by County.

<u>Schedule of Values</u> – In the case of a total, lump sum Bid, unit prices shall be established for this Contract by the submission of a Schedule of Values. In the case of an itemized Bid, unit prices are the prices bid. The Contractor shall submit a Schedule of Values within ten (10) days of Notice to Proceed date. The schedule shall include quantities and prices of items equaling the Total Offer and will subdivide the Work into components in sufficient detail to serve as the basis for progress payments during construction. Such prices will 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.

<u>Shop Drawings</u> - All drawings, diagrams, illustrations, schedules and other data which are specifically prepared by or for Contractor to illustrate some portion of the Work and all illustrations, brochures, standard schedules, performance charts, instructions, diagrams and other information prepared by a Supplier and submitted by Contractor to illustrate material or equipment for some portion of the Work.

<u>Special Provisions:</u> As required to define Work or procedures not covered in the standard Specifications, and as necessary to supplement or modify items in the standard Specifications.

<u>Subcontractor</u> - An individual or corporation having a direct contact with Contractor or with any other Subcontractor for the performance of a part of the Work at the site. Such person or firm has contractual relations with the Contractor, not with the County.

<u>Substantial Completion</u> - The stage in the progress of the Work (or a specified portion thereof) is sufficiently complete in accordance with the Contract Documents so the Work (or a specified portion thereof) can be utilized for the intended purpose.

<u>Successful Bidder</u> - The lowest, responsible and responsive Bidder to whom an Award is made.

Supplier - A manufacturer, fabricator, Supplier, distributor, material man or vendor.

<u>Surety</u> – A pledge or guarantee by an insurance company, bank, individual or corporation on behalf of the Bidder which protects against default or failure of the principal to satisfy the contractual obligations.

<u>Underground Facilities</u> - All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments and any encasement containing such facilities which have been installed underground to furnish any of the following services or materials: electricity, gases, steam, liquid petroleum products, telephone or other communications, cable television, sewage and drainage removal, traffic or other control systems or water.

<u>Unit Price Work</u> - Work to be paid for on the basis of unit prices.

<u>Work</u> - The entire completed construction or the various separately identifiable parts thereof required to be furnished under the Contract Documents. Work is the result of performing services, furnishing labor and furnishing and incorporating materials and equipment into the construction, all as required by the Contract Documents.

<u>Work Directive Change</u> - A written directive to Contractor, issued on or after the Effective Date of the Contract and signed by County and recommended by 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 to emergencies. A Work Directive Change itself may not change the Contract Price or 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 Price or Contract Price or Contract Time.

<u>Written Amendment</u> - A Written Amendment of the Contract Documents, signed by County and Contractor on or after the Effective Date of the Contract and normally dealing with the non-engineering or non-technical rather than strictly Work related aspects of the Contract Documents.

ARTICLE 2. PRELIMINARY MATTERS

Computation of Time: 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.

2.1 The Contractor must submit a proposed schedule of the Work at the Preconstruction Conference. The purpose of this schedule is to enable the County to govern the Work, to protect the functions of the local government and its citizens and to aid in providing appropriate surveillance. The County shall have the right to reschedule Work provided such rescheduling is in accordance with the remainder of the terms of the Contract. The schedule shall show, as 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 County, after necessary rescheduling and obtaining additional information for specific

purposes, shall review and approve the schedule. The Contractor shall also forward to the County, as soon as practicable after the first day of each month, a summary report of the progress of the various parts of the Work under the Contract, 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 County's review and approval. In addition, more detailed schedules may be required by the County for daily traffic control.

- 2.2 A Notice to Proceed may be given at any time within thirty (30) days after the Effective Date of the Contract. The Contract Time will commence at the time specified in such notice. 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 date on which the Contract Time commences to run.
- 2.3 If at any time the materials and appliances to be used appear to the County as insufficient or improper for securing the quality of Work required or the required rate of progress, the County may order the Contractor to increase his efficiency or to improve the character of his Work and the Contractor shall conform to such an order. The failure of the County to demand any increase of such efficiency of any improvement shall not release the County 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. The County may require the Contractor to remove from the Work such employees as the County deems incompetent, careless, insubordinate or otherwise objectionable, or whose continued employment on the Work is deemed to be contrary to the County's interest.
- 2.4 The County 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 3. CONTRACT DOCUMENTS: INTENT, AMENDING, RE-USE

3.1 The Contract Documents comprise the entire Contract between County and Contractor concerning the Work. The Contract Documents are complementary; what is called for by one is as binding as if called for by all. The Contract Documents will be construed in accordance with the laws and ordinances of the State of Florida and Manatee County.

Should a conflict exist within the Contract Documents, the precedence in order of authority is as follows: 1) Bid Summary, 2) Special Conditions, 3) General Conditions, and 4) Drawings.

Note: Computed dimensions shall govern over scaled dimensions.

- 3.2 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 in the Contract Documents. 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, 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 County, Contractor or Engineer, or any of their agents or employees from those set forth in the Contract Documents.
- 3.3 The Contract Documents may be amended to provide for additions, deletions and revisions in the Work or to modify the terms and conditions thereof in one or more of the following ways:
 - 3.3.1 A Written Amendment
 - 3.3.2 A Change Order
 - 3.3.3 An Administrative Contract Adjustment (ACA)
 - 3.3.4 A Work Directive Change
- 3.4 In addition, the requirements of the Contract Documents may be supplemented and minor variations and deviations in the Work may be authorized in one or more of the following ways:
 - 3.4.1 Contract Contingency Work Field Directive
 - 3.4.2 Engineer's approval of a Shop Drawing or sample

ARTICLE 4. CONTRACTOR'S RESPONSIBILITIES

- 4.1 Contractor shall keep on the Work at all times during its progress a competent resident superintendent; who shall be the Contractor's representative at the site and shall have authority to act on behalf of Contractor. All communications given to the superintendent shall be as binding as if given to Contractor.
- 4.2 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 will not permit overtime Work or the performance of Work on Saturday, Sunday or legal holiday without County's written consent given after prior notice to Engineer (at least seventy-two (72) hours in advance).

- 4.2.1 Contractor shall pay for all additional engineering charges to the County for any overtime Work which may be authorized. Such additional engineering charges shall be a subsidiary obligation of Contractor and no extra payment shall be made by County on account of such overtime Work. At County's option, overtime costs may be deducted from Contractor's monthly payment request or Contractor's Retainage prior to release of final payment.
- 4.3 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.
- 4.4 All materials and equipment shall be of good quality and new, except as otherwise provided in the Contract Documents. If required by 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.
- 4.5 Contractor shall be fully responsible to County 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. Nothing in the Contract Documents shall create any contractual relationship between County or Engineer and any such Subcontractor, Supplier or other person or organization, nor shall it create any obligation on the part of County to pay or to see to the payment of any monies due any such Subcontractor, Supplier or other person or organization.
- 4.6 <u>Permits</u>: Unless otherwise provided, Contractor shall obtain and pay for all construction permits and licenses. County 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.

- 4.7 During the progress of the Work, Contractor shall keep the premises free from accumulation of waste materials rubbish and other debris resulting from the Work. At the completion of the Work, Contractor shall remove all waste materials, rubbish, and debris from and about the premises as well as all tools, appliances, construction equipment and machinery and surplus materials and shall leave the site clean and ready for occupancy by County. Contractor shall restore to original conditions all property not designated for alteration by the Contract Documents.
- 4.8 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.
- 4.9 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:
 - 4.9.1 all employees on the Work and other persons and organizations who may be affected thereby;
 - 4.9.2 all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and
 - 4.9.3 other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures, utilities and Underground Facilities not designated for removal, relocation or replacement in the course of construction.
 - 4.9.4 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 way for the public and preservation of the County's business, taking into full consideration all local conditions. Contractor's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed.

- 4.10 <u>Emergencies</u>: In emergencies affecting the safety or protection of persons or the Work or property at the site or adjacent thereto, Contractor, without special instruction or authorization from Engineer or County, is obligated to act to prevent threatened damage, injury or loss. Contractor shall give County prompt written notice if Contractor believes that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If County determines that a change in the Contract Documents 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.
- 4.11 For substitutes not included with the Bid, but submitted after the Effective Date of the Contract, Contractor shall make written application to 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 provisions 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 Engineer in evaluating the proposed substitute. Engineer may require Contractor to furnish at Contractor's expense, additional data about the proposed substitute. In rendering a decision, County/Engineer and Contractor shall have access to any available Float or Slack Time in the construction schedule. In the event that substitute materials or equipment not included as part of the Bid, but proposed after the Effective Date of the Contract, are accepted and are less costly than the originally specified materials or equipment, then the net difference in cost shall be credited to the County and an appropriate Change Order executed.
 - 4.11.1 If a specific means, method, sequence, technique or procedure of construction is indicated in or required by the Contract Documents, Contractor may furnish or utilize a substitute means, method, sequence, technique or procedure of construction acceptable to Engineer if Contractor submits sufficient information to allow Engineer to determine that the substitute proposed is equivalent to that indicated or required by the Contract Documents.
 - 4.11.2 Engineer will be allowed a reasonable time within which to evaluate each proposed substitute. Engineer will be the sole judge of acceptability and no substitute will be ordered, installed or utilized without Engineer's prior written acceptance which will be evidenced by either a Change Order or an approved shop drawing. County may require Contractor to furnish at Contractor's expense a special performance guarantee or other Surety with respect to any substitute.

- 4.11.3 Contractor shall reimburse County for the charges of Engineer and Engineer's consultants for evaluating each proposed substitute submitted after the Effective Date of the Contract and all costs resulting from any delays in the Work while the substitute was undergoing review.
- 4.12 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 construction 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 will 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 will be held responsible for the preservation of all stakes, marks and if for any reason any of the stakes or marks or batter boards become destroyed or disturbed, they will be immediately and accurately replaced by the Contractor.
- 4.13 The Contractor has, by careful examination, satisfied himself as to the nature and location of the Work and all other matters which can in any way affect the Work under this Contract, including, but not limited to details pertaining to boring, as shown on the drawings, are not guaranteed to be more than a general indication of the materials likely to be found adjacent to holes bored at the site of the Work, approximately at the locations indicated. The Contractor shall examine boring data, where available, and make his own interpretation of the subsoil investigations and other preliminary data, and shall base his Bid on his own opinion of the conditions likely to be encountered. In no event shall an extension of time be considered for any conditions that existed at the time of bidding, nor shall the Contractor receive extra compensation for completion of the project as intended by the drawings and in keeping with the Contact documents. No verbal agreement or conversation with any officer, agent or employee of the County, before or after the execution of this Contract, shall affect or modify any of the terms or obligations herein contained.
- 4.14 If the Contractor, in the course of the Work, finds that the drawings and/or Contract Documents cannot be followed, he shall immediately inform the County in writing, and the County 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 risk.

ARTICLE 5. COUNTY'S RESPONSIBILITIES

- 5.1 County shall furnish the data required of County under the Contract Documents promptly and shall make payments to the Contractor within a reasonable time after the Work has been accepted by the County. Payment shall be made no more than twenty (20) business days if County is its own Engineer of Record or twenty-five (25) business days if outside agent approval is required after the pay estimate has been approved by the agent for the County. 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 County/Engineer. Standard County forms shall be utilized.
- 5.2 The County shall provide the lands upon which the Work under this Contract 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.
- 5.3 The County 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.

ARTICLE 6. CHANGES IN THE WORK

- 6.1 Without invalidating the Contract and without notice to any Surety, County may, at any time, order additions, deletions or revisions in the Work. These will be authorized by a Written Amendment, a Change Order, or a Work Directive Change. 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).
- 6.2 Contractor shall not be entitled to an increase in the Contract Price or an extension of the Contract Time with respect to any Work performed that is not required by the Contract Documents as amended, modified and supplemented.
- 6.3 County and Contractor shall execute appropriate Change Orders, or Written Amendments, covering changes in the Work which are ordered by County, or which may be required because of acceptance of defective Work.
- 6.4 At any time Engineer may request a quotation from Contractor for a proposed change in the Work and within twenty-one (21) calendar days after receipt, Contractor shall submit a written and detailed proposal for an increase or decrease in the Contract Price or Contract Time for the proposed change. 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 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.

ARTICLE 7. CHANGE OF CONTRACT PRICE

- 7.1 The Contract Price 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 his expense without change in the Contract Price.
- 7.2 The Contract Price may only be changed by Change Order or by a Written Amendment. Any claim for an increase or decrease in the Contract Price 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 ten (10) days from the beginning of such occurrence and shall be accompanied by claimant's written statement that the amount claimed covers all known amounts (direct, indirect and consequential) to which the claimant is entitled as a result of the occurrence of said event.
- 7.3 The value of any Work covered by a Change Order or of any claim for an increase or decrease in the Contract Price shall be determined in one of the following ways, at the County's discretion:
 - 7.3.1 Where the Work involved is covered by unit prices contained in the Contract Documents, cost will be determined by application of such unit prices to the quantities of the items involved.
 - 7.3.2 By mutual acceptance of lump sum.
 - 7.3.3 On the basis of the cost of the Work, plus a 15% Contractor's fee for overhead and profit. (Contractor shall submit an itemized cost breakdown together with supporting data.)
- 7.4 Either County or Contractor may make a claim for an adjustment in the Contract Price. The unit price of an item of Unit Price Work shall be subject to reevaluation and adjustment under the following conditions:
 - 7.4.1 If the total cost of a particular item of Unit Price Work amounts to 5% or more of the Contract Price 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 Contract; and

- 7.4.2 If there is no corresponding adjustment with respect to any other item of Work; and
- 7.4.3 If a Contractor believes that it has incurred additional expense as a result thereof; or
- 7.4.4 If County believes that the quantity variation entitles it to an adjustment in the unit price; or
- 7.4.5 If the parties are unable to agree as to the effect of any such variations in the quantity of Unit Price Work performed.

ARTICLE 8. CHANGE OF CONTRACT TIME

- 8.1 Contract Time may only be changed by a Change Order or a Written Amendment. 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 as a result of the occurrence of said event.
- 8.2 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 County or others performing additional Work; or to fires, floods, epidemics, abnormal weather conditions or acts of God.
- 8.3 All time limits stated in the Contract Documents are of the essence.

ARTICLE 9. WARRANTY, TEST/INSPECTION, CORRECTION

- 9.1 Contractor warrants, for a minimum period of three (3) years or as otherwise stated herein, and guarantees to County that all Work will be in accordance with the Contract Documents and will not be defective; that County, representatives of County, and governmental agencies with jurisdictional interests will have access to the Work at reasonable time for their observation, inspecting and testing (Contractor shall give 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 County).
- 9.2 If any Work (including work of others) that is to be inspected, tested, or approved is covered without written concurrence of Engineer, it must, if requested by Engineer, be uncovered for observation. Such uncovering shall be at Contractor's expense unless Contractor has given Engineer timely notice of Contractor's intention to cover the same and Engineer has not acted with reasonable promptness in response to such notice. Neither observations by

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.

- 9.3 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, County 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 engineers, architects, attorneys and other professionals and any additional expenses experienced by County 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 schedule and shall not be entitled to an extension of the Contract Time and the recovery of delay damages due to correcting or removing defective Work.
 - 9.3.1 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, County may correct and remedy any such deficiency to the extent necessary to complete corrective and remedial action. County 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 County has paid Contractor but which are stored elsewhere. All direct and indirect costs of County in exercising such rights and remedies will be charged against Contractor in an amount approved as to reasonableness by Engineer and a Change Order will be issued incorporating the necessary revisions.
 - 9.3.2 If within three (3) years after the date of completion 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 County and in accordance with County's written instructions, either correct such defective Work or if it has been rejected by County, remove it from the site and replace it with non-defective Work. If Contractor does not promptly comply with the terms of such instruction, County may have the defective Work corrected or removed and all direct, indirect and consequential costs of such removal and replacement will be paid by Contractor.

ARTICLE 10. SUSPENSION OR TERMINATION OF WORK

- 10.1 County reserves the right to suspend the Work, or any portion thereof, at any time without cause for a period not to exceed 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 Price or an extension of the Contract Time, or both, directly attributable to any suspension if Contractor makes an approved claim therefore.
 - 10.1.1 If Work is suspended by County for a period that exceeds ninety (90) days; or if Work is suspended by an order of court or other public authority; or if County fails to pay Contractor, then Contractor may, upon seven (7) days written notice to County, terminate the Contract and recover payment for all Work executed.
 - 10.1.2 In lieu of terminating the Contract, if the Engineer has failed to act on any Application for Payment or County has failed to make any payment as aforesaid, Contractor may, upon seven (7) days written notice to County, stop the Work until payment of all amounts then due have been received.
- 10.2 County reserves the right, after giving seven (7) days written notice, to terminate this Contract if:
 - 10.2.1 Contractor persistently fails to perform the Work in accordance with the Contract Documents;
 - 10.2.2 Contractor disregards laws or regulations of any public body having jurisdiction;
 - 10.2.3 Contractor commences a voluntary case under any chapter of the Bankruptcy Code or any similar action by filing a petition under any other federal or state law relating to bankruptcy or insolvency;
 - 10.2.4 Contractor has a petition filed against them under any chapter of the Bankruptcy Code or similar relief under any other federal or state law;
- 10.3 County may exclude Contractor from the site and take possession of the Work and of all Contractor's tools, construction equipment and machinery at the site and use 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 site or for which County has paid Contractor but which are stored elsewhere, and finish the Work as County may deem expedient.
 - 10.3.1 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.

- 10.3.2 If the direct, indirect and consequential costs of completing the Work exceed the unpaid balance of the Contract Price, Contractor shall pay the difference to County. Such costs incurred by County shall be verified by County and incorporated in a Change Order; but in finishing the Work, County shall not be required to obtain the lowest figure for the Work performed. Contractor's obligations to pay the difference between such costs and such unpaid balance shall survive termination of this Contract.
- 10.4 In the event sufficient budgeted funds are not available for a new fiscal year, County shall notify Contractor of such occurrence and Contract shall terminate on the last day of the current fiscal year without penalty or expense to County.
- 10.5 Failure of Contractor to comply with any of the provisions of this Contract shall be considered a Material Breach of Contract and shall be cause for immediate termination of Contract at the discretion of County.
- 10.6 In addition to all other legal remedies available to County, County reserves the right to terminate and obtain from another source, any commodities or services which have not been delivered within the Contract Time as stated in the Contract Documents.

ARTICLE 11. CONTRACT CLAIMS & DISPUTES

11.1 Except as otherwise provided herein, any dispute arising under this Contract shall be decided by the Purchasing Official in accordance with Section 2-26-63 of the Manatee County Code subject to an administrative hearing process provided in 2-26-64. The decision of the Board of County Commissioners in accordance with Section 2-26-64 of the Manatee County Code shall be the final and conclusive County decision subject to exclusive judicial review in the circuit court by a petition for certiorari.

ARTICLE 12. RESIDENT PROJECT REPRESENTATIVE - DUTIES, RESPONSIBILITIES

- 12.1 The Resident Project Representative is the Engineer's Agent, who will act as directed by and under the supervision of the Engineer, and who will confer with County regarding his actions. Resident Project Representative's dealing in matters pertaining to the on-site Work shall, in general, be only with the County and Contractor and dealings with Subcontractors shall only be through or with the full knowledge of Contractor.
- 12.2 Resident Project Representative will:
 - 12.2.1 Review the progress schedule, schedule of shop drawing submissions and Schedule of Values prepared by Contractor and consult with County concerning their acceptability.

- 12.2.2 Attend Preconstruction Conferences. Arrange a schedule of progress meetings and other job conferences as required in consultation with County and notify those expected to attend in advance. Attend meetings and maintain and circulate copies of minutes thereof.
- 12.2.3 Serve as County's liaison with Contractor, working principally through Contractor's superintendent and assist him in understanding the intent of the Contract Documents. As requested by Contractor, assist in obtaining additional details or information when required at the job site for proper execution of the Work.
- 12.2.4 Receive and record date of receipt of Shop Drawings and samples, receive samples which are furnished at the site by Contractor and notify Engineer of their availability for examination.
- 12.2.5 Advise Engineer and Contractor or his superintendent immediately of the commencement of any Work requiring a shop drawing or sample submission if the submission has not been approved by the County.
- 12.2.6 Conduct on-site observations of the Work in progress to assist Engineer in determining if the Work is proceeding in accordance with the Contract Documents and that completed Work will conform to the Contract Documents.
- 12.2.7 Report to County whenever he or she believes that any Work is unsatisfactory, faulty or defective or does not conform to the Contract Documents, or does not meet the requirements of any inspections, tests or approvals required or if Work has been damaged prior to final payment; and advise Contractor when he believes Work should be corrected or rejected or should be uncovered of observation or requires special testing, inspection or approval.
- 12.2.8 Verify that tests, equipment and system start-ups and operating and maintenance instructions are conducted as required by the Contract Documents and in the presence of the required personnel, and that Contractor maintains adequate records thereof; observe, record and report to Engineer appropriate details relative to the test procedures and start-ups.
- 12.2.9 Accompany visiting inspectors representing public or other agencies having jurisdiction over the project; record the outcome of these inspections and report to County.
- 12.2.10 Transmit to Contractor, Engineer's clarifications and interpretations of the Contract Documents.

- 12.2.11 Consider and evaluate Contractor's suggestions or modifications in drawings or Contract Documents and report them with recommendations to County.
- 12.2.12 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 subsequent to the execution of the Contract, Engineer's clarifications and interpretations of the Contract Documents, progress reports and other project related documents.
- 12.2.13 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. Send copies to County.
- 12.2.14 Record names, addresses and telephone numbers of all Contractors, Subcontractors and major Suppliers of materials and equipment.
- 12.2.15 Furnish 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.
- 12.2.16 Consult with Engineer in advance of scheduling major tests, inspections or start of important phases of the Work.
- 12.2.17 Report immediately the occurrence of any accident.
- 12.2.18 Review applications for payment with Contractor for compliance with the established procedure for their submission and forward them with recommendations to Engineer, noting particularly their relation to the Schedule of Values, Work completed and materials and equipment delivered at the site but not incorporated in the Work.
- 12.2.19 During the course of the Work, verify that certificates, maintenance and operations manuals and other data required to be assembled and furnished by Contractor are applicable to the items actually installed, and deliver this material to County for his review prior to final acceptance of the Work.
- 12.2.20 Before Engineer issues a certificate of Substantial Completion, submit to Contractor a list of observed items requiring completion or correction.

- 12.2.21 Conduct final inspection in the company of County and/or Engineer and Contractor and prepare a Punch List of items to be completed or corrected. Reference Florida Statutes § 218.735(7).
- 12.2.22 Verify that all items on final list have been completed or corrected and make recommendations to County concerning acceptance.
- 12.3 Except upon written instructions of Engineer, Resident Project Representative:
 - 12.3.1 Shall not authorize any deviation from the Contract Documents or approve any substitute materials or equipment;
 - 12.3.2 Shall not exceed limitations on Engineer's authority as set forth in the Contract Documents;
 - 12.3.3 Shall not undertake any of the responsibilities of Contractor, Subcontractors or Contractor's superintendent, or expedite the Work;
 - 12.3.4 Shall not 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;
 - 12.3.5 Shall not advise on or issue directions as to safety precautions and programs in connection with the Work;
 - 12.3.6 Shall not authorize County to occupy the project in whole or in part; and
 - 12.3.7 Shall not participate in specialized field or laboratory tests.

ARTICLE 13. APPRENTICES

- 13.1 If successful Contractor employs apprentices, he shall be governed and comply with the provisions of Fla.Stat. § 446.011.
 - NOTE: The form of all submittals, notices, Change Orders and other documents permitted or required to be used or transmitted under the Contract shall be determined by the County. Standard County forms shall be utilized.

END OF SECTION E

SECTION F FORM OF CONTRACT BETWEEN THE COUNTY OF MANATEE, FLORIDA AND CONTRACTOR AS IDENTIFIED BELOW ON THE BASIS OF A STIPULATED UNIT COST CONTRACT PRICE

ARTICLE 1. WORK

CONTRACTOR shall furnish all labor, materials, supplies, and other items required to complete the Work for IFB #14-2032CD- 10 MG Storage Tank and Interconnection at the Southeast Water Reclamation Facility in strict accordance with Contract Documents and any duly authorized subsequent Addenda thereto, all of which are made a part hereof.

ARTICLE 2. COMPENSATION

As compensation to CONTRACTOR, COUNTY shall pay and CONTRACTOR will accept as full consideration for the performance of all Work required by IFB #14-2032CD- 10 MG Storage Tank and Interconnection at the Southeast Water Reclamation Facility, subject to additions and deductions as provided therein, the sum of \$xxxxx.xx based on a completion time of <u>540</u> calendar days.

ARTICLE 3. LIQUIDATED DAMAGES

Time is of the essence in this CONTRACT. As of the date of this CONTRACT, the damages that will be suffered by COUNTY in the event of CONTRACTOR'S failure to timely complete the Work are impossible to determine. In lieu thereof, it is agreed that if CONTRACTOR fails to achieve Final Completion of the Work within <u>540</u> calendar days of issuance of the Notice to Proceed (accounting, however, for any extensions of time granted pursuant to approved Change Orders), CONTRACTOR shall pay to COUNTY,

as liquidated damages (and not as a penalty), the sum of \$3,770 per calendar day for each day beyond 504 days until CONTRACTOR achieves Final Completion. COUNTY shall have the option of withholding said liquidated damages from any pay application(s) thereafter submitted by CONTRACTOR. Alternatively, CONTRACTOR shall immediately pay said sums to COUNTY upon COUNTY'S demand for same.

ARTICLE 4. ENGINEER

The COUNTY of MANATEE, Public Works Department, is responsible as COUNTY and McKim & Creed, Inc. as "ENGINEER", designed this Project and is responsible for technical/engineering reviews and decisions. The ENGINEER is a member of COUNTY'S Project Management team which is collectively responsible for ensuring the Work is completed in accordance with the Contract Documents.

All communications involving this Project will be addressed to: <u>Anthony Benitez, PE,</u> <u>Project Engineer II, Public Works Department</u> and to the Engineer of Record, <u>Matthew</u> <u>S. Love, PE, McKim & Creed, Inc.</u> <u>All invoicing</u> will be addressed to the attention of: <u>Anthony Benitez, PE (address noted below) with invoice copies sent to Matthew S.</u> <u>Love, PE, McKim & Creed, Inc. (address noted below).</u>

Manatee County Public Works Dept. IFB# 14-2032CD Attention: Anthony Benitez, PE Project Engineer II 1022 26th Avenue East Bradenton, Florida 34208 Phone (941) 708-7450 ext. 7333

McKim & Creed, Inc. IFB# 14-2032CD Attn: Matthew S. Love, PE Project Manager 3903 Northdale Blvd. Ste 140W Tampa, Florida 33624 Phone (813) 549-3740

Where the terms ENGINEER and/or COUNTY are used in the Contract Documents, it shall mean COUNTY'S Project Management team.

ARTICLE 5. CONTRACTOR'S REPRESENTATIONS

In order to induce COUNTY to enter into this CONTRACT, CONTRACTOR makes the following representations:

- 5.1 CONTRACTOR has familiarized itself with the nature and extent of the Bid Documents, Work, site, locality and all local conditions and laws and regulations that in any manner may affect cost, progress, performance or furnishing of the Work.
- 5.2 CONTRACTOR has studied carefully all drawings of the physical conditions upon which CONTRACTOR is entitled to rely.
- 5.3 CONTRACTOR has obtained and carefully studied (or assumes responsibility for obtaining and carefully studying) all such examinations, investigations, explorations, tests, reports and studies which pertain to the physical conditions at or contiguous to the site or which otherwise may affect the cost, progress, performance or furnishing of the Work as CONTRACTOR considers necessary for the performance or furnishing of the Work at the Contract Price, within the Contract Time and in accordance with the other terms and conditions of the Bid Documents; and no additional examinations, investigations, explorations, tests, reports, studies or similar information or data are or will be required by CONTRACTOR for such purposes.
- 5.4 CONTRACTOR has reviewed and checked all information and data shown or indicated on the Bid Documents with respect to existing Underground Facilities at or contiguous to the site and assumes responsibility for the accurate location of said Underground Facilities. Any additional examinations, investigations, explorations, tests, reports, studies or similar information or data in respect of said Underground Facilities conducted by CONTRACTOR will be done at CONTRACTOR'S expense.

- 5.5 CONTRACTOR has correlated the results of all such observations, examinations, investigations, explorations, tests, reports and studies with the terms and conditions of the Bid.
- 5.6 CONTRACTOR has given COUNTY written notice of all conflicts, errors or discrepancies that have been discovered in the Bid Documents and the written resolution thereof by COUNTY is acceptable to CONTRACTOR.
- 5.7 CONTRACTOR shall schedule and perform the Work subject to COUNTY'S approval and shall hold COUNTY harmless from all liabilities incurred due to CONTRACTOR'S failure to coordinate with COUNTY.

ARTICLE 6. CONTRACT DOCUMENTS

The Contract Documents which comprise the entire CONTRACT between COUNTY and CONTRACTOR concerning the Work consist of the following:

- 6.1 This CONTRACT and Bid Document IFB #14-2032CD
- 6.2 Invitation for Bid #14-2032CD, in its entirety
- 6.3 Public Construction Bond Form and Insurance Certificate(s)
- 6.4 Drawings/Plans (not attached)
- 6.5 Addendum number \underline{x} to \underline{x} inclusive
- 6.6 CONTRACTOR'S Bid Form
- 6.7 Reports
- 6.8 The following, which may be delivered or issued after the Effective Date of the CONTRACT and are not attached hereto: all written Change Orders and other documents amending, modifying, or supplementing the Contract Documents.

6.9 The documents listed in paragraphs above are attached to this CONTRACT (except as noted otherwise above). There are no Contract Documents other than those listed above in this Article 6.

ARTICLE 7. DISPUTE RESOLUTION

Disputes shall be resolved as follows: good faith negotiations by the designated agents of the parties and if not resolved by such designated agents, CONTRACTOR shall submit its claim, with the basis for the dispute, in writing to the Manatee County Purchasing Official for a determination and handling in accordance with the provisions of Chapter 2-26 of the Manatee County Code.

ARTICLE 8. NO WAIVER

- 8.1 The failure of CONTRACTOR or COUNTY to insist on the strict performance of the terms and conditions hereof shall not constitute or be construed as a waiver or relinquishment of either party's right to thereafter enforce the same in accordance with this CONTRACT in the event of a continuing or subsequent default on the part of CONTRACTOR or COUNTY.
- 8.2 Nothing herein shall be interpreted as a waiver of COUNTY of its rights, including the limitations of the limited waiver of sovereign immunity, as set forth in Florida Statute 768.28, or any other statute, and COUNTY expressly reserves these rights to the full extent allowed by law.

ARTICLE 9. NO THIRD-PARTY BENEFICIARIES

This CONTRACT 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 CONTRACT is intended or shall be construed to confer upon or give any person, corporation, partnership, trust, private entity, agency, or any other governmental entity any right, privilege, remedy, or claim under or by reason of this CONTRACT or any provisions or conditions hereof.

ARTICLE 10. GOVERNING LAW, JURISDICTION AND VENUE

- 10.1 This CONTRACT and the construction and enforceability thereof shall be interpreted under the laws of the State of Florida.
- 10.2 CONTRACTOR consents and agrees that all legal proceedings related to the subject matter of this CONTRACT shall be governed by the laws of and maintained in courts sitting with the State of Florida.
- 10.3 CONTRACTOR consents and agrees that jurisdiction for such proceedings shall lie exclusively with such court and venue in Manatee County, Florida, or if in Federal Court, the Middle District of Florida, Tampa Division.
- 10.4 In the event of any litigation arising under the terms of this CONTRACT, each party shall be responsible for their own attorney's fees, including appellate fees, regardless of the outcome of the litigation.

ARTICLE 11. FORCE MAJEURE

Neither party shall be considered in default of performance of such obligations hereunder to the extent that performance of such obligations or any of them is delayed or prevented by Force Majeure. Force Majeure shall include, but not be limited to hostility, revolution, civil commotion, strike, epidemic, fire, flood, wind, earthquake, hurricane, or other disruptive event of nature, act of terrorism, explosion, lack of or failure of transportation or bridge/roadway facilities, any law, proclamation, regulation, ordinance or other act of government, or any act of God or any cause whether of the same or different nature, existing or future; provided that the cause, whether or not enumerated in this Article, is beyond the control and without the fault or negligence of the party seeking relief under this Article.

ARTICLE 12. MISCELLANEOUS

- 12.1 Terms used in this CONTRACT are defined in Article 1 of Section E, General Conditions.
- 12.2 No assignment by a party hereto of any rights under or interest in the Contract Documents will be binding on another party hereto without the written consent of the party sought to be bound; and specifically but without limitation, monies that may become due and monies that are due may not be assigned without such consent (except to the extent that the effect of this restriction may be limited by law); and unless specifically stated to the contrary in any written consent to an assignment, no assignment will release or discharge the assignee from any duty or responsibility under the Contract Documents.
- 12.3 COUNTY and CONTRACTOR each binds itself, its partners, successors, assigns and legal representatives to the other party hereto, its partners, successors, assigns and legal representatives in respect of all covenants, agreements, and obligations contained in the Contract Documents.
- 12.4 By accepting Award of this CONTRACT, 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 duties or services required hereunder.

CONTRACT

IFB #14-2032CD

IN WITNESS WHEREOF, the parties hereto have caused this CONTRACT **14-2032CD** to be duly executed by their authorized representatives.

CONTRACTOR

Ву: _____

Print Name & Title of Signer

Date: _____

COUNTY OF MANATEE, FLORIDA

By:

Melissa M. Wendel, CPPO Purchasing Official

Date: _____

BID FORM

(Submit in triplicate)

For: IFB #14-2032CD- 10 MG Storage Tank and Interconnection at the Southeast Water Reclamation Facility

Total Offer:

Based on a completion time of <u>540</u> calendar days

Only one schedule for Completion of the Work shall be considered. Only one Award shall be made.

We, the undersigned, hereby declare that we have carefully reviewed the Bid Documents and with full knowledge and understanding of the aforementioned herewith submit this Bid, meeting each and every specification, term, and condition contained in the Invitation for Bid package, in its entirety.

We understand that the Invitation for Bid package, in its entirety, including but not limited to, all Specifications, terms, and conditions shall be made a part of any resulting Contract between Manatee County and the Successful Bidder. Failure to comply shall result in Contract default, whereupon, the defaulting Contractor shall be required to pay for any and all re-procurement costs, damages, and attorney fees as incurred by County, and agrees to forfeit his/her Bid Bond.

Communications concerning this Bid shall be addressed as follows: (Complete all fields)

Bidder's Name:				
Mailing Address:				
Telephone: ()		Fax: ()		
Email Address:				
l,	c	on [date(s)]	attest that I have	
visited the Project site(s) to familia	arize myself with	the full Scope of Work required	for the Bid.	
Acknowledge Addendum No Da	ated: A	Acknowledge Addendum No	_ Dated:	
Acknowledge Addendum No Da	ated: A	Acknowledge Addendum No	_ Dated:	
Acknowledge Addendum No Da	ated: A	Acknowledge Addendum No	_ Dated:	
Authorized Signature((s):			
Name and Title of Above Signer(s):				
C (· ·			

Date: _____

BID FORM

(Submit in Triplicate)

10 MG STORAGE TANK AND INTERCONNECTION AT THE SOUTHEAST WATER RECLAMATION FACILITY

	-				
ITEM NO.		EST. QTY.	U/M	UNIT PRICE	EXTENDED PRICE
1	MOBILIZATION/ DEMOBILIZATION	1	LS	\$	\$
2	DEMOLITION	1	LS	\$	\$
3	SITE WORK	1	LS	\$	\$
4	EFFLUENT TRANSFER PUMP STATIONS TO LOW SERVICE PUMP STATIONS	1	LS	\$	\$
5	HIGH SERVICE PUMP STATION	1	LS	\$	\$
6	10 MG GROUND STORAGE TANK	1	LS	\$	\$
7	SITE PIPING	1	LS	\$	\$
8	OIL STORAGE BUILDING RELCOCATION	1	LS	\$	\$
9	ELECTRICAL WORK AND INSTRUMENTATION	1	LS	\$	\$
	TOTAL BASE BID "A" - Based on Completion Time of <u>540</u> Calendar Days				\$
10	CONTRACT CONTINGENCY WORK (USED ONLY WITH COUNTY APPROVAL)		5% OF	TOTAL BASE BID	\$
	TOTAL OFFER FOR BID "A" with Contract Cor - Based on Completion Time of <u>540</u> Calendar D	ntingency Days			\$

Bid "A" Based on Completion Time of 540 Calendar Days

Bidder Name: _____

Authorized Signature: _____

MAILING LABEL

Cut along the outside border and affix this label to your sealed Bid envelope to identify it as a "Sealed Bid". Be sure to include the name of the company submitting the Bid and the Bid due date and time where requested.

MAILING LABEL TO AFFIX TO OUTSIDE OF SEALED BID PACKAGE:

SEALED BID - DO NOT OPEN
CONTRACTOR:
SEALED BID NO: <u>14-2032CD</u>
BID TITLE: <u>10 MG Storage Tank and Interconnection at the</u> Southeast Water Reclamation Facility
DUE DATE/TIME: @

FORM A CONTRACTOR'S QUESTIONNAIRE

(Submit in Triplicate)

The 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:
	License/FDOT Certification#:
	License Issued to:
	Date License Received (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?
	BIDDER:

- 6. Attach a list of projects where this specific type of Work was performed.
- 7. Describe and give the date and County of the last three government or private work of similar scope you've completed which are similar in cost, type, size, and nature as this Project. Include contact name and phone number. Provide the budget, actual cost, size and summary of work for each project. Attach additional pages as necessary. (Note: If listing a Manatee County reference, contact person should not be directly associated with this Project.
- 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 projects 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:

BIDDER: ______

- 11. Will you subcontract any part of this Work? If so, describe which major portion(s):
- 12. If any, list (with Contract amount) MBE/DBE to be utilized:
- 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)

ist the following in con Surety's Name: Address:	nection with the Surety which is providing the bond(s):
Address:	
lame, address, phone process in Florida:	number and email of Surety's resident agent for service of
Agent's Name:	
Address:	
Phone:	
Email:	
	lame, address, phone rocess in Florida: Agent's Name: Address: Phone: Email:

FORM B PUBLIC CONTRACTING AND ENVIRONMENTAL CRIMES CERTIFICATION

SWORN STATEMENT PURSUANT TO ARTICLE V, MANATEE COUNTY PURCHASING ORDINANCE

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:

(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 County'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.

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

(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 County's Purchasing Official. Upon presentation of such satisfactory proof, the person or entity shall be allowed to contract with County.

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 CONTRACT 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 FLORIDA COUNTY OF				
Sworn to and subscribed before me this _	day of	, 20	by	
Personally known	OR Produced identificat	tion		
,		[Туре с	of identification]	
	My com	nmission expire	S	
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.

FORM C SWORN STATEMENT THE FLORIDA TRENCH SAFETY ACT

THIS FORM MUST BE SIGNED IN THE PRESENCE OF A NOTARY PUBLIC OR BY AN OFFICER AUTHORIZED TO ADMINISTER OATHS.

1. This Sworn Statement is submitted with IFB No. 14-2032CD

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 County and Engineer, 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)	Measure (LF, SY)	Unit <u>Quantity</u>	Unit Cost	Extended <u>Cost</u>
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 (Impress official seal)	day of	, 20		
Notary Public, State of Florida:				
My commission expires:				



R. B. "Chips" Shore

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

E PAYABLES APPLICATION

Company			
name			
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person			
Phone			
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	Name and phone nur	mber	
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BANK		Return completed for Via email to:	orm to:
		lori.bryan@manatee	<u>clerk.com</u>
		Via mail:	/41-4011
		PO Box 1000	
		Bradenton, Fl	34206

Revised: June 26, 2013

CONTRACT DOCUMENTS AND TECHNICAL SPECIFICATIONS

SEWRF 10 MG STORAGE TANK AND INTERCONNECTION

Prepared for BOARD OF COUNTY COMMISSIONERS COUNTY OF MANATEE, FLORIDA

COUNTY PROJECT NO. 6084880



ISSUE FOR BID

April 2014

Prepared by



1365 Hamlet Ave Clearwater, Florida 33756 Ph: 727/442-7196 Fax: 727/461-3827

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FDEP - Domestic Wastewater Facility Permit Geotechnical Investigation Dated 9-17-2013

END TOC
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

The Contractor shall furnish all labor, superintendence, materials, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, shop drawings, working drawings and other means of construction necessary or proper for performing and completing the work. He shall obtain and pay for all required permits necessary for the work, other than those permits such as the DEP permit and railroad permit which may have already been obtained. 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 Engineer, 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 costs incidental thereto. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the work.

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 therefore.

The Contractor shall provide and maintain such modern plant, tools, and equipment as may be necessary, in the opinion of the Engineer, to perform in a satisfactory and acceptable manner all the work required by this Contract. Only equipment of established reputation and proven efficiency shall be used. The Contractor shall be solely responsible for the adequacy of his workmanship, materials and equipment, prior approval of the Engineer notwithstanding.

C. Public Utility Installations and Structures

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 whether owned or controlled by the Owner, other governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewage, drainage, water or other public or private property which may be affected by the work shall be deemed included hereunder.

The Contractor shall protect all public utility 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 Engineer. The Contractor shall so arrange his operations as to avoid any damage to these facilities. 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 Plans or have been located in the field by the utility shall be repaired by the Contractor, at his expense, as approved by the Engineer. No separate payment shall be made for such protection or repairs to public utility installations or structures.

Public utility installations or structures owned or controlled by the Owner 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 therefore.

Where public utility installations or structures owned or controlled by the Owner or other governmental body are encountered during the course of the work, and are not indicated on the Plans or in the Specifications, and when, in the opinion of the Engineer, 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 Engineer, 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.

The Contractor shall give written notice to Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations, at least forty-eight hours in advance of breaking ground in any area or on any unit of the work. This can be accomplished by making the appropriate contact with the "Sunshine State One-Call of Florida, Inc. Call Center ("Call Sunshine") and per all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

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 Engineer.

1.02 PLANS AND SPECIFICATIONS

A. Plans

When obtaining data and information from the Plans, 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 Plans and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

C. Supplementary Drawings

When, in the opinion of the Engineer, 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 Engineer 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 Plans, Supplementary Drawings, Schedules, Specifications or other data received from the Engineer, 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 there from 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 Engineer, should such errors or omissions be discovered. All schedules are given for the convenience of the Engineer 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 contains General Requirements which govern the work. Products and Execution modify and supplement these by detailed requirements for the work and shall always govern whenever there appears to be a conflict.

F. Intent

All work called for in the Specifications applicable to this Contract, but not shown on the Plans 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 Plans 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.

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.

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

The names of proposed manufacturers, material men, suppliers and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Engineer for approval. Such approval must be obtained before shop drawings will be checked. No manufacturer will be approved for any materials to be furnished under this Contract unless he shall be of good reputation and have a plant of ample capacity. He shall, upon the request of the Engineer, be required to submit evidence that he has manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.

All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the Engineer, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.

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

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.

Spare parts shall be furnished as specified.

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.

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.

Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Plans, unless directed otherwise by the Engineer 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.

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 Engineer and made of ample size and strength for the purpose intended. Substantial templates and working drawings for installation shall be furnished.

The Contractor shall, at his own expense, furnish all materials and labor for, and shall properly bed in nonshrink grout, each piece of equipment on its supporting base that rests on masonry foundations.

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 300M. 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 Owner, such engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General

Inspection and testing of materials will be performed by the Owner unless otherwise specified.

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 (3) copies of the reports shall be submitted and authoritative certification thereof must be furnished to the Engineer as a prerequisite for the acceptance of any material or equipment.

If, in the making of any test of any material or equipment, it is ascertained by the Engineer 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 Owner.

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.

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 Owner formally takes over the operation thereof.

B. Costs

All inspection and testing of materials furnished under this Contract will be performed by the Owner or duly authorized inspection engineers or inspections bureaus without cost to the Contractor, unless otherwise expressly specified.

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.

Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the Owner for compliance. The Contractor shall reimburse the Owner 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 Engineer, at least two 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 Engineer 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 Engineer 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

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 Engineer notifies the Contractor, in writing, that the results of such tests are acceptable.

Five copies of the manufacturer's actual test data and interpreted results thereof, accompanied by a certificate of authenticity sworn to by a responsible official of the manufacturing company, shall be forwarded to the Engineer for approval. 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

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.

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 Owner. The Supplier shall assist in the final field tests as applicable.

H. Failure of Tests

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 Engineer 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 Owner, 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.

In case the Owner 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 Owner may, after the expiration of a period of thirty (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 Engineer 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 Engineer, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The Engineer 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 TEMPORARY SERVICES

A. 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 Plans, or as given by the Owner/Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

B. Safeguarding Marks

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 to removing without authorization such established points, stakes and marks. 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.

1.08 ADJACENT STRUCTURES AND LANDSCAPING

A. Responsibility

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 Plans, and the removal, relocation and reconstruction of such items called for on the Plans 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 Plans and when, in the opinion of the Engineer, additional work is deemed necessary to avoid interference with the work, payment therefore will be made as provided for in the General Conditions.

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.

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 Owner and to the satisfaction of the Engineer. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be given to the Engineer.

Prior to the beginning of any excavations, the Contractor shall advise the Engineer 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 Owner may order the Contractor, for the convenience of the Owner, to remove trees along the line or trench excavation. If so ordered, the Owner 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 in the manner described in the Workmanship and Materials Paragraph in Section 02900, Seeding and Sodding.

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 Engineer. 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.

Except in the event of an emergency, no work shall be done between the hours of 7:00 P.M. and 7:00 A.M., or on weekends. If the proper and efficient prosecution of the work requires operations during the night or weekends, the written permission of the Owner shall be obtained before starting such items of the work.

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

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 Engineer and in accordance with the Plans 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 Engineer, 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

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.

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 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 Engineer 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

SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS

- A. The work may consist of, but may not be limited to the following improvements for the SEWRF 10 MG Storage Tank and Interconnection:
 - 1. Convert the existing High Service Effluent Pump Station to the Low Service Pump Station. Remove the existing high service pumps and VFDs. Replace with new five (5) 100 HP vertical turbine pumps with VFDs.
 - 2. Construct a new High Service Pump Station for the proposed 10 MG Ground Storage Tank. The pump station will have four (4) 400 HP vertical turbine pumps in cans, each with a variable frequency drive and with a maximum capacity of approximately 8 MGD; and two (2) 200 HP vertical turbine pumps in cans, each with a variable frequency drive and with a maximum capacity of approximately 4 MGD. The pump station shall have a 42-inch intake pipe approximately 360 feet in length, a 36-inch discharge pipe with a flowmeter.
 - 3. Construct a 30-inch Low Service Reclaimed Water pipeline from the existing 30-inch Reclaimed Water pipeline southeast of south Equalization Tank to the connection to the proposed 20-inch Low Service Reclaimed Water pipeline , a length of approximately 480 feet.
 - 4. Construct approximately 2,040 feet of 20-inch Low Service Reclaimed Water pipeline from the proposed Low Service 30 -inch Reclaimed Water pipline , including connecting to existing pond metering assemblies for South Pond 1, South Pond 2, and East Pond.
 - 5. Construct a 30-inch High Service Reclaimed Water pipeline from the High Service Pump Station effluent to the existing 30 -inch Reclaimed Water pipline to be converted from low service to high service, a length of approximately 1,260 feet.
 - 6. Construct a 16-inch Storage Pond Return Reclaimed Water Pipeline to replace the storage pond return

pipeline that will be removed from storage tank site, a length of approximately 280 feet.

- 7. Construct a 10 MG Storage Tank with inner diameter of 200 feet and a side wall height of 42.5 feet.
- Construct a 42-inch Storage Tank Overflow pipeline to South Pond 1 , a length of app roximately 80 feet.
- 9. Construct a 42-inch Storage Tank Effluent pipeline from the proposed Storage Tank to the proposed High Service Pump Station , a length of approximately 360 feet. Provide and install a 42 inch outlet to the South Pond 1.
- 10. Construct a 36-inch Reclaimed Water High Service Pump Station Effluent pipeline from the proposed High Service Pump Station to the existing 30-inch pipeline to MARS, a length of approximately 180 feet.
- 11. Construct a 30-inch Storage Tank and Low Service Interconnect pipeline, a length of approximately 100 feet. Provide and install a 16 -inch surge anticipator valve.
- 12. Provide and install electric power, instrumentation and SCADA equipment, cables, control panels, etc., for the operation, con trol and monitoring of the proposed pumping stations, storage tank, flowmeters, etc.
- B. The Contractor shall furnish all labor, equipment, and incidentals, which are necessary for the full completion of the work whether specifically indicated in the Contract Documents or not. This includes, but is not limited to, miscellaneous concrete, dewatering, sheeting workplace safety, cleanup, etc.

1.02 PLANS AND SPECIFICATIONS

- A. The Plans and the Specifications indicate the extent and nature of the work to be performed.
- B. Plans: When obtaining data and information from the Plans, figures shall be used in preference to scaled dimensions, and large scale drawings in preference to small scale drawings.
- C. 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 Plans and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

- D. Supplementary Drawings: When, in the opinion of the County or Engineer, 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 and five paper prints thereof will be given to the Contractor.
- Contractor to Check Plans and Data: The Contractor Ε. shall verify all dimensions, quantities and details shown on the Plans, Supplementary Dr awings, Schedules, Specifications or other data received from the Owner, and shall notify him Owner 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. Contractor will not be allowed to take advantage of any errors or omissions , as full instructions will be furnished by the Engineer, should such errors or omissions be discovered. All schedules are given for the convenience of the Owner 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.
- F. Specifications: The Technical Specifications consist of three parts: General, Products and Execution. The General Section contains General Requirements which govern the work. Products and Execution modify and supplement these by detailed requirements for the work and shall always govern whenever there appears to be a conflict.
- G. Intent:
 - 1. All work called for in the Specifications applicable to this Contract, but not shown on the Plans 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 Plans 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. The names of proposed manufacturers, material s, suppliers and dealers who are to furnish materials, fixtures, equipment, appliances or other fittings shall be submitted to the Engineer and Manatee County Project Management for approval. Such approval must be obtained before shop drawings will be checked. No manufacturer will be approved for any materials to be furnished under this Co ntract unless he shall be of good reputation and have a plant of ample capacity. He shall, upon the request of the Engineer, be required to submit evidence that he has manufactured a similar product to the one specified and that it has been previously used for a like purpose for a sufficient length of time to demonstrate its satisfactory performance.
 - 2. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the Engineer, t hat the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way release the Contractor from his full responsibility under this Contract.
 - 3. 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.
 - 4. 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.

- B. 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.
- C. Installation of Equipment.
 - 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 Plans, unless directed otherwise by the Engineer 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 Engineer 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, at his own expense, 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 co at of coal tar epoxy equal to Koppers 300M.
- Service of Manufacturer's Engineer: The Contract D. 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 Owner, such engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the Owner in the pro per operation and maintenance of such equipment.

1.04 SUBMITTALS

- A. The Contractor shall submit to the Engineer, within ten days after receipt of Notice to Proceed, a schedule of Shop Drawing Submittals which shall include:
 - 1. The names of proposed manufacturers, suppliers, and dealers,
 - 2. A list of materials and equipment for shop drawing submittals, and
 - 3. Proposed shop drawing submittal dates.
- B. The Contractor shall coordinate all submittals with the related Vendor in a manner not to impede construction on the individual project(s).

1.05 CONTRACTS

A. Furnish all the labor and needed materials as ordered on a project basis under the Contract (Agreement).

1.06 CONSTRUCTION AREAS

The Contractor shall:

- A. Limit his use of the construction areas for work and for storage, to allow for:
 - 1. Work by other contractors.
 - 2. Owner Use.
- B. Coordinate use of work site under direction of Owner's Representative.
- C. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.
- D. Move any stored -products, under Contractor's control, which interfere with operations of the Owner or separate contractor.
- E. Obtain and pay for the use of additional storage of work areas needed for operations.

1.07 OWNER OCCUPANCY

It is assumed that portions of the work will be Α. completed prior to completion of the entire work. Upon completion of construction in each individual facility, including testing, if the Owner, at his sole discretion, desires to accept the individual facility, the Contractor will be issued a dated certificate of completion and acceptance for each individual facility. The Owner will assume ownership and begin operation of the individual facility on that date and the one -year guaranty period shall commence on that date. The Owner has the option of not accepti ng any individual completed facility, but accepting the entire work as a whole when it is completed and tested.

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

Α. 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 Engineer 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 Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress 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 Engineer 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 Engineer 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 Engineer 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 Engineer 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 Engineer, permanent relocation of a utility owned by the Owner 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 Owner will notify the utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the Owner 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 Engineer.
- 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 Engineer 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 Engineer. 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 Engineer.
- 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 Engineer and Owner.
- C. Detours around construction areas will be subject to the approval of the Owner and the Engineer. Where detours

are permitted, the contractor shall provide all necessary barricades and signs as required to divert the flow of traffic. While traffic is detoured, the Contractor shall expedite construction operations and periods when traffic is being detoured, will be strictly controlled by the Owner.

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 Engineer and Owner 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 Engineer.

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.
- All structures shall be protected in a manner approved by Β. the Engineer. Should any of the floors or other parts of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor, at his own expense and to the satisfaction of the Engineer. 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 Owner.

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 01030

SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 PERMITS

A. Upon notice of award, the Contractor shall immediately apply for and/or obtain all applicable permits not previously obtained by the Owner to do the work from the appropriate governmen tal agency or agencies. N o work shall commence until all applicable permits have been obtained a nd copies deliv ered to the Owner's Representative. The costs for obtaining all permits 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 r connections to the terminus of the existing systems all as shown on the Drawings or where directed by the Owner 's Representative. The cost for this work and for the actual connection to the existing systems shall be included in the price bid for the project and shall not result in any additional cost to the Owner.

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, drains and irrigation components 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 Engineer.

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 water, sewer, telephone, electrical, or other 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. Cost for relocation of <u>all</u> existing lines shall be included in the price bid for the project. Should damage occur to an existing line, the Contr actor shall bea r the cost of all repairs to said line.

- B. It is the re sponsibility 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 of an y such excavati on by the Contractor.
- 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 shal 1 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 Eng ineer of the lo cation of the pipeline or utility and shall reroute or relocate the pipeline or utility as directed. Cost for relocation of existing pipelines or utilities shall be included in the price bid for the project.
- E. The Contractor sh all exercise care in any excav ation to locate all existing piping and utilities. All utilities which do not interfe re with complet e work shall be carefu lly protected a gainst damage. Any existing utilities damaged i n any way by the Contractor shall be res tored or replaced by the Contractor at his expense as directed by the Owner's Representative and/or the owner of the utility.
- F. It is intended that wherever existing utilities such as water, sewer, telephone, electrical, or other service lines must be cross ed, deflection of the pipe

within recommended limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated in th e Drawings. However, when in the opinion of the Owner's Representative this procedure is not feasible, he may direct the use of fittings for a 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 Specifica tions 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 Owner's Representative and Owner a Hurricane Preparedness Plan. T he plan should outline the necessary measures which t he Contractor proposes to perform at no additional cost to the Owner in case of a hurricane warning.
- B. In the event of inclement weather, or whenever Owner's Representative shall direct, Contractor shall insure that he and his Subcontractors shall carefully protect work and materia ls against damage or injury from the weather. If, in the opinion of the Owner's Representative, any portion of work or materia ls is damaged due to the failure on the part o f 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 constructi on 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, building materials, etc., which is removed or replaced as a result of construction under this project may be designated as salvage by the Owner's Representative or Owner and, if so, shall be protected for a reasonable time until pic ked up by the O wner. Any equipment or material not worthy of salvaging, as directed by the Owner's Representative , 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 th e excavations for the duration of the Contract and with his own equipment. He shall dispos e of this w ater in an app ropriate manner.

1.10 ADDITIONAL PROVISIONS

- A. Before commencing work on a ny of the ex isting pipelines, structures or equipment, the Contractor shall notify the Owner's Representative, 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 an d for protection of, all exist ing facilities. The Owner'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 Engineer.
- C. Contractor shall provide protective matting, fuel containment and all other materials, equipment and labor during construction. Any spill of fuel, hydraulic fluid, or oil sha ll be contained. Any contaminated soil shall be removed and disposed of according to all applicable federal, state and local regulations, entirely at the Contractor's expense. Contractor shall, prior to beginning construction, submit a "Fueli ng Spill Preven tion Plan" that shall clearly indicate how fuel spills will be prevented.

1.11 CONSTRUCTION CONDITIONS

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

1.12 PUBLIC NUISANCE

- A. The Contractor shall not creat e a public nui sance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, exce ssive noise or dust.
- B. Sound levels must comply with all applicable state and local codes. Sound levels in excess of those listed in said codes a re sufficient cau se to have the work halted until equipment can be quieted to these levels. Work stoppage by the Engineer or County for excessive noise shall <u>not</u> relieve the Contractor of the other portions of this specification including, but not limited to contract time and contract price.
- C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.13 CHANGES TO GENERAL CONDITIONS

A. The word "completion" shall be replaced with the words "substantial completion" in Specification Section 00700- General Conditions, Article 9.3.2.

1.14 FIELD OFFICES

- A. Office space w ill be made avail able at the sit e for the temporary field offices of the Contractor (and his subcontractors) and for storage of construction materials. The Contractor (and his subcontractors) shall provide all necessary temporary fencing and gates to prote ct materials from pilferage. The location and ty pe of temporary buildings shal 1 be subject to the approval of the OWNER and the Engineer.
- B. Record documents required by the General Conditions and other sections of the Contract Documents shall be kept in the office.
1.15 EXISTING FACILITIES - PLAN OF OPERATION

- The functions of the existing wastewater treatment Α. facility include flow equalization, screening, grit removal, aeration, secondary clarification, sludge recycle, sludge wasting, filtration, chlorin е disinfection prior to discharge to the MCMRS System, sludge digestion and sludge dewatering facilities. These functions must be main tained and sha ll be maintained by the contractor throughout the construction period unless otherwise specified herein, such that there is no deterioration in the quality of the treated effluent. At no time will an overflow of wastewater of a quality less than that which meets the County's discharge permit and which is not disinfected as required by State regulations, be all owed as a result of the Contractor's operations. Construction operations shall be scheduled a nd undertaken so that treatment of the wastewater is continuously maintained, as specified above, throughout the life of the project. The existing limitations fo r the facility must be met during the construction period.
- All electrical work shall b e scheduled to Β. allow continuous electrical operation of the existing facilities with a minimum of required outages. Any power outage or any work which required interrup tion of the plant flow shall be scheduled during a normally dry weather period of the year and at those times of the day and/or night when sewage flows are low. In such cases, the Contractor sha ll submit a wr itten request at leas t seven days prior to the scheduled work or outage and obtain the written permission of the Owner. Suc h permission shall give consideration to recent weather conditions and plant flow patterns, as well as p rojected weather fo recasts for the area, and the Contractor's preparedness to perform the work. The Contractor shall coordinate with the electric utility, as required, regarding the scheduling of the power outages.
- C. The Contractor shall prepare a detailed construction sequence to maintain continuous treatment to allow the facility to meet the required effluent limitations. Continuous treatment shall be d efined, at a mi nimum, as consisting of the following unit processes:
 - Flow Equalization

- Screening
- Grit Removal
- Aeration
- Secondary Clarification
- Sludge Recycle
- Sludge Wasting
- Filtration of Plant Water
- Disinfection
- Effluent Pumping and Flow Measurement
- Plant Water System
- Aerobic Digestion
- Dewatering

This plan shall require approval by the Engineer before any of t he existing fac ilities are mod ified. In this plan he shall successful ly demonstrate to the Engineer that the continuity and degree (quality) o f treatment will not be adversely affected.

- 1. In development of this detailed construction sequence, the contractor shall give particular consideration to the following:
 - a. Connection of the low service p ump station effluent and high service influent and effluent to ground storage tank shall occur during the min imum flow hour s and be coordinated with Operational St aff 10 -days in advance. During this work, plant flow shall be channeled to the existing pipeline to one of the ponds. Contactor shall provide all means to dewater his work area as required to perform the work.
 - b. Contractor shal l coordinate with the Operational Staff, 10 days in advance, all power interrup tions and ya rd piping interconnections, including the tie-ins to the 20" and 30 " effluent line s, and the relocation of the 16" storage pond return.
 - c. All other work including new construction and demolition n ot mentioned in the above schedule may be performed concurrently with any st age of the work as 1 ong as the performance of such work will in no way jeopardize the continuity and quality of treatment of wastewater. The Contractor

shall coordinate his work close ly with the ongoing functions of the existing treatment facility, chemical and other deliveries and with the work of all subcontractors.

- D. Any process equipment, utility, etc. n ecessary to maintain treatment must be maintained. The primary goal is to ma intain continuous treatment t o the required levels.
- E. The Owner's personnel s hall be responsible for the day-to-day operations including meter reading, process monitoring, and establishing control system modifications to ensure compliance with the effluent limits. Maintenance of temporary process equipment including routine correc tive repairs and maintenance shall be perform ed by the Contr actor as part o f the base bid price. Operational c hanges (valves, etc.) shall be perfor med by the O wner o r the O wner's representative.
- F. As part of the construction sequence, the Contractor may fi nd that temporary pumping facilities and temporary piping will be requir ed for wastewat er or other process s treams. These facilities or other means that the Contractor elects shall be s ubject to the review and approval of the Engineer and shall be provided by the Contractor to maintain continuous process operations.
- G. The Contractor shall make whatever provisions are necessary to protect and maintain the continued operation of the existing facilities. Such provisions shall include, but not be limited to the following.
 - 1. Protection of the structural integrity of the existing structures adjacent to work shall be provided as necessary and required for the successful rehabilitation and modification.
 - 2. Installation of suitable temporary piping to replace those which must be demolished as part of the construction or as otherwise required to maintain continuous treatment.
- H. In addition t o the master schedule, pr ior to commencing alteration work on any existing facility, The Contractor shall submit to the Engineer, a

proposed method and schedule o f construction in the immediate area, taking into account the precautions and requirements specified here in. Such work shall not commence until approval is obtained with the Engineer and interruptions of normal plant operation s reviewed with the Owner. n general, tem porary Ι isolation of existing plant components for construction operations shall be carefully coordinated beforehand with the Owner and Engineer so that treatment of wastewater can continue. All work shall be clos ely coordinated with the Owner's operating personnel so that they can adjust their normal operating procedures to any temporary conditions imposed upon them. No temporary isolation of plant components will be permitted until the Contractor has on hand all materials, labor, tools and equ ipment necessary to ac complish the wo rk in that iso lated area. Such work shall begin immediately and be expedited to satisfactory completion as soon as particular area or plant component has been isolated.

I. The Contractor s hall assist the Owner in maint aining any process equipment, utility, etc., necessary to maintain continuous treatment. Any such equipment that must be relocated, either temporarily or permanently, or any process equipment, utilities, etc., that must be in stalled, either temporarily or permanently, to maintain wastewater treatment shall be the responsibility of the General Contractor. The Contractor shall include the cost of all temporary facilities required to maintain treatment, meeting secondary standards, during the construction period in his bid prices. The cost shall include the cost of all labor, tools, equipment and materials necessary.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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.
 - 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 Engineer. Do not proceed with work until Engineer 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.

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.
 - 1. All survey work required in execution of Project.
 - 2. All costs of construction layout shall be included in the unit and lump sum prices contained in the respective divisions of the Contract Bid Form.
 - Civil, structural or other professional engineering services specified or required to execute Contractor's construction methods.

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 approved by the Owner _____. The Contractor shall be responsible for the layout of all such lines and grades, which will be subject to verification by the Engineer.

1.03 SURVEY REFERENCE POINTS

- A. Existing horizontal and vertical control points for the Project are designated on the Contract Drawings.
- 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 Engineer.

- D. Report to Engineer 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.

1.05 RECORD DRAWINGS

- A. Maintain a complete, accurate log of all control and survey work as it progresses.
- B. The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare and certify Record Drawings per Section 01720 - Project Record Documents.

1.06 SUBMITTALS

- A. Submit name and address of Professional Surveyor and Mapper to Engineer for Owner's approval.
- B. Submit certificate signed by the Professional Surveyor and Mapper certifying that elevations and locations of improvements are in conformance, or nonconformance, with Contract Documents.
- PART 2 PRODUCTS (NOT USED)
- PART 3 EXECUTION (NOT USED)

REFERENCE STANDARDS

PART 1 GENERAL

1.01 REQUIREMENTS

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

- A. 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.
- B. Publication Date: The most recent publication in effect on the date of Contract Documents (including addenda), except when a specific publication date is specified.

1.03 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 NW Washington, DC 20036
- ANSI American National Standards Institute 1430 Broadway New York, NY 10018
- ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers 1791 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, Florida 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

Manatee County Utility Operations Department MCUOD 4410 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 National Electrical Manufacturer's Assoc. NEMA 2101 L Street N.W. Washington, DC 20037 OHSA Occupational Safety and Health Assoc. 5807 Breckenridge Pkwy., Suite A Tampa, FL 33610-4249 Portland Cement Association PCA 5420 Old Orchard Road Skokie, IL 20076 Prestressed Concrete Institute PCT 20 North Wacker Drive Chicago, IL 60606 SDI Steel Door Institute 712 Lakewood Center North Cleveland, OH 44107 Sheet Metal and Air Conditioning Contractor's SMACNA National Association 8224 Old Court House Road Vienna, VA 22180 SSPC Steel Structures Painting Council 402 24^{th} Street, Suite 600 Pittsburgh, PA 15213 Southwest Florida Water Management District SWFWMD 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)

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

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

1.02 GENERAL

A. All contract lump sum prices included in the Bid Proposal section will be full compensation for all labor, equipment and incidentals to construct the 10 MG Storage Tank and Interconnection and appurtenances as specified in the Contract Documents under this contract.

1.03 WORK OUTSIDE AUTHORIZED LIMITS

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

1.04 PAYMENT

A. Lump Sum Items: 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 within the limits of work shown or specified.

1.05 COSTS INCLUDED IN PAYMENT ITEMS

- A. Separate Payment: No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of work.
 - 1. Clearing and grubbing.
 - Trench excavation, including necessary pavement and rock removal, except as otherwise specified.
 - 3. Dewatering and disposal of surplus water.
 - 4. Structural fill, backfill, grading, and related transport costs.
 - 5. Replacement of unpaved roadways, grass (sod) and shrubbery plots.
 - 6. Cleanup.

- 7. Foundation and borrow materials, except as hereinafter specified.
- 8. Testing and placing system in operation.
- 9. Any material and equipment required to be installed and utilized for tests.
- 10. Pipe, structures, pavement replacement, restoration and/or appurtenances included within the limits of lump sum work, unless otherwise shown.
- 11. Maintaining the existing quality of service during construction, including any required by-pass pumping.
- 12. Appurtenant work as required for a complete and operable system.
- 13. Repair of damaged irrigation piping and sprinkler heads.
- 14. Maintaining access to treatment plant structures with barriers, lights, signage etc.
- B. Cleanup: CONTRACTOR's attention is called to the fact that cleanup is considered a part of the work of construction. No payment will be made until cleanup is essentially complete.

1.06 BID ITEMS

Bid Item No. 1 - Mobilization/Demobilization

- Mobilization shall be the preparatory work and Α. operations in mobilizing for beginning work on the project, including, but not limited to, those operations necessary for the movement of pers onnel, equipment, supplies and incidentals to the project site, and for the establishment of temporary offices, storage buildings, safety equipment and first aid supplies, sanitary and other facilities, as required by the Contract Documents and applicable laws and regulations. The costs of bonds, required insurance, permits and any other preconstruction expense necessary for the start of the work, excluding the cost of construction materials, shall also be included in this item. Demobilization shall be the work of removing temporary facilities from the site.
- B. Payment for mobilization/demobilization shall not exceed 5 percent (5%) of the Bid Price. Partial payments for this item will be made in accordance with the following schedule:

Original Contract	Allowable % of the Lump
Amount Earned (%)	Sum Price for the Item
After Contract Execution	25
10	35
20	45
30	55
40	65
50	70
60	75
70	80
80	85
90	90
Substantial Completion	95
Final Payment	100

C. These payments will be subject to the standard retainage provided in the agreement. Payment of the retainage will be made after completion of the work and demobilization.

Bid Item No. 2 - Demolition

A. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all plant, labor, materials and equipment necessary for the removal, demolition and disposal of structures, equipment, piping, valves and soil materials for installation of new facilities. Demolition shall include removal of the existing pumps , valves, fittings, structures, asphalt , electrical, instrumentation and piping; and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 3 - Site Work

A. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all plant, labor, materials and equipment necessary to provide and relocate stormwater pond, grading; sodding; asphalt paving; and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

<u>Bid Item No. 4 - Effluent Transfer Pump Stations</u> Conversion to Low Service Pump Stations

A. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all plant, labor, material s and equipment necessary to convert the effluent transfer pump stations to low service pump stations, provide and install 5 vertical turbine pumps; butterfly valves, check valves, magnetic meters air release valve, and pressure gauge; including all site p reparation, clearing, grading, drainage, paving, grassing, borrow, demolition, excavation, fencing, signage and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 5 - High Service Pump Station

Payment of the applicable lump sum price shall be full Α. compensation for furnishing, but is not limited to, all plant, labor, materials and equipment necessary to provide and install a High Service Pump Station south of Chlorine Contact Chamber 3&4, including dewatering; sheeting; excavation; grading; crushed stone base; backfill; sod; precast; concrete encasement; concrete pad; 6 vertical turbine pumps; ductile iron pipes, check valves, butterfly valves; air release and vacuum valve; magnetic flowmeter; pip e supports; pressure gauges; control panel; variable frequency drives; electrical work; instrumentation and SCADA; and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 6 - 10 MG Ground Storage Tank

A. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all plant, labor, materials and equipment n ecessary to provide and install a 10 MG Ground Storage Tank , including dewatering; excavation grading; crushed stone base; backfill; asphalt paving; sod; concrete pad; 1 ground storage tank; access ladder; 30 inch inlet with motor operated valve, 30 inch outlet, 42-inch overflow; 16 inch surge relief valve; pipe supports ; 12-inch drain pip e; control panels; electrical work; instrumentation and SCADA; and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 7 - Site Piping

A. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all plant, labor, materials and equipment necessary to provide and install site piping, including dewatering; excavation; bedding; haunching, initial backfill; 42, 36,30,20,16, and 12-inch Reclaimed Water pipelines; 42inch Ground Storage Tank Effluent Pipeline; 42-inch Ground Storage Tank Overflow pipeline; 30 and 20-inch Low Service Pond Influent pipelines; 30-inch Ground Storage Tank Influent Pipeline ; 30-inch High Service Pond Influent pipeline; 16-inch Storage Pond Return; 12-inch Ground Storage Tank Drain pipelines; gate valves, butterfly valves and plug valves; concrete collars; connection to Ground Storage Tank; connection to High Service Pump Station; connection to South Pond 1, South Pond 2, and East Pond; grading; sodding; asphalt paving; and all other appurtenant work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 8 - Oil Storage Building Relocation

A. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all plant, labor, materials and equipment necessary to relocate the Oil Storage Building to the east of the Headworks and all other work related to this lump sum pay item as presented in the Contract Documents.

Bid Item No. 9 - Electrical Work And Instrumentation

A. Payment of the applicable lump sum price shall be full compensation for furnishing, but is not limited to, all plant, labor, materials and equipment necessary to construct a complete power and control system including switches, panels, switchgear, VFD's, MCC, control panels, duct banks, lighting, power circuitry; and install, set -up, calibrate, program, integrate, and coordinate a complete instrumentation package as specified including al l instruments, PLC's, software and programming, fiber optic cable, transmitters, interface panels, programming terminal, and all appurtenances as shown on the plans and specifications.

Bid Item No. 10 - Contract Contingency

- A. This payment item is for the Owner's requested changes in the work pertaining to the 10 MG Storage Tank and Interconnection Work that requires authorization of the Owner prior to the work being performed. This item is not to cover work outlined in the plans and/or specifications or for work incidental to the completion of the project as outlined herein, and shall only be used when directed by the Owner.
- B. Payment shall be made based on written authorization of the additional work. The authorization shall reflect the actual amounts agreed to by the Contractor and the Owner.
- PART 2 PRODUCTS (NOT USED)
- PART 3 EXECUTION (NOT USED)

REQUESTS FOR PAYMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. 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 Owner and Contractor.

1.02 FORMAT AND DATA REQUIRED

- A. Submit payment requests in the form provided by the Owner 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 Owner or the Engineer 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 (3) copies of each application; all signed and certified by the Contractor.
- PART 2 PRODUCTS (NOT USED)
- PART 3 EXECUTION (NOT USED)

END OF SECTION

01152-1

CHANGE ORDER PROCEDURES

PART 1 GENERAL

1.01 DEFINITION

- A. Change Order: Major change in contract scope or time that must be approved by the Board.
- B. Administrative Change Adjustment: Minor change order under 10% of project cost or 20% time, does not have to be Board approved.
- C. Field Directive Change: Change to contract quantity that does not require a change of scope or time extension.

1.02 REQUIREMENTS INCLUDED

- A. The Contractor shall promptly implement change order procedures:
 - 1. Provide full written data required to evaluate changes.
 - Maintain detailed records of work done on a timeand-material/force account basis.
 - 3. Provide full documentation to Engineer 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.
- C. The Board of County Commissioners executes all Change Orders.

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 DIRECTIVE CHANGE

- A. In lieu of a Change Order, the Project Manager may issue a Field Directive change for the Contractor to proceed with additional work within the original intent of the Project.
- B. Field Directive change 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 Directive change 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 Engineer/Owner 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, plus additional information.
 - 1. Name of the Owner'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 Owner, 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 Owner for approval. The Owner 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. Owner's definition of the scope of the required changes.
 - Contractor's Proposal for a change, as approved by the Owner.

- 3. Survey of completed work.
- B. The amounts of the unit prices to be:
 - 1. Those stated in the Agreement.
 - Those mutually agreed upon between Owner and Contractor.

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

- A. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article "Documentation of Proposals and Claims" of this Section.
- B. Engineer will determine the allowable cost of such work, as provided in General Conditions and Supplementary Conditions.
- C. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.
- D. Owner and Contractor will sign and date the Change Order to indicate their agreement therewith.

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)

PROJECT MEETINGS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. The Owner or Engineer 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. Owner's Engineer.
 - 2. Owner'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. Owner's REQUIREMENTS.
- 7. Temporary utilities.
- 8. Housekeeping procedures.
- 9. Liquidated damages.
- 10. Equal Opportunity Requirements.
- Laboratory testing.
 Project / Job meetings: Progress meeting, other special topics as needed.
- PRODUCTS (NOT USED) PART 2
- PART 3 EXECUTION (NOT USED)

CONSTRUCTION SCHEDULE AND PROJECT RESTRAINTS

PART 1 GENERAL

1.01 GENERAL

A. Construction under this contract must be coordinated with the Owner 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. nor on weekends or legal holidays without written permission of the Owner. 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 Owner. Such permission, however, may be revoked at any time by the Owner 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.

1.03 PROGRESS OF THE WORK

The work shall be executed with such progress as may be required to prevent any delay to the general completion of the work. The work shall be executed at such times and in or on such parts of the project and with such forces, materials and equipment to assure completion of the work in the time established by the Contract and in the manner set forth in the Contract.

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 Engineer to review Contractor's planning, scheduling, management and execution of the work; to assist Engineer 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 Owner 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 8-1/2 inches by 11 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 Engineer to review all submittals as set forth in the Contract Documents; items of work required of Owner 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 Owner.
- 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 Engineer, 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 calendarday 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.
 - 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 Engineer. 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.
- Should Engineer 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 start-up schedule and an asbuilt 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 three copies of 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 Owner, 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 monthly progress schedules with each month's application for payment.

G. Contractor shall submit three monthly status reports which will be retained by the Owner and Engineer.

2.06 MONTHLY STATUS REPORTS

- A. Contractor shall submit three copies of 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 Engineer and Contractor at a monthly schedule meeting and Contractor will address Engineer'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 Engineer 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 timescaled (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. Engineer shall have 10 calendar days after receipt of the submittal to respond. Upon receipt of Engineer's comments, Contractor shall make the necessary revisions and submit the revised schedule within 10 calendar days. The resubmittal, if concurred with by Owner, 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 by Engineer and concurrence by Owner. 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 Engineer.

PART 3 EXECUTION (NOT USED)

SHOP DRAWINGS, PROJECT DATA AND SAMPLES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. The Contractor shall submit to the Engineer for review and approval: working drawings, shop drawings, test reports and data on materials and equ ipment (hereinafter in this section called data), and material samples (hereinafter in this section called samples) as are required for the proper contr ol of work, including, but not limit ed to those wo rking drawings, shop drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.
- Within thirty (30) calendar days after the effe Β. ctive date of the Agreement, the Contractor shall submit to the Engineer, a complete list of preliminary d ata on items for which Shop Drawings are to be su bmitted. Included in thi s list shall b e the names of all proposed manufacturers furnishing specified items and which each Sho p Drawing shal the date on l be submitted. Review of this list by the Engineer shall in no way relieve the Contractor from submitting complete Shop Drawings and providing materials, equipment, etc., fully in accordance with the Specifications. This procedure is required in order to expedite final review of Shop Drawings.
- C. The Contractor is to maintain an accurate u pdated submittal log and will bring this log to each scheduled progre ss meeting with the Owner and the Engineer. This log should include the following items:
 - 1. Submittal description and number assigned.
 - 2. Date to Engineer.
 - 3. Date returned to Contractor (from Engineer).
 - 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 contract.
- 10. Status of O&M manuals submitted.

1.02 CONTRACTOR'S RESPONSIBILITY

- A. It is the dut y of the Contractor to chec k all drawings, data and samples prepared by or for him before submitting them to the Engineer for review. Each and every copy of the Dra wings and data shall bear Contractor's stamp showing that they have been so checked. Shop drawings submitted to the En gineer 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 Engineer a sch edule of Shop Drawing submittals fixing the respective dates for the submissi on of shop a nd 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 return ed for correction until a revision or correction thereof has been reviewed and returned to him, by the Engineer, with No Exceptions Taken or Approved As Noted.
- E. The Contractor shall submit to the Engin eer all drawings and schedules sufficiently in advance of construction requirements to provide no less than twenty-one (21) calendar days for checking and
appropriate action from the time the Engineer receives them.

- F. The Contractor shall submit five (5) copies of descriptive or product data submittals to complement shop drawings for the Engineer plus the additional copies if the Contractor requires more than one (1) being returned. The Engineer sha ll retain four (4) sets.
- G. The Contractor s hall be responsible for and bear all costs 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 Engineer of the necessary Shop Drawings.

1.03 ENGINEER'S REVIEW OF SHOP DRAWINGS AND WORKING DRAWINGS

- A. The Engineer's review of drawi ngs, data and s amples submitted by the Contractor shall cover only ge neral 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.
 - As relieving the Contractor of responsibility for any errors, i ncluding details, dimensions and materials.
 - As approving departures from details furnished by the Engineer, except as otherwise provided herein.
- C. If the drawings or schedules as submitted describe variations and show a departur e from the Con tract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as n ot to involve a chan ge in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting any exception.
- D. When reviewed by the Engineer, each of the Sho p 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 Eng ineer on previous submissions. The Contractor shall make any corrections required by the Engineer.
- F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor s hall give written notice thereof to the Engineer.
- G. The Engineer sh all review a submittal a maxim um of three (3) times after which co st of review sh all be borne by the Contractor. The cost of engineering shall be equal to the Engineer's actual payroll cost.
- H. When the Shop and Working Drawings have been completed to the satisfac tion of the Eng ineer, the Cont ractor shall carry out the construction in accordance therewith and s hall make no fu rther changes t herein except upon written instructions from the Engineer.
- 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 s chedules shall be checked and coordinated with the work of all trades invo lved, before they are submitted for review by the Engineer and shall bear the Contractor's stamp of approval and original signature as evidence of such checkin g 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 building or facility.
 - 4. Name of contractor and subcontractor submitting drawing.
 - 5. Clear identification of contents and locat ion 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 acceptabl e, 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 equi pment 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 f urnish equipment or products shall submit an installation list to the Engineer along with the required shop drawings. The in stallation list shall include at least five installations where identical equipment has been installed and have be en in operation for a period of at least one (1) year.
- H. Only the Engineer 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; unde rpinning; 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 t he Engineer wh ere required b y the Contract Documents or requested by the Enginee r and shall be submitted at least thirty (30) days (unless otherwise specified by the Engineer) in advance of their being required for work.
- С. Working drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State o f Florida and shall convey, o r be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended m anner of use. Prior to commencing such work, working drawings must have been reviewed without specific exceptions by the Engineer, 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 erro r are assumed by the Contractor; the Owner and Eng ineer shall not have responsibility therefore.

1.06 SAMPLES

- A. The Contractor shall furnish, for the review of the Engineer, samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to th e Engineer as s pecified or dir ected. The Contractor shall prepay al 1 shipping char ges on samples. Materials or equipment for which samples are required shall not be used in work until reviewed by the Engineer.
- B. Samples shall be of sufficient size and quan tity 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 tw o samples of ea ch item shall b e submitted.
- C. Each sample shall have a label indicating:
 - 1. Name of product.
 - 2. Name of Contractor and Subcontractor.
 - 3. Material or equipment represented.
 - 4. Place of origin.
 - 5. Name of Producer and Brand (if any).
 - Location in project. (Samples of finished materials shall have additional markings that will identify them under the finished schedules.)
 - 7. Reference specification paragraph.
- D. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required above. He shall enclose a copy of this letter with the shipment and send a copy of this letter to the Engineer. Review of a sample shall be only for the characteristics or use named in such and shall not b e construed to change or modif y any Contract requirements.
- E. Reviewed samples not destroyed in testing shall be sent to the Engineer or stored at the site of the work. Reviewed samples of the hardware in good condition will be marked for identification and may be used in the work. Mat erials and eq uipment

incorporated in work shall match the reviewed samples. If requested at the time of submission, samples which failed testing or were rejected shall be re turned to the Contractor at his expense.

- PART 2 PRODUCTS (NOT USED)
- PART 3 EXECUTION (NOT USED)

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. The Contractor shall submit to the Engineer a Schedule of Values allocated to the various portions of the work, within 10 days from the date of Notice to Proceed.
- B. Upon request of the Engineer, 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 Engineer 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:
 - 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)

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 two prints 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 Owner and Engineer 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 x 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 Engineer 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 Engineer on digital video disks (DVD) for the permanent and exclusive use of the Engineer 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 Engineer. In addition, no progress payments shall be made until the preconstruction video recordings are accepted by the Engineer.
- PART 2 PRODUCTS (NOT USED)
- PART 3 EXECUTION (NOT USED)

TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Owner 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. Owner may elect to have materials and equipment tested for conformity with the Contract Documents at any time.
 - Contractor shall cooperate fully with the laboratory to facilitate the execution of its required services.
 - 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 Engineer 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 Owner 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 Owner 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 Engineer.
- H. If the test results indicate the material or equipment complies with the Contract Documents, the Owner 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)

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. 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.

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.
- B. The Contractor shall service, clean and maintain facilities and enclosures.

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 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.

TRAFFIC REGULATIONS

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 & 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.
 - At no time will more than one (1) 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.
 - 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 al 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 Engineer will consult with the Owner 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 Engineer 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 six inches below the adjacent pavement surface.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

PROJECT IDENTIFICATION AND SIGNS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Furnish, install and maintain County project identification signs.
- B. Remove signs on completion of construction.
- C. Allow no other signs to be displayed except for traffic control and safety.

1.02 PROJECT IDENTIFICATION SIGN (COUNTY)

- A. One painted sign, of not less than 32 square feet (3 square meters) area, with painted graphic content to include:
 - 1. Title of Project.
 - 2. Name of Owner.
 - 3. Names and titles of authorities as directed by Owner.
 - 4. Prime Contractor.
- B. Graphic design, style of lettering and colors: As approved by the Engineer and subject to approval of the Owner.
- C. Erect on the site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the Engineer and the Owner

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.
 - 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: Manatee County Project Management shall generate and the General Contractor shall distribute door hangers to all residents who will be impacted by project construction.
 - 1.0 Residents impacted include anyone who resides inside, or within 500 feet of project limits of construction.
- 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, 201X and be completed in July 201X.

Location Map

WE HOPE TO KEEP ANY INCONVENIENCE TO A MINIMUM. HOWEVER, IF YOU HAVE ANY PROBLEMS, PLEASE CONTACT THE FOLLOWING:

- A. Contractor Contractor Address Contractor Phone (Site Phone)
- B. Project Inspector Inspector Phone Number
- C. Project Manager

PM Address PM Phone No. & Ext.

> 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.

ENGINEER'S FIELD OFFICE

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Contractor shall furnish, install and maintain one temporary field office during the entire construction period for the sole use of the Engineer.

1.02 OTHER REQUIREMENTS

- A. Prior to installation of the Engineer's field office, the Contractor shall consult with the Engineer on location, access and related facilities.
- B. All site use approvals shall be obtained by the Contractor.
- C. Upon completion of construction, the Contractor shall remove the field office and restore the site to its original condition.

1.03 REQUIREMENTS FOR FACILITIES

- A. Construction:
 - 1. The field office shall be structurally sound, weather tight, with floors raised aboveground.
 - 2. At Contractor's option, portable or mobile buildings may be used.
- B. Office for Field Engineer:
 - A separate office for sole use of the Engineer with secure entrance doors, key and lock shall be provided.
 - Area: 250 sq. ft. minimum, with minimum dimension of 8 feet.
 - 3. Windows:
 - a. Minimum of three (3).
 - b. Operable sash and insect screens.
 - c. Locate field office to provide maximum view of construction areas.

- 4. Furnishings:
 - a. Two standard size chairs and desks with three drawers each.
 - b. One drafting table: 39"x72"x36" high, with one equipment drawer.
 - c. One metal, double-door storage cabinet with lock and key.
 - d. One plan rack to hold a minimum of six sets of project drawings.
 - e. One standard four-drawer legal-size metal filing cabinet with lock and key.
 - f die liesen fest af beskeleter
 - f. Six linear feet of bookshelves.
 - g. One swivel arm chair.
 - h. Two straight chairs.
 - i. One drafting table stool.
 - j. One waste basket.
 - k. One tackboard, 36"x30".
 - 1. One fire extinguisher.
 - m. One first aid kit.
- 5. Services:
 - a. Adequate lighting.
 - b. Exterior lighting at entrance door.
 - c. Automatic heating and mechanical cooling equipment to maintain comfort conditions.
 - d. Minimum of four 110 volt duplex electric convenience outlets, at least one on each wall.
 - e. Electric distribution panel: Two circuits minimum 110 volt, 60 hertz service.
 - f. Convenient access to drinking water and toilet facilities.
 - g. Telephone: One private direct line instrument.
 - h. Fax: combination fax/duplicator.

PART 2 PRODUCTS

2.01 MATERIALS, EQUIPMENT, FURNISHINGS

A. May be new or used, but must be serviceable, adequate for required purpose and must adhere to all applicable codes or regulations including the Manatee County Building Codes.

PART 3 EXECUTION

3.01 PREPARATION

A. Fill and grade site as necessary for temporary structure

to provide positive surface drainage.

3.02 INSTALLATION

- A. Construct temporary field office on proper foundation and provide connections for all utility services.
 - 1. Secure portable or mobile building when used.
 - 2. Provide steps and landings at entrance doors.

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.
 - Comply with size, make, type and quality specified, or as specifically approved in writing by the Engineer.
 - 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 Engineer. 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 Engineer 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.
 - 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

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)

STORAGE AND PROTECTION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. 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.
 - Equipment shall not be shipped until approved by the Engineer. 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 Engineer.
 - 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 Engineer 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 insure 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 insure 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)

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 Engineer and Owner 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 Engineer determines that the work is not substantially complete:
 - 1. The Engineer shall notify the Contractor in writing, stating the reasons.
 - The Contractor shall remedy the deficiencies in the work and send a second written notice of substantial completion to the Engineer.
 - 3. The Engineer shall reinspect the work.
- E. When the Engineer finds that the work is substantially complete:
 - He shall prepare and deliver to the Owner 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 Owner as provided in Conditions of the Contract. When the Engineer considers the work substantially complete, he will execute and deliver to the Owner and the Contractor 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 Owner's representative and are operational.
 - 5. The work is completed and ready for final inspection.
- B. The Engineer shall make an inspection to verify the status of completion after receipt of such certification.
- C. If the Engineer determines that the work is incomplete or defective:
 - The Engineer 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 Engineer that the work is complete.
 - 3. The Engineer shall reinspect the work.
- D. Upon finding the work to be acceptable under the Contract Documents, the Engineer 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 Owner for the Engineer's fees.

1.04 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

- 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 Engineer.
- 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. 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)

1.06

PART 3 EXECUTION (NOT USED)

CLEANING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. 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 Owner 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.

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Contractor shall maintain at the site for the Owner one record copy of:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Engineer's field orders or written instructions.
 - 6. Approved shop drawings, working drawings and samples.
 - 7. Field test records.
 - 8. Construction photographs.

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Store documents and samples in Contractor's field office apart from documents used for construction.
 - 1. Provide files and racks for storage of documents.
 - Provide locked cabinet or secure storage space for storage of samples.
- B. File documents and samples in accordance with CSI format.
- C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.
- D. Make documents and samples available at all times for inspection by the Engineer.

1.03 MARKING DEVICES

A. Provide felt tip marking pens for recording information in the color code designated by the Engineer.

1.04 RECORDING

A. Label each document "PROJECT RECORD" in neat large printed letters.

- B. Record information concurrently with construction progress.
- C. Do not conceal any work until required information is recorded.
- D. Drawings Legibly mark to record actual construction:
 - 1. All underground piping with elevations and dimensions; Changes to piping location; Horizontal and vertical locations of underground utilities and appurtenances (referenced to permanent surface improvements. Actual installed pipe material, class, etc.). Locations of drainage ditches, swales, water lines and force mains shall be shown every 200 feet (measured along the centerline) or alternate lot lines, whichever is closer. Dimensions at these locations shall indicate distance from centerline of right-of-way to the facility.
 - 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. Equipment and piping relocations.
 - 6. Locations of all valves, fire hydrants, manholes, water and sewer services, water and force main fittings, underdrain cleanouts, catch basins, junction boxes and any other structures located in the right-of-way or easement, shall be located by elevation and by station and offset based on intersection P.I.'s and centerline of right-of-way. For facilities located on private roads, the dimensioning shall be from centerline of paving or another readily visible baseline.
 - 7. Elevations shall be provided for all manhole rim and inverts; junction box rim and inverts; catch basin rim and inverts; and baffle, weir and invert elevations in control structures. Elevations shall also be provided at the PVI's and at every other lot line or 200 feet, whichever is less, of drainage swales and ditches. Bench marks and elevation datum shall be indicated.

- Slopes for pipes and ditches shall be recalculated, based on actual field measured distances, elevations, pipe sizes, and type shown. Cross section of drainage ditches and swales shall be verified.
- 9. Centerline of roads shall be tied to right-of-way lines. Elevation of roadway centerline shall be given at PVI's and at all intersections.
- Record drawings shall show bearings and distances for all right-of-way and easement lines, and property corners.
- 11. Sidewalks, fences and walls, if installed at the time of initial record drawing submittal, shall be located every 200 feet or alternate lot lines, whichever is closer. Dimensions shall include distance from the right-of-way line and the back of curb and lot line or easement line.
- 12. Sanitary sewer mainline wyes shall be located from the downstream manhole. These dimensions shall be provided by on-site inspections or televiewing of the sewer following installation.
- Elevations shall be provided on the top of operating nuts for all water and force main valves.
- 14. Allowable tolerance shall be \pm 6.0 inches for horizontal dimensions. Vertical dimensions such as the difference in elevations between manhole inverts shall have an allowable tolerance of \pm 1/8 inch per 50 feet (or part thereof) of horizontal distance up to a maximum tolerance of \pm 2 inch.
- 15. Properly prepared record drawings on mylar, together with two copies, shall be certified by a design professional (Engineer and/or Surveyor registered in the State of Florida), employed by the Contractor, and submitted to the Owner/Engineer.
- E. Specifications and Addenda; Legibly mark each Section to record:
 - Manufacturer, trade name, catalog number and supplier of each product and item of equipment actually installed.
 - 2. Changes made by field order or by change order.

- F. Shop Drawings (after final review and approval):
 - Five sets of record drawings for each process equipment, piping, electrical system and instrumentation system.

1.05 SUBMITTAL

- A. Prior to substantial completion and prior to starting the bacteria testing of water lines, deliver signed and sealed Record Documents and Record Drawings to the Engineer. These will be reviewed and verified by the inspector. If there are any required changes or additions, these shall be completed and the entire signed and sealed set resubmitted prior to final pay application.
- B. The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare record drawings. Record drawings shall be certified by the professional(s) (Engineer or Surveyor licensed in Florida), as stipulated by the Land Development Ordinance and submitted on signed and dated mylar drawings together with a recordable compact disk (CD).
- C. The CD shall contain media in AutoCAD Version 2005 or later, or in any other CAD program compatible with AutoCAD in DWG or DXF form. 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 noted as to its relevance and use.
- D. Accompany submittal with transmittal letter, containing:
 - 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.

Note: The data required to properly prepare these record drawings shall be obtained at the site, at no cost to the County by the responsible design professional or his/her duly appointed representative. The appointed representative shall be a qualified employee of the responsible design professional or a qualified inspector retained by the responsible design professional on a project-by-project basis.

PART 2 STANDARDS

2.01 MINIMUM RECORD DRAWING STANDARDS FOR ALL RECORD DRAWINGS SUBMITTED TO MANATEE COUNTY

- A. Record drawings shall be submitted to at least the level of detail in the contract documents. It is anticipated that the original contract documents shall serve as at least a background for all record information. Original drawings in CAD format may be requested of the Engineer.
- B. Drawings shall meet the criteria of paragraph 1.04 D above.

PART 3 EXECUTION (NOT USED)

OPERATING AND MAINTENANCE DATA

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Compile product data and related information appropriate for Owner'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 Owner's personnel in maintenance of products and equipment and systems.
- D. Provide three (3) sets of operating and maintenance manuals for each piece of equipment provided within this Contract.

1.02 FORM OF SUBMITTALS

- A. Prepare data in form of an instructional manual for use by Owner's personnel.
- B. Format:
 - 1. Size: 8-1/2 inch x 11 inch
 - 2. Paper: 20 pound minimum, white, for typed pages
 - 3. Text: Manufacturer's printed data or neatly typewritten
 - 4. Drawings:
 - a. Provide reinforced punched binder tab, bind in with text.
 - b. Fold larger drawings to size of text pages.
 - 5. Provide fly-leaf for each separate product or each piece of operating equipment.
 - a. Provide typed description of product and major component parts of equipment.
 - b. Provide indexed tabs.
 - 6. Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
 - a. Title of Project.
 - b. Identity of separate structures as applicable.
 - 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.
 - 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. Description of sequence of operation by control manufacturer.

- 7. 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.
- 8. As installed control diagrams by controls manufacturer.
- 9. Each contractor's coordination drawings.
 - a. As installed color coded piping diagrams.
- 10. Charts of valve tag numbers, with location and function of each valve.
- 11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
- 12. 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.
- 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.
- 8. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- D. Prepare and include additional data when the need for such data becomes apparent during instruction on Owner'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 two 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 OWNER'S PERSONNEL

- A. Prior to final inspection or acceptance, fully instruct Owner'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.
 - 1. 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)

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 Engineer for review and transmittal to Owner.

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.
 - Date of beginning of warranty, bond or service and maintenance contract.
 - 5. Duration of warranty, bond or service maintenance contract.
 - 6. Provide information for Owner's personnel:
 - a. Proper procedure in case of failure.
 - b. Instances which might affect the validity of warranty or bond.
 - 7. Contractor, name of responsible principal, address and telephone number.

1.03 FORM OF SUBMITTALS

A. Prepare in duplicate packets.

- B. Format:
 - Size 8-1/2 inch x 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 ten 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, service and maintenance contracts as specified in respective sections of Specifications.
- B. Approval by the Owner 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)

DEMOLITION

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. This Section includes demolition , debris removal and items to be salvaged as indicated on the Drawings and as specified herein.
- B. Demolition items consist of the following:
 - Removal of: Concrete, asphalt, sidewalk, various sizes and lengths of yard piping , concrete structures, manholes, fencing and other items as shown on the drawings and as specified herein.
- C. Items to be salvaged and turned over to the Owner shall be identified by the Owner during the preconstruction meeting.

1.02 QUALITY ASSURANCE

- A. Accomplish all demolition work so there is no injury to any persons and no damage to adjacent structures or property. All demolition methods shall be in full compliance with municipal, county, state, and federal ordinances. Demolition work shall comply with the requirements of the Occupational Safety and Health Administration (OSHA).
- B. The Contractor shall comply with all municipal, county, state and federal ordinances regarding the disposal of rubble, scrap metal, and refuse.
- C. Demolition procedures shall provide for safe conduct of the work, protection of property which is to remain undisturbed, and coordination with other work in progress.

1.03 JOB CONDITIONS

A. It shall be the responsibility of the Contrac tor to visit the site and inspect the nature and condition of the items to be removed and salvaged before submitting his bid.

- B. Dust Control: Control the amount of dust resulting from demolition to prevent the spread of dust to occupied portions of building s and to avoid creation of a nuisance in the surrounding area. Do not use water when it will result in, or create, hazardous or objectionable conditions such as flooding and pollution.
- C. Protection of Existing Work : Protect existing work. Work damaged by t he Contractor shall be repaired to match existing work.
- D. No interference with plant operations: Demolition work shall be scheduled and conducted so there is no interference with normal plant operations or deliveries.

PART 2 PRODUCTS

2.01 REPAIR AND REPLACEMENT MATERIALS

A. Materials used in the repair or replacement of existing work to remain shall be identical or equal to the materials used in existing work when new.

PART 3 EXECUTION

3.01 STRUCTURES AND BUILDINGS

A. Remove all parts of existing structures to be demolished to a minimum depth of 3 -ft below grade unless otherwise shown on the drawings. Structures left below grade shall be punctured to allow water to pass through and prevent flotation.

3.02 EQUIPMENT

- A. Completely remove equipment which is designated to be removed.
- B. Remove concrete equipment bases if the existing bases are not to be used for new equipment.
- C. Completely remove isolated equipment bases.

3.03 PIPING

A. Completely remove piping, conduit, and wiring in structures and buildings which are to be demolished, partially demolished, and where otherwise designated to

be removed as shown on the Drawings . When not indicated on the Drawings, the removal of said piping, conduit and wiring shall be a minimum of 5 -feet from the outside of the structure or building. The Contractor shall schedule underground pipe removal and new pipe installation in order to minimize disruption of the existing piping system and reduce bypass pumping.

- B. Underground piping, conduit, and wiring which are to be abandoned and do not inter fere with new work may be left in place, unless otherwise shown on the Drawings. Plug and seal ends of underground piping to be abandoned. Grout fill abandoned pipes in accordance with plans. Do not leave abandoned branches of piping and wiring "live". Is olate abandoned branches by closing branch valve at main or by disconnecting branch at main. Plug, cap, and seal active branch at isolating valve or point of disconnection.
- C. Properly disconnect, seal and plug utility services to structures and buildings wh ich are completely demolished. Properly disconnect, seal, and plug utility lines within structures and buildings which are partially demolished.

3.04 STORAGE AND REMOVAL OF EXCAVATED MATERIAL

- A. Suitable excavated material required for filling and backfilling operations may be stockpiled on the job site.
- B. Excavated material shall be separated into at least 4 stockpiles:
 - 1. Acceptable fill for the bottoms of the Reject storage Pond and the North reclaimed water storage pond.
 - Acceptable fill for the earth berms for the Reject storage pond and North reclaimed water storage pond.
 - Acceptable topsoil that can be used for the growth of vegetation, including planted grass, sod, flowers, bushes, trees, etc.
 - 4. Unsuitable excavation material.
- C. Remove unsuitable materials from the job site as soon as unsuitable materials are excavated.

D. Excavated suitable surplus materials shall remain the Owner's property and shall be stockpiled at the location (s) on the treatment plant site designated by the Owner.

3.05 DISPOSAL

- E. Equipment, piping, and materials which are designated to remain the property of the Owner shall be moved to a location within the project site designated by the Owner.
- F. All removed equipment, piping, and materials not specifically designated to remain the pro perty of the Owner shall become the property of the Contractor and shall be removed from the site.
- G. Do not allow debris and rubbish to accumulate on the site. Remove debris and rubbish from the site.
- H. If the Contractor uses the Manatee County Sanitary Landfill for disposal, the Contractor shall be required to pay a tipping fee w hen crossing the landfill weighing scales.

3.06 FILLING

- A. Backfill excavations resulting from demolition.
- B. Backfill excavations which will not be beneath new structures, buildings, pipi ng, or other new work as specified in this paragraph.
- C. Backfill excavations more than three feet deep or more than five cubic yards in volume as specified in Section 02200 Earthwork.
- D. Place and compact backfill in other excavations to produce an adequate foundation for grassing.

3.07 CLEAN-UP

- A. Clean-up in areas where other work is to be done following demolition shall be as specified in the applicable Sections.
- B. Clean-up the job site in areas where no other work is to be done under this Contract following demolition. Remove all debris and rubbish, temporary facilities,

and equipment. Level surface irregularities to eliminate depressions. Leave the work in a neat and presentable condition.

CLEARING AND GRUBBING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Traffic: Conduct site -clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks, or other occupied or used facilities without written permission from the Owner.
- B. Protection: Provide temporary fences, barricades, coverings, or other protection to preserve existing items indicated to remain and to prevent injury or damage to persons or property. Provide protection for adjacent properties as required.
- C. Restore or replace damaged work to existing or better condition than prior to start of Work.
- D. Protect existing trees and vegetation from physical damage. Do not store materials or equipment within tree drip line s. Use licensed arborist for tree damage repair. Replace damaged trees that cannot be restored to full growth, as determined by arborist, unless otherwise acceptable to the Owner.
- E. Existing Services: Locations indicated are approximate; determine exact location before commencing Work. Coordinate with local utility service requirements and comply with their instructions.
- PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Site Clearing: Remove trees, shrubs, grass, and other vegetation, improvements, or obstructions as indicated or that interfere with new construction. Removal includes digging out stumps and roots, together with subsequent off-site disposal.
- B. Strip and stockpile topsoil that will be reused in the Work.

- C. Remove existing improvements, both above -grade and below-grade, to extent indicated on the drawings or as otherwise required to permit new construction.
- D. Salvageable Items: Carefully remove items indicated to be salvaged and store on premises where indicated or directed by the Owner.
- E. Control air pollution caused by dust and dirt; comply with governing regulations.
- F. Fill depressions and voids resulting from site-clearing operations. Using satisfactory soil materials, place in maximum 6-inch-deep horizontal layers and compact each layer to density of surrounding original ground.
- G. Grade ground surface to conform to required contours and to provide surface drainage.
- H. Dispose of waste materials, including trash, debris, and excess topsoil, off property.
- Burning of any waste materials on site is not permitted.

EARTHWORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes digging of excavations for structures, piping, ponds and roadways; backfilling around structures and piping; shaping and contouring the ground surface to conform to established grades and elevations; compacting of earth or rock materials to specified densities; bracing, sheeting and shoring; dewatering; removal of surplus excavated materials; and related work as shown on the Drawings and as specified herein.

1.02 DEFINITIONS

- A. Excavation: Removal of earth and rock to form cavities for the construction of foundations and structures and to form trenches for the installation of piping or conduits.
- B. Cavity: Formed by the removal of earth and rock.
- C. Earth: Unconsolidated material in the crust of the earth derived by weathering and erosion. Earth includes:
 - 1. Materials of both inorganic and organic origin
 - 2. Boulders less than 1/3 cubic yard in volum e, gravel, sand, silt, and clay
 - 3. Materials which can be excavated with a backhoe, trenching machine, drag line, clam shell, bulldozer, highlift, or similar excavating equipment without the use of explosives, rock rippers, rock hammers, or jack hammers
- D. Rock: A natural aggregate of mineral particles connected by strong and permanent cohesive forces. Rock includes:
 - 1. Limestone, sandstone, dolo mite, granite, marble, and lava
 - 2. Boulders 1/3 cubic yard or more in volume

- 3. Materials which cannot be excavated by equipment which is used to remove earth overburden without the use of explosives, rock rippers, rock hammers, or jack hammers.
- E. Undercutting: Excavation of rock and unsuitable earth below the bottom of a foundation, structure, pipe or conduit to be constructed or installed.
- F. Subgrade: Undisturbed bottom of an excavation
- G. Bedding: Earth placed in trench to support pipe and conduit.
- H. Backfill and Fill: Earth placed around structures from the bottom of an excavation to finished grade, or to the subbase of pavement. Earth placed in a trench from the top of bedding to finished grade, or to subbase of pavement.
- I. Structural Compact Fill: Required to establish the finished grade s hould consist of clean cohesion less fill comprising the SP to SP -SM un ified soil classification or AAS HTO A -3 Classification. Each lift, which should not exceed 12 inches, should be uniformly compacted to not less that 95% of the modified proctor maximum density.
- J. Topsoil: Earth containing sufficient organic materials to support the growth of grass.

1.03 JOB CONDITIONS

- A. Carefully maintain bench marks, monuments and other reference points, and if disturbed or destroyed, replace as directed.
- B. Should the Contractor encounter unusual subsurface and/or latent conditions at the site, he shall immediately give notice to the Owner and Engineer of such conditions before they are disturbed.

1.04 QUALITY ASSURANCE

- A. Codes and Standards : Perform excavation and landfill work in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Testing and Inspection Service: The Owner will retain a Soils Engineer to perform soil testing and inspection service for quality control testing of earthwork

operations. Tests revealing satisfactory results will be paid for by the Owner. The cost of tests revealing unsatisfactory results will be deducted from monies due to the Contractor.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Earth for General Fill and Backfill : Earth used for fill or backfill shall be of such gradation and moisture content that it will compact to the specified density and remain stable.
- B. Pipe Bedding : Pipe bedding material for Type A -2 trenches shall be No. 57 crushed stone with gradation as noted in Table 1 of Section 901 of the FDOT Standard Specifications.
- C. Pipe Cover Material: Pipe cover material shall consist of durable particles ranging in size from fine to coarse (No. 200 to 1-inch) in size, in a substantially uniform combination. Unwashed bank run sand and crushed bank-run gravel will be considered generally acceptable. Bedding material may be used for cover material.
- D. Special Backfill : Special backfill shall be the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols	Typical Name				
GW	Well-graded gravels and gravel-sand mixtures, little or no fines				
GP	Poorly graded gravels and gravel - sand mixtures, little or no fines				
SW	Well-graded sands and gravelly sands, little or no fines				
SP	Poorly graded sands and gravelly sands, little or no fines				

E. Suitable Backfill : Suitable backfill shall be the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols	Typical Name					
GW	Well-graded gravels and gravel - sand mixtures, little or no fines					
GP	Poorly graded gravels and gravel - sand mixtures, little or no fines					
GM	Silty gravels, gravel -sand-silt mixtures					
GC	Clayey grav els, gravel -sand-clay mixtures					
SW	Well-graded sands and gravelly sands, little or no fines					
SP	Poorly graded sands and gravelly sands, little or no fines					
SM	Silty sands, sand-silt mixtures					
SC	Clayey sands, sand-clay mixtures					
ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands					
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays					

F. Unsuitable Materials : Materials which are unsuitable for backfill include stones greater t han 6-inches in their largest dimension, pavement, rubbish, debris, wood, metal, plastic, and the following soils, classified by the Unified Soil Classification System, ASTM D-2487:

Group Symbols	Typical Name				
OL	Organic silts and organic silty clays of low plasticity				
МН	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts				
СН	Inorganic clays of high plasticity, fat clays				

OH	Organic	clays	of	medium	to	high
	plastic					

- PT Peat, muck, and other highly organic soils
- G. Structural/Pond Compact Fill: Preparation of the subgrade prior to backfilling shall necessitate removal and replacement of silts as well as the very loose silty soils on the flanks of the structure or pond (see the Geotechnical Report for further requirements). The entire footprint, plus a margin of at least 5 feet outside the perimeter sh all be stripped down to the existing elevations, including over-excavation of any accumulated sediments, followed by proof -rolling with heavy vibratory compaction equipment. Compaction shall consist of no greater than 12-inch lifts throughout the entire area plus a margin of not less than 5 feet beyond the perimeters. The perimeter area for the ponds and structures shall be densified at the bottom of footing elevations. Compaction shall continue so as to develop a uniform density of not less than 95% of the modified proctor maximum dry density per ASTM D -1557. Compaction tests shall be conducted at intervals of no less than 1 test for each 2500 square feet and each 50 feet of foundation perimeter at a depth of 1 foot and at the compacted subgrade elevation.

PART 3 EXECUTION

3.01 PROTECTION OF EXISTING FACILITIES

- A. Support and protect all poles, fences, utility pipes, wire, conduits, buildings and structures.
- B. Proceed with c aution during excavation so the exact location of underground utilities and structures, both known and unknown, may be determined. Contractor shall be responsible for the repair of utilities and structures when broken or otherwise damaged.
- C. Wherever water, or other pipes or conduits cross the excavation, the Contractor shall support said pipes and conduits without damage to them and without interrupting this Contract. The manner of supporting such pipes, or similar items, shall be subject to the approval of the Engineer.
- D. When utilities that have to be removed or relocated are encountered within the areas of operations, the Contractor shall notify the Owner in ample time for the

necessary measure to be taken to prevent interruption of the service.

- E. The Contr actor shall so conduct the work that no equipment, material, or debris will be placed or allowed to fall upon private property in the vicinity of the work, unless he shall have first obtained the property Owner's written consent to do so and shall have shown said written consent to the Owner.
- F. All excavated material shall be piled in a manner that will not obstruct driveways. Hydrants under pressure, valve pit covers, valve boxes, curb stop boxes, or other utility controls shall be left unobstructed and accessible until the work is completed. Drainageways shall be kept clear or other satisfactory provisions made for drainage.
- G. Natural watercourses shall not be obstructed, except where specifically permitted for the construction of outfall and subaqueous crossings.

3.02 CLEARING AND GRUBBING

- A. Before excavating, clear and remove logs, stumps, brush, vegetation, rubbish, and other perishable matter from the project site. Clearing and grubbing shall be in accordance with FDOT "Standard Specification for Road and Bridge Construction" Sections 110 and 120.
- B. Do not remove or damage trees that do not interfere with the finished work. Completely remove trees required to be removed, including stumps and roots. Replace trees removed unnecessarily. Properly treat damaged trees which can be saved.

3.03 STRIPPING AND STOCKPILING TOPSOIL

A. Strip topsoil and vegetation from the areas to be excavated. Clean topsoil may be stockpiled for reuse; the Contractor shall coordinate with the Owner for location of excavated stockpiled materials.

3.04 EXCAVATING

A. Make excavations to elevations and dimensions necessary to permit bracing, sheeting, erection of forms, inspection of foundation and installation of piping or conduits. Excavate trenches to the required alignment, depth and width. Exca vate trenches in advance of pipe and conduit installation only as far as necessary to provide proper alignment and grade. Plan trenching operations to cause a minimum of danger to adjacent property and a minimum of inconvenience to the public.

- B. The width of trenches at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and to allow the backfill to be placed and compacted as specified. Maximum trench width shall be such that design loadings on pipe will not be exceeded. Tren ches shall be of such extra width, when required, to permit the placement of supports, sheeting, bracing, and appurtenances.
- C. Depth of trenches shall be such as to allow installation of pipelines at the grades or elevations shown.
- D. Trees, boulders, and oth er surface encumbrances, located so as to create a hazard to anyone involved in the excavation work or who is in the vicinity of the work at anytime during operations, shall be removed or made safe before excavating is begun.
- E. Contractor shall be responsib le for the determination of the angle of repose of the soil in which the excavating is to be done. Excavate all slopes to at least the angle of repose except for areas where solid rock allows for line drilling or presplitting.
- F. Sides, slopes, and faces of all excavations shall meet accepted engineering requirements by scaling, benching, barricading, rock bolting, wire meshing, or other equally effective means. Give special attention to slopes which may be adversely affected by weather or moisture content.
- G. Flatten the excavation sides when an excavation has water conditions, silty materials, loose boulders, and areas where erosion and slide planes appear.
- H. Shore or otherwise support sides of excavations in hard or compact soil when the excavation is more th an five feet in depth. In lieu of shoring, the sides of the excavation above the five -foot level may be sloped to preclude collapse, but shall not be steeper than a one-foot rise to each 1/2-foot horizontal.
- I. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Do not allow water to accumulate in

an excavation. If possible, the grade should be away from the excavation.

- J. Excavations shall be inspected by a competent Contractor's representative after every rainstorm or other hazard-increasing occurrence, and the protection against slides and cave -ins shall be increased if necessary.
- K. Do not store excavated or other material nearer than four feet from the edge of any excavation. Store and retain materials to prevent them from falling or sliding back into the excavation. Install substantial stop log s or barricades when mobile equipment is utilized or allowed adjacent to excavations.

3.05 DEWATERING

A. Keep excavations free from water until foundations, structures, and piping are completed and will safely withstand forces generated by water. Provide sufficient dewatering equipment and make proper arrangements for the disposal of water from dewa tering operation. Dewatering shall not damage property, create nuisances, or interfere with other work. Do not use sanitary sewers for the disposal of water from dewatering operations.

3.06 SHEETING

- A. The Contractor has the option of sheeting excavations.
- B. Supporting systems, such as piling, cribbing, shoring, and bracing shall be designed by a qualified Contractor's representative and meet accepted engineering requirements. When tie rods are used to restrain the top of sheeting or other retaining systems, securely anchor the tie rods well back of the angle of repose. When tight sheeting or sheet piling is used, assume full loading due to groundwater table, unless prevented by weep holes or drains or other means. Provide additional stringers, ties, and bracing to allow for any necessary temporary removal of individual supports.
- C. Materials used for sheeting, sheet piling, cribbing, bracing, shoring and underpinning shall be in good, serviceable condition. Timbers shall be sound, free from large or loose knots, and of proper dimensions.

- D. Take special precautions in sloping or shoring the sides of excavations adjacent to a previously backfilled excavation or a fill, particularly when the separation is less than the depth of the excavation. Pay particular attention to joints and seams of material comprising a face and to the slope of such seams and joints.
- E. If it is necessary to place or operate power shovels, derricks, trucks, materials, or other heavy objects on a level above or near an excavation, sheet-pile, shore, and brace the side of the excavation as necessary to resist the extra pressure due to such superimposed loads.
- F. If the stability of adjoining buildings or walls is endangered by excavations, provide shoring, bracing, or underpinning as necessary to ensure the safety of adjoining buildings or walls. Such shoring, bracing or underpinning shall be inspected daily or more often, as conditions warrant, by a competent C ontractor's representative and the protection effectively maintained.
- G. The Contractor shall be held responsible for the sufficiency of all sheeting and bracing used, and for all damage to persons or property resulting from the improper quality, strength, placing, maintaining, or removing of the same. This includes damage to trees, sidewalks, and other property on the project site as well as on the private grounds.
- H. Drive sheeting ahead of excavation. Do not remove sheeting until the excavation backfill has reached within two feet of the top of the excavation, except that the lower course of sheeting may be removed from a double sheeted excavation. When sheeting is drawn, completely fill all cavities remaining in or adjoining the excavation. When sheeting is left in place, completely fill all cavities behind such sheeting.

3.07 ROCK REMOVAL

A. Rock, bou lders or other hard, lumpy or unyielding materials encountered in trench bottoms shall be removed to a depth at least 12 -inches below the bottom of any pipes to be installed. All rock and other hard foundation material under structures shall be freed of all loose material, cleaned, and cut to a firm surface; either level, stepped vertically and horizontally or serrated, as may be directed. All seams shall be cleaned out and filled with concrete or mortar. B. Blasting of rock or other hard to remove materials will not be permitted on this project.

3.08 SUBGRADES

- A. Do not construct foundations, footings, slabs, or piping on loose soil, mud, or other unstable or unsuitable soil.
- B. Fill excess cuts under foundations, footings, and slabs with concrete.
- C. Fill excess cuts under piping with compacted bedding as specified in this Section.

3.09 FOUNDATION SOILS REMOVAL AND COMPACTION

- A. In areas where building s, structure foundations, and precast concrete tanks are located just below the surface, the site shall be proofrolled using a large vibratory roller (Dynapac CA -25 or equivalent). Proofrolling shall consist of at least ten overlapping passes. Water shal 1 be added in order to achieve moisture content near optimum to facilitate compaction. Purpose of the proofrolling is to det ect any areas of unstable or unsuitable soils as well as to density the near-surface soils. Materials which yield excessively during the proofrolling shall be undercut and replaced with well-compacted structural fill.
- B. The Owner will retain a Soils Enginee r to be present during proofrolling operations to observe the proofrolling and recommend the nature and extent of any remedial work.
- С. In areas where foundations and storage ponds are located, preparation of the subgrade prior to pond backfilling will necessitate removal and replacement of pond bottom silts as well as the very loose silty soils on the flanks of the pond (see the Geotechnical Report for further requirements). The entire pond footprint, plus a margin of at least 5 feet outside the perimeter shall be strip ped down to the existing pond bottom elevation, including over-excavation of any accumulated sediments, followed by proof -rolling with heavy vibratory compaction equipment. The contractor shall anticipate the excavation will extend to approximately EL 10.00 feet. Compaction should consist of no less than ten (10) complete cove rages throughout the entire pond area plus a margin of not less than 5 feet beyond the pond perimeters. Compaction shall continue so as
to develop a uniform density of not less than 95% of the modified proctor maximum dry density per ASTM D -1557. Compaction tests shall be conducted at intervals of no less than 1 test for each 2500 square feet at a depth of 1 foot and at the compacted subgrade elevation.

D. Any fill requir ed to achieve finished grade in structural areas or used as structural compact fill shall be inorganic, non -plastic granular soil containing less than 10% material passing a No. 200 sieve. Fill shall be placed in level lifts not to exceed 12 -inches loose thickness and compacted to a minimum of 95% of the modified Proctor maximum dry density as determined by ASTM Specification D -1557. In-place density tests will be performed on each lift to verify that the specified degree of compact tion has been achieved.

3.10 BACKFILLING FOUNDATION AND STRUCTURE EXCAVATIONS

- A. Remove debris and other unstable or unsuitable materials from excavations before backfilling is started.
- B. Backfill excavations in areas to be paved with Special Backfill. Place Special Backfill in 12 -inch lifts. Compact each lift of backfill to not less than 100% of the maximum dry density as determined in accordance with AASHTO T99, Method A. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Do not compact backfill by puddling, unless permitted by the Engineer.
- Backfill excavations not requiring Special Backfill С. with Suitable Material. Place backfill and fill materials in lifts no greater than 12 -inches in loose depth. Place backfill a nd fill materials in lifts no greater than four inches in loose depth where hand tampers are used. Backfill and fill shall be within 2% of optimum moisture content. For soils containing less than 5% material passing a No. 200 sieve, moisture content may be increased to within 3% of optimum. Compact backfill and fill to not less than 95% of the maximum dry density. Compact backfill and fill for restoration of dirt driveways shall be not less than 100% of the maximum dry density for the last lift. Tests for determination of maximum dry density shall meet the requirements of ASTM D698 Method C. Use compaction equipment which is suited to the soil being compacted.

- D. If suitable, use stored excavated material for backfill and fill. Provide additional material, if required, to complete backfill and fill. Additional backfill and fill material shall be provided at no additional cost to the Owner.
- E. Do not use the following materials for backfill:
 - 1. Unsuitable materials
 - 2. Materials which are too wet or too dry to be compacted to the densities specified in this Section.
- F. Place the backfill and fill in a manner which will not overload foundations or structures. Place backfill and fill evenly on all sides of foundations and structures. Do not use equipment that will overload foundations or structures during filling or backfilling.
- G. Do all cutting, filling, and grading necessary to bring the entire area around foundations and outside of structures to the following subgrade levels:
 - 1. To the underside of the respective s urfacing for walks and pavement
 - 2. To finished grade for lawns and planted areas within the project site.

3.11 BACKFILLING PIPING TRENCHES

- A. Do not backfill trenches and excavations until all utilities have been inspected by the Owner's representative and until all unde rground utilities and piping systems are installed in accordance with the requirements of the specifications and the drawings.
- B. Remove debris and other unsuitable materials from excavations before backfilling is started.
- C. Place and tamp bedding and backfilling in a manner which will not damage pipe coating, wrapping, or encasement.
- D. Bedding procedures shall be as specified in the particular Section for the applicable pipe material.
- E. If bedding does not cover the pipe, place pipe cover material from the top of bedding to 12-inches over the

pipe. Compact pipe cover material to the density required to allow backfill over the pipe cover material to be compacted to the density specified.

- F. Do not use the following materials for backfilling:
 - 1. Unsuitable Materials
 - 2. Materials which are too wet or too dry to be compacted to the densities specified in this Section.
- If suitable, use stored excavated material for backfill G. and fill. Provide additional material, if required, to complete backfill and fill. Additional backfi ll and fill material shall be provided at no additional cost Backfill excavations in areas to be to the Owner. paved with Special Backfill. Place Special Backfill in 12-inch lifts. Compact each lift of backfill to not less than 100% of the maximum dry density as determined in accordance with AASHTO T99, Method A. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Backfill and fill materials shall be within 2% of optimum moisture content . Do not compact backfill by puddling, unless permitted by the Engineer.
- H. Backfill trenches not requiring Special Backfill with Suitable Material. Place backfill and fill materials in lifts no greater than 12 -inches in loose depth and compact to produce an adequate foundation for seeding. The top 4-inches of backfill shall not contain stones or other objects larger than 1 -inch in maximum dimension. Mound backfill above finish grade to allow for settlement. Fill and restore any settlement of the backfill. Grade area to be restored to finish grade after settlement of backfill and immediately before restoration of vegetated areas.

3.12 SHELL BASE

A. Construction of a base course composed of shell shall be as specified in Section 250 of the FDOT Standard Specifications.

3.13 FINISH GRADING

A. Shape the surface of all earthwork to conform to the lines, grades, contours and cross-sections shown on the drawings. Hand dressing may be required in certain

areas or in confined areas where equipment operation is restricted.

- B. In final shaping of the surface of the earthwork a tolerance of 0.1 foot above or below the plan elevation will be allowed with the following exceptions:
 - 1. Earthwork shall be shaped to slope away from all buildings and structures.
 - Earthwork shall be shaped to match adjacent pavement, curb, sidewalks, and similar appurtenances.
 - 3. Ditch bottoms and swales shall be shaped so that no water will be impounded except in areas designated for impoundment.

3.14 CLEANUP AND MAINTENANCE

- A. Cleanup the job site as grading is completed. Remove excess earth, rock, bedding, materials, and backfill materials. Remove unused piping materials, structure components, and appurtenances. Restore items moved, damaged, or destroyed during construction.
- B. Maintain the job site until the work has been completed and accepted. Fill excavations which settle when settlement is visible. Restore items damaged by construction or improper restorations. Keep dust conditions to a minimum.

3.15 STORAGE AND REMOVAL OF EXCAVATED MATERIAL

- A. Suitable excavated ma terial required for filling and backfilling operations may be stockpiled on the job site.
- B. Remove unsuitable materials from the job site as unsuitable materials are excavated. Remove surplus suitable materials from the job site as excavations are backfilled.
- C. Excavated suitable surplus materials shall remain the Owner's property and shall be stockpiled at the location(s) on the treatment plant site designated by the Owner.

3.16 DUST CONTROL

A. The Contractor shall take all steps possible to prevent and reduce dust arising from the construction activity. The Contractor shall have adequate water trucks on the site at all times and water, as necessary, the areas where dust may arise. He shall cooperate fully with the Owner's Representative and water immediately when instructed to do so.

END OF SECTION

SECTION 02211

STEEL SHEET PILES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish and install steel sheet piles to brace and shore open excavations for workers' safety and/or protection of adjacent facilities, or as required by these specifica tions or as shown on the Drawings.

1.02 SUBMITTALS

- A. Submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and shall include details of the construction and erection of the steel sheet piling, shoring and bracing and the procedure the Contractor intends to follow in performing the work.
- B. Submit complete erection drawings showing bolt locations and details of openings, etc. Erection drawings shall show all necessary secondary steel framing members required to support the steel pilings.
- C. Drawings of the sheeting and bracing and design computations shall be submitted to the Owner and construction shall not be started until such drawings are received. The drawings and computations shall be prepared and sealed by a Florida registered Engineer employed by the contractor and shall be in sufficient detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the substructures.

PART 2 PRODUCTS

2.01 MATERIAL

- A. Steel Sheet Piles
 - Steel Sheet Piles shall conform to ASTM A328. Steel pile sections shall be the continuously interlocking deep arch equal to PLZ23. The section modulus per linear foot shall not be less than 30.2 cubic inches and the weight shall be not less than 22.6 pounds per square foot of wall.

Sheet pile sections shall be not less than 3/8 - inch thick.

- 2. All sheet piles shall be furnished with standard pulling holes located approximately four inches below the top of the pile, unless specified otherwise.
- B. Wales and Caps: Structural steel shapes and plates shall conform to ASTM A36. Bolts shall conform to ASTM A307.

PART 3 EXECUTION

3.01 INSTALLATION

- The Contractor shall furnish, put in place, and Α. maintain such sheeting and bracing as may be required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures or roadways from undermining or other damage. If the County's Representative is of the opinion that sufficient or proper supports have not been provided, the County's Representative may order additional supports put in at the expense of the Contractor, and compliance with such order shall not relieve or release the Contractor from his 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.
- B. All sheeting and bracing shall be carefully removed in such manner as not to endanger the construction or other structures, utilities, or property. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose , by watering or otherwise as may be directed.
- C. The County shall have the right to order sheeting and bracing left in place and this right shall not be construed as creating any obligation on the County's part to issue such orders, and the County's failure to exercise its right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient

sheeting and bracing to prevent any caving or moving of the ground.

- D. Prior to setting, the sheet piles shall be thoroughly cleaned and inspected for defects and for proper interlock dimensions. The Contractor shall provide a tool for checking the interlock dimensions.
- E. Each sheet pile shall have sufficient clearance in the interlocks to slide, under its own weight, in the interlock of the sheet pile previously placed during the setting operation until the top of existing ground is reached by the tip of the sliding pile. In no case during the setting operation shall a vibratory or drive hammer be used to force the interlock of a pile into the interlock of an adjacent pile.
- F. Before driving is started, check the sheet piles for position and align ment. Vertical alignment of each sheet pile shall be not more than 1/8 inch per foot from the vertical in all directions. Provide a plumb line or other device for checking vertical alignment.
- G. Excavation shall not be carried in advance of the steel sheet piling.
- H. Drive sheet piles in rotating stages such that the tip of any sheet pile is not more than 5 feet below the tip of any adjacent sheet pile nor more than 8 feet below the tip of any other sheet pile in the bulkhead.
- I. Use a suitable driving head to keep deformation of the driving end to a minimum. If any sheet pile is driven out of interlock, it shall be removed and replaced at the Contractor's sole expense.
- J. Piles shall be driven with air, steam, or diesel hammer having sufficient energy to achieve the required penetration. However, the means and methods selected by the Contractor shall be to prevent damage to any nearby structures.
- K. Obstructions encountered before the specified penetration for the piles is obtained shall be removed. Damaged piling or one with faulty alignment shall be withdrawn and new piling driven properly in its place. The cost of such additional work shall be considered as part of the pile driving and shall be borne by the Contractor.

L. Cut the tops of the sheet piles on a true h orizontal line with a tolerance of plus or minus 1/2 inch by burning or other suitable method that will not damage the pile. For trench sheeting of pipes, no sheeting is to be withdrawn if driven below mid-diameter of pipe.

END OF SECTION

SECTION 02221

TRENCHING, BEDDING AND BACKFILL FOR PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill, grading, trench protection or other related work required to complete the piping work shown on the Drawings and specified herein. The work shall include, but not be limited to: vaults; duct conduit; pipe; roadways and paving; backfilling; required fill or borrow operations; grading; disposal of surplus and unsuitable materials; and all related work such as sheeting, bracing and dewatering.
- B. Prior to commencing work, the Contractor shall examine the site and review test borings if available, or undertake his own subsurface investigations and take into consideration all conditions that may affect his work.
- C. The Contractor is responsible for the protection of every tree which is scheduled to remain in the project area. This includes trees which may or may not be shown on the plans. Every tree shall be adequately protected in place at no additional cost to the County. This includes, but is not limited to protecting the root systems and adjusting grades as necessary for tree/root protection.

1.02 PROTECTION

- A. Sheeting and Bracing in Excavations
 - 1. In c onnection with construction of underground structures, the Contractor shall properly construct and maintain cofferdams. These shall consist of: sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in a ny way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing yard pipe and/or foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.

- 2. Trench sheeting for pipes: no sheeting is to be withdrawn if driven below, mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by the Engineer. During the progress of the work, the Engineer may direct the Contractor in writing to leave additional wood sheeting in place. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given for an alternate method of removal.
- 3. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. Unless otherwise approved or indicated on the Drawings or in the Specification s, all sheeting and bracing shall be removed after completion of the piping or structure, care being taken not to disturb or otherwise injure the pipeline or finished masonry. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools specifically made for that purpose, by watering, or as may otherwise be directed.
- The Contractor shall construct, to the extent he 4. deems it necessary for his method of operation, the cofferdams and sheeting outside the neat lines of the pipeline trench or foundation unless otherwise indicated on the Drawings or directed by the Owner/Engineer. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the pipeline or structure will be subjected. Pumping, bracing and other work within the cofferdam shall be done in a manner to avoid disturbing any construction of the pipeline or the enclosed masonry. Any movement or bulging which may occur shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.
- 5. Drawings of the cofferdams and design computations shall be submitted to the Engineer and approved prior to any construction. However, approval of these drawings shall not relieve the Contractor of the responsibility for the cofferdams. The drawings and computations sha ll be prepared and stamped by a Registered Professional Engineer in the State of Florida and shall be in sufficient

detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the pipeline a nd substructures.

- B. Dewatering, Drainage and Flotation
 - The Contractor shall construct and place all pipelines, concrete work, structural fill, bedding rock and limerock base course, in -the-dry. In addition, the Contractor shall make the final 24" of excavation for this work in -the-dry and not until the water level is a minimum of 6" below proposed bottom of excavation.
 - 2. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispos e of properly all water entering excavation and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
 - 3. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.
 - 4. Wellpoints may be required for dewatering the soil prior to final excavation for deeper in -ground structures or piping and for maintaining the lowered groundwater level until construction has been completed to avoid the structure, pipeline, or fill from becoming floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from wellpoints shall be continuous and standby pumps shall be provided.
 - 5. The Contractor shall furnish all materials and equipment to perform all work required to install and maintain the proposed drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.
 - 6. Where required, the Con tractor shall provide a minimum of two operating groundwater observation

wells at each structure to determine the water level during construction of the pipeline or structure. Locations of the observation wells shall be at structures and along pipelines as approved by the Engineer prior to their installation. The observation wells shall be extended to 6 inches above finished grade, capped with screw-on caps protected by 24" x 24" wide concrete base and left in place at the completion of this Project.

- 7. Prior to excavation, the Contractor shall submit his proposed method of dewatering and maintaining dry conditions to the Engineer for approval. Such approval shall not relieve the Contractor of the responsibility for the satisfactory performance of the system. The Contractor shall be responsible for correcting any disturbance of natural bearing soils for damage to pipeline or structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.
- 8. As part of his request for approval of a dewatering system, the Contractor shall demonstrate the adequacy of the proposed system and wellpoint filter sand by means of a test installation. Discharge water shall be clear, with no visible soil particles in a one q uart sample. Discharge water shall not flow directly into wetlands or Waters of the State as defined by FDEP and SWFWMD.
- 9. During backfilling and construction, water levels shall be measured in observation wells located as directed by the Engineer.
- Continuous pumping will be required as long as water levels are required to be below natural levels.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General
 - Materials for use as fill and backfill shall be as described below. For each material, the Contractor shall notify the Eng ineer of the source of the material and shall furnish the Engineer, for approval, a representative sample weighing

approximately 50 pounds, at least ten calendar days prior to the date of anticipated use of such material.

- 2. Additional materials shall be furnished as required from off-site sources and hauled to the site.
- B. Structural Fill
 - Structural fill shall be used below spread footing foundations, slab -on-grade floors and other structures as backfill within three feet of the below grade portions of structures.
 - 2. Structural fill material shall be a minimum of 60 percent clean sand, free of organic, deleterious and/or compressible material. Minimum acceptable density shall be 98 percent of the maximum density as determined by AASHTO T-180. Rock in excess of 2-1/2" in diameter shall not be used in the fill material. If the moisture content is improper for attaining the specified density, either water shall be added or material shall be permitted to dry until the proper moisture content for compaction is reached.
- C. Base Course
 - 1. Asphalt, crushed concrete, soil cement or approved equal, shall be used as base course for bituminous paved roads and parking areas.
- D. Common Fill
 - Common fill material shall be free from organic matter, muck or marl and rock exceeding 2-1/2" in diameter. Common fill shall not contain broken concrete, masonry, rubble or other similar materials. Existing soil may be used to adjust grades over the site with the exception of the construction area.
 - 2. Material falling within the above specific cation, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Engineer, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials by the Contractor.

- E. Crushed Stone
 - 1. Crushed stone may be used for pipe bedding, manhole bases, as a drainage layer below structures with underdrains and at other locations indicated on the Drawings.
 - Crushed stone shall be size No. 57 with gradation as noted in Tabl e 1 of Section 901 of Florida Department of Transportation, Construction of Roads and Bridges.

PART 3 EXECUTION

3.01 FILL PLACEMENT

- A. General
 - 1. Material placed in fill areas under and around pipelines and structures shall be deposited within the lines and to the grades shown on the Drawings or as directed by the Engineer, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the Engineer. If sufficient common fill material is not available from excavation on site, the Contractor shall provide borrows as may be required.
 - 2. Limerock base course material, structural fill and screened limerock, may be provided as borrow.
 - 3. Fill shall be brought up in substantially level lifts throughout the site, starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section. Fill shall not be placed against concrete structures until they have attained sufficient strength.
 - 4. Fill shall be dumped and spread in layers by a bulldozer or other approved method. During the process of dumping and spreading, all roots, debris and stones greater in size than specified under Materials, shall be removed from the fill areas. The Contractor shall assign a sufficient number of men to this work to insure satisfactory compliance with these requirements.

- 5. If the compacted surface of any layer of material is determined to be t oo smooth to bond properly with the succeeding layer, it shall be loosened by harrowing or by another approved method before the succeeding layer is placed.
- 6. All fill materials shall be placed and compacted "in-the-dry". The Contractor shall dewater excavated areas and is required to perform the work in such manner as to preserve the undisturbed state of the natural inorganic soil.

3.02 COMPACTION

- A. Structural fill, limerock base course and screened limerock in open areas, shall be placed in layers not to exceed nine inches in depth as measured before compaction. Each layer shall be compacted by a minimum of six coverages (3 passes each way) with the equipment described below, to at least 98 percent of the maximum density, as determined by AASHTO T -180. Inciden tal compaction due to traffic by construction equipment will not be credited toward the required minimum six coverages.
- B. Common fill shall be placed and compacted in a manner similar to that described above for structural fill, with the following exception s: layer thickness prior to compaction may be increased to 12-inches in open areas; and common fill except dike fill, required below water level in peat excavation areas may be placed as one lift, in-the-wet, to an elevation one foot above the water level at the time of filling.
- C. Compaction equipment in open areas shall consist of a medium-heavy vibrator roller (minimum static weight of 10 tons) operated at resonant frequency and at a speed of 2 fps or less or other compaction equipment approved by the Engineer.
- D. Areas adjacent to pipelines, structures and other confined areas inaccessible to the vibrator roller shall be compacted with a manually operated sled-type vibratory compactor. The Contractor shall also conform to additional backfill requirements at pipelines and structures as specified in the Contract Documents. Compaction of the fill by such means shall be to the same degree of compaction as obtained by the rubber-tired equipment, and the Engineer may make the necessary tests to determine the amount of compactive effort necessary to obtain equal compaction. Unless such tests indicate that

modifications may be made, the fill compacted by mechanical compactors shall be placed in 6-inch layers and thoroughly tamped over the entire surface.

Compaction equipment is subject to approval by the Engineer.

- E. It is the intention that the fill materials with respect to moisture be used in the condition they are excavated insofar as this is practicable. Material which is too wet shall be spread on the fill a rea and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits.
- F. If the Engineer determine s that added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, whic h will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued.
- G. The Contractor shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and all other materials and equipment necessary to place the water in the fill in the manner specified.

3.03 TRENCH EXCAVATION AND BACKFILLING

- A. Excavation for all trenches required for the installation of pipes and electrical ducts shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches.
- B. Rock shall be removed to a minimum 6" clearance around the bottom and sides of all the pipe or ducts being laid.
- C. Where pipes or ducts are to be laid in limerock bedding or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.
- D. Where the pipes or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated manually, shall be done in such a manner that will give a flat bottom true to grade so that pipe or duct can be evenly supported on undisturbed material. Bell holes shall be made as required.

- E. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected and the trench filled with suitable compacted material to the mid-diameter of the pipe.
- F. Backfilling over ducts shall begin not less than three days after placing concrete encasement.
- G. All backfilling shall be prosecuted expeditiously and as detailed on the Drawings.
- H. Any space remaining between the pipe and sides of the trench shall be packed full by hand shovel with selected earth, free from stones having a diameter greater than 2" and thoroughly compacted with a tamper as fast as placed, up to a level of one foot above the top of the pipe.
- I. The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.
- J. The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted by rolling, ramming, or puddling, as the Engineer may direct, sufficiently to prevent subsequent settling.

3.04 GRADING

- Grading shall be performed at such places as are Α. indicated on the Drawings, to the lines, grades and elevations shown or as directed by the Engineer and shall be made in such a manner that the requirements for formation of embankments can be followed. A11 unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all time s. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.
- B. If at the time of excavation it is not possible to place any material in its proper section of the permanent pipeline structure, it shall be stockpiled in approved areas for later use.
- C. Minute adjustments in lines or grades may be made if found necessary as the work progresses, due to

discrepancies on the Drawings or in order to obtain satisfactory construction.

- D. Stones or rock fragments larger than 2-1/2" in their greatest dimensions shall not be permitted in the top 6" of the subgrade line of all dikes, fills or embankments.
- E. All fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings, or as directed by the Engineer.
- F. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All fill slopes shall be uniformly dr essed to the slope, cross section and alignment shown on the Drawings or as directed by the Engineer.
- G. No grading is to be done in areas where there are existing pipelines that may be uncovered or damaged until such lines which must be maintained are reloc ated, or where lines are to be abandoned and removed, all required valves are closed and drains plugged at manholes.

END OF SECTION

SECTION 02260

FINISH GRADING

PART 1 GENERAL

1.01 WORK INCLUDED

- A. The Contractor shall finish grade sub-soil.
- B. The Contractor shall cut out areas to receive stabilizing base course materials for paving and sidewalks.
- C. The Contractor shall place, finish gra de and compact top soil.

1.02 PROTECTION

A. Prevent damage to existing, facilities, fencing, trees, landscaping, natural features, bench marks, pavement and utility lines. Correct damage at no cost to the Owner.

PART 2 PRODUCTS

2.01 GENERAL

A. Topsoil: Friable loam free from subsoil, roots, grass, excessive amount of weeds, stones, and foreign matter; pH of 5.5 to 7.5; containing a minimum of 4 percent and a maximum of 25 percent organic matter. Use topsoil stockpiles on site if conforming to these requirements.

PART 3 EXECUTION

3.01 SUB-SOIL PREPARATION

- A. Rough grade sub -soil systematically to allow for a maximum amount of natural settlement and compaction. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, etc. Remove sub-soil which has been contaminated with petroleum products.
- B. Cut out areas to sub -grade elevation, which are to receive stabilizing base for paving and sidewalks.
- C. Bring sub -soil to required levels, profiles and contours. Make changes in grade gradual. Blend slopes into level areas.

- D. Slope grade away from building minimum 2 inches in 10 feet unless indicated otherwise on the Drawings.
- E. Cultivate sub -grade to a depth of 3 inches, where topsoil is to be placed. Repeat cultivation in areas where equipment, used for hauling and spreading topsoil, has compacted sub-soil.
- F. The Contractor shall not change grades to cause water to flow onto adjacent property.

3.02 PLACING TOPSOIL

- A. Place topsoil in areas where seeding, sodding and planting are to be performed. Place to the following minimum depths, up to finished grade elevations.
 - 1. 6 inches for seeded areas.
 - 2. 4-1/2 inches for sodded areas.
 - 3. 24 inches for shrub beds.
 - 4. 18 inches for flower beds.
- B. Use topsoil in relatively dry state. Place during dry weather.
- C. Fine grade topsoil eliminating rough and low areas to ensure positive drainage. Maintain levels, profiles and contours of sub-grades.
- D. Remove stone, roots, grass, weeds, debris, and other foreign material while spreading.
- E. Manually spread topsoil around trees, plants, building, to prevent damage which may be caused by grading equipment.
- F. Lightly compact placed topsoil.

3.03 SURPLUS MATERIAL

- A. Remove surplus sub-soil and topsoil from site.
- B. Leave stockpile areas and entire job site clean and raked, ready to receive landscaping.

END OF SECTION

SECTION 02276

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

- A. The work specified in this Section consists of furnishing, maintaining, and removing temporary erosion and sedimentation controls as necessary.
- B. Temporary erosion controls include, but are not limited to, sodding, mulching, netting, watering, and reseeding on-site surfaces and spoil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations which will ensure that erosion durin g construction will be either eliminated or maintained within acceptable limits as established by the Owner.
- C. Temporary sedimentation controls include, but are not limited to, silt dams, traps, floating turbidity barriers, and appurtenances at the foot of sloped surfaces which will ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the Owner.
- D. The Contractor is responsible for providing effective temporary erosion and sediment control measu res during construction or until final controls become effective.

1.02 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 EROSION CONTROL

- A. Sod specified in Section 02900 Seeding and Sodding.
- B. Netting fabricated of material acceptable to the Owner.

2.02 SEDIMENTATION CONTROL

A. Bales - clean, seed free cereal hay type.

- B. Netting fabricated of material acceptable to the Owner.
- C. Filter stone crushed stone conforming to Florida Dept. of Transportation specifications.
- D. Concrete block hollow, non-load-bearing type.
- E. Concrete exterior grade not less than one inch thick.

PART 3 EXECUTION

3.01 EROSION CONTROL

- A. Minimum procedures for grassing are:
 - Scarify slopes to a dept h of not less than six inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.
 - Sow seed within twenty-four (24) hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
 - 3. Apply mulch loosely and to a thickness of between 3/4-inch and 1-1/2 inches.
 - 4. Apply netting over mulched areas on sloped surfaces.
 - 5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit u nsatisfactory growth. Backfill and seed eroded areas.

3.02 SEDIMENTATION CONTROL

A. Install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings. Hay bales which deteriorate and filter stones which are dislodged shall be replaced.

3.03 PERFORMANCE

A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results which comply with the requirements of the State of Florida, Contractor shall immediately take whatever steps are necessary to correct the deficiency at his own expense.

END OF SECTION

SECTION 02513

ASPHALT CONCRETE PAVING

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials and equipment necessary to complete all asphalt concrete paving as shown on the Drawings.

1.02 QUALITY ASSURANCE

- A. Qualifications of Asphalt Concrete Producer: Use only materials which are furnished by a bulk asphalt concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete.
- B. Qualification of Testing Agency: The Owner will employ commercial testing laboratories to conduct test s and evaluations of asphalt concrete materials and design.
 - 1. Provide asphalt concrete testing and inspection service acceptable to Engineer.
 - 2. Include sampling and testing asphalt concrete materials proposed, and tests and calculations for asphalt concrete mixtures.
 - 3. Provide field testing facilities for quality control testing during paving operations.
- C. Requirements of Regulatory Agencies: Comply with applicable requirements of:
 - 1. Manatee County Public Works Deptartment
 - 2. Florida Deptartment of Transportation

1.03 PAVING QUALITY REQUIREMENTS

- A. General: In addition to other specified conditions, comply with following minimum requirements:
 - Test in -place asphalt concrete courses for compliance with requirements for density, thickness and surface smoothness.
 - 2. Provide final surfaces of uniform texture, conforming to required grades and cross sections.

- 3. Take not less than four inch diameter pavement specimens for each completed course, from locations as directed by the Engineer.
- 4. Repair holes from test specimens as specified for patching defective work.
- B. Density:
 - Compare density of in -place material against laboratory specimen of same asphalt concrete mixture, when subjected to 50 blows of standard Marshall hammer on each side of specimen.
 - Minimum acceptable density of in -place course material is 98% of the recorded laboratory specimen density.
- C. Thickness: In-place compacted thicknesses will not be acceptable if less than the thicknesses shown on the Drawings.
- D. Surface Smoothness:
 - 1. Test finished surface of each asph alt concrete course for smoothness, using a 10 ft. straightedge applied parallel to and at right angles to centerline of paved areas.
 - 2. Check surfaced areas at intervals directed by Engineer.
 - 3. Surfaces will not be acceptable if exceeding the following:
 - a) Base Course: 1/4 in. in 10 ft.
 - b) Surface Course: 3/16 in. in 10 ft.
 - c) Crowned Surfaces:
 - Test crowned surfaces with a crown template, centered and at right angles to the crown.
 - Surfaces will not be acceptable if varying more than 1/4 in. from the template.

1.04 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.
- B. Samples: Provide samples of materials for laboratory testing and job-mix design.
- C. Test Reports: Submit laboratory reports for following materials tests:
 - 1. Coarse and fine aggregates from each material source and each required grading:
 - a) Sieve Analysis: ASTM C 136 (AASHTO T 27)
 - b) Unit Weight of Slag: ASTM C29 (AASHTO T 19)
 - c) Soundness: ASTM C 88 (AASHTO T 104) for surface course aggregates only.
 - d) Sand Equivalent: ASTM D 2419 (AASHTO T 176)
 - Abrasion of Coarse Aggregate: ASTM C131 (AASHTO T 96), for surface course aggregates only.
 - 2. Asphalt cement for each penetration grade:
 - a) Penetration: ASTM D5 (AASHTO T49)
 - b) Viscosity (Kinematic): ASTM D2170 (AASHTO T 201)
 - c) Flash Point: ASTM D92 (AASHTO T 48)
 - d) Ductility: ASTM D 113 (AASHTO T 51)
 - e) Solubility: ASTM D 4 (AASHTO T 44)
 - f) Specific Gravity: ASTM D 70 (AASHTO T 43).
 - 3. Job-mix design mixtures for each material or grade:
 - a) Bulk Specific Gravity f or Coarse Aggre gate: ASTM C 117 (AASHTO T 85)
 - b) Bulk Specific Gravity for Fine Aggre gate: ASTM C 128 (AASHTO T 84)

- 4. Uncompacted asphalt concrete mix: Maximum Specific Gravity: ASTM D 2041 (AASHTO T 209).
- 5. Compacted asphalt concrete mix:
 - a) Bulk Density: ASTM D 1188 (AASHTO T 166)
 - b) Marshall Stability and Flow: ASTM D 1559
- 6. Density and voids analysis:
 - a) Provide each series of asphalt concrete mixture text specimens, in accordance with A.I. MS -2 "Mix Design Methods for Asphalt Concrete".
 - b) Use Marshall meth od of mix design unless otherwise directed or acceptable to the Engineer.
 - c) Report the quantity of absorbed asphalt cement in pounds of dry aggregate, percent air voids, and percent voids in mineral aggregate.
- 7. Sampling and testing of asphalt concrete mixtu res for quality control during paving operations:
 - a) Uncompacted asphalt concrete mix.
 - 1) Asphalt Cement Conte nt: ASTM D 2172 (AASHTO T 164)
 - 2) Penetration of Recovered Asphalt Cement: ASTM D 5 (AASHTO T 49)
 - 3) Ductibility of Recovered Asphalt Cement: ASTM D 113 (AASHTO T 51)
 - b) Compacted asphalt concrete mix:
 - 1) Bulk Density: ASTM D 1188 (AASHTO T 166)
 - Marshall St ability and Flow: ASTM D 1559)
 - c) Perform at least one test for each day's paving.

- 8. Asphalt plant inspection: ASTM D 290.
- 9. Additional testing:
 - Perform as may be required if any of the previous tests indicate insufficient values, or if directed by the Engineer.
 - b) Continue testing until specified values have been attained.
- 10. Asphalt concrete materials not complying with specified requirements will not be per mitted in the work.

1.05 JOB CONDITIONS

- A. Weather Limitations:
 - Apply bituminous prime and tack coats only when the ambient temperature in the shade is above 50 degrees F. and when the temperature has not been below 35 degrees F. for 12 hours immediately prior to application.
 - 2. Do not apply when the base surface is wet or contains an excess of moisture which would prevent uniform distribution and the required penetration.
 - Construct asphalt concrete surface course only when atmospheric temperature is above 40 d egrees F., when the underlying base is dry, and when weather is not rainy.
 - 4. Base course may be placed when air temperature is not below 30 degrees F. and rising, when acceptable to the Engineer.
- B. Grade Control: Establish and maintain the required lines and grades, including crown and cross-slope, for each course during construction operations.
- C. Traffic Control: Maintain vehicular and pedestrian traffic during paving operations, as required for other construction activities.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Shell Marl Stabilized Sub-Base: as specified in FDOT Section 260, "Shell tabilized Base," and on the plans.
- B. Limerock Base Course: as specified in FDOT Section 200, "Limerock Base," and on the plans.
- C. Aggregate for Asphalt Concrete, General:
 - Sound, angular crushed stone, crushed gravel, or crushed slag: ASTM D 692.
 - 2. Sand, stone, or slag screening: ASTM D 1073.
 - 3. Provide aggregate in gradations for various courses to comply with local highway standards.
- D. Surface Course Aggregates: Provide natural san d, unless sand prepared from stone, slag, or gravel or combinations are required to suit local conditions.
- E. Asphalt Cement: Comply with ASTM D 946 for 85 -100 penetration grade.
- F. Prime Coat:
 - 1. Cut-back liquid asphalt.
 - 2. Medium-Curing type: ASTM D 2027, Grade MC-70.

2.02 ASPHALT-AGGREGATE MIXTURES

- A. Job-mix criteria:
 - Provide job -mix formulas for each required asphalt-aggregate mixture. Provide FDOT Section 333 Type III asphaltic concrete.
 - Establish a single percentage of aggregate passing each required sieve size, a single percentage of asphalt cement to be added to aggregate, and a single temperature at which asphalt concrete is to be produced.
 - Comply with the mix requirements of local governing highway standards.
 - 4. Maintain material quantities within allowab le tolerances of the governing standards.

2.03 TRAFFIC AND PARKING MARKING MATERIALS

- A. Traffic lane marking paint with chlorinated rubber base.
- B. Factory mixed, quick drying and non bleeding, FS TT-P-115C, Type III.
- C. Color: Driving Lane Dividers White
- D. No Parking Zone Yellow
- E. Parking Dividers White

PART 3 EXECUTION

3.01 SURFACE PREPARATION

- A. Subbase Preparation:
 - The Contractor shall remove from the area all organic substance encountered to a depth of six or eight inches (6" or 8"), or to such depth and width as directed by the Engineer. The entire area shall be plowed and dragged prior to placing a stabilizing additive, if required to meet minimum bearing value.
 - 2. Subbase shall be compacted to a minimum density of 98 percent of the maximum as determined by the Modified Proctor Density AASHTO T180, and shall have a minimum bearing value of 40 pounds per square inch as determined by the Florida Bearing Test.
- B. Base Course:
 - 1. Check subgrade for conformity with elevations and section immediately before placing base material.
 - 2. Place base material in compacted layers not more than 6 inches thick, unless continuing tests indicate the required results are being obtained with thicker layers.
 - 3. In no case will more than 8-inches of compacted base be placed in one lift.
 - 4. Spread, shape, and compact all base material deposited on the subgrade during the same day.

- 5. Compact base course material to be not less than 95% of maximum density: ASTM D 1557, Method D (98 percent maximum density: AASHTO T-180).
- 6. Test density of com pacted base course: ASTM D 2167.
- 7. Conduct one test for each 250 sq. yds. of in-place material, but in no case not less than one daily for each layer.
- C. Loose and Foreign Material:
 - Remove loose and foreign material from compacted subbase surface immediately before application of paving.
 - 2. Use power brooms or blowers, and brooming as required.
 - 3. Do not displace subbase material.
- D. Prime Coat:
 - Uniformly apply at rate of 0.20 to 0.5 gal. per sq. yd. over compacted and cleaned subbase surface.
 - Apply enough material to penetrate and seal, but not flood the surface.
 - 3. Allow to cure and dry as long as required to attain penetration and evaporation of volatile, and in no case less than 24 hours unless otherwise acceptable to the Engineer.
 - 4. Blot excess asphalt with just enough sand to prevent pick-up under traffic.
 - 5. Remove loose sand before paving.
- E. Tack Coat:
 - 1. Dilute material with equal parts of water and apply to contact surfaces of previously constructed asphalt concrete or portland cement concrete and similar surfaces.
 - 2. Apply at rate of 0.05 to 0.15 gal. per sq. yd. of surface.

- 3. Apply tack coat by brush to contact surfaces of structures projecting into or abutting asphalt concrete pavement.
- 4. Allow surfaces to dry until material is at condition of tackiness to receive pavement.

3.02 FRAME ADJUSTMENTS (IF APPLICABLE)

- A. Placing frames:
 - 1. Surround frames set to elevation with a ring of compacted asphalt concrete base prior to paving.
 - 2. Place asphalt concrete mixture up to 1 in. below top of frame, slope to grade, and compact by hand tamping.
- B. Adjust frames to proper position to meet paving.
- C. If permanent covers are not in place, provide temporary covers over openings until completion of rolling operations.
- D. Set cover frames to grade, flush with surface of adjacent pavement.

3.03 PREPARING THE MIXTURE

- A. Comply with ASTM D 995 for material storage, control, and mixing, and for plant equipment and operation.
- B. Stockpiles:
 - 1. Keep each component of the various -sized combined aggregates in separate stockpiles.
 - Maintain stockpiles so that s eparate aggregate sizes will not be intermixed and to prevent segregation.
- C. Heating:
 - 1. Heat the asphalt cement at the mixing plant to viscosity at which it can be uniformly distributed throughout mixture.
 - Use lowest possible temperature to suit temperature-viscosity characteristics of asphalt.
 - 3. Do not exceed 350 degrees F. (176.6 degrees C.).

- D. Aggregate:
 - 1. Heat-dry aggregates to reduce moisture content to not more than 2.0%.
 - Deliver dry aggregate to mixer at recommended temperature to suit penetration grade and viscosity characteristics of asphalt cement, ambient temperature, and workability of mixture.
 - 3. Accurately weigh or measure dry aggregates and weigh or meter asphalt cement to comply with job mix formula requirements.
- E. Mix aggregate and asphalt cement t o achieve 90-95% of coated particles for base mixtures and 85-90% of coated particles for surface mixture, when tested in accordance with ASTM D 2489.
- F. Transporting:
 - 1. Transport asphalt concrete mixtures from mixing site in trucks having tight, clean compartments.
 - Coat hauling compartments with a lime -water mixture to prevent asphalt concrete mixture from sticking.
 - 3. Elevate and drain compartment of excess solution before loading mix.
 - 4. Provide covers over asphalt concrete mixture when transporting to protec t from weather and to prevent loss of heat.
 - 5. During periods of cold weather or for long distance deliveries, provide insulation around entire truck bed surfaces.

3.04 EQUIPMENT

- A. Provide size and quantity of equipment to complete the work specified within project time schedule.
- B. Bituminous Pavers: Self -propelled that spread hot asphalt concrete mixtures without tearing, shoving or gouging surfaces, and control pavement edges to true lines without use of stationary forms.
- C. Rolling Equipment:
- Self-propelled, steel-wheeled and pneumatic -tired rollers that can reverse direction without backlash.
- 2. Other type rollers may be used if acceptable to the Engineer.
- D. Hand Tools: Provide rakes, lutes, shovels, tampers, smoothing irons, pavement cutters, portable heaters, and other miscellaneous small tools to complete the work specified.

3.05 PLACING THE MIX

- A. Place asphalt concrete mixture on prepared surface, spread and strike-off using paving machine.
- B. Spread mixture at a minimum temperature of 225 degrees F. (107.2 degrees C.).
- C. Inaccessible and small areas may be placed by hand.
- D. Place each course at thickness so that when compacted, it will conform to the indicated grade, cross-section, finish thickness, and density indicated.
- E. Paver Placing:
 - Unless otherwise directed, b egin placing along centerline of areas to be paved on crowned section, and at high side of sections on one -way slope, and in direction of traffic flow.
 - After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips.
 - 3. Complete base courses for a section before placing surface courses.
 - 4. Place mixture in continuous operation as practicable.
- F. Hand Placing:
 - 1. Spread, tamp, and finish mixture using hand tools in areas where machine spreading is not possible, as acceptable to Engineer.

- 2. Place mixture at a rate that will insure handling and compaction before mixture becomes cooler than acceptable working temperature.
- G. Joints:
 - Carefully make joints between old and new pavements, or between successive days' work, t o ensure a continuous bond between adjoining work.
 - Construct joints to have same texture, density and smoothness as adjacent sections of asphalt concrete course.
 - 3. Clean contact surfaces free of sand, dirt, or other objectionable material and apply tack coat.
 - Offset transverse joints in succeeding courses not less than 24 inches.
 - 5. Cut back edge of previously placed course to expose an even, vertical surface for full course thickness.
 - 6. Offset longitudinal joints in succeeding courses not less than 6 inches.
 - 7. When the edges of longitudinal joints are irregular, honeycombed, or inadequately compacted, cut back unsatisfactory sections to expose an even, vertical surface for full course thickness.

3.06 COMPACTING THE MIX

- A. Provide sufficient rollers to obtain the r equired pavement density.
- B. Begin rolling operations as soon after placing when the mixture will bear weight of roller without excessive displacement.
- C. Do not permit heavy equipment, including rollers to stand on finished surface before it has thoroughly cooled or set.
- D. Compact mixture with hot hand tampers or vibrating plate compactors in areas inaccessible to rollers.
- E. Start rolling longitudinally at extreme lower side of sections and proceed toward center of pavement. Roll to slightly different lengths on alternate roller runs.

- F. Do not roll centers of sections first under any circumstances.
- G. Breakdown Rolling:
 - Accomplish breakdown or initial rolling immediately following rolling of transverse and longitudinal joints and outside edge.
 - 2. Operate rollers as close as possible to paver without causing pavement displacement.
 - Check crown, grade, and smoothness after breakdown rolling.
 - 4. Repair displaced areas by loosening at once with lutes or rakes and filling, if required, with hot loose material before continuing rolling.
- H. Second Rolling:
 - Follow breakdown rolling as soon as possible, while mixture is hot and in condition for compaction.
 - 2. Continue second rolling until mixture has been thoroughly compacted.
- I. Finish Rolling:
 - 1. Perform finish rolling while mixture is still warm enough for removal of roller marks.
 - 2. Continue rolling until roller marks are eliminated and course has attained specified density.
- J. Patching:
 - 1. Remove and replace defective areas.
 - 2. Cut-out and fill with fresh, hot asphalt concrete.
 - 3. Compact by rolling to specified surface density and smoothness.
 - 4. Remove deficient areas for full depth of course.
 - 5. Cut sides perpendicular and parallel to direction of traffic with edges vertical.

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6. Apply tack coat to exposed surfaces before placing new asphalt concrete mixture.

3.07 MARKING ASPHALT CONCRETE PAVEMENT

- A. Cleaning:
 - 1. Sweep surface with power broom supplemented by hand brooms to remove loose material and dirt.
 - 2. Do not begin marking asphalt concrete pavement until acceptable to the Engineer.
- B. Apply paint with mechanical equipment.
 - 1. Provide uniform straight edges.
 - Not less than two separate coats in accordance with manufacturer's recommended rates (min. wet film thickness of 15 mils).
 - 3. Width of Stripe: Width shall be 4 -inches unless shown otherwise.

3.08 CLEANING AND PROTECTION

- A. Cleaning: After completion of paving operations, clean surfaces of excess or spilled asphalt materials to the satisfaction of the Engineer.
- B. Protection:
 - After final rolling, do not permit vehicular traffic on asphalt concrete pavement until it has cooled and hardened, and in no case sooner than 6 hours.
 - 2. Provide barricades and warning devices as required to protect pavement.
 - Cover openings of structures in the area of paving until permanent coverings are placed (if applicable).

END OF SECTION

SECTION 02900

SEEDING AND SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials and equipment necessary to satisfactorily return all construction areas to their original conditions or better.
- B. Work shall include furnishing and placing seed or sod, fertilizing, planting, watering and maintenan ce until acceptance by Owner.

1.02 RELATED WORK NOT INCLUDED

A. Excavation, filling and grading required to establish elevation shown on the Drawings are included under other sections of these Specifications.

1.03 QUALITY ASSURANCE

- A. Requirements
 - 1. It is the intent of this Specification that the Contractor is obliged to deliver a satisfactory stand of grass as specified. If necessary, the Contractor shall repeat any or all of the work, including grading, fertilizing, watering and seeding or sodding at no additional cost to the Owner until a satisfactory stand is obtained. For purposes of grassing, a satisfactory stand of grass is herein defined as a full lawn cover over areas to be sodded or seeded, with grass free of weeds, alive and growing, leaving no bare spots larger than 3/4 square yard within a radius of 8 feet.
 - 2. All previously grassed areas where pipelines are laid shall be sodded. All sodding and grassing shall be installed in accordanc e with these Specifications or as directed by the Owner's Representative.

1.04 SUBMITTALS

A. All submittals shall be in accordance with Specification
01340 - Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Fertilizer
 - The fertilizer shall be of the slow -release type 1. meeting the following minimum requirements: 12 percent nitrogen, 8 percent phosphorus, 8 percent potassium; 40 percent other available materials derived from organic sources. At least 50 percent of the phosphoric acid shall be from normal super phosphate or an equivalent source which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container. Fertilizer shall be uniform in composition, dry and free flowing delivered to sites in original unopened containers bearing manufacturer's statement or guarantee.
- B. Seeding/Grassing
 - The Contractor shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications, Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications, except that no additional payment will be made for mulching, fertilizing and/or watering.
- C. Sodding
 - 1. Sod shall be provided as required on the construction drawings or at locat ions as directed by the Owner's Representative in accordance with Florida Department of Transportation, Specifications Section 575 and 981. The Contractor shall furnish Bahia grass sod or match existing sod whichever is more stringent . Placement and watering requirements shall be in accordance with FDOT Specifications Section 575, except that no additional payment will be made for placement and/or watering. This cost shall be included in the Contract lump sum prices bid for the treatment plant improvements.

- D. Topsoil
 - 1. Topsoil stockpiled during excavation may be used as necessary. If additional topsoil is required to replace topsoil removed during const ruction, it shall be obtained off site at no additional cost to the Owner. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants and grassing specified herein.
- E. Water
 - It is the Contractor's responsibility to supply all 1. water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The Contractor shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life. The Owner shall provide reclaimed water at no cost to the Contractor for irrigation of grass, plants and trees planted or installed during construction. The Contractor shall provide all conveyance equipment (tank trucks, pumps, pipes) and irrigation equipment to irrigate the vegetation.

PART 3 EXECUTION

3.01 INSTALLATION

- A. When the trench backfill has stabilized sufficiently, the Contractor shall commence work on lawns and grassed areas, including fine grading as necessary and as directed by the Owner's Representative.
- B. Finish Grading
 - Areas to be seeded or sodded shall be finish graded, raked, and debris removed. Soft spots and uneven grades shall be eliminated.
- C. Protection
 - 1. Seeded and sodded areas shall be protected against traffic or other use by placin g warning signs or erecting barricades as necessary. Any areas damaged

prior to acceptance by the Owner shall be repaired by the Contra ctor as directed by the Owner's Representative.

3.02 CLEANUP

A. Soil or similar materials spilled onto paved areas shall be removed promptly, keeping those areas as clean as possible at all times. Upon completion of seeding and sodding operations, all excess soil, stones and debris remaining shall be removed from the construction areas.

3.03 MAINTENANCE

- A. Any existing seeded or sodded areas damaged or altered during construction by the Contractor shall be restored or replaced.
- B. Maintain new seeded or sodded areas for a period of 90 days immediately following complete installation of work or until Owner accepts project. Watering, weedin g, cultivating, restoration of grade, mowing and trimming, protection from insects and diseases, fertilizing and similar operations as needed to ensure normal growth and good health for live plant material shall be included at no additional cost to the Owner.

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATORS

A. Lawn areas planted under this Contract and all lawn areas damaged by the Contractor's operation shall be repaired at once by proper soil preparation, fertilizing, sodding, and watering in accordance with these Specifications.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provi sions of the Contract, including General and Supplementary Conditions and Division 1 Specification S ections, apply to this Specification.
- B. Related Specification Sections:
 - 1. Section 03900 Hydraulic Structures Testing
 - 2. Section 09900 Painting and Coatings

1.02 SUMMARY

- A. This Section specifies cast -in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.
 - 1. Cast-in-place concrete includes the following:
 - a) Foundations and footings
 - b) Slabs-on-grade
 - c) Equipment pads and bases

1.03 SUBMITTALS

- A. General: All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.
 - Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry -shake finish materials and others if requested by Engineer.
 - 2. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Shop drawings to show proposed location of all construction joints. Comply with ACI 315 "Manual of Standard Practice for Detailing

Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures. Engineer's review is for general compliance only. The Contractor will be responsible for size, num ber and lengths of reinforcing.

- 3. Shop drawings for formwork indicating fabrication and erection of forms for specific finished concrete surfaces. Show form construction including jointing, special form joints or reveals, location and pattern of form tie placement, and other items that affect exposed concrete visually. Engineer's review is for general applications and features only. Designing formwork for structural stability and efficiency is Contractor's responsibility.
- The testing laboratory shall submit three (3) copies of results of concrete cylinder tests to Engineer together with one (1) copy each to Owner, Contractor, and Concrete Supplier.
- 5. Ready-mixed concrete delivered shall be accompanied by delivery tickets showing the following:
 - a) Date and time leaving the plant
 - b) Type of cement and weight
 - c) Quantity of water and time added
 - d) Aggregate moisture correction factor
 - e) Admixtures and weight
 - f) Site arrival time
 - g) Site leaving time

h) Type of fly ash and weight

- Laboratory test reports for concrete materials and mix design test. Contractor shall submit three (3) copies.
- 7. Material certificates in lieu of material laboratory test reports when permitted by Engineer. Material certificates shall be signed

by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.

- 8. Hot weather and cold weather concreting plan shall include curing method and specific curing plan, ready mixed supplier plan, contingency plans and materials list as a minimum. All hot wea ther plans shall meet requirements of ACI 305. All cold weather plans shall meet requirements of ACI 306.
- 9. A pouring plan will be submitted by the Contractor to the Engineer for approval showing the location of all construction joints and sawed contraction joints.

1.04 QUALITY ASSURANCE

- A. Codes and Standards: Comply with provisions of the latest revision of the following codes, specifications and standards, except where more stringent requirements are shown or specified:
 - 1. American Concrete Institute (ACI) 211 "Proportions for Normal, Heavyweight and Mass Concrete."
 - American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 - ACI 318, "Building Code Requirements for Reinforced Concrete."
 - 4. ACI 347 "Recommended Practice for Concr ete Formwork."
 - 5. ACI 350 "Environmental Engineering Concrete Structures."
 - 6. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
 - 7. ASTM C 94 Standard Specifications for Ready -Mix Concrete.
 - 8. Florida Building Code 2010 edition.

- 9. ACI 305 "Specification for Hot Weather Concreting" and 306 "Standard Specification for Cold Weather Concreting."
- B. Concrete Testing Service: Owner will engage a testing agency to perform material evaluation tests.
- C. Materials and installed work may require testing and retesting at any time during progress of Work. Any retesting of rejected materials for installed Work, shall be done at Contractor's expense.
- D. Review requirements for submittals, status of coordinating work and availability of materials. Establish prel iminary work progress schedule and procedures for materials inspection, testing and certifications. Require representatives of each entity directly concerned with cast -in-place concrete to coordinate, including, but not limited to, the following:
 - 1. Contractor's superintendent
 - 2. Agency responsible for concrete design mixes
 - 3. Agency responsible for field quality control
 - 4. Ready-mix concrete producer
 - 5. Concrete subcontractor
 - 6. Primary admixture manufacturers

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Forms for Exposed Fin ish Concrete: Plywood, me tal, metal-framed plywood faced or other acceptable panel type materials to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on drawings.
- B. Use plywood complying with U.S. Product Standard PS -1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- C. Forms for Unexposed Finish Concret e: Plywood, lumber, metal or another acceptable material. Provide lumber

dressed on at least two (2) edges and one (1) side for tight fit.

- D. Forms for Cylindrical Columns and Supports: Metal, glass-fiber-reinforced plastic, or paper or fiber tubes that wi ll produce smooth surfaces without joint indications. Provide units with sufficient wall thickness to resist wet concrete loads without deformation.
- E. Form Release Agent: Provide commercial formulation form release agent with a maximum of 350 g/L volatile organic compounds (VOCs) that will not bond with, stain or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.
- F. Form Ties: Factory -fabricated, adjustable -length, removable or snap -off metal form ties designed t o prevent form deflection and to prevent spalling of concrete upon removal. Provide units that will leave no metal closer than 1 -1/2 inches to the plane of the exposed concrete surface.
- G. Provide ties that, when removed, will leave holes not larger than 1 i nch and no smaller than ½ inch in diameter in the concrete surface. Form ties for exposed concrete shall be of the cone-washer type. The cones shall be made of approved wood or plastic. Ties for liquid containment structures shall have an integral waterstop that is tightly welded to the tie. Common wire will not be allowed for form ties.

2.02 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615 Grade 60 deformed
- B. Steel Wire: ASTM A 82, plain, cold-drawn steel
- C. Welded Wire Fabric: ASTM A 185, welded steel wire fabric.
- D. Supports for Reinforcement: Bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing bars and welded wire fabric in place. Use wire bar -type supports complying with CRSI specifications.
- E. For slabs -on-grade, use supports with sand plates or horizontal runners where base material will not support chair legs.

F. For exposed -to-view concrete surfaces where legs of supports are in contact with forms, provide supports with legs that are protected by plastic (CRSI, Class 1) or stainless steel (CRSI, Class 2).

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150
 - 1. Type I/II
- B. Fly Ash: ASTM C 618, Class F
 - 1. Use one brand of cement and fly ash throughout Project unless otherwise acceptable to Engineer.
- C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete. Fine aggregate shall be natural silica sand.

2.04 WATER

A. Mixing water shall meet specified requirements of ASTM C 94, Section 5.

2.05 ADMIXTURES, GENERAL

Provide concrete admixtures that contain not more than one tenth of one percent (0.1%) chloride ions.

- A. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.
 - Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a) Monex Air or Monex NVR, Monex Resources, Inc.
 - b) Air-Tite, Cormix Construction Chemicals
 - c) Air-Mix or Perma-Air, Euclid Chemical Co.
 - d) Darex AEA or Daravair, W.R. Grace & Co.
 - e) MB-VR or Micro-Air, Master Builders, Inc.
 - f) Sealtight AEA, W.R. Meadows, Inc.

- g) Sika AER, Sika Corp.
- B. Water-Reducing Admixture: ASTM C 494, Type A or D.
 - Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a) Monex Resources, Inc.
 - b) Chemtard, ChemMasters Corp.
 - c) PSI N, Cormix Construction Chemicals
 - d) Eucon WR-75, Euclid Chemical Co.
 - e) WRDA, W.R. Grace & Co.
 - f) Pozzolith Normal or Polyheed, Master Builders, Inc.
 - g) Metco W.R., Metalcrete Industries
 - h) Prokrete-N, Prokrete Industries
 - i) Plastocrete 161, Sika Corp.
- C. High-Range Water-Reducing Admixture: ASTM C 494, Type F or Type G.
 - Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a) Monex SP or Mighty RD, Monex Resources, Inc.
 - b) Super P, Anti-Hydro Company, Inc.
 - c) Eucon 37, Euclid Chemical Company
 - d) WRDA 19 or Daracem, W.R. Grace and Company
 - e) Rheobuild or Polyheed, Master Builders, Inc.
 - f) Superslump, Metalcrete Industries
 - g) PSP, Prokrete Industries
 - h) Sikament 300, Sika Corp.

2.06 CALCIUM CHLORIDE

A. The use of calcium chloride will not be permitted.

2.07 RELATED MATERIALS

- A. Reglets: Where sheet flashing or bituminous mem branes are terminated in reglets, provide reglets of not less than 0.0217 - inch-thick galvanized sheet steel. Fill reglet or cover face opening to prevent intrusion of concrete or debris.
- B. Dovetail Anchor Slots: Hot-dip galvanized sheet steel, not less than 0.0336 inch thick with bent tab anchors. Fill slot with temporary filler or cover face opening to prevent intrusion of concrete or debris.
- С. Waterstops: Provide ribbed -type waterstops at construction joints exposed to water pressure, including groundwate r pressure, and other joints as indicated. Provide ribbed type with centerbulb waterstops at expansion joints. In general waterstops shall be 9" wide. Install 6" w ide waterstops at intersections with reinforced sections with 3" of clear cover. All waterstops shall be a minimum of 3/8" thick. All waterstops shall be provided with either metal grommets or integral tie wires located along the top and bottom of the waterstop spaced at 12". Other styles or sizes of waterstops may be considered based on their specific application.
- D. Polyvinyl Chloride Waterstops: Corps of Engineers CRD-C 572.
 - 1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated in the Work include, but are not limited to, the following:
 - a) BoMetals, Inc.
 - b) The Burke Co.
 - c) Greenstreak Plastic Products Co.
 - d) Meadows, Inc.
 - e) Progress Unlimited
 - f) Schlegel Corp.

g) Vinylex Corp.

- E. Sand Cushion: Clean, manufactured or natural sand.
- F. Vapor Retarder: Provide vapor retarder that is resistant to d eterioration when tested according to ASTM E 154, as follows:
 - 1. Polyethylene sheet not less than 8 mils thick.
- G. Water-resistant barrier consisting of heavy kraft papers laminated together with glass -fiber reinforcement and overcoated with black polyethylene on each side.
- H. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd., complying with AASHTO M 182, Class 2.
- I. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
 - 1. Waterproof paper
 - 2. Polyethylene film
 - 3. Polyethylene-coated burlap
- J. Epoxy Adhesive: ASTM C 881, two -component material suitable for use on dry or damp surfaces. Provide material type, grade and class to suit Project requirements.
 - Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a) Burke Epoxy M.V., The Burke Co.
 - b) Spec-Bond 100, Conspec Marketing and Mfg. Co.
 - c) Resi-Bond (J-58), Dayton Superior
 - d) Euco Epoxy System #452 or #620, Euclid Chemical Co.
 - e) Epoxtite Binder 2390, A.C. Horn, Inc.
 - f) Epabond, L&M Construction Chemicals, Inc.

- g) Concresive Standard Liquid, Master Builders, Inc.
- h) Rezi-Weld 1000, W.R. Meadows, Inc.
- i) Metco Hi-Mod Epoxy, Metalcrete Industries
- j) Sikadur 32 Hi-Mod, Sika Corp.
- k) Stonset LV5, Stonhard, Inc.
- 1) Series, Symons Corp.

2.08 PROPORTIONING AND DESIGNING MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301, ACI 211, and ACI 350. For the trial batch method, use an independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.
- B. Do not use the same testing agency for field quality control testing.
- C. Limit use of fly ash to not exceed twenty percent (20%) of the total cementitious content by weight. Fly ash shall be used either as an admixture or as a partial cement replacement. Fly ash may be used in all structural concrete.
- D. Submit written reports to Engineer of each proposed mix for each class of concrete at least fifteen (15) days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Engineer.

2.09 COMPRESSIVE STRENGTHS

A. Design mixes to provide concrete with the following properties as indicated on schedules:

CLASS	7 DAY	<u>28 DAY</u>	MAXIMUM WATER - CEMENTITIOUS <u>RATIO</u>	MINIMUM CEMENTITIOUS <u>MATERIAL</u> (LBS/CY)
Structural	2670	4000	0.44	564
NON SCLUCCULAL	2000	5000	0.30	470

2.10 STRUCTURAL CONCRETE

A. Structural Concrete shall be used in all reinforced concrete structures. .

2.11 SLUMP LIMITS

- A. Proportion and design mixes to result in concrete slump at point of placement as follows:
 - Ramps, slabs and sloping surfaces: Not more than 3 inches.
- B. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.
- C. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2 3 inch slump concrete.

2.12 CONCRETE MIX ADJUSTMENTS

A. Mix design adjustments may be requested by Contractor when characteristics of materials, job conditions, weather, test results or other circumstances warrant, as accepted by Engineer. Laboratory test data for revised mix design and strength results must be submitted to and accepted by Engineer before using in Work.

2.13 ADMIXTURES

- A. Use high -range water -reducing admixture in pumped concrete, concrete for heavy -use industrial slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.
- B. Use air -entraining admixture in e xterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air

content of five percent (5%) with a tolerance of plus or minus one percent (1%).

2.14 READY-MIXED CONCRETE

- A. Comply with requirements of ASTM C 94, and as specified.
 - When air temperature is between 85 °F and 90 °F, reduce mixing and delivery time from one and a half (1-1/2) hours to seventy-five (75) minutes, and when air temperature is above 90 °F, reduce mixing and delivery time to sixty (60) minutes.

2.15 WATERPROOFING

A. Provide above and below-grade surface applied coatings in accordance with Project Specification Section 09900.

2.16 CRACK INJECTION MATERIALS

- A. Hydrophilic Resin:
 - 1. Shall be a low viscosity, expanding polyurethane resin. It shall cure into a flexible rubber -like material that has the potential for unrestrained increase in volume in excess of 100 percent in the presence of water.
 - 2. Prepare substrate and install in accordance with the manufacturers recommendations.
 - 3. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a) Sika Injection 29, by Sika Corporation.
 - b) Duroseal Inject, as manufactured by BBZ USA, Inc.
 - c) Or equal.

PART 3 EXECUTION

3.01 GENERAL

A. Coordinate the installation of joint materials, vapor retarder/barrier and other related materials with placement of forms and reinforcing steel.

- B. Forms
 - 1. General: Design, erect, support, br ace and maintain formwork to support vertical, lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:
 - a) Provide Class A tolerances for concrete surfaces exposed to view.
 - b) Provide Class C tolerances for other concrete surfaces.
- C. Construct forms to sizes, shapes, lines and dimensions shown and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses, moldings, rustications, reglets, chamfer s, blocking, screeds, bulkheads, anchorages and inserts, and other features required in the Work. Use selected materials to obtain required finishes. Solidly butt joints and provide backup at joints to prevent cement paste from leaking.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like for easy removal.
- E. Provide temporary openings for clean -outs and inspections where interior area of formwork is inaccessible before and during concrete placement. Securely brace temporary openings and set tightly to forms to prevent losing concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- F. Chamfer all exposed corners and edges, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints. Chamfer edges to be ¾" unless otherwise approved by Engineer, or noted on the construction drawings.

- G. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
- H. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT

- A. General: Comply with Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars," for details and methods of reinforcement placement and supports and as specified.
- B. Avoiding cutting or puncturing vapor retarder/barrier during reinforcement placement and concreting operations. Repair damages before placing concrete.
- C. Clean reinforcement of loose rust and mill scale, earth, ice and other materials that reduce or destroy bond with concrete.
- D. Accurately position, support and secure reinforcement against displacement. Locate and support reinforcing by metal chairs, runners, bolsters, spacers and hangers, as approved by Engineer.
- E. Place reinforcement to maintain minimum coverages as indicated for concrete protection. Arrange, space and securely tie bars and bar supports to hold reinforcement in position during concrete placement operations. Set wire ties so ends are directed into concrete, not toward exposed concrete surfaces.
- F. Install welded wire fabric in lengths as long as practicable. Lap adjoining piece s at least one (1) full mesh and lace splices with wire. Offset laps of adjoining widths to prevent continuous laps in either direction.

3.03 JOINTS

- A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Engineer.
- B. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- C. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- D. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form continuous diaphragm in each joint. Support and protect exposed waterstops during progress of Work. Field -fabricate joints in waterstops according to manufacturer's printed instructions.
- E. Isolation Joints in Slabs-on-Grade: Construct isolation joints in slabs-on-grade at points of contact between slabs-on-grade and vertical s urfaces, such as column pedestals, foundation walls, grade beams, and other locations, as indicated.
- F. Joint fillers and sealants shall be as follows:
 - 1. Joint Fillers
 - a) Self-expanding Cork Joint Filler: Preformed strips complying with ASTM D 1752 for Type III.
 - b) Cork Joint Filler: Preformed strips complying with ASTM D 1752 for Type II.
 - c) Sponge Rubber Joint Filler: Preformed strips complying with ASTM D 1752 for Type I.
 - d) Bituminous Fiber Joint Filler: Performed strips complying with ASTM D 1751: Granulated cork with asphalt binder encased between two (2) layers of saturated felt of glass-fiber felt of width and thickness indicated.
 - 2. Joint Sealers shall be appropriate for their intended use and installations. Follow

manufactures instruction for use and installation. All joint sealants shall be in accordance with ACI 504R.

3.04 INSTALLING EMBEDDED ITEMS

- A. General: Set and build into formwork anchorage devices and other embedded items required for other work that is attached to or supported by cast-in-place concrete. Use setting drawings, diagrams, instructions, and directions provided by suppliers of items to be attached.
- B. Forms for Slabs: Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and contours in finished surfac es. Provide and secure units to support screed strips using strike-off templates or compacting-type screeds.

3.05 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, non-residual, low-VOC, form-coating compound before placing reinforcement.
- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
- C. Coat steel forms with a non-staining, rust-preventative material. Rust -stained steel formwork is not acceptable.

3.06 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other t rades to permit installation of their work.
- B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified.

Deposit concrete to avoid segregation at its final location.

- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
- E. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand -spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
- F. Do not use vibrators to transport concrete inside forms. In sert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mix to segregate. A spare vibrator will be on-site for emergency use at all times.
- G. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints or expansion joints, until completing placement of a panel or section.
- H. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
- I. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- J. Maintain reinforcing in proper position on chairs during concrete placement.
- K. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

- L. When air temperature has fallen to or is expected to fall below 40 °F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 °F and not more than 80 °F at point of placement.
- M. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
- N. Do not use salt, other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs. Calcium chloride will not be allowed.
- O. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.
- P. Cool ingredients before mixing to maintain concrete temperature at time of placement to be in accordance with ACI. Mixing water may be chilled or chopped ice may be used to c ontrol temperature, provided water equivalent of ice is calculated to total amount of mixing water. Ice can not be used to replace more than half of the design total water content. Using liquid nitrogen to cool concrete is Contractor's option.
- Q. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
- R. Fog spray forms, reinforcing steel and subgrade just before placing concrete. Ke ep subgrade moisture uniform without puddles or dry areas.
- S. Use water-reducing retarding admixture when required by high temperatures, low humidity or other adverse placing conditions, as acceptable to Engineer.

3.07 FINISHING FORMED SURFACES

A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off. Finish shall be a Class C in accordance with ACI 347.

- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting or another similar system. This is an as -cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed. Finish shall be a Class A in accordance with ACI 347.
- C. Grout-Cleaned Finish: Provide grout -cleaned finish on scheduled concrete surfaces that have received smooth formed finish treatment.
 - 1. Combine one part Portland cement to one and one half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene -based bonding admixture and water to form the consistency of thick paint. Blend standard Portland cement and white Portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.
 - Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least thirty-six (36) hours after rubbing.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces adjacent to formed surfaces, strike -off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adj acent unformed surfaces unless otherwise indicated.
- E. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or ela stic roofing, or sand-bed terrazzo; and where indicated.
 - 1. After screeding, consolidating and leveling concrete slabs, do not work surface until ready

for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power -driven floats, or both. Consolidate surface with powerdriven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 25 (floor flatness) and F(L)20 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular tex ture. Class of surface shall be a class C surface in accordance with 347 R.

- F. Non-slip Broom Finish: Apply a non -slip light broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
 - 1. Immediately after float finishing, sl ightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.
- G. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work. All grout shall be non-shrinking.
- H. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.
- I. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishin g machines and equipment.
- J. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings and associated items. Cast -in

safety inserts and accessories as shown on drawings. Screed, tamp and non-slip broom concrete surfaces.

K. Below Grade C oncrete: Waterproof the exterior (grade) side of tank and building walls. Prepare surface based upon manufacturers recommendations. Material may be spray, brush or roller applied. Conform to manufacturers recommendations for chosen application.

3.08 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than fourteen (14) days as required due to weather.
- C. Curing Methods: Cure concrete by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.
 - 1. Provide moisture curing by the following methods:
 - a) Keep concrete surface continuously wet by covering with water.
 - b) Use continuous water-fog spray.
 - c) Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch lap over adjacent absorptive covers.
 - 2. Provide moisture -retaining cover curing as follows:
 - a) Cover concrete surfaces with moisture retaining cover for curing concrete, placed in widest practicab le width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing

period using cover materi al and waterproof tape.

- 3. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. As soon as initial set has occurred, place a soil soaker hose along the tops of all walls t o keep concrete forms wet during the curing period. If forms are removed, continue curing by methods specified above, as applicable, for the remainder of the curing period. If forms are removed before the end of the curing period, then the concrete shall be continuously moist for the remainder of the curing period by fog spraying or covering with moist burlap.
- Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping and other flat surfaces, by applying the appropriate curing method.
- 5. Final cure concrete surfaces to receive finish flooring with a moisture -retaining cover, unless otherwise directed.

3.09 SHORES AND SUPPORTS

- A. General: Comply with ACI 347 for shoring and reshoring in multistory construction, and as specified.
- B. Extend shoring from ground to roof for structures four(4) stories or less, unless otherwise permitted.
- C. Remove shores and reshore in a planned sequence to avoid damage to partially cured concrete. Locate and provide adequate reshoring to support work without excessive stress or deflection.
- D. Keep reshores in place a minimum of fifteen (15) days after placing upper tier, or longer, if required, until concrete has attained its required twenty-eight (28) day strength and heavy loads due to construction operations have been removed.

3.10 REMOVING FORMS

A. Formwork, such as columns, beam soffits, elevated slabs, joists, walls and other structural elements, may

not be removed until concrete has attained at least seventy percent (70%) of design minimum compressive strength at twenty-eight (28) days. No earth loads or live loads will be structurally placed against or on any poured structurally reinforced concrete until the concrete has reached its twenty-eight (28) day compressive strength or otherwise approved by the Engineer. Determine potential compressive strength of in-place concrete by testing field -cured specimens representative of concrete location or members.

B. Form-facing material may be removed four (4) days after placement only if shores and other vertical supports have been arranged to permit removal of form -facing material without loosening or disturbing shores and supports.

3.11 REUSING FORMS

- A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-coating compound as specified for new formwork.
- B. When forms are extended for successive concrete placement, thoroughly clean surfaces, remove fins and laitance, and tighten forms to close joints. Align and secure joint to avoid offsets. Do not use patched forms for exposed concrete surfaces except as acceptable to Engineer.

3.12 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Engineer.
- B. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects include color and texture irregularities, cracks, s palls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.
- C. Repair concealed formed surfaces, where possible, containing defects that affect the concrete's

durability. If defects cannot be repaired, remove and replace the concrete.

- D. Repairing Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and verify surface tolerances specified for each surface and finish. Correct low and high areas as specified. Test unformed surfaces sloped to drain for trueness of slope and smoothness by using a template having the required slope.
- E. Repair finished unformed surfaces containing defects that affect the concrete's durability. Surface defects include crazing and cracks in excess of 0.01 inch wide or that penetrate to the reinforcement or completely through nonreinforc ed sections regardless of width, spalling, popouts, honeycombs, rock pockets and other objectionable conditions.
- F. Correct high areas in unformed surfaces by grinding after concrete has cured at least fourteen (14) days.
- G. Correct low areas in unformed surfa ces during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete. Proprietary underlayment compounds may be used when acceptable to Engineer.
- H. Repair defective areas, except random cracks and single holes not exceeding 1 inch in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose reinforcing steel with at least 3/4 inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials to provide concrete of same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
- I. Additional repair of concrete cracks in formed and unformed surfaces: All concrete for liquid retaining structures, elevated slabs subject to rainfall and washdown, below grade members and all concrete in contact with earth, water or exposed directly to the elements shall be watertight. All leaks through concrete that exhibit any dampness or flowing water and any cracks, holes or other defective concrete in areas of potential leakage, sh all be repaired and made watertight by CONTRACTOR. Where it is not possible to

verify that a crack is not leaking, it shall be repaired. Determination of leakage and / or dampness shall be made by Engineer. Repair, removal, and replacement of defective con crete as directed by ENGINEER shall be at no additional cost to the OWNER.

1. Method of Repair: Cracks shall be pressure grouted using hydrophilic resin. Apply in accordance with the manufacturer's directions and recommendations.

3.13 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. General: The Contractor will employ a testing agency to perform tests and to submit test reports. The testing agency shall be approved by the Engineer. Any retesting due to non-acceptable work or materials shall be at the Contractors expense.
- B. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.
- C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
- D. Slump: ASTM C 143; one (1) test at point of discharge for each compressive strength test; additional tests when concrete consistency seems to have changed or as directed by the Engineer.
- E. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one (1) for each compressive strength test.
- F. Concrete Temperature: ASTM C 1064; one (1) test hourly when air temperature is 40 °F and below, when 90 °F and above, and one (1) test for each set of compressive – strength specimens.
- G. Compression Test Specimen: ASTM C 31; one (1) set of four (4) standard cylinders for each compressive strength test, unless otherwise directed. Mold and store cylinders for laboratory -cured test specimens except when field-cured test specimens are required.
- H. Compressive-Strength Tests: ASTM C 39; one (1) set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one (1) day; one (1) specimen test ed at seven (7) days, two (2)

specimens tested at twenty-eight (28) days, and one (1) specimen retained in reserve for later testing if required.

- I. When frequency of testing will provide fewer than five (5) strength tests for a given class of concrete, conduct testing from at least five (5) randomly selected batches or from each batch if fewer than five (5) are used.
- J. When strength of field-cured cylinders is less than eighty-five percent (85%) of companion laboratory-cured cylinders, evaluate current operat ions and provide corrective procedures for protecting and curing the inplace concrete.
- K. Strength level of concrete will be considered satisfactory if averages of sets of three (3) consecutive strength test results equal or exceed specified compressive str ength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- L. Test results will be reported in writing to Engineer, ready-mix producer, and Owner within twenty-four (24) hours after tests. Reports of compre ssive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at twenty-eight (28) days, concrete mix proportions and materials, compressive breaking strength, and type of break for both seven (7) day tests and twenty-eight (28) day tests.
- M. Nondestructive Testing: Impact hammer, sonoscope or other nondestructive device may be permitted but shall not be used as the sole bas is for acceptance or rejection.
- N. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other characteristics have not been atta ined in the structure, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. These additional tests shall be at the Contractor's expense.

END OF SECTION

SECTION 03361

CIRCULAR PRESTRESSED CONCRETE TANK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. The work consists of furnishing all labor, equipment and material and performing all operations necessary for the construction of one 10 MG pre-stressed concrete water storage tanks, with 200 ft. diameter and 4 2'-6" SWD, as shown on the Drawings and as specified.

1.02 QUALITY ASSURANCE

- A. The entire tank, including all portions of the floor, wall and roof shall be designed and built by the tank contractor, using its own tra ined personnel and equipment.
- B. Qualifications and Experience. The Tank C ontractor shall have the following qualifications and experience:
 - 1. Shall be a firm specializing in the design and construction of wire -wound circular prestressed composite tanks; shall have had at least ten years experience in this specialty; and shall give satisfactory evidence that it has the skill, reliability, and financial stability to build and guarantee the tank in accordance with the quality required by these specifications; and be presently responsible for, a minimum of five prestressed composite circular tanks of comparable size now giving satisfactory service.
 - 2. The tank contractor shall have on its staff a full-time structural engineer, registered in the State of Florida, who shall have no less than ten years experience in the design and field construction of circular prestressed composite tanks, and who shall be in responsible engineering charge of the work to be done. All working drawings and design calculations shall carry the seal of such a registered structural professional engineer.
- C. Available Tank Contractors. Subject to compliance with requirements, Tank Contractors offering products which

may be incorporated in the work are limited to the following:

- 1. Crom Corporation, Gainesville, Florida
- 2. Precon Corporation, Newberg, Florida

1.03 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.
- B. Design Analysis and Drawings. After award of the contract, the tank contra ctor shall submit complete design analyses, working drawings and details of the structure signed and sealed by a registered Florida Professional Engineer per paragraph 1.2, B. 2. Such drawings shall include details, influent and effluent pipes, plan and elevation details of the tank proposed for erection. In addition, upon request, the Contractor shall provide complete signed and sealed calculations upon which his drawings are based.
- C. Upon completion of construction, the tank contractor shall submit one s et of signed and sealed record drawings to the Owner. Record drawings shall note any deviations from the design drawings.

1.04 WARRANTY

A. The tank contractor shall guarantee workmanship and materials on the complete structural portion of the tank for a five-year period from date of acceptance of the work. In case of leakage or other defects appear within the five-year period, the Tank Contractor shall promptly repair the tank at its own expense upon written notice by the Owner that such defects have been found. Leakage is defined as a stream flow of liquid appearing on the exterior of the tank, the source of which is from the inside of the tank.

PART 2 PRODUCTS

2.01 DESIGN CRITERIA

A. The thickness of the circular pre-stressed composite walls shall be calculated so as to accept the initial compressive forces applied by prestressing, hydrostatic
stresses induced by contents, and other applicable loads such as Soil Backfill, Live and Wind.

- Soil Backfill in accordance with the Project Geotechnical Report prepared b y Driggers Engineering Services, Inc. Reference Project Specification Appendix B for additional information.
- 2. Roof Load: Process Slabs = 50 psf (minimum).
- 3. Wind Load:
 - a) Ultimate design wind speed (3 -second peak gust) = 155 mph, Exposure = C and Risk category = III.

2.02 MATERIALS

- A. Concrete
 - 1. Compressive Strength f' $_{\rm c}$ 4000 psi at 28 days
- B. Shotcrete
 - 1. Compressive Strength f' $_{\rm g}$ 4000 psi or greater at 28 days
 - 2. Allowable Compressive Stress fg 0.45 f'g
 - 3. Allowable Compressive Stress Due to Initial Prestressing Force f_{gi} .50 f_{gi} or less, with a maximum of 2250 psi (where f gi is defined as compressive strength at time initial prestressing force is applied)
- C. Prestressing Wire
 - Wire Size Diameter 0.162-inch (8 gauge)or larger, but no larger than 0.250-inch
 - 2. Working Stress, Wall f_s 115,000 psi
 - 3. Working Stress, Dome Ring f_s 120,000 psi
 - 4. Allowable Tensile Stress Before Losses f_{si} 145,600 psi or no greater than 0.70 f's
 - 5. Ultimate Tensile Strength f' $_{\rm s}$ 231,000 psi or greater

D. Reinforcing Steel

- 1. Allowable Tensile Stress f_s 18,000 psi
- 2. Yield Strength f_v 60,000 psi

2.03 TANK CONSTRUCTION

- A. Floor: Concrete membrane floors (4 -inches thick minimum) shall have a minimum thickness of 8-inches of concrete over all pipe encasements and sumps. The minimum percentage (0.60%) of reinforcing steel applies to these thickened sections and shall extend a minimum of 2-feet into the adjacent membrane floor.
 - 1. The tank contractor shall be responsible to design and provide a sufficiently thick reinforced floor slab, including the foundation sl ab beneath the walls for the vertica l loading. Soil boring information included in the Project Geotechnical Report and part of these Project Specifications is available to the tank manufacturer. Additional required soil information shall be at the expense of the tank manufacturer.
 - Floors shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.
 - 3. Floors shall be continuously water cured until tank construction is completed.
- B. Core Wall. The core wall shall be constructed of shotcrete, encasing a continuous steel diaphragm without horizontal splices.
 - 1. The thickness of the core wall shall be calculated so as to accept the initial compressive forces applied by prestressing, backfill, and other applicable loads. The wall may taper uniformly on the outside face from top to bottom as required by design computations. In no case shall the core wall be less than $3^1/_2$ -inches thick. Horizontal sections of the wall shall form true circles without flats, excessive bumps or hollows.
 - 2. To compensate for bending moments and for shrinkage, differential drying and temperature stresses, the following reinforcing steel shall be incorporated in the core wall:

- a) The top 2 feet of core wall shall have not less than 1 percent c ircumferential reinforcing.
- b) The bottom 3 feet of core wall shall have not less than 1 percent circumferential reinforcing.
- c) Inside Face:
 - Minimum of 26 gage continuous galvanized steel shell diaphragm without horizontal splices.
 - Additional vertical and ho rizontal reinforcing steel bars as required by design computations.
- d) Outside Face:
 - Vertical reinforcing steel; minimum of #4 bars at 12- inches center to center.
 - Additional vertical and horizontal reinforcing steel bars as required by design computations.
- С. Galvanized Steel Shell Diaphragm: A minimum 26 gage galvanized steel tank shell with a minimum thickness of 0.017 in. conforming to the requirements of ASTM A653/A653M. Weight of zinc coating shall be no less than G 90 of Table 1 of ASTM A653/A653M shall be used within and throughout the core wall providing positive waterstop. The galvanized steel shell diaphragm shall be incased and protected with shotcrete no less than one-inch thick at all places. The galvanized steel shell is to be so formed and erect ed that a mechanical key between shotcrete and diaphragm will be created. The sheets of galvanized steel diaphragm shall be continuous from top to bottom of wall; horizontal joints or splices will not be permitted.
 - All vertical joints in the diaphragm sha ll be 1. sealed watertight by mechanical crimping and epoxy injection. This epoxy injection shall be carried out from bottom of wall to top of wall, using pressure pumping procedure; after the steel shell has been fully encased, inside and outside, with shotcrete. The epoxy sealant shall be suitable for bonding to concrete, shotcrete and steel. The sealant shall conform to the requirements of ASTM C 881/C 881M, Type III, Grade 1, and shall be 100 percent solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77 degrees F.

- 2. The galvanized steel shell design and its epoxy injection procedure (covered by U.S. Patent 5,150,551) shall have been used and proven satisfactory in the tanks required in the tank contractor's experience record. No nail or other holes shall be made in the steel shell for erection or other purposes except for inserting pipe sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an approved epoxy sealant.
- D. Shotcrete. Wet mix and dry mix shotcrete shall be applied by experienced nozzlemen certified by American Concrete Institute (ACI) as outlined in ACI certification publication CP-60.
 - 1. Shotcrete mixes, measured by weight, shall be:
 - a) First coat on steel shell diaphragm and prestressing wire: 1 part cement to 3 parts sand, a maximum of 25% of cementitious material may be fly ash.
 - All other shotcrete: 1 part cement to 4 parts sand, a maximum of 25% of cementitious material may be fly ash
 - 2. Each shotcrete layer shall be broomed prior to final set to affect satisfactory bonding of the following layer. No shotcrete shall be applied to reinforcing steel or diaphragm that is encrusted with overspray. No less than ¹/₆-inch thick shotcrete shall separate reinforcing steel and prestressing wire.
- E. Horizontal Prestressing. Circumferential prestressing of the tank shall be achieved by the application of cold-drawn, high-carbon steel wire complying with ASTM A-821/A821M Type B, placed under high tension. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel.
 - 1. Placement of the prestressing steel wire shall be in a continuous and uniform helix of such pitch as to provide in each lineal foot of core wall height an initial force and unit compressive stress equivalent to that shown on the drawings. Splicing of the wire shall be permitted only when

completing the application of a full coil of wire, or when removing a defective section or wire.

- 2. Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire as it is positioned on the tank wall. Tension in the wire shall be generated by me thods not dependent on cold working or redrawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the drawings. No circumferential movement of the wire along the tank will be permitted during or after tensioning. Shotcrete shall be used to completely encase each individual wire, and protect it from corros ion. To facilitate this encasement, the clear space between adjacent wire is to be not less than one wire diameter.
- F. Measurement of Wire Stress. The tank contractor shall supply equipment at the construction site to measure tension in the wire after it is positioned on the tank wall. This stress measuring equipment shall include: electronic-direct reading stressometer (with accuracy to within 2%); calibrated dynamometers; test stand to field verify the accuracy of the stressometer. The initial tension in each wire shall be recorded.
- G. Exterior Covercoat. After circumferential prestressing wires have been placed, they shall be protected by encasement in shotcrete. This shotcrete encasement shall completely encapsulate each wire, and shall permanently bo nd the wire to the tank wall. The shotcrete cover shall have a thickness of no less than one-inch over the wire. When multiple layers of the wire are required, shotcrete cover between layers shall be no less than 1/8-inch thick.
- H. Dome Roof. The dome roof shall be constructed of reinforced concrete, circumferentially prestressed. Dome shell reinforcement shall consist of reinforcing steel bars or welded wire fabric meeting ASTM A -185, not galvanized. Bolsters for wire fabric and reinforcing bars shall be plastic tipped. Wire ties shall be galvanized.
 - 1. The dome shall be designed as a free span, spherical thin shell, with a one-tenth rise. The

dome ring girder shall be prestressed with sufficient wire to withstand the dome dead load and design live loads. The ring girder shall have a cross section suitable to accept the applied prestressing forces. All surfaces in the wall/dome ring girder joint shall be coated with an approved bonding epoxy.

- 2. The high water level in the tank shall be permitted to encroach on the dome shell no higher than the upper horizontal plane of the dome ring girder. Precast concrete overflows shall be installed on the dome roof in such numbers as will provide an overflow open area three times the area of the largest tank pipe.
- 3. The concrete dome roof shall be water cured until the dome ring girder is prestressed.
- 4. The typical dome thickness and steel reinforcement shall meet the requirements of AWWA D110 -04, Section 3.6.3., Thickness and reinforcement. In all cases, the thickness of the dome shall be no less than 3 inches.
- 5. The dome edge and upper wall shall be designed to resist the moments, thrusts, and shears that occur in this region due to dome and wall prestressing and loading conditions. The following design parameters shall be used:
 - a) A determination of the buckle diameter shall be made, as defined by

 $d_{\scriptscriptstyle b} = 2.5 \bullet \sqrt{r_{\scriptscriptstyle d} \bullet t_{\scriptscriptstyle d}}\,,$ rounded up to the next foot

Where: d_b = buckle diameter in feet

 r_d = dome radius in feet

 t_d = typical dome thickness in feet

- b) Dome edge thickening shall begin at a radial location on the dome, defined as S_2 , which is at least one buckle diameter away from the tank wall.
- c) A springline haunch shall be provided, which extends radially from the inside face of the tank wall to radial location s_1 , which is defined as:

 $s_1 = 0.6 \bullet \sqrt{1.5 \bullet r_d \bullet t_d}$, rounded up to the next foot

This springline haunch shall begin at the inside face of the tank wall with a springline thickness as required by paragraph f. below and shall end at radial location s_1 with the following thickness:

$$t_{d1} = 1.33 \bullet t_d$$

- Where: t_{d1} = minimum thickness at s_1 in feet t_d = typical dome thickness in feet at one buckle diameter from tank wall
- d) Beginning at s_1 and continuing to s_2 , the dome shell shall be a straight line taper.
- e) Parameters b., c., and d. above are not required for domes where the calculated typical dome thickness is less than 75 percent of the actual typical dome thickness.
- f) Sufficient concrete thickness at the springline of the dome shall be provided so that no more than 2 feet of the springline haunch is considered in calculating the effective dome edge ring cross sectional area. Compressive stress in this area shall not exceed 1,000 psi when subjected to initial pres tressing, offset by dead load only.
- 6. Dome Edge Steel Reinforcement
 - a) Throughout the dome edge, the percentage of steel reinforcement, both radially and circumferentially, shall be no less than 0.25 percent of the gross cross sectional area of concrete.
 - b) Along the dome edge, steel reinforcement shall be distributed between the upper and lower layers unless finite element analysis calculations indicate that tensile stress does not exist in the concrete along the bottom face of the dome edge. In that case,

only top bars are required radially and circumferentially. In addition, radial and circumferential reinforcing bars will not be required along the bottom face of the dome edge where the calculated typical dome thickness is less than 75 percent of the actual typical dome thickness.

- c) Where reinforcing bars are required in the bottom layer, they shall be anchored near the tank wall to insure adequate development at the intersection between dome and wall.
- d) In all cases, the percentage of circumferential steel rei nforcement in the first two feet of the dome edge shall be no less than one percent of the gross cross sectional area of concrete.
- e) Where bottom dome edge steel reinforcement is required, vertical steel reinforcement along the inside face of the tank wall shall be no less than 0.5 percent of the cross sectional area of wall shotcrete.
- I. Pipe Openings. Insofar as possible, all pipes shall pass into the tank through the floor slab. Under-floor piping shall be encased in concrete.
 - 1. When it is necessary for a pipe to pass through the tank wall, the invert of such pipe shall be no less than 18-inches above the floor slab, and the prestressing wires required at the pipe elevation shall be distributed above and below the opening, leaving an unbanded strip around the entire tank. Ordinarily, unbanded strips shall have a vertical dimension of no more than 36-inches.
 - A design analysis will be required for unbanded wall spaces having a vertical dimension greater than 36-inches.
 - 3. All pipe sleeves passing through the wall shall be sealed to the steel sheet diaphragm by epoxy injection; after the sleeve and diaphragm have been encased in shotcrete.
 - 4. Pipes passing through the floor slab for each tank shall consist of the following:
 - a) 30" Inlet/Outlet

- b) 42" Outlet
- c) 12" Drain
- d) 42" Overflow

2.04 TANK ACCESSORIES

- A. The tank contractor shall furnish, install, and guarantee for five years the following tank accessories for each tank:
 - 1. Wall Manhole (2) 316 Stainless steel frame, cover, and bolts $-1'-5'' \ge 4'-4''$ rectangular
 - Exterior Ladder T-6061-T6 aluminum with safety cage and gate and or TS Safety Rail as shown on the plans
 - 3. Handrail with Toe board T-6061-T6 aluminum as shown on the plans.
 - Roof Hatch and Cover All fiberglass with Type 316 stainless steel fasteners manufactured in strict accordance with Specifications for Fiberglass Reinforced Plastic Products.
 - 5. Roof Ventilator Stainless steel and fiberglass materials as shown on the drawings and noted above.
 - Exterior Liquid Level Indicator Stainless steel and fiberglass materials as shown on the drawings and noted above.
 - Precast Concrete Overflow Six (6) precast concrete openings with 24x24 mesh FRP insect screen in openings.
 - 8. 8" Dome Probe Curb (1) Precast concrete
 - 9. Fiberglass Vortex Plate at tank outlet with 316 stainless steel hardware
 - 10. 12" tall dome parapet wall as shown on the drawings

PART 3 EXECUTION

3.01 CONSTRUCTION CLEARANCE

- A. In order to allow for proper application of shotcrete and prestressing wire, a level and unobstructed construction area no less than 15-feet wide shall be provided around the circumference of each tank at subfloor elevation.
- B. Excavation. Excavation shall be made around the structures as shown on the drawings and as specified in Section 02200 - Earthwork.

3.02 EXCAVATION AND REFILL

A. If encoun tered, t he contractor shall remove any unsuitable soils at the location of the proposed storage tank and refill with clean structural fill, compacted as specified in Section 02200 - Earthwork.

3.03 FILLING AND TESTING

A. The contractor shall be responsible for filling the ground storage tank to the overflow level and testing for leaks and/or pre-loading. Reclaimed water shall be made available for the contractor's initial use by the Owner. Any subsequent reclaimed water required for testing due to constructio n deficiencies or test failures shall be paid for by the Contractor. The contractor shall be responsible for all piping, valves, fittings and pumps required to fill the tank.

3.04 PAINTING

- A. Contractor shall paint the outside surface of the tank wall and roof dome with colors to be selected by the Owner. The paint schedule is as follows:
 - 1. Finish: Two coats Tnemec Series 156.
 - Paint shall be applied as specified in Section 09900 - Painting and Coatings.

3.05 DISINFECTION

A. Each tank shall be thoroughly cleaned in a ccordance with the requirements of AWWA C652 for potable water storage tanks.

- B. After completion of cleaning, each tank shall be disinfected in accordance with chlorination method requirements of AWWA C652 (Chlorination Method 3).
- C. Chlorinated water shall be disposed of in a manner that will not harm the environment. Approval by the Owner must be obtained before heavily chlorinated water is discharged to the sanitary sewer at a specified allowable discharge rate. Heavily chlorinated water must be neutralized in a separate vessel or pipe prior to being discharged to the wastewater treatment plant or to a drainage way. One of the chemicals listed in AWWA C651 Appendix B, or C652 Appendix A, shall be used for neutralization.

3.06 CLEAN-UP

A. Clean project site of 1 itter and foreign substances. Sweep paved areas to a broom -clean condition; remove stains, petrochemical spills and other foreign deposits. Rake grounds which are neither planted nor paved, to a smooth, even-textured surface.

END OF SECTION

SECTION 03600

GROUTING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. This Section includes grouting of equipment bases and such locations as shown on the Drawings and as specified.
- B. The types of grouting include the following:
 - 1. Portland Cement Grout
 - 2. Non-shrink, Non-expanding Grout

1.02 DELIVERY AND STORAGE

- A. Prevent damage to or contamination of grouting materials during delivery, handling and storage.
- B. Store all grouting materials in undamaged condition with seals and labels intact as packaged by the manufacturer.

1.03 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 PREMIXED GROUTS

- A. Portland Cement Grout
- (
- B. (Grout Mortar for use as fillets and leveling)
 - 1. Portland Cement: ASTM C150, Type I
 - 2. Sand: ASTM C33, Fine Aggregate (Marson's sand)
 - 3. Water: Potable
 - 4. Mix 1-part Portland cement to 3-parts sand.

- C. Pre-Mixed non -shrink, Non-expanding Grout (Nonmetallic). Non-shrink grout as shown on the Drawings shall be a mixture of selected s ilica sands, Portland cement, water reducing agents, plasticizing and shrinkage compensating agents. Grout shall be nonmetallic non-corrosive, non-staining and comply with CRD-C-588, Type D.
- D. The grout shall be non -shrink in accordance with ASTM C827, ASTM C191, and ASTM C109. The water-grout ratio shall be approximately 8 to 10 quarts of water per cubic foot of grout adjustable for varying job conditions.
- E. Grout shall not contain calcium chloride or other salt; aluminum or other metals; chemical additives, gypsum or expansive cements. Grout shall not expand after set.
- F. Grout shall be used and applied in accordance with the manufacturer's written instructions.
- G. Subject to compliance with requirements provide from the following:
 - 1. L&M Construction Chemicals, Inc. Crystex
 - 2. Grout Corp. Five Star Non -shrink Grout or equivalent

2.02 NONSHRINK GROUT

- A. Non-shrink grout shall conform to the following requirements:
 - Manufactured under rigid quality control specifically for grout used in transferring heavy loads.
 - Contain nonmetallic aggregates specially graded to minimize bleeding.
 - 3. Have an initial setting time of approximately one hour at 70°F.
 - 4. Produce no settlement or drying shrinkage at 3 days or later.
 - 5. Have higher strength at all ages than plain cement grout of the same flowability.

- 6. Resist attack by oil and water and have lower absorption than plain cement grout of the same flowability.
- Minimum compressive strength, in accordance with ASTM C-109, shall be 2500 psi after 1 day and 7000 psi after 28 days.

2.03 MIXES

- A. For less than 2-inch clearance, or where size or shape of space makes grouting difficult, grout mix shall consist of Portland cement, fine aggregate and water.
- B. For greater than 2 -inch clearances where coarse aggregate will not obstruct free passage of the grout, extend grout by adding 50 pounds of pea gravel per 100 pounds grout material.
- C. Use minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding.
- D. Portland cement mortar for raked -out edges of nonshrink grout: one part Portland cement, two parts sand and 0.50 part water by weight.

2.04 MIXING

- A. Mix grout in accordance with manufacturer's printed specifications.
- B. Mix grouting materials and water in a mechanical mixer for no less than 3-minutes.
- C. Mix grout as close to the work area as possible and transport the mixture quickly and in a manner that does not permit segregation of materials.
- D. After the grout has been mixed, do not add more water for any reason.

PART 3 EXECUTION

3.01 PROCEDURES

A. Installation methods and procedures shall be approved by Engineer and shall be in accordance with manufacturer's printed specifications before work is begun.

3.02 SURFACE PREPARATION

- A. Surface preparation shall be in accordance with manufacturer's printed specifications.
- B. Remove defective concrete, laitance, dirt, oil, grease and other foreign material from concrete surfaces by bush-hammering, chipping, or other similar means, until a sound, clean concrete surface is achieved.
- C. Lightly roughen the concrete, but not enough to interfere with the proper placement of grout. Cover concrete areas with waterproof membrane until ready to grout. Immediately before grouting remove waterproof membranes and clean any contaminated surfaces.
- D. Remove foreign materials from metal surfaces in contact with grout. Align, level and maintain final positioning of all components to be grouted.
- E. Saturate concrete surfaces with clean water; remove excess water and leave none standing.

3.03 PLACING

- A. Placing shall be in accordance with manufacture r's printed specifications.
- B. Place non -shrink grouting material quickly and continuously by the most practical means permissible; pouring, pumping or under gravity pressure.
- C. Do not use either pneumatic -pressure or dry packing methods without written permission of the Engineer.
- D. Apply grout from one side only to avoid entrapping air.
- E. Final installation shall be thoroughly compacted and free from air pockets.
- F. Do not vibrate the placed grout mixture or allow it to be placed if the area is being vibrated by nearby equipment.
- G. Do not remove leveling shims for at least 480 hours after grout has been placed. After shims have been removed, fill voids with plain cement-sand grout.

H. After non-shrink grout has reached initial set, rake out exposed edges approximately 1-inch into the grouted area and paint with Portland cement mortar.

3.04 CURING

A. Cure grout for 3-days after placing by keeping wet and covering with curing paper or by another approved method.

END OF SECTION

SECTION 03900

HYDRAULIC STRUCTURES TESTING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Scope
 - 1. The Contractor shall perform cleaning, flushing and testing for all hydraulic structures in accordance with the requirements of the Contract Documents.
 - 2. The Work shall include all lab or and material s required to prepare a structure for testing an d to convey reclaimed water to the point of use from the source designated by Owner, and al l labor and materials required to drain, and dispose of reclaimed water used for testing.
- B. Related Divisions and Sections
 - 1. Section 03300 Cast-In-Place Concrete

1.02 QUALITY ASSURANCE

- A. Reference Standards: Comply with the applicable provisions and recommendations of the following unless otherwise shown or specified.
 - 1. ACI 350, Code Requirements for Environmental Engineering Concrete Structures and Commentary (ACI 350R).

1.03 CONTRACTOR SUBMITTALS

A. All submittals The Contractor shall submit a mi nimum fourteen (14) day advance wr itten notice o f the proposed testing schedule for a given structur e for review and concurrence of the Engineer and Owner. The Contractor's proposed plans for water conveyance, control and di sposal shall a lso be submitt ed in writing.

- B. Contractor shall submit all testing data collected for each structure/cell tested in accordance wi th ACI 350 for approval.
- C. All submittals for this Specif ication shall b e in accordance with Section 01340 - Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 MATERIALS REQUIREMENTS

A. Temporary valves, bulkheads or other water control equipment and materials, shall be as determined by the Contractor subject to the Engineer's review. Cost of all materials required for testing, supply and discharge of testing water shall be included in the Base Bid.

PART 3 EXECUTION

3.01 GENERAL

- A. Reclaimed water for testing will be furnished by the Owner. The Contractor shall make all nec essary provisions for conveying the reclaimed water from the source to the points of use.
- B. All hydraulic structures and appurtenant pressure piping connections shall be tested.
- C. Concrete coatings, paint and/or liners shall n ot be applied until a ll leak testing operations hav e been completed and the structure is accepted.
- D. Release of wate r from structur es, after testi ng has been completed, shall be as approved by the Engineer. Discharge location shall be approved by Owner.
- E. Clean structures after testing and prepare substrates for coating installation in accordance with relevant specification sections.

3.02 LEAKAGE TESTING OF HYDRAULIC STRUCTURES

A. Analysis of data from leakage tests of hyd raulic structures will be performed by the Contractor following the requirements of ACI 350, ACI 350R and as specified herein. The Contractor shall supply all materials and la bor as needed to assist the Engineer in obtaining data from the test.

- B. Prior to the start of leakage testing, the following requirements shall be met.
 - 1. All elements of the structure that resist any portion of the retained liquid pressure shall be in place and at specified stren gth levels. All concrete shall be fully cured.
 - 2. Structure walls shall not be backfilled prior to leakage testing.
 - 3. All valves, gates, blind flanges and other non concrete items that control the flow of , or otherwise retain the liquid contents of the structure, shall be checked for water-tightness. If not watertight, means shall be taken to assure water-tightness during the period of the leakage test.
 - 4. The portions of the structure to be tested shall be cleaned of a ll construction debris and other foreign materials.
 - 5. Defective concrete shall be repaired.
 - Standing water, soil, construction materials and any other material that interferes with the exposed concrete surfaces of the structure shall be removed.
 - 7. The Contractor shall notify the Engineer and Owner a minimum of seventy-two (72) hours prior to start of f illing of struct ure for leakage testing. Leakage testing shall not start untill the structure is inspected by the Engineer.

The structure shall be tested prior to the application of all coating systems.

- C. The following special requirements apply:
 - 1. All structures which contain basins, channels and/or chambers that are independent or are separated by a common wall shall be teste d independently unless otherwise agreed to by Engineer. All leakage occurring between/through common walls shall be repaired in addition to all other repair requirements.
 - Each influent, effluent or overflow trough shall be tested independently.
- D. Filling Structure with Reclaimed Water:
 - The portion of the structure to be tested shall be filled at a rate not to exceed 2 feet per hour.
 - 2. Structure shall be filled to the normal operating depth of the structure as i ndicated on th e Contract Drawings. Where no op erating depth is indicated or where operating depth is controlled by flowing over a weir, the structure shall be filled to a depth 6 inches below the weir or top of wall elevation, whichever is lower.
 - Reclaimed w ater in the structure shall be maintained at the specified test elevation for a minimum of three (3) days.
- E. After reclaimed water has b een brought to the test elevation, the exposed elements of the structure shall be inspected for leakage. All locations that exhibit any amount of leakage flow or dampness shall be repaired prior to the start of leakage t esting. Dampness is defined as any visible water staining the following:
 - At Exterior Wal ls the exterior sides of the walls.
 - At Interior Wal ls the opposite sides of the walls containing the water.
- F. Leakage test duration shall be determined by the Engineer based on ACI 350.1R b ut shall not be less than three (3) days.

- G. Leakage Allowance:
 - 1. For concrete structures, the maximum allowable leakage rate shall be 0.075 percent of the volume per twenty-four (24) hour period.
- H. Test Locations:
 - Structure cells which are less than 1000 square feet in area shall have measurements of water level taken at two (2) locations that are located approximately 180 degrees apart.
 - Structure calls which are greater than 1000 square feet in area shall have measurements o f water level taken at fou r (4) locations that are located approximately 90 degrees apart.
 - 3. Each test location shall be marked and given a reference number. A reference point shall be marked on the f ace of the wall above the test water surface in a manner that will prevent its movement or deterioration during the period of the test.
- I. Evaporation and Precipitation Measuring:
 - In open structures, a clear plastic calibrated open top contai ner not less than 18 inches in diameter and depth shall be partially filled, floated in the tank, and held in position near each measurement location.
 - 2. The container shall be located so as to not be shaded by tank walls and away from any items passing over it such as beams or pipes.
- J. Test Measurements:
 - Leakage tests shall not be star ted when periods of severe weather conditions or major changes i n average daily temperature are predicted.
 - The following measurements shall be recorded at each test locat ion at the start of the test period and at twenty -four (24) hour intervals thereafter.

- a) Distance from reference point to test water surface.
- b) Depth of reclaimed water in the floating container.
- c) Temperature of the test reclaimed water at 18 inches below water surface.
- d) Temperature of the reclaimed water in the evaporation-precipitation container at mid depth.
- K. Leakage Determination:
 - The change in water surface elevation at each test location shall be averaged and adjusted a s follows:
 - a) The total change in test water surface elevation shall be adjusted by the average change in water surface elevation in the evaporation-precipitation containers.
 - b) Where ave raged water temperature measurements vary by more than 3 degrees from start to completion of the test period, adjustment in tank volume shall be determined by change of water density resulting from the change in the average water temperature.
- L. Retesting:
 - 1. The leakage test shall be considered as failed if the specified leakage allowance is exceeded or if any leakage or dampness is observed.
 - 2. If the test bec omes unreliable due to excessive precipitation or other external factors, it shall be restarted.
 - 3. If a l eakage t est fails, it may be retested immediately without repairs if approved by the Engineer. If subsequent leakage tests fail, the Contractor shall repair all probable areas of leakage and the leakage test s hall be repeate d until it meets the specified leakage criteria.

END OF SECTION

SECTION 05500

METAL FABRICATIONS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. Metal fabrications include items made from iron, steel or aluminum shapes, plates, bars, strips, tubes, pipes and castings which are not specified elsewhere.
- B. Extent of metal fabrications is indicated on the drawings or as required to complete the work.

1.02 RELATED SECTIONS

A. Painting metal items is specified in Section 09900 -Painting and Coatings.

1.03 TYPES OF WORK

- A. Types of work in this section include metal fabrication for:
 - 1. Miscellaneous framing and supports
 - 2. Miscellaneous castings
 - 3. Floor drains
 - 4. Fasteners

1.04 SHOP ASSEMBLY

A. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

1.05 SUBMITTALS

- A. All submittals shall be in accordance with Specification
 01340 Shop Drawings, Project Data and Samples.
- B. Product Data: Submit manufacturer's specification s, anchor details and installation instructions for products used in miscellaneous metal fabrications, including paint products and grout.

C. Shop Drawings: Submit shop drawings for fabrication and erection of miscellaneous metal fabrications including but not limited to rain diverters and prefabricated steel tank cradles. Include plans, elevations and details of sections and connections. Show anchorage and accessory items. Provide templates for anchor and bolt installation by others.

PART 2 PRODUCTS

2.01 FERROUS METALS

- A. Metal Surfaces, General: For fabrication of miscellaneous metal work which will be exposed to view, use only materials which are smooth and free of surface blemishes including pitting, seam marks, roller marks, rolled names and roughness.
- B. Steel Plates, angles, channels and Bars: ASTM A 36. Item requiring to be galvanized to be Hot Dipped Galvanized -2 Oz. Per SF.
- C. Wide Flange Sections: ASTM A 572 (Fy=50 ksi).
- D. Steel Tubing: Cold-formed, ASTM A 500, Grade B (Fy=46 ksi).
- E. Steel Pipe: Standard weight Schedule 40, ASTM A53, Grade B (Fy=35 ksi).
- F. Gray Iron Castings: ASTM A 48, Class 30.

2.02 ALUMINUM METALS AND FABRICATIONS

A. Miscellaneous Aluminum: ASTM B 221, Alloy 6063.

Plate and Sheet	ASTM	В209	6061-T6	T651 Alloy
Structural Shapes	ASTM	B308	6061-т6	Alloy
Extruded Shapes	ASTM	B221	6061-т6	
Castings	ASTM	B108		214 Alloy

2.03 FASTENERS

- A. Provide Type 316 stainless steel fasteners for all exterior and interior work unless otherwise shown or specified.
- B. Bolting
 - 1. Either

- a) Bolts Astm A193 Grade B8
- b) Nuts Astm A194 Grade M
- 2. Or
 - a) Bolts Astm 276 Type 316 Stainless Steel
 - b) Nuts Astm 276 Type 316 Stainless Steel

2.04 GALVANIZING

- A. Galvanizing
 - 1. Shapes ASTM A-123 2.0 OZ/SF
 - 2. Hardware ASTM A-153 2.0 OZ/SF
- B. STAINLESS STEEL
 - 1. STAINLESS SHAPES ASTM A276 TYPE 316
 - 2. STAINLESS PLATE ASTM A240 TYPE 316

2.5 FABRICATION, GENERAL

- A. Workmanship: Use materials of size and thickness indicated, or if not indicated, as required to produce strength and durability in finished p roduct for use intended. Work to dimensions indicated or accepted on shop drawings, using proven details of fabrication and support. Use type of materials indicated or specified for various components of work.
- B. Aluminum fabrication shall be in conformance with the Aluminum Association, Inc. "Specifications for Aluminum Structures".
- C. Weld corners and seams continuously, complying with AWS recommendations. At exposed connections, grind exposed welds smooth and flush to match and blend with adjoining surfaces.
- D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners whenever possible. Use exposed fasteners of type indicated or, if not indicated, Phillips flathead (countersunk) screws or bolts.

- E. Provide for anchorage of type indicated, coordinated with supported structure. Fabricate and space anchoring devices to provide adequate support for intended use.
- F. Cut, reinforce, drill and tap miscellaneous metal work as indicated to receive finish hardware and similar items.
- G. Fabricate joints which will be exposed to weather in a manner to exclude water or provide weep holes where water may accumulate.
- H. Surface Preparation: Prepare ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparat ion specifications and environmental exposure conditions of installed metal fabrications, unless otherwise specified.
 - Exterior (SSPC Zone 1B): SSPC-SP6 "Commercial Blast Cleaning".
 - Interiors (SSPC Zone 1A): SSPC -SP3 "Power Tool Cleaning".
- I. Provide miscellaneous steel framing and supports which are not a part of structural steel framework, as required to complete work.

PART 3 EXECUTION

3.01 FIELD MEASUREMENTS

- A. Take field measurements prior to preparation of shop drawings and fabrication, where possible. Do not delay job progress; allow for trimming and fitting where taking field measurements before fabrication might delay work.
- B. Coordinate and furnish anchorages, setting drawings, diagrams, templates, instructions, and directions for installation of anchorage s, such as concrete inserts, sleeves, anchor bolts and miscellaneous items having integral anchors, which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to project site.

3.02 TOUCH-UP PAINTING

A. Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paints, and paint exposed areas with same material as used for shop painting. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils. B. All aluminum surfaces to come in contact with concrete or dissimilar metals shall be coated with a minimum two coats of bituminous paint.

END OF SECTION

SECTION 09900

PAINTING AND COATING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. The work includes furnishing all labor, materials and equipment required to complete the painting and coatings as indicated on the Drawings and in these specifications.
- B. Surface preparation, paint and coatings materials, and their application shall be as recommended by the coating manufacturer and approved by the OWNER'S Representative. The CONTRACTOR shall take all health and safety precautions necessary to prevent accidents during the storage, handling, application, and drying of any of the coatings described.
- C. Paints and coatings used to furnish the surfaces of structures or vessels which come into contact with potable water shall meet the applicable requirements of the County Health Department and the State Department of Environmental Protection or other regulatory agencies having jurisdiction.
- D. Related Work Specified Elsewhere:
 - Section 09905: Piping and Equipment Identification System.

1.02 QUALITY ASSURANCE

- A. The CONTRACTOR is responsible for a satisfactory paint application which will adhere without peeling, flaking, blistering or discoloration. Before application of any painting materials, the CONTRACTOR shall submit a letter of Certification from the manufacturer of the materials selected for the application proposed.
- B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work are limited to the following:
 - 1. Tnemec Company, Inc. Basis of Design

- 2. Carboline Company
- 3. Induron Coatings
- 4. Dudick Inc.

1.03 SUBMITTALS

- A. Data Sheets and Color Charts:
 - The full name of each product and descriptive literature shall be submitted along with a list of water and wastewater plants in Florida where the product has been used.
 - 2. Within a minimum of 30 days prior to application of paints and coatings, the CONTRACTOR shall submit six sets of color charts and data sheets for selection by the OWNER. Before work is commenced, the CONTRACTOR shall prepare samples as required until the color and textures are satisfactory to the OWNER.
 - 3. Resubmit samples as requested until required sheen, color and texture is achieved.
 - a. On 12 -inch x 12 -inch hardboard, provide two samples of each color and material, with texture to simula te finish conditions. On actual wood surfaces, provide two 4-inch x 8-inch samples for stained wood finish. On concrete Masonry, provide two 4-inch square samples of masonry for each type of finish and color, defining filler, prime and finish coats. On actual wall surfaces and other building components, duplicate painted finish of acceptable samples, as directed by the OWNER'S Representative.

1.04 DELIVERY AND STORAGE

A. Deliver materials to job site in new, original, and unopened containers bearing manuf acturer's name, trade name, and label analysis. Store where directed in accordance with manufacturer's instructions. All paint materials used on the job shall be kept in a single place which shall be kept neat and clean. All oily rags, waste or debris shall be removed every night and all precautions taken to avoid the danger of fire. NOTE: Materials may be flammable, and the area should be marked accordingly. Keep coatings out of the weather.

B. Extra Stock: At the conclusion of the project, the CONTRACTOR shall provide the OWNER with a minimum of one quart from each 50 gallons or fraction thereof for each paint system used on the project. The paint or coating container shall indicate the applicable paint system as indicated in these specifications.

1.05 JOB CONDITIONS

- A. Painting or coating and finishing of interior and exterior items and surfaces, unless otherwise indicated:
 - 1. Paint all new construction and portions of existing facilities disturbed by new construction.
 - 2. Paint all exposed surfaces, excep t as otherwise indicated, whether or not colors are designated. If not designated, colors will be selected by the OWNER'S Representative from standard colors available for the coatings required.
 - 3. Includes field painting of bare and covered pipes and ducts (including color coding), and hangers, exposed steel and iron work, and primed metal surfaces of equipment installed under mechanical and electrical work.
 - 4. Painting shall be done at such times as the CONTRACTOR and OWNER'S Representative may agree upon in order that dust -free and neat work is obtained. Painting shall be done strictly in accordance with the manufacturer's instructions and shall be performed in a manner satisfactory to the OWNER'S Representative.
 - 5. "Shop" painting as referred to defines the paint coat which shall be applied in the shop or plan t immediately after manufacture , fabrication or assembly and prior to shipment to the site of installation. "Field" painting defines the paint coats to be applied at the project site where the structure or equipment is completed, erected, or installed in place as specified.
- B. Materials and Application:

- Obtain painting materials from one manufacturer. Painting materials not obtainable from the prime manufacturer shall be obtained from a second source recommended by the prime manufacturer. All solvents for thinning shall be obtained from the coating manufacturer. Only use solvents as listed on the manufacturer's product literature.
- 2. There shall be a perceptible difference in shades of successive coats of paint so that the application of successive coats of paint can be properly and uniformly spread and inspected. Pipes, sheet metal ducts and other metal items which are to be installed in inaccessible locations shall be painted prior to installation.
- 3. Each coat shall be allowed to dry for the period of time recommended by the manufacturer before the next coat is applied.
- 4. Proceeding to apply the coatings indicates that the coating contractor has accepted the condition of the existing coating. If questions arise, they should be brought to the attention of the OWNER or OWNER'S REPRESENTATIVE. Do not proceed until resolved.
- C. Equipment, Machinery, and Shop Fabricated Items:
 - Pumps, motors, machinery, equipment and other manufactured items shall have sur faces prepared, primed and finish -coated in accordance with the standard practice of the manufacturer. Finish coat colors shall be as approved by the OWNER'S Representative.
 - 2. Shop-fabricated items and components for field assembly shall have surfaces prep ared and shop primed. Finish coat colors shall be as approved by the OWNER'S Representative. Items for submerged service shall be field sandblasted and primed per Paint System B-4.

PART 2 - PRODUCTS

- 2.01 GENERAL REQUIREMENTS ALL SYSTEMS
 - A. The film thi ckness designated and/or the number of coats to be applied shall not be decreased and shall be increased where required to meet other manufacturer's recommendations.

- B. Manufacturer's recommendations as to which finish coat should be used with a particular primer shall be observed. In all cases, the prime coat, intermediate coat, finish coat, and all solvents and thinners shall be from the same manufacturer. All paint shall be mildew resistant.
- C. Tnemec products are given as examples of painting and coating systems identified in the following paragraphs. The products of other manufacturer's (listed in Paragraph 1.02.B.) may be used as long as they are of the same quality and meet the performance criteria.
- D. Substitution requests must be considered provided th ey are submitted ten (10) days prior to bid opening and follow the criteria specified in Section 01640.
- 2.02 GROUP A CONCRETE AND MASONRY (NOT IN CONTACT WITH POTABLE WATER)
 - A. System A-1: For use on above grade interior walls , ceilings, and architectura l surfaces not subject to high moisture, corrosion, splashing, or fumes. Typical areas would include control rooms and electrical rooms.

Surface Preparation: Level protrusions and remove mortar splatter from all surfaces. Allow new concrete to cure 28 days prior to coating. All surfaces shall be clean and dry before proceeding.

- 1. Interior Concrete Surfaces Excluding CMU (Non-Immersion):
 - a. Prime: Apply 1 coat of Tnemec Series 54 Masonry Filler at 80 - 100 sq.ft. per gallon.
 - b. Intermediate: Apply 1 coat of Tnemec Series 1029
 Enduratone at 2.0 3.0 mils dft.
 - c. Finish: Apply 1 coat of Tnemec Series 1029 Enduratone at 2.0 - 3.0 mils dft.
- 2. Interior CMU or Porous Block (Non-Immersion):
 - a. Prime: Apply 1 coat of Tnemec Series 1254
 Epoxoblock WB at approximately 7 5 100 sq.ft.
 per gallon.
 - b. Intermediate: Apply 1 coat of Tnemec Series 1029 Enduratone at 2.0 - 3.0 mils dft.
 - c. Finish: Apply 1 coat of Tnemec Series 1029 Enduratone at 2.0 - 3.0 mils dft.

B. System A-2: For use on above grade interior walls, ceilings, and non-traffic slabs that are subject to high moisture, physical abuse, mild chemical fumes, splashing and spillage of water or wastewater byproducts, etc. Typical areas would include filter press building walls, UF Building process area walls, etc.

Surface Preparation: Level protrusions and remove mortar splatter from all surfaces. Allow new concrete to cure 28 days. All surfaces shall be clean and dry before proceeding. Pressure washing may assist in removing loose dirt and contamination.

- 1. Interior Concrete Surfaces Excluding CMU (Non Immersion):
 - a. Prime: Apply 1 coat of Tnemec Series 1254 Epoxoblock WB at 125 - 150 sq.ft. per gallon.
 - b. Intermediate: Apply 1 coat of Tnemec Series N69 Hi-Build Epoxoline II at 4.0 - 6.0 mils dft.
 - c. Finish: Apply 1 co at of Tnemec Series N69 Hi -Build Epoxoline II at 4.0 - 6.0 mils dft.
- 2. Interior CMU or Porous Block (Non-Immersion):
 - a. Prime: Apply 1 coat of Tnemec Series 1254
 Epoxoblock WB at approximately 120 130 sq.ft.
 per gallon.
 - b. Intermediate: Apply 1 coat of Tnemec Series N69 Hi-Build Epoxoline II at 4.0 - 6.0 mils dft.
 - c. Finish: Apply 1 coat of Tnemec Series N69 Hi-Build Epoxoline II at 4.0 - 6.0 mils dft.
- 3. Interior CMU or Porous Block For Locker Rooms, Bathrooms:

Surface Preparation: Clean and dry, level protrusions, and remove mortar splatter from all surfaces. Allow mortar to cure 14 days before proceeding with coating.

- a. Prime/Surfacer: Apply 1 coat of Tnemec Series 1254 Epoxoblock WB at 120 - 130 sq.ft. per gallon.
- b. Intermediate: Apply 1 coat of Tnemec Series 113 H.B. Tneme-Tufcoat at 4.0 - 6.0 mils dft.
c. Finish: Apply 1 coat of Tnemec Series 113 H.B. at 4.0 - 6.0 mils dft.

C. System A-3: For use on exterior concrete walls above grade to a point at least 6" below finish grade (extend to depth where nearest course ends, if applicable) . Applicable to all buildings.

Surface Preparation: Fill all voids with grout; remove loose mortar, mortar splatter, protrusions, etc. Allow all concrete or grout to cure a minimum 28 days before proceeding. Remove all dirt or contamination before proceeding.

- 1. Exterior Concrete Buildings: Poured or cast -inplace.
 - a. Prime: Apply 1 coat of Tnemec Series 6 Tneme-Cryl
 at 2.0 3.0 mils dft.
 - b. Intermediate: Apply 1 coat of Tnemec Series 6
 Tneme-Cryl at 2.0 3.0 mils dft.
 - c. Finish: Apply 1 coat of Tnemec Series 6 Tneme -Cryl at 2.0 - 3.0 mils dft.
- 2. Exterior Concrete Buildings: CMU
 - a. Prime: Apply 1 coat of Tnemec Series 1254
 Epoxoblock WB at a spreading rate of between 120 130 sq.ft. per gallon.
 - b. Intermediate: Apply 1 coat of Tnemec Series 6
 Tneme-Cryl at 2.0 3.0 mils dft.
 - c. Finish: Apply 1 coat of Tnemec Series 6 Tneme Cryl at 2.0 3.0 mils dft.
- Or, if an elastomer is preferred, use the following:
- 3. Exterior Concrete Buildings: CMU or PIP -Elastomeric
 - a. Prime: Apply 1 coat of Tnemec Series 156 Enviro-Crete at 4.0 - 6.0 mils dft.
 - b. Finish: Apply 1 coat of Tnemec Series 156 Enviro-Crete at 4.0 - 6.0 mils dft.
- D. System A-4: For use on all exterior concrete walls below a point six inches below finish grade.

Surface Preparation: Remove all loose dirt and contamination. Clean and dry before proceeding.

- 1. Exterior Concrete Walls: Poured or Cast-in-Place
 - a. Prime: Apply 1 coat of Tnemec Series 46H -413 Tneme-Tar at 8.0 - 10.0 mils dft.
 - b. Finish: Apply 1 coat of Tnemec Series 46H -413 Tneme-Tar at 8.0 - 10.0 mils dft.
- E. System A-5: For use on interior concrete floors.

Surface Preparation: Allow new concrete to cure 28 days. Verify dryness by testing for moisture with a "plastic film tape-down test" (reference ASTM D 4263). Should moisture be detected, perform "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor using Anhydrous Calcium Chloride" (reference ASTM F 1869). Moisture content not to exceed three pound s per 1,000 sq.ft. in a 24 -hour period. Acid -etch or mechanically abrade concrete to remove laitance and create profile. If acid-etching, no contaminants or surface additives/treatments such as form release agents, curing compounds, hardeners or sealers sh ould be present in the surface of the concrete as they can impede the acid's ability to properly etch and profile the floor. If these conditions exist, mechanical preparation is the only recommended method to clean and profile the floor. Large voids and ot her cavities should be filled with recommended filler or surfacer (reference SSPC-SP13).

- 1. Interior Concrete Floors: Control Rooms, Offices, similar.
 - a. Surface Profile: Abrade to ICRI CSP 2-3.
 - b. Prime: Apply 1 coat of Tnemec Series 287 Enviro-Pox 6 at 3.0 - 4.0 mils dft.
 - c. Intermediate: Apply 1 coat of Tnemec Series 287 Enviro-Pox 6 at 3.0 - 4.0 mils dft.
 - d. Finish: Apply 1 coat of Tnemec Series 291 Clear CRU at 2.0 - 3.0 mils dft.
- 2.03 GROUP B STRUCTURAL STEEL; STEEL TANKS; EQUIPMENT AND PIPING (NOT IN CONTACT WITH POTABLE WATER)
 - A. System B -1: For all new steel or site fabricated steel: Exterior or interior and moderate immersion exposure.
 - Surface Preparation: Non-immersion For exposed steel, excluding immersion service, abrasive blast per SSPC SP6 to a Commercial Grade finish to obtain

a 1.5 mil blast profile. For immersion exposure abrasive blast per SSPC SP10 to a Near White finish to obtain a minimum 1.5 mil blast profile.

- 2. Shop or field apply 1 coat of Tnemec Series 1 Omnithane at 2.5 - 3.5 mils dft. As an option, apply 1 coat of Tnemec Series 90G-1K97 Tneme-Zinc at 2.5 -3.5 mils dft.
- B. System B-2: For use on exterior exposed structural and miscellaneous steel; interior and exterior - non immersion exposure. Typical items include steel piping, ex terior of steel tanks, structural support steel, etc. This system can be exposed to a corrosive atmosphere; not in contact with wastewater or where a color finish is desired.
 - Surface Preparation: Remove all grease and dirt per SSPC SP1 before proceeding. Commercial blast clean per SSPC SP -6 to achieve a minimum 1.5 mil blast profile.
 - 2. Shop Prime: Apply 1 coat of Tnemec Series 1 Omnithane at 2.5 - 3.5 mils dft.
 - 3. Prime Coat: For steel that has been shop primed, clean damaged areas by Power Tool Cleaning SS PC SP3 and spot prime using Tnemec Series 27WB at 3.0 5.0 mils dft before applying the "Primer". For steel that has not been shop primed, apply 1 coat of Tnemec Series 1 Omnithane at 2.5 3.5 mils dft.
 - 4. Intermediate: Apply 1 coat of Tnemec Seri es 27WB Typoxy at 4.0 - 6.0 mils dft.
 - 5. Finish: Apply 1 coat of Tnemec Series 750 UVX at 3.0 5.0 mils dft.

C. System B-3: For use on bituminous coated cast iron or steel pipe.

- Surface Preparation for bituminous pipe: Wash to remove all grease and dirt before coating. Sweep blast per SSPC SP7 or Power Tool Clean per SSPC SP -3.
- Prime: Spot prime all bare and damaged areas with one coat of Tnemec Series 135 Chembuild at 3.0 - 5.0 mils dft.

- 3. Intermediate: Apply 1 coat overall of Tnemec Series 135 Chembuild at 3.0 5.0 mils dft.
- 4. Finish: Apply 1 coat of Tnemec Series 750 UVX at 3.0 - 5.0 mils dft.
- D. System B-4: For use on exterior steel tanks, piping and equipment, submerged in moderate corrosive service, excluding chains, sprockets and similar items. This system shall be used for all materials submerged in wastewater. For use in splash and spillage and where a color stable topcoat is required, use System B-2.
 - Surface Preparation: For a shop application, see System B-1. For field applications, abrasive bl ast all steel to a Near White finish per SSPC SP10 to achieve a minimum 1.5 mil blast profile.
 - Prime: All steel shall be primed with 1 coat of Tnemec Series 1 Omnithane at 2.5 - 3.5 mils dft, whether shop or field applied.
 - 3. Intermediate: Apply 1 coat of Tnemec Series 446 Perma-Shield MCU at 6.0 - 8.0 mils dft.
 - 4. Finish: Apply 1 coat of Tnemec Series 446 Perma-Shield MCU at 6.0 - 8.0 mils dft. Use alternating colors between coats.
- E. System B -5: For all submerged metals in severe wastewater service. Typical areas would include headworks, grit chambers, and other areas of severe H_2S exposures. Severe abrasion exposure.
 - Surface Preparation: Field abrasive blast to a White Metal finish per SSPC-SP5 to achieve a minimum 3.0 mil blast profile. Prime before any rust bloom.
 - 2. Prime: Apply 1 coat of Tnemec Series 435 Perma-Glaze at 15.0 20.0 mils dft.
 - 3. Finish: Apply 1 coat of Tnemec Series 435 Perma-Glaze at 15.0 - 20.0 mils dft. Alternating colors should be used.
- F. System B-6: For use on hollow metal (steel) doors and frames, steel embedments, and steel lintels: Preprimed with alkyd primer, shop or unknown primer, or bare metal. Interior or exterior exposure.

- Surface Preparation: Remove all grease and oil before proceeding by SSPC SP1. Abrade per SSPC -SP3 before proceeding.
- Prime (touch-up only): Prime bare or damaged areas with 1 coat of Tnemec Series 27WB Typoxy at 2.0 -5.0 mils dft.
- 3. Intermediate: Apply 1 coat of Themec Series 27WB Typoxy at 3.0 5.0 mils dft.
- 4. Finish: Apply 1 coat of Tnemec Series 750 UVX at 3.0 - 5.0 mils dft.

2.04 GROUP C - GALVANIZED AND NON-FERROUS METALS

- A. System C -1: For galvanized steel in interior (buildings) or exterior substrates in corrosive areas, non-submerged surfaces, non-potable water applications, including ductwork.
 - 1. Surface Preparation: Remove all grease and oil before proceeding by SSPC SP1. Abrade all surfaces to be coated by Brush-Off blasting per SSP SP7 to achieve a minimum 1.5 mil blast profile.
 - Prime: Spot prime all bare or rusted areas with 1 coat of Tnemec Series 27WB Typoxy at 2.0 - 5.0 mils dft.
 - 3. Intermediate: Apply 1 coat of Themec Series 27WB Typoxy at 3.0 5.0 mils dft.
 - 4. Finish: Apply 1 coat of Tnemec Series 750 UVX at 3.0 - 5.0 mils dft.

B. System C-2: For use on (in interior dry) all aluminum, including ductwork.

- 1. Surface Preparation: Solvent clean per SSPC-SP1 and abrade the surface to provide a mechanical bond.
- 2. Prime: Apply 1 coat of Tnemec Series 66 Hi-Build Epoxoline at 2.0 - 3.0 mils dft.
- 3. Finish: Apply 1 coat of Tnemec Series 740 UVX at 2.5 - 4.0 mils dft.

C. System C-3: For use in exterior non -corrosive areas, galvanized steel and aluminum materials, including ductwork. Refer to System C-1 or C-2.

2.05 GROUP D - EXPOSED HOT METAL SURFACES

- A. System D -1: For use on un-insulated surfaces a t temperatures between 250° and 1000°.
 - Surface Preparation: Solvent clean per SSPC -SP1 before proceeding. Abrasive blast all ferrous metal to be coated to an SSPC SP10 Near White Finish with a 1.5 mil blast profile.
 - 2. Prime: Apply 1 coat of Dampney Thurmalox 245 High Heat primer at 1.5 - 2.0 mils dft.
 - 3. Finish: Apply 1 coat of Dampney Thurmalox 230 High Heat coating at 1.5 - 2.0 mils dft. For an aluminum finish, use Dampney Thermalox 280 at the same thickness.

2.06 GROUP J - WATER TANKS AND SURFACES IN C ONTACT WITH POTABLE WATER $% \left({{\left[{{{\left[{{{\rm{ATER}}} \right]}} \right]}_{\rm{ATER}}}} \right)$

The interior tank paint system shall meet USEPA, National Sanitation Foundation (NSF), and Florida Department of Environmental Protection (FDEP) health standards for use in potable water service. A letter of acceptance by the FD EP shall be furnished to the ENGINEER for the system selected prior to paint application. Disinfection of tank shall be in accordance with Section 15400: Disinfection of Water Storage Facilities.

- A. System J-1: For poured or cast-in-place concrete in immersion service of potable water requiring an NSF 61 approved lining. All concrete surfaces must be allowed to cure for a minimum of 28 days at 75°F.
 - Surface Preparation: Remove all dirt and debris before proceeding. Abrasive blast the surface per SSPC SP13/NACE 6 to achieve a surface profile per ICRI CSP 5. Fill all holes, voids, cracks, and pits with Tnemec Series 218 Mortarclad as required. Apply one (1) coat of Tnemec Series 218 Mortarclad at an average of 1/16" dft.

Choose the preference for a liner. Both materials are NSF 61 tested and listed.

- 2. Immersion Service: Epoxy
 - a. Prime: Surface all walls and underside of roof with 1 coat of Tnemec Series 218 Mortarclad at a minimum 1/16" dft.
 - b. Finish: Apply 1 coat of Tnemec Series FC 22 Epoxoline at 20 - 25 mils dft.
- 3. Immersion Service: Elastomeric flexible liner
 - a. Prime: Apply 1 coat of Tnemec Series N140 @ 4 6 mils dft.
 - b. Finish: Apply 1 coat of Tnemec Series 264 Elasto-Shield at 50 - 60 mils dft.
- B. System J-2: For steel tanks in immersion service for potable water when the lining is required to meet NSF 61 standards.
 - 1. Surface Preparation: Abrasive blast all surfaces to a minimum Near White Finish in accordance with SSPC SP10 to achieve a minimum 3.0 mil blast profile.
 - 2. Prime: Apply 1 coat of Tnemec Series N140 Pota-Pox Plus at 3.0 - 5.0 mls dft.
 - 3. Intermediate: Stripe by brush all welds, edges, corners, etc. with 1 coat of Tnemec Series N140 Pota-Pox Plus.
 - 4. Finish: Apply 1 coat of Tnemec Series FC 22 Epoxoline at 20 - 25 mils dft.
- 2.07 GROUP K METAL EXPOSED TO CORROSIVE ATMOSPHERE (EXTERIOR OF NEW STEEL TANKS); EXPOSED INTERIOR OF OPEN TOP STEEL TANKS; STRUCTURAL STEEL, EQUIPMENT AND PIPING
 - A. System K-1: For use on the exterior of new steel tanks and support structures; steel catwalks, and other exposed structural steel, equipment, and piping subject to a corrosive atmosphere. Refer to System B-2.
- 2.08 GROUP L CONCRETE TANKS IMMERSION SERVICE
 - A. System L-1: For use on exterior of concrete tank walls below a point 6 inches below finish grade. Refer to System A-4.
 - B. System L -2: For use on the interior of open top concrete tanks. Exposed concrete or masonry surfaces 09900-13

in a corrosive immersion environment. Typical areas would include headworks, grit chambers and areas of high H_2S environments.

- 1. Surface Preparation: Allow new concrete to cure 28 days. Verify dryness by testing for moisture with a "plastic firm tape -down test" (reference ASTM D 4263). Should moisture be detected, perform "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" (reference ASTM F 1869). Moisture content not to exceed 3 pounds per 1,000 sq.ft. in a 24-hour period. Acid -etch or mechanically abrade concrete to remove laitance and create profile. If acid-etching, no contaminants or surface additives/treatments such as f orm release agents, curing compo unds, hardeners or sealers should be present in the surface of the concrete as they can impede the acid's ability to properly etch and profile the floor. If these con ditions exist, mechanical preparation is the only recommended method to clean and profile the floor. Large voids and other cavities should be filled with recommended filler or surfacer (reference SSPC -SP13). Abrasive blast the surface per SSPC SP13/NACE 6 to achieve a surface profile of ICRI CSP 5. Fill all holes, voids, cracks and pits with Tnemec Series 218 Mortarclad as required.
- 2. Surfacer: Surface all walls with 1 coat of Tnemec Series 218 Mortarclad at a minimum 1/16 " dft. For floors, Tnemec Series 215 may be used.
- 3. Intermediate: Apply 1 coat of Tnemec Series 434 Perma-Shield H2S at a minimum 125 mils dft.
- 4. Finish: Apply 1 coat of Tnemec Series 435 Perma-Glaze at 15 - 20 mils dft.
- C. System L -3: For use on the interior of open top concrete tanks. Exposed concrete or masonry surfaces in a corrosive immersion environment. Typical areas would include clarifiers, digesters, etc.
 - Surface Preparation: Allow new concrete to cure 28 days. Verify dryness by testing for moisture with a "plastic firm tape -down test" (reference ASTM D 4263). Should moisture be detected, perform "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous

Calcium Chloride" (reference ASTM F 1869). Moisture content not to exceed 3 pounds per 1,000 sq.ft. in a 24-hour period. Acid -etch or mechanically abrade concrete to remove laitance and create profile. If acid-etching, no contaminants or surface additives/treatments such as f orm release agents, curing compounds, hardeners or sealers shou ld be present in the surface of the concrete as they can impede the acid's ability to properly etch and profile the floor. If these conditions exist, mechanical preparation is the only recommended method to clean and profile the floor. Large voids and other cavities should be filled with recommended filler or surfacer (reference SSPC -SP13). Abrasive blast the surface per SSPC SP13/NACE 6 to achieve a surface profile of ICRI CSP 5. Fill all holes, voids, cracks and pits with Tnemec Series 218 Mortarclad as required.

- Surfacer: Surface all walls with 1 coat of Tnemec Series 218 Mortarclad at a minimum 1/16 " dft. For floors, Tnemec Series 215 may be used.
- 3. Prime: Apply 1 coat of Tnemec Series N69-1211 Hi-Built Epoxoline II at 4.0 - 6.0 mils dft.
- Intermediate and Finish: Apply 2 coats of Tnemec Series 446 Perma-Shield MCU at 5.0 - 7.0 mils dft. Alternating colors may be used.
- D. System L-4: For use on the exterior of concrete tanks.
 - 1. Surface Preparation: Remove all loose dirt, debris and contamination. Clean and dry.
 - Intermediate and Finish: Apply 2 coats of Tnemec Series 156 Enviro-Crete at 4.0 - 8.0 mils dft. A minimum of 10 mils dft shall be applied.
- 2.09 GROUP M SPECIAL COATINGS
 - A. System M-1: For use as barrier between dissimilar materials and metal s; i.e., such as aluminum and concrete connections.
 - 1. Surface Preparation: Clean and dry.
 - 2. Prime: None

- 3. Finish: Apply 2 coats of Tnemec Series 46 -465 H.B. Tnemecol at 8.0 - 12.0 mils per coat.
- B. System M-2: For use as a primer sealer for coloring asphaltic and tar surfaces.
 - 1. Prime: Apply 1 coat of Tnemec Series 66HS Epoxoline at 4.0 6.0 mils, dft.
 - 2. Finish: Coat primer with paint appropriate to location and environment.
- C. System M-3: For sealing concrete floors where concrete is shown as natural in the Finish Schedules and on all exposed concrete floors where no finish has been shown.
 - 1. Surface Preparation: Allow new concrete to cure 28 days. Verify dryness by testing for moisture with a "plastic firm tape -down test" (reference ASTM D 4263). Should moisture be detected, perform "Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride" (reference ASTM F 1869). Moisture content not to exceed 3 pounds per 1,000 sq.ft. in a 24-hour period. Ac id-etch or mechanically abrade concrete to remove laitance and create profile. If contaminants or surface acid-etching, no additives/treatments such as form release agents, curing compounds, hardeners or sealers should be present in the surface of the conc rete as they can impede the acid's ability to properly etch and profile the floor. If these conditions exist, mechanical preparation is the only recommended method to clean and profile the floor. Large voids and other cavities should be filled with recommended filler or surfacer (reference SSPC-SP13).
 - 2. Prime: Apply 1 coat of Tnemec Series 287 Enviro-Pox clear at 3.0 5.0 mils dft.
 - 3. Finish: Apply 1 coat of Tnemec Series 294 Clear CRU at 2.0 3.0 mils dft. Both products are available in a pigmented versio n if a solid color floor is preferred.
- D. System M-4: For coating of PVC piping, interior or exterior.
 - Surface Preparation: Degrease and clean per SSPC-SP-1 first, then scarify surface.

- 2. Prime: Apply 1 coat of Tnemec Series 66 Hi-Build Expoxoline at 2.0 3.0 mils dft.
- 3. Finish: Apply 1 coat of Tnemec Series 740 UVX at 2.5 5.0 mils dft.
- E. System M-5: For coating of FRP piping, interior or exterior.
 - 1. Surface Preparation: SSPC -SP-1 first, then abrade the surface to be coated. Remove any dust, dirt or contamination before proceeding. Clean and dry.
 - 2. Prime: Apply 1 coat of Tnemec Series 66 Hi -Build Expoxoline at 2.0 3.0 mils dft.
 - 3. Finish: Apply 1 coat of Tnemec Series 740 UVX at 2.5 4.0 mils dft.
- 2.10 GROUP N COATINGS FOR DUCTILE IRON PIPE IN WASTEWATER ENVIRONMENTS

This section covers the specification for lining ductile iron pipe for wastewater environments, both interior and exterior of pipe. The system shall also be specified for all fittings and flanges.

- A. System N-1: Exterior coating system for above ground exposed DIP where a color is required. Non-immersion service. Pipe should be ordered as shop primed.
 - Surface Preparation: Ductile iron pipe is cleaned per NAPF Standards 500 -03 for Commercial Grade abrasive blast cleaning.
 - 2. Shop Prim ed: Apply 1 coat of Tnemec Series N140 Pota-Pox Plus at 4.0 - 6.0 mils dft. The following is for pipe in the field:
 - a. Power tool clean all bare and damaged areas by SSPC SP3.
 - b. Prime: Apply 1 coat of Tnemec Series 27WB Typoxy at 3.0 - 5.0 mils dft.
 - c. Intermediate: Apply 1 coat of Tnemec Series 27WB at 4.0 - 6.0 mils dft.
 - d. Finish: Apply 1 coat of Tnemec Series 740 UVX at 3.0 - 5.0 mils dft.

- B. System N-2: For the exterior of ductile iron pipe in immersion service or exposed to a severe H_2S environment.
 - Surface Preparation: Ductile iron pipe is cleaned per NAPF Standards 500 -03 for Commercial Grade abrasive blast cleaning to obtain a 3 mil blast profile.
 - 2. Finish: Apply Tnemec Series 435 Perma -Shield Glaze at 35.0 40.0 mils dft.
- C. System N-3: Lining duct ile iron pipe for severe wastewater environments. Order pipe lined from the factory.
 - Surface Preparation: Abrasive blast and grind pipe to SSPC SP5 White Metal Finish with a minimum 3.0 mil blast profile.
 - 2. Finish: Apply Tnemec Series 431 Perma-Shield PL at a nominal 40 mil thickness or Induron's Protecto 401 at a nominal 40 mil thickness.
- D. System N -4: Lining duc tile iron pipe and fittings conveying aggressive potable water in the water treatment plant. Order pipe lined from the factory.
 - Surface Prepara tion: Abrasive blast and grind pipe to SSPC SP5 white metal finish with a minimum 3.0 mil blast profile.
 - Finish: Apply Induron's Ceramapure at a nominal 30 mil thickness. The Ceramapure shall be NSF 61 approved.
- 2.11 FINISH COAT OVER EXISTING FINISH
 - A. The required painting shall consist of one coat of the system "Finish Coat" to provide continuity of texture and color over previously painted surface
- 2.12 THINNING
 - A. Where thinning is necessary, only the products for the particular purpose and by the m anufacturer furnishing the paint shall be allowed. All thinning shall be done strictly in accordance with the manufacturer's instructions and with the full knowledge and approval of the OWNER'S Representative.

PART 3 - EXECUTION

3.01 GENERAL

- A. All painting shall be done in strict accordance with the recommendations of the manufacturer and shall be performed in a manner satisfactory to the Owner/Engineer.
- B. All recommendations of the paint manufacturer in regard to mixing, applying, thinning and curing, as well as the health and safety of the workers, shall be followed.
- C. Dry film thickness for masonry is approximate for application to a smooth surface.
- D. Sequence painting to ensure work area is dust free.
- 3.02 SHOP PAINTING
 - A. All ferrous and non-ferrous surfaces shall be solvent cleaned before priming. Primer shall be applied in the shop to protect surfaces from rust during shipment and storage.
 - B. Apply two coats of paint to surfaces which are inaccessible after assembly or erection.

3.03 FIELD PREPARATION

- A. All surfaces to be painted shall be prepared in a workmanlike manner with the objective of obtaining a smooth, clean and dry surface. No painting shall be done before the prepared surfaces are approved by the OWNER'S Representative.
- B. Surface preparation fo r miscellaneous surfaces to be painted, not specifically covered in these specifications, shall be as recommended by the manufacturer of the paint selected for use and as approved by the OWNER'S Representative.
- C. Perform preparation and cleaning procedures in strict accordance with coating manufacturer's instructions for each substrate condition.

D. Remove hardware and accessories, machined surfaces, plates, lighting fixtures and similar items in place and not to be finish-painted, or provide surface applied p rotection. Reinstall removed items after painting is completed. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes to masonry walls unless moisture content of surfaces are below 12 percent.

3.04 MIXING

- A. Exercise care to keep fire hazards to a minimum. Provide an approved hand fire extinguisher near each paint storage and mixing area. No oily waste, rags, or painting equipment shall be left scattered throughout the premises.
- B. Mix coatings in accordance with manu facturer's instructions. Colors shall be thoroughly mixed with no streaks or separation of color. Do not add thinners, driers or other additives except as recommended by the coating manufacturer. Do not incorporate in the coating any thinners or solvents used for cleaning brushes or equipment.
- C. Protect all adjacent areas against damage and leave storage and mixing areas clean at the completion of painting.

3.05 PROTECTION OF ADJACENT SURFACES

- A. Provide necessary protection for completed work and all adjoining surfaces. Provide temporary closures as required to prevent circulation of dust from adjacent areas where other work is in progress. Where it is necessary to remove existing protection of work of others, such protection shall be fully replaced.
- B. Locate and protect all existing utilities, structures, or appurtenances.

3.06 APPLICATION

- A. Mix, prepare, and store painting and finishing materials in accordance with manufacturer's directions.
- B. Apply painting and finishing materials in accordance with the ma nufacturer's directions. Use applicators and techniques best suited for the material and surfaces to which applied. 09900-20

- С. Workmanship for applying paint shall be of professional quality. The painter shall apply each coat at the rate recommended by the manufac turer smoothly without runs, sags, or holidays. If the material has thickened or must be diluted for use with a spray gun, the coating shall be built up to the same thickness as achieved with undiluted materials. In other words, one gallon of paint as or iginally furnished by the manufacturer shall not cover a great square foot area when applied by spray gun than when applied by brush. Deficiencies in film thickness shall be corrected by the application of an additional coat or coats of paint. On masonry , application rates will vary according to the surface texture; however, in no case shall the manufacturer's stated coverage rate be exceeded. On porous surfaces, it shall be the painter's responsibility to achieve a protective and decorative finish eithe r by decreasing the coverage rate or by applying additional coats of Before succeeding coats are applied to a paint. surface, the preceding coat shall have been approved by the OWNER'S Representative.
- D. Drying time shall be construed to mean "under normal conditions". Where conditions are other than normal because of the weather or because painting must be done in confined spaces, longer drying times will be necessary. Additional coats of paint shall not be applied, nor shall units be placed in service, u ntil paints are thoroughly dry.

3.07 VENTILATION

A. Provide adequate ventilation for safe application and for proper drying of coatings on interior surfaces. Ensure solvent vapors are released during and after application of coatings. Remove vapors by exhausting air from the lowest portions of tanks or enclosed spaces and keep tops open and clear. During coating application in enclosed areas, the capacity of ventilating fans shall be at least 300 cfm per gallon of coating applied per hour. Provide continuous forced ventilation at a rate of at least one complete air change per 4 hours for at least 7 days after coating application is completed. A. At completion of the painting work, clean off all paint spots and other paint materials from su rfaces where they are not intended to be. Remove from the premises all rubbish and accumulated material and leave the work in clean orderly condition, acceptable to the ENGINEER and OWNER. All cloths and waste that might constitute a fire hazard shall be placed in closed metal containers or destroyed at the end of each day. Upon completion of the work, all staging, scaffolding, and containers shall be removed from the site and/or destroyed in an approved and legal manner.

3.09 DAMAGED COATINGS

- A. Damaged coatings, pinholes, and holidays shall have edges feathered and repaired in accordance with the recommendations of the manufacturer, as approved by the ENGINEER.
- B. All finish coats, including touch -up and damage-repair coats, shall be applied in a manner which will present a uniform texture and color-match appearance.

3.10 UNSATISFACTORY APPLICATION

- A. If the item has an improper finish, color, or insufficient dry film thickness, the surface shall be cleaned and top coated with the specified material to obtain the specified color and coverage. Specific surface preparation information to be secured from the coatings' manufacturer and the ENGINEER.
- B. All visible areas of chipped, peeled, or abraded paint shall be hand or power sanded, feathering the edges. The areas shall then be primed and finish coated in accordance with the specifications.
- C. Work shall be free of runs, bridges, shiners, laps, or other imperfections. Evidence of these conditions shall be cause for rejection.
- D. Any defects in the coating system shall be repaired by the CONTRACTOR per written recommendations of the coating manufacturer.
- E. Any repairs made on steel surfaces for immersion service shall be holiday detected in accordance with ASTM G 62 low voltage holiday detection. Areas found to have hol idays shall be marked and repaired in 09900-22

accordance with the paint manufacturer's instructions. The ENGINEER shall be notified of time of testing so that he might be present to witness testing.

3.11 GUARANTEE AND ANNIVERSARY INSPECTION

- A. All work shall be warrant ed in accordance with the General Conditions and Specification 01740.
- B. The OWNER will notify the CONTRACTOR at least 30 days prior to the anniversary date and shall establish a date for the inspection. Any defects in the coating system shall be repaired by the CONTRACTOR at no additional cost to the OWNER. Should a failure occur to 25% of the painted surface, either interior or exterior, the entire surface shall be cleaned and painted in accordance with these specifications.

END OF SECTION

SECTION 09902

PIPE AND EQUIPMENT PAINTING

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes pipe painting and identification as required for this project.

1.02 SUBMITTALS

A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.

PART 2 PRODUCTS

2.01 PAINTING AND IDENTIFICATION

- A. Exposed piping (except stainless steel) shall be painted. Metal pipe shall be painted B-3 or B-4 depending on location. Seal coats shall be used over bitumen coated surfaces as app licable utilizing System B-2. Plastic pipe shall be painted in accordance with pipe manufacturer's recommendations utilizing System M-3.
- B. General Notes and Guidelines:
 - 1. All color numbers and names herein refer to Tnemec master color card. Colors of specif ied equal manufacturers may be substituted with approval of the Owner's Representative.
 - 2. Pipe lines, equipment, or other items which are not listed here shall be assigned a color by the Engineer and shall be treated as an integral part of the Contract.
 - 3. When color coding is specified or directed by the Engineer, it shall consist of color code painting and identification of all exposed conduits, through lines and pipelines for the transport of gases, liquids, or semi -liquids including all accessories such as valves, insulated pipe coverings, fittings, junction boxes, bus bars, connectors and any operating accessories which are integral to a whole functional mechanical pipe and electrical conduit systems.

- 4. Description on titles (Abbreviated Code on Pipe/Equipment), to be lettered on pipes or equipment will be black or white to contrast with color of pipes and equipment, and shall be stencil applied, as approved by the Owner's Representative.
- 5. All moving parts, drive assemblies, and covers for moving parts which are potential hazards shall be Safety Orange 04SF.
- 6. All safety equipment shall be painted in accordance with OSHA standards.
- 7. All inline equipment and appurtenances not assigned another color shall be painted the same base color as the piping. The pipe s ystem shall be painted with the pipe color up to but not including the flanges attached to pumps and mechanical equipment assigned another color.
- 8. All pipe hangers and pipe support floor standards shall be painted.
- 9. All conduit shall be painted to match it s background surface.
- 10. Building surface colors shall be painted as scheduled in the Finish Schedule or as selected by the Owner's Representative.
- 11. Doors and frames shall be painted as scheduled in the Finish Schedule or as selected by the Owner's Representative.
- 12. Wood casework, frames, doors, etc. shall be finished with urethane as specified except as specifically noted otherwise.

2.02 PAINT COLOR CODE SCHEDULE

A. In situations where two colors do not have sufficient contrast to easily differentiate between the m, a six inch band of contrasting color should be painted on one of the pipes at approximately 30 -inch intervals. The name of the liquid or gas should also be painted (stenciled) on the pipe in a contrasting color. In some cases, it may be advantageous to paint arrows indicating the direction of flow.

Color of Pipe and Equipment			
Title Description to be Lettered on Pipes and Equipment	Title Letters	Color Name	Color Number
Effluent Transfer Pumps	White	Pantone Purple	522-C
Reuse High Service Pumps	White	Pantone Purple	522-C
Conduit	White	Cypress Green	G0383
Conduit Trays	White	Cypress Green	G0383
Effluent Reuse Pipe (RCW)	White	Pantone Purple	522-C
Chlorine Sample Pipe (CLS)	Black	Safety Yellow	02SF
Chlorine Feed Pipe (CL)	Black	Safety Yellow	02SF
Reclaimed Water Return (RCWR)	White	Pantone Purple	522-C

2.03 PAINTING OF EXISTING STRUCTURES, PIPING, VALVING AND EQUIPMENT

- A. Touch up existing structures and equipment where finish has been damaged by new construction.
- PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 11001

EQUIPMENT - BASIC REQUIREMENTS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Provisions: Requirements specified in Division 1 form a part of this Section.
- B. Work Included in this Section. The Contractor shall provide all the required labor, project equipment and materials, tools, construction equipment, safety equipment, transportation, and test equipment for furnishing, installation, adjustment, and full test loading of all the mechanical work shown on the Contract Drawings and included in these Specifications.
- C. Unless otherwise specified, the work of this division is also subject to the requirements of all other divisions of these specifications including, but not limited to: Divisions 9, 13, 15 and 16. Unless otherwise specified, all other sections of th is division are subject to the requirements of this section.

1.02 QUALITY ASSURANCE

- A. Incorporated Documents : Published specifications, standards, tests, or recommended methods of trade, industry, or governmental organizations apply to work of these Specificati ons where cited below. In every situation, the latest specifications, standards, tests, etc., shall apply unless otherwise noted.
- B. Variances: In instances where two codes are at variance, the more restrictive requirements shall apply.
- C. Contractor's Expense: The Contractor shall obtain and pay for the required bonds, insurance, licenses, permits, and inspections (unless otherwise specified), and pay all taxes, fees and utility charges that shall be required for the construction work.
- D. Extra Work: Work that is not included in the Contract Documents shall not be performed, except when approved in writing by the Owner.

- E. Standard of Quality: Items of equipment are specified herein by the name of a manufacturer for the purpose of establishing a standard of qua lity and acceptable experience. Alternate equipment will be given consideration, per Section 01600 - Material and Equipment.
- F. Data: Unless otherwise specified, all equipment furnished shall have a data plate fabricated of 316 stainless steel with a minimum thickness of 1/16 inch and embossed or preprinted lettering, and fastened to the frame with corrosion -resisting pins. Nameplates shall have stamped on them the manufacturer, serial number, model number, type, operating and performance data, and other pertinent data. Letters and numerals shall not be smaller than 3/16 inch high.
- G. Taggings: Where the size of the equipment prevents the fastening of data plates, name tags shall be provided and attached to the equipment and device item to identify it. The na me tags shall have a rectangular configuration with square corners and shall be approximately 1-1/2 inches by 3 inches in size. They shall be made from brass or stainless steel sheet metal and have a minimum thickness of 0.032-inch. Letters and numerals shall be engraved or etched in the name tags by a professional engraver and shall not be smaller than 3/16 inch high in size. The name and number for each item of equipment, as designated on the Contract Drawings, shall appear on the name tag for the Valve tag information shall conform to Section item. 15100 - Valves and Appurtenances. A 3/16-inch diameter hole shall be provided in the upper left-hand corner of each name tag and shall be used to attach the name tags to the equipment and device items with 1/8-inch stainless steel cable.

1.03 DRAWINGS

- A. Project Drawings : The Drawings are diagrammatic and show the general layout of the complete construction work.
 - 1. Locations of equipment, inserts, anchors, motors, panels, condu its, stub -ups, fittings, fixtures, air, water, power and process inlets, unless specifically dimensioned on the Contract Drawings, shall be determined to suit field conditions encountered, and the Contractor shall be responsible for ensuring clearance between pipes,

equipment, and similar app urtenances, without extra cost to the Owner.

- 2. The Contractor shall review the Contract Drawings and Specifications of other trades and shall include the mechanical work shown thereon that will be required for the installations.
- 3. Should there be a need to d eviate from the Contract Drawings and Specifications, the Contractor shall submit written details and reasons for all changes to the Engineer for approval before making such changes. All extra costs to make the changes will be borne by the Contractor.
- 4. In the event of varying interpretations of the Contract Documents, the Engineer's interpretation shall govern.
- B. Shop Drawings
 - 1. Prior to fabrication, the Contractor shall obtain, from the manufacturer, shop drawings for all equipment. Shop drawings shall incl ude fabrication, assembly, unit support drawings, installation drawings, and wiring dia grams together with detailed specifications and data covering materials used, power drive assembly, parts, devices, and other accessories forming a part of the equipment to be furnished.
 - 2. The Contractor shall submit Certified performance or Certified test curves, as specified for all pumps furnished under this Contract. The Contractor shall notify the Engineer three weeks prior to all testing should the Engineer elect to witness the tests.
 - Submit shop drawings and material lists for approval as specified in applicable Sections and in conformance with the requirements of Section 01340 - Shop Drawings, Project Data and Samples.

1.04 ADAPTATION OF EQUIPMENT

A. Should any altern ate equipment selected require any revision to the structure, piping, electrical, or other work shown on the Contract Drawings, the Contractor shall include the cost of such revisions in his bid for the equipment and no extra payment shall be made for such revision. All such revisions shall be subject to the approval of the Engineer.

1.05 UTILITY SERVICE AND PROCESS INTERRUPTION

A. All utility service and/or process interruptions initiated by the Contractor in the prosecution of his work shall be scheduled in advance and approved in writing by the appropriate Utility Company and the Owner.

1.06 OPERATION AND MAINTENANCE MANUALS

A. The Contractor shall submit to the Engineer operation and maintenance manuals on all mechanical equipment in accordance with Specification 01730 - Operation and Maintenance Data. Two (2) copies of draft manuals shall be submitted for approval not later than the date of shipment of the equipment. Five (5) final conformed copies shall be submitted and available to Owner's personnel at least two weeks prior to start -up and instruction for each piece of equipment. Refer to Division 1.

1.07 INSTALLATION MANUALS

A. In addition to operation and maintenance manuals, the Contractor shall submit to the Engineer three (3) copies of all installation manuals for each piece of equipment. This manual shall be submitted at the same time as the operation and maintenance manual. Installation of equipment shall not be performed until installation manuals are received.

1.08 EQUIPMENT GUARANTEE

A. The Contractor shall furnish and replace, without cost to Owner, all equipment parts that are defecctive or show undue wear within 3 years from the date of substantial completion of the work by the Owner unless extended periods of warranty for specific pieces of equipment are specified elsewhere. In addition to performance guarantees, all processes or systems shall comply with the requirements of applicable portions of the Sections of these Specifications describing those systems.

PART 2 PRODUCTS

2.01 MATERIALS AND WORKMANSHIP

- A. All equipment furnished under this Division shall be new and guaranteed free from defects in materials, design, and workmanship. These Specifications, to the extent possible, identify service conditions and requirements for all equipment; however, it shall be the manufacturer's responsibility to ascertain, to his satisfaction, the conditions and service under which the equipment will operate and to warrant that operation under those conditions will be successful. All parts of the equipment shall be amply proportioned for all stresses that may occur during fabrication , erection, and intermittent or continuous operation.
- B. All equipment shall be designed, fabricated, and assembled in accordance with the best modern engineering and shop practice. Individual parts shall be manufactured to standard sizes and gauges so that repair parts, furnished at any time, can be installed in the field. Like parts of duplicate units shall be interchangeable. Equipment shall not have been in service at any time prior to delivery, except as required by tests. Materials shall be suitable for service conditions.
- С. Except where otherwise specified, structural and miscellaneous fabricated steel used in items of equipment shall conform to the Standards of the American Institute of S teel Construction. All structural members shall be considered as subject to shock or vibratory loads. Unless otherwise specified, all steel which will be submerged, all or in part, during normal operation of the equipment, shall have a minimum nominal thickness of 1/4 inch. The location of the fabricator and his shop schedule shall be furnished to the Engineer prior to the beginning of fabrication so that the Engineer can schedule shop inspection if so desired.

2.02 EQUIPMENT BASES AND BEDPLATES

A. Unless otherwise indicated, a 316 Stainless Steel (SS) base shall be provided for each item of equipment which is to be installed on a concrete foundation. Equipment assemblies, unless otherwise specified, or shown on the Contract Drawings, shall be mounted on a single, heavy, 316 SS bedplate. Bases and bedplates shall be provided with machined support pads, tapered dowels for alignment or mating of adjacent items, adequate openings to facilitate grouting, and openings for electrical conduits. All seams and contact edges between SS plates and shapes shall be continuously

welded and ground smooth. The plates shall have a minimum thickness of 1/4 inch. All pump bedplates must include a drip lip and provision for directing accumulated gland leakage to a single disposal drain point.

2.03 JACKING SCREWS AND ANCHOR BOLTS

- A. Jacking screws shall be provided in the equipment bases and bedplates to aid in leveling prior to grouting.
- Equipment suppliers shall furnish anchor bolts, nuts, Β. washers, and sleeves of adequate design as required for proper anchorage of the bases and bedplates to the concrete bases. Sleeves shall be a minimum of 1 -1/2times the diameter of the anchor bolts. Unless otherwise shown or specified, anchor bolts for items of equipment mounted on baseplates shall be long enough to permit 1-inch of grout beneath the baseplate and to provide adequate anchorage into structural concrete. Anchor bolts, together with templates or setting drawings, shall be delivered sufficiently early to permit setting the anchor b olts when the structural Anchor bolts shall be 316 concrete is placed. stainless steel which conforms to ASTM A -167 and ASTM A-267.

2.04 LUBRICATION

Lubrication of equipment shall ensure constant presence Α. of lubricant on all wearing surfaces. Lubricant fill and drain openings shall be readily accessible. Easy means for checking the lubricant level shall be provided. Prior to testing and/or operation, the equipment shall receive the prescribed amount and type of lubricant as required by the equipment manufacturer. The Contractor shall provide to the Owner a 1 -vear supply of lubricants for each piece of equipment installed. All lubricants shall be properly packaged, labeled, and delivered to the Owner concurrent with equipment installation. An inventory listi ng of lubricant types by equipment and quantities shall be provided.

PART 3 EXECUTION

3.01 COORDINATION

A. The Contract Drawings show, in a diagrammatic form, the arrangements desired for the principal apparatus, piping, and similar appurtenances, and shall be

followed as closely as possible. Proper judgment must be exercised in carrying out the work to secure the best possible headroom and space conditions throughout, to secure neat arrangement of piping, valves, fixtures, hangers, and similar appurtenances, a nd to overcome local difficulties and interference of structural conditions wherever encountered.

B. The Contractor shall take all measurement for his work at the installation sites, verify all subcontractor Drawings prior to required submittal and be responsible for the proper installation, within the available space, of the apparatus specified and shown on the Drawings. The Contractor must secure the approval of the Engineer for all variations and/or substitutions before making any changes.

3.02 PROTECTION

- A. All equipment shall be boxed, crated, or otherwise completely enclosed and protected during shipment, handling and storage. All equipment shall be protected from exposure to the elements and shall be kept thoroughly dry and clean at all times. Pumps, blowers, motors, electrical equipment, and other equipment having anti-friction or sleeve bearings shall be stored in weather tight storage facilities such as warehouses. All materials and equipment showing evidence of rust, dirt contamination, or other surfac e or subsurface deterioration shall be cleaned and restored to the Engineer's satisfaction prior to installation.
- B. Painted surfaces shall be protected against impact, abrasion, discoloration, and other damage. All painted surfaces which are damaged prior to acceptance of equipment shall be repainted in accordance with the requirements of Section 09900 - Painting and Coatings to the satisfaction of the Engineer.
- C. Electrical equipment, controls, and insulation shall be protected against moisture or water damage.
- D. The Contractor shall maintain equipment storage facilities in accordance with the provision s of Division 1.
- E. All equipment shall be stored in the designated storage facilities from delivery until installation.
- F. All mechanical equipment, whether in the Contractor's designated storage facility prior to final

installation, or whether installed, but not yet placed into service or accepted by the Owner, shall be periodically exercised at intervals, and in accordance with procedures prescribed by each man ufacturer, if such a recommendation is included in the manufacturer's installation, operation and maintenance instructions.

3.03 INSTALLATION CHECK

- Α. The Contractor shall have an experienced, competent, and authorized representative of the manufacturer or supplier of each major item of equipment visit the site of the work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the equipment supplier's representative shall be present when the equipment is placed in operation. The Contractor shall have the equipment supplier's representative revisit the job site as often as necessary until all problems are corrected and the equipment installation and operation is satisfactory to the Engineer.
- B. Each equipment supplier's representative shall furnish to the Owner, through the Contractor, a written report certifying that the equipment: (1) has been properly installed and lubricated; (2) is in accurate alignment; (3) is free from all stress imposed by connecting piping or anchor bolts; and, (4) has been operated successfully under full load conditions.
- C. Equipment manufacturers shall furnish the services of competent, fac tory-trained personnel during the warranty period specified to inspect, service, and repair the equipment where required. Service requests shall be answered and acted upon promptly. This requirement shall not include normal maintenance and service of equipment, which will be the responsibility of the Owner.
- D. All costs for this work shall be included in the price bid by the Contractor.

3.04 EQUIPMENT INSTALLATION

A. All equipment shall be installed in full accordance with the equipment manufacturer's recommendations and good practice. Where specified in other parts of this Division, factory-trained service personnel sha ll be on-site to supervise the installation. Sufficient notice shall be given to the Engineer prior to equipment installation in order that the Engineer or his representative may be present during installation. In general, the following installation prac tices shall be followed:

- Examine equipment for damage in shipping and handling. The examination shall include checking for corrosion, poor workmanship, dirt or deleterious substances, and poor fits.
- 2. Level the base plate or bedplate
- 3. Install equipment
- 4. Check alignment of couplings
- 5. If grout has been used, check alignment and levelness after the grout has set.
- 6. Check direction of rotation and correct, if necessary, to insure proper operation.
- 7. Ensure that all submerged or intermittently submerged powered equipment does not have power and control cable splices of any kind inside wells or pits.

3.05 PLACING IN OPERATION

Α. Prior to being placed in operation, equipment shall be inspected by the manufacturer's factory -trained personnel. All defects discovered during this inspection shall be corrected prior to initial equipment start-up. Internal coatings applied at the factory shall be removed if required. Lubricant shall be applied in the proper places and levels shall conform to the manufacturer's recommendations . In the presence of the Engineer, full-load operational testing shall be performed and the results of such tests shall be recorded. Unsatisfactory performance shall be corrected and tests shall be repeated until the equipment performance meets the Specif ications. The Contractor shall furnish all power, materials, services, test equipment and labor required to successfully complete all full load equipment testing specified. The Contractor shall certify in writing to the Engineer, in triplicate, that all tests were conducted in accordance with these Specifications and that all components within each system successfully function as required. The Contractor shall notify the Engineer ten (10) calendar days in advance of the time when the equipment will be placed into operation.

During the course of initial operation, the Contractor shall instruct Owner's personnel in the proper operation and maintenance of the equipment, as specified herein.

3.06 INSTRUCTION

After the equipment specified in Divisions 11, 1 3, 15 Α. and 16 has been installed, tested, adjusted, and placed in satisfactory operating condition, services of representatives of each equipment manufacturer shall be provided to instruct the operating personnel in the use and maintenance of the equipment. The instruction period shall be scheduled at a time mutually agreed upon with the Owner, prior to final acceptance. The manufacturer's representatives shall fully instruct the Owner's personnel regarding use and maintenance of the equipment. During this instruction period, it shall be the responsibility of the manufacturer to answer all questions from the Owner's operating personnel. Manufacturer shall also demonstrate lubrication, disassembly, adjusting, routine parts replacement, and other "hands-on" activities related to maintenance of Provide a minimum of not less than the equipment. eight (8) hours for this instruction for each piece of equipment or set of identical pieces of equipment provided unless otherwise specified. More days shall be provided if called for in the individual equipment specification. Each manufacturer shall include the service in the price of his equipment. Training session schedules shall be coordinated with the Owner and Engineer and under no circumstances shall more than two training sessions be scheduled for the same day. The Contractor shall designate an individual through whom manufacturer's training will be coordinated. This individual will coordinate all training sessions through Owner's designated training coordinator.

3.07 SPECIAL TOOLS AND ACCESSORIES

A. All special tools, special tool lists, equipment, or accessories required for the installation and maintenance of equipment specified in Division 11, as well as three (3) copies each of instruction manuals necessary for the proper use of such tools, equipment, or accessories shall be provided by the equipment manufacturer. Special tools shall be defined as those items manufactured by the equipment supplier specifically for performing maintenance and installation of their resp ective equipment, including knocker wrenches for gearboxes.

3.08 SHOP PAINTING

- A. Except as specifically supplemented or superseded by requirements herein, shop painting shall conform to requirements in Section 09900 - Painting and Coatings. Electric motors, ge ars, starters, and other similar self-contained or enclosed components shall be shop primed and finished with a high -grade oil -resistant acrylic enamel. Surfaces which will be inaccessible after assembly shall be painted or otherwise protected before assembly by a method which provides protection for the life of the equipment.
- B. Surfaces to be painted at the project site shall be shop painted with one or more coats of a primer which will adequately protect the equipment until finishes are applied at the pro ject site. Primers shall be as specified in Section 09900 - Painting and Coatings. All equipment shall be primed with primer compatible with the coating system selected by the Contractor, and if not, the Contractor shall reprime the equipment such that it is compatible and in conformance with Section 09900 - Painting and Coatings.
- C. Machined and polished metallic surfaces which are not to be painted shall be coated with a rust preventive compound as specified in Section 09900 - Painting and Coatings.

3.09 DAMAGED PRODUCTS

- A. The Contractor shall notify the Engineer in the event that any equipment or material is damaged subsequent to receipt at the job site, and prior to acceptance of the installation by the Owner.
- B. Repairs to damaged products in lieu of replacement shall not be made without prior approval by the Engineer.

END OF SECTION

SECTION 11100

PUMPS - GENERAL

PART 1 - GENERAL

1.01 THE REQUIREMENT

- A. The CONTRACTOR shall provide all pumps and pumping appurtenances, complete and operable, in accordance with the Contract Documents.
- B. The provisions of this Section shall apply to all pumps and pumping equipment except where otherwise indicated in the Contract Documents.
- C. The requirements of Section 11001 Equipment Basic Requirements apply to this Section.
- D. Unit Responsibility: The CONTRACTOR shall be made responsible for furnishing the WORK. The Pump Manufacturer shall be responsible for the coordination of design, assembly and factory testing of the Pumps, if required. The Contractor shall be responsible to the OWNER for compliance with the requirements of each pump.
- E. Single Manufacturer: Where 2 or more pump systems of the same type or size are required, the pumps shall all be produced by the same manufacturer.

1.02 CONTRACTOR SUBMITTALS

- A. Furnish submittals in accordance with Section 01310 -Shop Drawings, Project Data and Samples.
- B. Shop Drawings: Shop Drawings shall contain the following information:
 - Pump name, identification number, and specification Section number.
 - Performance data curves showing head, capacity, horsepower demand, NPSH required, and pump efficiency over the entire operating range of the pump. The equipment manufacturer shall indicate separately the head, capacity, horsepower demand,

overall efficiency, and minimum submergence required at the design flow conditions and the maximum and minimum flow conditions. Performance curves at intervals of 100 rpm from minimum speed to maximum speed shall be furnished for each centrifugal pump equipped with a variable speed drive.

- 3. The CONTRACTOR shall require the manufacturer to indicate the limits on the performance curves recommended for stable operation without surge, cavitation, or excessive vibration. The stable operating range shall be as wide as possible based on actual hydraulic and mechanical tests.
- 4. Assembly and installation drawings including shaft size, seal, coupling, bearings, anchor bolt plan, part nomenclature, material list, outline dimensions, and shipping weights.
- 5. Elevation of proposed local control panel showing panel-mounted devices, details of enclosure type, single line diagram of power distribution, and current draw of panel, and list of all terminals required to receive inputs or to transmit outputs from the local control panel.
- Wiring diagram of field connections with identification of terminations between local control panels, junction terminal boxes, and equipment items.
- 7. Complete electrical schematic diagram.
- C. Technical Manual: The Technical Manual shall contain the required information for each pump Section.
- D. Spare Parts List: A spare parts list shall contain the required information for each pump Section.
- E. Factory Test Data: Signed, dated, and certified factory test data for each pump system which requires factory testing, submitted before shipment of equipment.
- F. Certifications
 - 1. Manufacturer or manufacturer's representative certification of proper installation.
 - 2. CONTRACTOR'S certification of satisfactory field testing.

PART 2 - PRODUCTS
2.01 GENERAL

- A. Compliance with the requirements of the individual pump Sections may necessitate modifications to the manufacturer's standard equipment.
- B. Performance Curves: All centrifugal pumps shall have a continuously rising curve or the system operating range shall not cross the pump curve at two different capacities or "dip region." Unless indicated otherwise, the required pump shaft horsepower at any point on the performance curve shall not exceed the rated horsepower of the motor or engine or encroach on the service factor.
- C. All components of each pump system provided under the pump Sections shall be entirely compatible. Each unit of pumping equipment shall incorporate all basic mechanisms, couplings, electric motors or engine drives, variable speed controls, necessary mountings, and appurtenances.

2.02 MATERIALS

- A. All materials shall be suitable for the intended application; materials not indicated shall be highgrade, standard commercial quality, free from all defects and imperfections that might affect the serviceability of the product for the purpose for which it is intended, and shall conform to the following requirements:
 - Cast iron pump casings and bowls or volutes shall be of close-grained gray cast iron, conforming to ASTM A 48 - Gray Iron Castings, Class 30, or equal.
 - Bronze pump impellers shall conform to ASTM B 62

 Composition Bronze or Ounce Metal Castings, or
 B 584 Copper Alloy Sand Castings for General
 Applications, where dezincification does not occur.
 - Stainless steel pump shafts shall be Type 416 or 316. Miscellaneous stainless steel parts shall be Type 316.

- 4. Anchor bolts, washers, and nuts in Standard Service (Non-Corrosive Application) shall be galvanized steel in accordance with the requirements of Section 05500 - Miscellaneous Metalwork. Anchor bolts, washers, and nuts in Corrosive Service as defined in Section 05500 shall be stainless steel in accordance with that Section.
- B. Materials in contact with potable water shall be listed as compliant with NSF Standard 61.

2.03 PUMP COMPONENTS - GENERAL

- A. Flanges and Bolts: Suction and discharge flanges shall conform to ANSI/ASME B16.1 - Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800 or ANSI/ASME B16.5 - Pipe Flanges and Flanged Fittings dimensions. Bolts shall be in accordance with Section 05500.
- B. Lubrication: Vertical pump shafts of clean water pumps shall be product water lubricated, unless otherwise indicated. Deep-well pumps and pumps with dry barrels shall have water- or oil-lubricated bearings and seals and enclosed line shafts. Pumps for sewage, sludge, and other process fluids shall be lubricated as indicated.
- C. Handholes: Handholes on pump casings shall be shaped to follow the contours of the casing to avoid any obstructions in the water passage.
- D. Drains: All gland seals, air valves, cooling water drains, and drains from variable speed drive equipment shall be piped to the nearest floor sink or drain, with galvanized steel pipe or copper tube, properly supported with brackets.
- E. Grease Lubrication: For all vertical propeller, mixed-flow, and turbine pumps, other than deep well pumps, of bowl sizes 10-inches and larger, the CONTRACTOR shall provide a stainless steel tube attached to the column for grease lubrication of the bottom bearing.

- F. Stuffing Boxes: Where stuffing boxes are indicated for the pump seal, they shall be of the best quality, using the manufacturer's suggested materials best suited for the specific application. For sewage, sludge, drainage, and liquids containing sediments, the seals shall be fresh-water flushed, using lantern rings. If fresh water is not available, the seal shall be flushed with product water cleaned by a solids separator as manufactured by John Crane Co., Lakos (Claude Laval Corp.), or equal.
 - 1. Conventional Packing Gland Type Seal: Unless otherwise indicated, the packing material shall be interlaced Teflon braiding, containing 50 percent ultrafine graphite impregnation to satisfy the following. Acceptable ring materials are asbestos-free die-molded packing rings of braided graphite material free of PTFE, Chesterton 1400R, or equal for non-potable water service and braided PTFE material, Chesterton 1725 or equal that is listed under NSF Standard 61 for potable water service.

Shaft speeds	up to 2500 fpm
Temperature	up to 500 degrees F
pH range	0-14

2. Mechanical Seals (Conventional Non-Split Type): Mechanical seals shall be fresh water-flushed unless indicated otherwise; in which case product water cleaned by a solids separator as above shall be used. Mechanical seals shall be as manufactured by the following, or equal:

Sewage, Sludge, or Wastewater Pumps	Double seals	John Crane Type 88, Flowserve Type ISCPP, Chesterton Type GDS or 255
Water Pumps (hot and cold)	Single seals	John Crane Type 88SRS, Flowserve Type ISCPX, Chesterton Type UV, GSS, or 155

3. Mechanical Seals (Split Type): Split type mechanical seals shall be fresh water flushed unless indicated otherwise; in which case product water cleaned by a solids separator as above shall be used. Mechanical seals shall be as manufactured by the following or equal

Sewage, Sludge, or Wastewater Pumps	Double seals	John Crane Type 3710, Flowserve Type PSS2, Chesterton Type 442
Abrasives, Grit, or Lime Slurry Pumps	Double seals	Split seals are not recommended.
Chemicals or Corrosive Liquid Pumps	Single seals	Split seals are not recommended because of leakage.
Water Pumps (hot and cold)	Single seals	John Crane Type 3710, Flowserve Type PSS II, Chesterton Type 442

- 4. Mechanical Seals (Tandem Type): Tandem type mechanical seals shall have an oil chamber between the seals. The seals shall be used with the rotating seal faces being carbon and the stationary seal faces to be ceramic. The lower seal shall be replaceable without disassembly of the seal chamber and without the use of special tools. Pump-out vanes shall be present at the back of the impeller to keep contaminants out of the seal area. Tandem Type Mechanical Seals shall be John Crane type 21, BF1C1.
- G. Where indicated, a buffer fluid must be circulated a minimum 20 psi above discharge pressure, or as required by the manufacturer, in order to maintain reliable seal performance.
- H. Mechanical seals for all services shall be equipped with nonclogging, flexible-mounted seats with elastomer secondary seals. Wetted metal parts shall be Type 316 stainless steel, Alloy 20, or Hastelloy B or C, whichever has the best corrosion resistance to the pumped fluid.

Dual cartridge seals shall be double balanced to allow for seal integrity in case of flush water pressure reversal. All single and double seals shall have springs in the non-wetted end of the seal. I. Fresh water shall be delivered to the seals through appropriate size piping with plug valves, strainers, pressure regulators, electrically operated solenoid valves, and rotameters. Wiring shall comply with Division 16 and solenoid control shall comply with Division 17.

2.04 PUMP APPURTENANCES

- A. Nameplates: Each pump shall be equipped with a stainless steel nameplate indicating serial numbers, rated head and flow, impeller size, pump speed, and manufacturer's name and model number.
- B. Solenoid Valves: The pump manufacturer shall provide solenoid valves on the water or oil lubrication lines and on all cooling water lines if seal water flush is required. Solenoid valve electrical ratings shall be compatible with the motor control voltage.
- C. Gauges
 - All pumps (except sample pumps, sump pumps, and hot water circulating pumps) shall be equipped with pressure gauges installed at pump discharge lines. Pump suction lines shall be provided with compound gauges. Gauges shall be located in a representative location, where not subject to shock or vibrations, in order to achieve true and accurate readings.
 - 2. Where subject to shock or vibrations, the gauges shall be wall-mounted or attached to galvanized channel floor stands and connected by means of flexible connectors.

2.05 FACTORY TESTING

- A. The following tests shall be conducted on each indicated pump system:
 - 1. Pump Systems: All centrifugal pump systems with drives 10 hp up to and including 150 hp shall be tested at the pump factory in accordance with the American National Standard for Centrifugal Pump Tests (ANSI/HI 1.6) acceptance Level "A" or the American National Standard for Vertical Pump Tests (ANSI/HI 2.6) as approved by ANSI and

published by the Hydraulic Institute. For sump pumps, acceptance shall be in accordance with Level "B" of ANSI/HI 1.6 unless indicated otherwise. For pumps with motors of 100 hp or less, the manufacturer's certified test motor shall be acceptable. Testing of prototype models will not be acceptable. The following minimum test results shall be submitted:

- a. Hydrostatic test results
- b. At maximum speed, a minimum of five hydraulic test readings between shutoff head and 25 percent beyond the maximum indicated capacity, recorded on data sheets as defined by the Hydraulic Institute.
 For variable speed driven pumps, each pump shall be tested between maximum and minimum speed at 100 rpm increments.
- c. Pump curves showing head, flow, bhp, and efficiency requirements.
- d. NPSH required test curve if required by the pump specification. Otherwise, a calculated NPSH required curve may be submitted.
- e. Certification that the pump shaft horsepower demand did not exceed the rated motor horsepower of 1.0 service rating at any point on the curve.
- 2. Factory Witnessed Tests: All pumps, and motors, 150 hp and larger shall be factorytested as complete assembled systems and may be witnessed by the OWNER and ENGINEER. The CONTRACTOR shall give the ENGINEER a minimum of 2 weeks notification prior to the test. All costs for OWNER and ENGINEER shall be borne by the CONTRACTOR and shall be included in the bid price. Such costs shall include travel and subsistence for two people excluding salaries. Test results shall be submitted to the ENGINEER. No equipment shall be shipped until the test data have been approved by the ENGINEER.
- 3. Acceptance: In the event of failure of any pump to meet any of the requirements, the CONTRACTOR shall make all necessary modifications, repairs, or replacements to conform to the requirements of the Contract

Documents and the pump shall be re-tested until found satisfactory.

PART 3 - EXECUTION

3.01 SERVICES OF MANUFACTURER

- A. Inspection, Startup, and Field Adjustment: Where required by the individual pump Sections, an authorized service representative of the manufacturer shall visit the Site for the number of days indicated in those sections to witness the following and to certify in writing that the equipment and controls have been properly installed, aligned, lubricated, adjusted, and readied for operation.
 - 1. Installation of the equipment
 - 2. Inspection, checking, and adjusting the equipment
 - 3. Startup and field testing for proper operation
 - Performing field adjustments to ensure that the equipment installation and operation comply with requirements
- B. Instruction of the Owner's Personnel
 - 1. Where required by the individual pump Sections, an authorized training representative of the manufacturer shall visit the Site for the number of days indicated in those Sections to instruct the OWNER'S personnel in the operation and maintenance of the equipment, including step-bystep troubleshooting with necessary test equipment. Instruction shall be specific to the models of equipment provided.
 - 2. The representative shall have at least 2 years experience in training. A resume for the representative shall be submitted.
 - 3. Training shall be scheduled a minimum of 3 weeks in advance of the first session.
 - 4. Proposed training material and a detailed outline of each lesson shall be submitted for review. Comments shall be incorporated into the material.
 - 5. The training materials shall remain with the trainees.
 - 6. The OWNER may videotape the training for later use with the OWNER'S personnel.

3.02 INSTALLATION

- A. General: Pumping equipment shall be installed in accordance with the manufacturer's written recommendations.
- B. Alignment: All equipment shall be field tested to verify proper alignment and freedom from binding, scraping, shaft runout, or other defects. Pump drive shafts shall be measured just prior to assembly to ensure correct alignment without forcing. Equipment shall be secure in position and neat in appearance.
- C. Lubricants: The CONTRACTOR shall provide the necessary oil and grease for initial operation.

3.03 PROTECTIVE COATING

A. Materials and equipment shall be painted as required in Section 09900 - Painting and Coatings.

3.04 FIELD TESTS

- A. Each pump system shall be field tested after installation to demonstrate:
 - 1. Satisfactory operation without excessive noise and vibration.
 - 2. No material loss caused by cavitation.
 - 3. No overheating of bearings.
 - 4. Indicated head, flow, and efficiency at design point.
- B. The following field testing shall be conducted:
 - 1. Startup, check, and operate the pump system over its entire speed range. If the pump is driven by a variable speed drive, the pump and motor shall be tested at 100 RPM increments. If the pump is driven at constant speed, the pump and motor shall be tested at max RPM. Unless otherwise indicated, vibration shall be within the amplitude limits recommended by the Hydraulic Institute Standards at a minimum of four pumping conditions defined by the ENGINEER.
 - 2. Obtain concurrent readings of motor voltage, amperage, pump suction head, and pump discharge head for at least 4 pumping conditions at each

pump rotational speed if variable speed at 100 RPM increment or at max RPM if constant speed. Check each power lead to the motor for proper current balance.

- 3. Determine bearing temperatures by contact type thermometer. A run time until bearing temperatures have stabilized shall precede this test, unless insufficient liquid volume is available.
- Electrical and instrumentation tests shall conform to the requirements of the sections under which that equipment is specified.
- C. Field testing will be witnessed by the ENGINEER. The CONTRACTOR shall furnish 3 days advance notice of field testing.
- D. In the event any pumping system fails to meet the indicated requirements, the pump shall be modified or replaced and re-tested as above until it satisfies the requirements.
- E. After each pumping system has satisfied the requirements, the CONTRACTOR shall certify in writing that it has been satisfactorily tested and that all final adjustments have been made. Certification shall include the date of the field tests, a listing of all persons present during the tests, and the test data.
- F. The CONTRACTOR shall be responsible for all costs of field tests, including related services of the manufacturer's representative, except for power and water, which the OWNER will bear. If available, the OWNER'S operating personnel will provide assistance in field testing.

END OF SECTION

SECTION 11313

VERTICAL TURBINE PUMPS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This section includes furnishing and installing eleven (11) line shaft vertical turbine pumps in the locations shown in the Drawings. The pumps shall be suitable for pumping the specified quantity of effluent at specified pressures when installed and operating under the conditions shown.

1.02 QUALITY ASSURANCE

- A. Design, fabricate, install and test in accordance with the Standards of the Hydraulic Institute.
- B. Subject to compliance with the requirements of this Section, manufacturer's offering products which may be incorporated in the work include the following:
 - 1. Goulds/Hudson
 - 2. Aurora Vertiline
 - 3. Paco/Johnston
 - 4. Flowserve
 - 5. Or approved equal
- C. Related Work Specified Elsewhere:
 - 1. Section 09900- Painting and Coatings
 - 2. Section 13300- Instrumentation and Control
 - 3. Section 16150- Motors
 - 4. Section 16483- Variable Frequency Drives
- D. Pumps shall conform to the requirements of ANSI/AWWA E101 except as modified in these specifications.
- E. Vibration limits shall be in accordance with the Hydraulic Institute Standards. The pump manufacturer shall insure that the first critical frequency of each vertical turbine pump is a minimum of 25% above the maximum operating speed and the second critical

frequency is a minimum of 25% below the minimum anticipated operating speed (80% of maximum).

1.03 SUBMITTALS

- A. All submittals for vertical turbine pumps shall be in accordance with Specification 01340 Shop Drawings, Project Data and Samples.
- B. Operation and Maintenance (O&M) Manuals shall be submitted in accordance with Section 01730 - Operating and Maintenance Data.
- C. Submit Manufacturer's Certificate of Compliance certifying compliance with the referenced specifications and standards.
- D. Submit certified copies of reports of factory tests specified in this section and required by referenced standards.
- E. Submit results of vibration testing on the pumps provided or on similar pumps recently manufactured and tested.
- F. Submit shop drawings showing all dimensions; also include performance data and physical characteristics.
- G. Submit manufacturer's parts list, operation and maintenance literature and instructions.
- H. Submit three copies of Service Representative's Report of Field Tests.

1.04 WARRANTY

A. The Contractor shall provide a 3 year w arranty from substantial completion.

PART 2 PRODUCTS

2.01 LINE SHAFT VERTICAL TURBINE PUMPS CONSTRUCTION

A. Bowl Assembly: Pump bowls shall be made of ASTM A48 Class 30 close grained cast iron, free from blow holes, sand holes and all other faults. Bowls sh all be accurately machined and fitted to close dimensions. The bowl design shall be heavy walled to withstand the pressure developed by the pump and shall have sufficient lateral design to accommodate hydraulic shaft stretch when the pump is operating. T he discharge case shall be fitted to attach to the discharge column. The suction case shall be fitted with a cast iron suction bell to reduce entrance losses to a minimum. Pump bowls or impellers shall be provided with replaceable bronze wear rings in acc ordance with manufacturer's standard. Porcelain enameled bowls may be utilized.

- B. Impeller: Pump impellers shall be ASTM B584 (alloy 83800) bronze, of heavy construction, accurately fitted and statically and dynamically balanced. Impellers shall be secur ely fastened to a pump shaft of 416 stainless steel. The shaft shall be sized to provide minimum deflection. Bronze sleeve bearings shall be provided in each bowl and in the suction bell. Bowl bearings shall be lubricated by the pumped liquid. Suction bell bearing shall be packed permanently with non-soluble grease and fitted with a bronze sand collar.
- C. Column Assembly: Discharge column pipe shall be ASTM A53 Grade B steel pipe with flanged connections, line shaft, line shaft coupling, bearing retainer, and bearing. Column pipe shall be interchangeable and not over 10' in length for 1800 RPM and 5' in length for 3600 RPM.
- Line Shafting: Line shafting shall be 416 stainless D. steel with stainless steel keyed line shaft couplings or with threaded Monel metal or stainless steel couplings of a different alloy to prevent galling. Shaft diameter shall be sized to conform with ANSI/AWWA Specifications for the motor horsepower. Line shafts shall be furnished in interchangeable sections not over 10' in length at 1800 RPM or 5' in length at 3600 RPM. The shafts shall be machined so that maximum runout in 10' shall not exceed 0.005 inch and so that maximum permissible axial misalignment of the thread axis within the shaft axis is 0.002 inch in 6 inches.
- E. Bearings: Column shaft bearings shall be spiral grooved C425-65 fluted rubber for lubrication by the pumped liquid. Bearings shall be supported by "spider" type bronze retainers installed between each length of discharge column to insure proper shaft alignment. Maximum spacing shall be 10' at 1800 RPM and 5' at 3600 RPM. Bearing retainers shall be so constructed as to allow field reversal; such reversal will result in the bearing surface on the shaft to be completely relocated. The suction and case bearings shall be

bronze. Bearings for intermediate bowls shall be dual bronze and rubber.

- F. Surface Discharge Head Assembly: Discharge heads shall be of close grained cast iron (ASTM A48-76 Class 30) or fabricated steel (ASTM A53 & A36) with an integral discharge flange.
- G. Discharge flanges shall be flat face type faced and drilled for ANSI B-16.1 Class 125.
- H. The discharge head base shall be of sufficient size to span an opening of such dimensions as to permit removal of the complete pump unit connected below. Lifting lugs with capacity to support the weight of the entire pump shall be provided. Discharge head mounting base shall be a round flange type with accurately machined surfaces. The top of the head shall be machined with a register fit for locating the driving motor . Cast discharge heads shall be so designed that casting sections supporting the motor shall form a "tee" section for maximum torsional rigidity. Adequate openings shall be provided to permit easy access to the stuffing box and shaft coupling.
- I. Stuffing bo x shall be of cast iron fitted with a mechanical seal. Mechanical seals shall be of the type recommended by the seal manufacturer for the application. Mechanical seals shall be replaceable without removing the motor, disassembling the pump, or disturbing the piping.
- J. Stuffing Box Housing: Stuffing box housing shall be one piece construction made of cast iron. It shall have an accurately machined pilot located in a close tolerance counterbore in the discharge head. Pump stuffing box shall be located on th is pilot and clamp the bearing housing in place. A bronze sleeve bearing shall be provided in the bearing housing.
- K. Head shaft shall be Type 416 stainless steel. Impeller adjustment shall be provided at the top of the head shaft by an adjustable flanged headshaft coupling with bronze adjusting nut and set screws.
- L. Pumps shall be supplied with the pump manufacturers' standard fabricated steel sub -base plate. The steel sub-base plate shall be of sufficient thickness to support the pump discharge head and motor and suitable for grouting with a smooth surface for mounting the discharge head. Anchor bolts and all hardware for

securing the head to the base plate shall be furnished or approved by the pump manufacturer.

- M. Pump Driver: Pumps shall be driven by vertical hollowshaft or solid shaft electric motors. Motors shall be provided with non -reverse ratchets. When mechanical seals are provided for pumps, a solid shaft motor with a flanged adjustable spacer to allow easy removal of the seal without removal of the motor shall be used. Drive motors shall be suitable for installation in a corrosive atmosphere at the locations shown without additional protection. The motor horsepower shall be non-overloading for all conditions of head and flow. Motors shall be pr emium efficiency NEMA B motors. Motors shall be rated for inverter duty and meet all the requirements of Section 16150 - Motors.
- N. Variable Frequency Drives (VFDs). The pump supplier shall coordinate with the Contractor to insure that the VFD's furnished u nder Section 16 483 - Variable Frequency Drives are suitable for operation with the pumps furnished.

PART 3 EXECUTION

3.01 EXAMINATION

A. Examine pumps to be sure all passages are clean and clear of obstructions and that impellers rotate freely. Examine pump mounting surface and also make certain that bolts are properly located. Correct any irregularities prior to installation.

3.02 INSTALLATION

- A. Install pump in accordance with specifications, drawings and manufacturer's written instructions. Install units level and plumb. Securely anchor units. Insure that stress is not applied to discharge connection by piping. Make sure all connections are tight.
- B. If supplied pump discharge differs from proposed discharge line size shown in the Contract Drawings , Contractor to provide and install ductile iron reducers of appropriate size to connect the pumps to the discharge piping.

3.03 TESTING

- A. The pump manufacturer shall provide five copies of certified performance curves of the most recent certified performance test f or each pump size of a similar pump.
- B. The discharge head and bowl assembly shall be hydrostatically tested to 100 psig at the factory. Certification of the hydrostatic testing and the test results shall be submitted.
- C. After installation, test each pump in accordance with the Hydraulic Institute Standards. The pumps shall be field tested to establish field head and overall efficiency. Report and test shall include voltage and amperage measurement.

3.04 MANUFACTURER'S REPRESENTATIVE

A. Provide services of qual ified manufacturer's service representative to inspect equipment and installation , perform required field tests of each pump , and to instruct the Owner in the operation and maintenance of the pumps. Three days (3) shall be provided for these services.

3.05 TOOLS AND SPARE PARTS

- A. One set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys. See Section 01700 - Contract Closeout.
- B. The manufacturer shall furnish recommended spare parts necessary for the first five years of operation of the pumping system, which shall include at least the following:
 - 1. Two complete sets of gaskets for each pump size supplied.
 - 2. Two complete sets of mechanical seals for each pump size supplied.
 - 3. Two complete sets of shaft sleeves, keys and accessories for each pump size supplied.

4. One spare pump and motor of the capacity and size listed in Section 3.07.

3.06 PUMP CHARACTERISTICS

- A. Pump shall have the following capacities when operating at the design conditions shown. Motor horsepower, efficiency, and speed may vary from that shown depending upon manufacturer of the vertical turbine pump. Manufacturer shall meet the design condition listed. The additio nal points of the pump curve may vary.
- B. Pump shall operate satisfactorily within the operating range indicated in 3.07:

3.07 VERTICAL TURBINE PUMP DATA SHEET

	Design
	Condition
Manufacturer & Model	Goulds
(Basis of Design)	Model VIT-FFFM
Quantity	5
Pump Nos.	1 thru 5
	Design
	Condition
Design Point:	
Capacity - GPM	4,167
TDH - Feet	62
Max Speed - RPM	1180
Type of Speed	Variable
Maximum Horsepower(NOL)	81.5
Minimum Efficiency at Design Point	84.2%
Shutoff Head- Feet	94.7
Max. Column Size - Inches	14
Max. Pump Discharge Size - Inches	14
Discharge Pipe Size - Inches	14
Barrel or Can Required	No
NPSH Required - Feet	15.0
Motor Voltage - Volts	460
Type of Motor Drive	Variable Frequency

A. Low Service Transfer Pumps

	Design
	Condition
Manufacturer & Model	Goulds
(Basis of Design)	Model VIC-FLFM
Quantity	4
Pump Nos.	1 thru 4
	Design
	Condition
Design Point:	
Capacity - GPM	5,600
TDH - Feet	208.0
Max Speed - RPM	1800
Type of Speed	Variable
Maximum Horsepower(NOL)	370.3
Minimum Efficiency at Design Point	80%
Shutoff Head- Feet	392.8
Max. Column Size - Inches	16″
Max. Pump Discharge Size - Inches	16″
Discharge Pipe Size - Inches	16″
Barrel or Can Required	Can
NPSH Required - Feet	50.0
Motor Voltage - Volts	460
Type of Motor Drive	Variable Frequency

B. <u>High Service Duty Pumps</u>

	Design
	Condition
Manufacturer & Model	Goulds
(Basis of Design)	Model VIC-FLFM
Quantity	2
Pump Nos.	1 thru 2
	Design
	Condition
Design Point:	
Capacity - GPM	2,800
TDH - Feet	208.0
Max Speed - RPM	1800
Type of Speed	Variable
Maximum Horsepower(NOL)	189.1
Minimum Efficiency at Design Point	78.6%
Shutoff Head- Feet	310.0
Max. Column Size - Inches	12″
Max. Pump Discharge Size - Inches	12″
Discharge Pipe Size - Inches	12″
Barrel or Can Required	Can
NPSH Required - Feet	21.8
Motor Voltage - Volts	460
Type of Motor Drive	Variable Frequency

C. <u>High Service Jockey Pumps</u>

END OF SECTION

SECTION 13300

INSTRUMENTATION AND CONTROLS, GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 THE REQUIREMENT:

- The Contractor shall provide, through the services of Α. a singl e Cont rol Syst em Int egrator (CSI), all components and system installation services, as well as all required and sp ecified ancillary s ervices, whether reflected in the Contract Documents or not, in connection with the In strumentation and Control System (ICS) as specified herein for a c omplete and operable s ystem. The sy stem shall incl ude a ll materials, la bor, tools, fe es and docume ntation required to furn ish, install, te st and place in to operation, a complete and operable ICS whether or not shown and/or specified within this section, related ICS spec ification sections, and subsections within equipment specifications. The s ystem shall include all meas uring element s, signal c onverters, transmitters, s pecialty c ables, cont rol p anels, digital hardware and software, remote telemetry units (RTU), sig nal and data t ransmission sy stems, interconnecting wiring and such accessories as shown, specified an d/or required to p rovide the functions indicated, whether specifically mentioned or not.
- B. The requirements provided within this section shall be applied to all of the Instrumentation and Controls specif ications, Secti ons 13300 thro ugh 13330, as well as additional specifications sections as referenced. The ICS shall be provided as a single and c omplete system as s pecified he rein and as specified within the following ICS specifications:
 - Section 13310 Instrumentation and Controls, Field Equipment
 - Section 13320 Instrumentation and Controls, Control Enclosures
 - 3. Section 13330 Instrumentation and Controls, SCADA Hardware
 - 4. Section 13340 Existing Telemetry System Modifications

- For the purposes of these specifications the Control С. System Integrator shall be r eferred to as th e CSI. Where r eferences are mad e to the SCA DA Sy stem Programmer or the SSP, it sh all be unders tood that CSI will not be pro viding t hat work under t his Contract. Although the SSP will provide programming services outside of this Contract, that in no way relieves the CSI from providing all materials, labor, documentation, etc., i ncluding c oordination, programming, st artup, and t esting s ervices as necessary to en sure the complete sys tem is fully capable of providing all specified functions, whether provided by the CS I or p rogrammed by the S SP. Additional cl arifications of re sponsibilities a re provided her ein and with in relate d I CS specifications, as it per tains to the re lationship between the CSI and the SSP.
- The Contractor shall be u ltimately responsible for D. installation of the ICS. How ever, the CSI will include ins tallation within t he sco pe of the subcontract to provid e for furnis hing and installation of the complete system as specified. shall a lso coo rdinate t his work with the The CSI Contractor to ensure that the proper type, size and number of wires with their conduits are provided and installed. This coordination will also ensure that proper electrical power circuits are provided for all components and systems.
- E. The Contractor's responsibilities, as distinct from the CSI's responsibilities, shall be to provide all additional materials and work necessary to supplement the materials and work provided by the CSI, thereby satisfying all requirements that are within I CS specification sections.
- F. The Contractor shall coordinate stru ctural wo rk, penetrations, p ainting, et c., as req uired fo r installation of a com plete ICS. In-line o r integrally mou nted ite ms (such as f low elements, level sen sors, etc.) shal l be install ed under the supervision of the CSI.
- G. The CSI shall be resp onsible for co ordinating interfaces between ICS equipment provided under these specification sections and the equipment provided under other sections of the specifications. The CSI shall ver ify a nd coordi nate space req uirements, process equipment power supply and voltage, process

equipment con trol power sup ply and volta qe, compatibility of cont rol sig nals, details of equipment ins tallation and inte rconnection. Coordination shall include distribution of approved shop drawings to all vendo rs, subcontractors, etc., involved in the control interface. Likewise, the CSI shall ensure that instrumentation and control devices provided under other sections of the speci fications ity and are comp atible and of the same qual characteristics as simil ar devices specified under the ICS specification sections.

H. The CSI will not be responsible for providing PLC and HMI control programming and l ogic. Thes e services will be provided under a separate contract.

1.02 SCOPE:

- A. The scope listed within this subsection pertains to major i tems of supply. Ref er to the complete Contract Do cuments for all r equirements. For additional clarification of s cope refer t o related specification sections.
- B. This p roject sh all pr ovide for the ex pansion and upgrade of th e Manate e Coun ty South east W ater Reclamation Facility. This project will in clude and provide additions, upgrades and modifications to the in-plant SCADA System and existing ICS. The ICS shall monitor and control t he ne w High Se rvice Pump Station, the R eclaimed Wat er Sto rage T ank, the conversion of the existing Effluent Pump Stations to Low Head T ransfer Pump S tations and as sociated facilities and components as shown on th e Drawings and Technical Specifications.
- C. Monitoring and control shall be through PLC control panels com municating o ver a f iber op tic Ethe rnet network or wir eless c ommunications sy stem to the Human-Machine In terface (HMI) o perator inter faces located in the control room. Network communications shall consist of fiber c ables, patch panels, patch cables (fiber and hard-wired), fiber optic switches, etc. as required and specified to provide a complete system.

- D. Modifications will be requ ired in existing PLC control panels SP-1(Main Electrical Building), RTU-3 and RTU-5 (Reclaim Water Ponds) to accommodate the new signal Input/Output requirements.
- E. A new High Service Pump Station SCADA Control Panel (SP-6) will be provided at the new High Pump Station area to acc ommodate the I/O requirements for the equipment in this area.
- F. The following additional major items of supply shall be provided:
 - Furnish a nd i nstall in strumentation a s specified.
 - 2. Furnish TVSS for instrumentation and control panels as specified.
 - 3. Furnish and install new equipment to provide all specified SCADA Input/Output signals and functions.
 - 4. Furnish and in stall all C ontrol Panels a s scheduled.
 - 5. Provide, i nstall and configure all SCADA software packages specified and as needed to complete the requirements noted herein.
 - 6. Interface with control panels provided by other e quipment suppliers under this contract.
 - 7. Spare parts as described herein.
 - 8. Implementation and testing of the complete system, including testing with the SSP.
 - 9. Training of Owner personnel.
 - 10. Operations and Maintenance Manuals.

1.03 RELATED WORK SPECIFIED ELSEWHERE:

- A. Division 11 Equipment
 - Refer to i ndividual p roduct sp ecifications within specification sections for additional requirements sp ecific to t hose dev ices. Instrumentation and con trol equip ment supplied as part of packaged systems shall be integrated into the ICS as specified.

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- 2. Where D ivision 11 equi pment su ppliers ar e d contr providing i nstrumentation an ol equipment for which there is no specification within th eir respecti ve equipment specification, t hey shall pro vide equi pment in accor dance with the I CS spe cifications. This equipment shall be compatible and of the same quality and characteristics as simila r devices speci fied unde r the ICS specifications. If possible the same make and/or mo del supplied unde r the ICS specifications shall be provided.
- 3. PLC and HMI programming performed by Division 11 equipment suppliers shall be coordinated with the CSI to provide supervisory control and mon itoring of cont rol p anels prov ided under Division 11 via network communications.

B. Division 16 - Electrical

- Where electrical subco mponents are to be provided as part of ICS equipment, but for which there is no specification, provide in accordance with Divisi on 16 - Electrical. These subcomponents shall be c ompatible and of the same qua lity and cha racteristics as similar devices specified under Division 16 -Electrical. If possible the same make and/or model su pplied under Di vision 16 shall b e provided.
- The following work shall be provided under Division 16 - Electrical:
 - a) Conduit, raceways and installation of wire and cab le fo r all in strumentation and control syste m signal w iring, ground ing systems, special cables and network cables except as noted.
 - b) Instrumentation and control system signal field wire.
 - c) Final wire preparation and termination of field wires to ICS equipment as directed by the CSI.
 - d) Grounding systems for all ICS equipment.
 - e) Mounting of ICS electrical enclosures (i.e. control pan els, TVSS bo xes, electronic

instrumentation, e tc.) wi th e xclusion of final measuring elements of instrumentation (i.e. flow tub es, se nsors in proce ss piping, etc.) which shall be as coordinated by the Contractor.

3. The CSI shal | provid e all termin ation information for the ICS equipment, to support equipment t erminations pr ovided und er Division 1 6. This information shall be provided wit hin ten (10) da ys of IC S equipment arr ival onsite or as required b y the project schedule. The information shall be in t he form of drawings and termination howing complete termina lists, s tion information (t o/from panels, termin al numbers, term inal block loca tions, sign al types, voltages, etc.).

1.04 CODES AND STANDARDS:

- A. The ICS shall comply with the National Electric Code, National E lectric Safe ty Co de, OSHA and with a ll applicable fed eral, s tate, county, municipal and electrical utility codes and regulations, as well as the Contract Documents. In the event of any conflict between the se codes, regulations and C ontract Documents, the most restrictive shall apply.
- B. The Instrumentation and Control System shall comply with the following codes and standards as well as any others within the specifications and dra wings. In the e vent of any conflict b etween these co des, regulations, standards and Contract Documents, the most restrictive shall apply.
 - Applicable state, county and m unicipal code requirements.
 - 2. Applicable stan dards of the Na tional Fire Protection Association (NFPA)
 - a) National Electrical Code (NEC).
 - 3. Applicable st andards of the U nderwriter's Laboratories, Inc. (U.L.)
 - a) UL 508 Industrial Control Equipment
 - b) UL 508A Industrial Control Panels

- c) UL 698 Industrial Control Equipment for Use in Hazardous Locations
- 4. Applicable sta ndards o f t he I nstitute o f Electrical and Electronics Engineers (IEEE)
- 5. Applicable sta ndards of th e Natio nal Electrical Manufacturers Association (NEMA)
 - a) NEMA 2 50 En closures fo r Electrical Equipment (1000 V Maximum)
 - b) NEMA ICS 1 Indu strial Control and Systems: General Requirements
 - c) NEMA I CS 6 E nclosures for Industrial Control and Systems
- 6. Applicable st andards of the I nternational Society of Automation (ISA)
 - a) S5.1 In strumentation Sym bols and Identification
 - b) S5.4 Instrument Loop Diagrams
 - c) S20 Spe cification Form s for Proces s Measurement an d Con trol In struments, Primary Elements, and Control Valves
 - d) TR20.00.01 Specification Forms for Process Measurement and Control Instruments

1.05 SUBMITTALS:

- A. All shop drawi ngs shall be in accordance with Section 01340 - Shop Drawings, Project Data and Samples. In addition to the requirements set forth in Section 01340 - Shop Drawings, Project Data and Samples, the following a dditional subm ittal requirements included herein shall apply.
- B. Every s ubmittal shall h ave a separa te sec tion entitled "Req uested D eviations fro m IC S Specifications" which sh all clearly define and explain all r equested deviations and exce ptions of the Inst rumentation and Co ntrol System t o t his Specification. Only those deviations requests listed in this section will be reviewed by the Engineer.
- C. After all changes or corrections resulting from the Engineer's review of the syst em supplier's drawings have been m ade, panels m ay be built a nd

instrumentation devices may be supplied in accordance with the approved drawings. One set of 'As Shipped' prints shall be included in the panels when shipped from the system supplier's wiring and assembly shop.

- D. The foll owing m ajor lis t of s ubmittals sh all be provided as a minimum. Ma jor submittals are generally lis ted in the order they are to be provided. Re fer to re lated ICS spe cification sections and equipment sub sections for add itional submittals and submittal requirements.
 - 1. Process Field Instrumentation
 - 2. SCADA System Control Panel and Modifications
 - 3. Preliminary Operation and Maintenance Manuals
 - 4. Training
 - 5. Testing Submittal
 - 6. Tools, Supplies and Spare Parts
 - 7. Site Installation/Startup Plan
 - 8. Final Operation and Maintenance Manuals
- E. Process Field Instrumentation Submittal
 - This submittal shall provide complete documentation of all field instruments and other instrument and control equipment not specified to be submitted elsewhere.
 - a) Provide data sheets for each component listing all model numbers, optional and ancillary devices that are being provided.

The data sheets shall be provided with an index and proper identification and cross referencing. They shall in clude but not be limited to the following information:

- 1) Plant Equipment Number and ISA tag number per the Loop Diagrams.
- Product (item) name used herein and on the Contract Drawings.
- 3) Manufacturers complete model number.
- 4) Location of the device.
- 5) Input output characteristics.
- 6) Range, size and graduations.

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- Physical size with dimensions, enclosure NEMA classification and mounting details.
- Materials of c onstruction of all components.
- 9) Instrument or c ontrol device s izing calculations where applicable.
- Certified calibration data on all flow metering devices.
- b) Provide equipment specification sheets which shall fully describe the device including the intended function, how it operates and it s physical envi ronmental and performance characteristic s. Each data sheet shall have appropriate cross references to loop or equipment identification tags. As a minimum the specification s heets shall in clude the following:
 - 1) Dimension, rigid clearances.
 - 2) Mounting or installation details.
 - 3) Connection.
 - 4) Electrical power or air requirements.
 - 5) Materials of construction.
 - 6) Environmental characteristics.
 - 7) Performance characteristics.
- c) The submittal shall also contain all planning information, site preparation instructions, grounding and bonding procedures, cabling diagrams, plug identifications, safety precautions or guards and equipment layouts in order to enable the Contractor to proceed with the detailed site preparation for all equipment.
- F. SCADA System Control Panel and Modifications Submittal
 - 1. This submittal shall provide com plete documentation of the proposed hardware

(control panels, PLCs, peripherals, etc.)
including:

a) A complete system block diagram(s) showing in schematic fo rm, the interco nnections between major hardware components such as: control centers, panels, power supplies, consoles, computer and peripheral devices, telemetry equipment, local digital processors and like equipment. The block diagram shall reflect th e total integration of all digital devices in the system and shall reflect any man/machine interface locations. All components shall be clearly ide ntified with a ppropriate cross references to the location of each.

The diagram shall refe rence all interconnecting cabling requirements for digital components of the system including any data communication links.

b) Data sheets for each hardware component, listing all m odel numbers, optional, auxiliary and ancillary devices that are being provided.

The data sheets shall be provided with an index and proper identification and cross referencing. They shall includ e but not be limited to the following information:

- Equipment Number and ISA tag number per the Lo op Diagrams (as applicable).
- Product (item) name used herein and on the Contract Drawings.
- 3) Manufacturers complete model number.
- 4) Location of the device.
- 5) Input output characteristics.
- 6) Range, size and graduations.
- Physical size with dimensions, enclosure NEMA classification and mounting details.
- Materials of c onstruction of all components.

- Power supply device sizing calculations where applicable.
- c) Equipment specification sheets shall fully describe the device, the intended function, how it operates and its physical environmental and performance characteristics. Each data sheet shall have appropriate cross references to loop or equipment identification tags. As a minimum the sp ecification she ets shall include the following:
 - 1) Dimensions and working clearances.
 - 2) Mounting or installation details.
 - 3) Connection diagrams.
 - Electrical power requirements (volts, amps).
 - 5) Materials of construction.
 - 6) Environmental characteristics.
 - 7) Performance characteristics.
- d) Provide detailed loop diagrams on a single 11-in x 17-in or 8.5-In x 11-in sheet for each monitoring or control loop. The loop diagram shall show all analog, digital and discrete components of the loop, including all relays, swit ches, dropping r esistors, etc. which are being provided for proper operation. Loop numbers used shall correspond to the loop numbers indicated in the Contract Documents. The format shall be the International Society of Automation, Stan dard for Instru ment Loop Diagrams, ISA -S5.4 plus the following requirements:
 - On each diagram, present a tabular summary of (1) the output capability of the transmit ting instrument, (2) the input impedance of each receiving instrument, (3) an estimate of the loop wiring impedance based on wire sizes and appro ximate length u sed, (4) the total loop impedance, (5) reserve output capacity.

- 2) Show all interconnecting wiring between equipment, panels, terminal junction boxes and field m ounted components. The diagrams shall show all components and panel te rminal board identification numbers and all wire numbers. This diagram shall include all intermediate terminations between field elements and p anels (e.g. terminal junction boxes). The diagrams sh all be coordinated with the electrical contractor and shall bear his mark showing this has been done.
- 3) Show location of all devices.
- 4) Show instrument description including type, manufacturer, model number, range, set points and operation (e.g. fail open, ope n on energizat ion, normally closed, etc.) as applicable.
- 5) Show all instrument loop power or instrument air requirements back to termination on terminal bloc k or bulkhead, fuse b lock (including fuse size), etc., as applicable.
- e) Provide detailed drawings covering control panel consoles and/or enclos ures which shall include:
 - Cabinet assembly and layout dra wings to scale. These shall include both front, rear (wh ere applicable) and interior layouts.
 - Material, fabrication and painting specifications.
 - 3) Color selection samples for selection by the Engineer.
 - 4) Where graphic display panels are required, submit detailed layou t to scale, includin g symbols and line widths, as well as color selection samples and det ails of fabrica tion. Half-scale layout will be acceptable.
 - 5) Panel wiring d iagrams showing all power connections to equipment within and on the panel, combined panel power draw requirements (volts,

amps), breaker sizes, fuse sizes and grounding. This wiring diagram shall be in ladder format and shall reference the appropriate loop drawing for cont inuations or det ails where required. Show all wire numbers and terminal block designations.

- f) The SCADA submittal shall also contain all planning information, site preparation instructions, grounding and bonding procedures, cabling diagrams, plug identifications, safety precautions or guards, and equipment layouts in order to enable the Contractor to proceed with the detailed site preparation for all equipment.
- G. Training Submittals
 - 1. Training Plan Submittal: The training plan shall include:
 - a) Definitions of each course with necessary pre-requisites.
 - b) Specific course attendance.
 - c) Schedule of tr aining courses including dates, duration and locations of each class.
 - d) Résumés of the instructors who will actually conduct the training.
- H. Testing Submittals
 - Three levels of system testing shall be required: Unwitnessed Factory Testing, Operational Readiness Testing and Performance Acceptance Testing.
 - Test plans shall be submitted only after all hardware submittals have been approved by the Owner and/or Engineer.
 - 3. The test plan shall demonstrate that the CSI has designed and configured a system that meets the design specifications. The documents for the test plan shall be

structured so that the Owner understands what the inputs are, wha t the predicted outputs should be, and what the actual outputs are. The test plan should have sign-off and date block for the CSI, the Contractor and the Owner.

- 4. The complete test plan should include but not be limited to the following:
 - a) Test assumptions and methods
 - b) Test Equipment List
 - c) Test Personnel Staffing and Qualifications
 - d) Test Schedule with time allotted for each task
 - e) System hardware and software summary.
 - f) Communications test to the various PLCs for Discrete and Analog I/O data transfer.
 - g) One hundred percent (100%) I/O point test including all spare points based upon the previously submitted System I/O list.
 - h) Functional and Control strategy tests.
- 5. Test Procedures: Submit the procedures proposed to be followed during the test. Procedures shall include test descriptions, forms and checklists to be used to control and document the required tests. Testing may not be started until all Testing Submittals have been approved.
- Test Documentation: Submit a copy of the signed off test procedures upon completion of each required test.
- I. Tools, Supplies and Spare Parts Lists Submittal
 - This submittal shall include a list of all required and recommended spares. The following information shall be provided in table format:
 - a) Specification Section
 - b) Tagname
 - c) Description
 - d) Quantity

- e) Manufacturer
- f) Model, part, order number
- g) Local distributor and manufacturer contact information. C ontact informati on shall include address, phone number and website.
- J. Operation and Maintenance Manuals
 - Prior to i nstallation of any equipme nt onsite, preliminary O&M m anuals shall ha ve been submitted and approved. No installation of equipment shall be permitted without the Contractor maintaining an updated version of these preliminary O&M manuals onsite for the Owner's and Engineer's use.
 - 2. After all field changes or corrections made during installation and field check out have been completed, all sys tem sup plier documentation, i ncluding dra wings, shall be revised to r eflect t he "a s instal led, corrected and accepted" c ondition of the system and final record copies of O&M manuals for the system shall be provided to the Owner and Engineer for approval.
 - Final system documentation shall be provided 3. in 3 -hole type binders of archi val quality (e.g. slant D or ellipti cal bin ding, vin yl with metal hinge or extra heavy weight vinyl, etc.) with a b inding no lar ger than 3'' . Materials shall be printed on 8.5" x 11" or 11" x 17" tear resistant paper or ring reinforced paper where tear resistant is not available. D rawings shall be either folded to fit within an $8.5'' \times 11''$ binder or in a n 11" x 17" 3 -hole binder. Each binder shall include fifteen percent (15%) spare space for addition o f future mate rial. the Tear resistant paper shall be Xerox Never Tear or equal.
 - 4. Where electronic documentation is available, either by purchase through the manufacture or via Internet download, it shall be organized and provided on CD. All CA D drawings and word processing documents prepared by the CS I or one of their sub contractors shall be organized and provided on CD. Electron ic

documentation f ormats s hall be Adobe PDF, AutoCAD, Microsoft Office documents, HTML, or as approved by the Engineer or Owner.

- 5. All ele ctronic media (i.e. softwa re, electronic do cumentation, config uration files/reports, device backups, etc.) shall be provided wit h t wo (2) bac kup copies, each organized i nto a separ ate b inder. Med ia storage bin ders shall i nclude but not be limited to the following:
 - a) Table of contents
 - b) Archival me dia holder s (e. g. CD, DV D, floppy, tape disk, etc.)
 - c) Support con tacts (i.e. c ompany, phone , internet link, etc.)
 - d) Software sy stem requ irements and installation instructions
- 6. Laminated water/tear resistant copies of all applicable instrumentation and control system drawings shall be supplied in drawing pocket of each cont rol enclos ure after "as installed, corrected, and accepted" revisions have been made to the enclosure.
- 7. Operation a nd Maint enance manuals sha ll include but not be limited to the following:
 - a) Manufacturer standard O &M manuals for a ll equipment and software furnished.
 - b) Custom O&M inf ormation d escribing t he specific conf iguration o f equip ment an d software, and the operation and maintenance requirements for this particular project.
 - c) The manu als shall con tain al l illustrations, d etailed draw ings, wirin g diagrams and in structions necessary fo r installing, ope rating and maintaining the equipment.
 - d) All modifications to manufa cturer standard equipment and /or compone nts shall be clearly ident ified and show n on the drawings and schematics. All information contained therein shall app ly specifically to the equ ipment furnished and s hall only include instructions that are applicable.
- e) A functi onal d escription of t he entire system, with re ferences to dra wings an d instructions.
- f) A complete "as built" set of all approved shop drawings, which shall reflect all work required to achieve f inal syst em acceptance.
- g) A complete list of the equipment supplied, including ser ial numbers , ra nges and pertinent data.
- h) Full specifications on each item.
- i) Detailed service, maintenance and operation instructions for each item supplied.
- j) Special maintenance requirements particular to this system shall be clearly defined, along wit h spec ial calib ration and test procedures.
- k) Complete parts lists with stock numbers and name, address and telephone number of the local supplier.
- 1) References to manufa cturers' standa rd literature where applicable.
- m) Warning notes shall be located throughout the manual where such notes are required to prevent accidents or inadvertent misuse of equipment.
- n) The o perating instructions shall clearly describe the s tep by step pr ocedures that must be followed to implement all phases of all oper ating m odes. The instructions shall be in terms understandable and usable by oper ating p ersonnel an d m aintenance crews and shall be useful in the training of such personnel.
- o) The maintenance instructions shall describe the det ailed p reventive a nd corrective procedures required , includin g environmental requirements during equipment storage and sy stem operation, to keep the System in go od operating condition. Al l hardware mai ntenance doc umentation shal l make reference to appropriate diagnostics, where applicable, and all ne cessary wiring diagrams, com ponent draw ings and PCB schematic drawings shall be included.

1.06 MEETINGS:

- A. The Contractor shall be required to give the Owner, the En gineer and their representatives, at least three (3) we eks notic e pri or to any s cheduled meetings. The notice may be shortened with Owner's and Engineer's consent.
- Β. Preliminary Des ign Revi ew Me eting: A preliminary design review meeting shall be conducted by the Contractor for the Owner and E ngineer, to ens ure design complian ce, installatio n strategies and proper coordination between responsible subcontractors related to the I CS. The Contra ctor shall be responsible for arranging the on -site meeting no later than sixty (60) days after noti ce The Contractor shall arrange to proceed. for detailed meeting minutes to be recorded, approved and distributed to meeting attendees. Two (2) weeks prior to the meeting the Contractor shall submit the following for approval:
 - A proposed list of meeting attendees including organization and phone number.
 - 2. A proposed meeting agenda.
 - A list of personnel to be involved in the project including their responsibilities, qualifications and phone numbers.
 - 4. An overall system description.
 - 5. An overall system block diagram.
 - 6. A description of all numbering, lettering, color and format conventions that will be used including examples of loop drawings, interconnection diagrams, schematic diagrams, documentation table of contents, etc.
 - 7. A project schedule and implementation plan that coordinates the ICS installation with the installation of the entire site project.
- C. Preliminary Site Testing Meeting: A preliminary site testing meeting shall be conducted by the Contractor for the Owner and Engineer, to ensure site readiness, te sting strateg ies and pr oper coordination between parties related or involved in testing the I CS. The Con tractor shall be responsible for arranging the on -site meeting after

the Site Testing Plan has bee n approved and no earlier than three (3) weeks prior to testing. The Engineer must be satisfied that the site is re ady and that the t esting will be performed to their satisfaction prior to any documented ICS testing being performed. The Contractor shall arrange for detailed meeting minutes to be recorded, approved and distributed to meeting attendees. Additional meetings may be required at the discretion of the Owner and Engineer to resolve specific action items not add ressed in the preliminary site testing meeting. Two (2) weeks prior to the meeting the Contractor shall submit the following for approval:

- 1. A proposed list of meeting attendees including organization and phone number.
- 2. A proposed meeting agenda.
- 3. A list of personnel to be involved in the testing including their responsibilities, qualifications and phone numbers.
- 4. A list of t asks requiring Owner, Engineer or outside party involvement in testing.
- 5. A testing schedule that coordinates the ICS testing with the operability of the specific equipment being tested.
- D. Additional meetings may be required at the discretion of t he Owner and En gineer, to reso lve specific action items not addressed in the preliminary design review or preliminary site testing meeting.

1.07 CONTROL SYSTEM INTEGRATOR:

- A. The Control System Integrator shall be regul arly engaged in the deta iled de sign, fabrication, installation and startup of i nstrumentation and control systems for water and wastewater treatment facilities in the state of Florida. Any CSI that has been subject to litigat ion or the asses sment of liquidated damages for nonperformance on any project within the last five (5) calendar years shall not be acceptable.
- B. Where specific manufacturers and/or models of ma jor hardware or software products (PLC, software, network equipment, wireless equipment, etc.) are specified to be used on this project, the CSI shall have completed

at leas t one (1) pro ject using that spe cified hardware or sof tware. As us ed herein, the term "completed" sh all mean that a project has b een brought to final completion and final payment has been made.

- C. Control System Integrators shall meet the fol lowing minimum qualifications:
 - A minimum of seven (7) years experience with at least five (5) years in water / wastewater projects
 - References for three (3) com pleted projects of like size and application to the project specified herein
 - 3. Project bondi ng capacity of two milli on dollars (\$2,000,000)
 - 4. UL 508 certified control panel manufacturing shop
 - 5. On sta ff li censed p rofessional eng ineer registered in the s tate of Florida, i f required to perf orm engin eering services as specified to implement this project.
- D. The listing of a cceptable Control System Integrators in this specification in no way relieves the Control System Integrator from meeting the qu alifications specified herein. A cceptable Cont rol Sys tem Integrators shall be as follows:
 - 1. Revere C ontrol Systems: 2240 Rocky Rid ge
 Road, Bir mingham, AL, 35216; (205) 824 0004; www.reverecontrol.com
 - 2. Curry Con trols Company: 1019 Pipkin Roa d, Lakeland, FL 33811, (863) 646-5781; www.currycontrols.com
 - 3. DCR Engineering: 502 CR 640 E.; Mulberry, FL 33860, (863) 428-8080; www.dcreng.com
 - 4. Rocha Controls: 5025 Rio Vista Ave; Tampa, Florida 33634; (813) 628 -5584; www.rochacontrols.com
- E. The Owner shall have the right of access to the CSI's facilities and the facilities of their equip ment suppliers to inspect materials and parts, to witness inspections, tes ts and wor k in progres s, and to examine ap plicable de sign do cuments, records a nd 13300-20

certifications during a ny s tage of d esign, fabrication and tests. The CSI and their equipment suppliers shall furnish office space, supplies and services required for these surveillance activities.

1.08 QUALITY ASSURANCE:

- A. The listing of specific produc ts in thi s specification in no way re lieves the Co ntractor of furnishing equipment which shall meet the performance and quality criteria specified herein.
- B. All equipment and materials shall be new and the products of reputable recognized suppliers having adequate experience in the man ufacture of the se particular items.
- C. For uniformity, only one (1) ma nufacturer will be accepted for each type of product.
- D. All equi pment s hall be de signed for the se rvice intended a nd sh all be of rugged construction, o f ample strength for all stresses that may occur during fabrication, transportation and erection as well as during cont inuous or intermittent oper ation. Equipment shall be a dequately staye d, braced and anchored an d sh all be i nstalled in a ne at a nd workmanlike manner. A ppearance and safety, as well as utili ty, sh all be give n consideration in the design of details.
- E. All com ponents and dev ices installed s hall be standard items of industrial grade, unless otherwise noted, whi ch s hall b e of sturdy and d urable construction and be suitable for long, trouble free service.
- F. Electronic e quipment sha ll be suitabl e for the specified environmental conditions.
- G. Optional or sub stituted equipment or both req uiring changes in details or dimensions required to maintain all stru ctural, mechani cal, electrical, c ontrol, operating, mai ntenance or design fea tures incorporated in these sp ecifications and dra wings, shall be made at no additional cost to the Owner. In the even t tha t the chan ges are neces sary, calculations an d drawin gs sho wing the proposed revisions sh all be submit ted for appr oval. The Contractor shall coordinate all change s with other

affected trades and contracts and pay all additional charges incurred.

1.09 DEFINITIONS AND ABREVIATIONS:

A. The following definitions and abbreviations are used throughout th e specific ations and drawin gs when referring to ins trumentation and control eq uipment, functions, and service. Defin itions an d abbreviations are not listed for those used in common industry practice except where to provide explicit meaning. Re fer to ISA, IEEE, and oth er in dustry standard references for those not listed herein.

CSI	Control System Integrator		
ICS	Instrumentation and Control System		
OITTIO	Operator Interface Terminal		
HMI	Human-Machine Interface		
OWS	Operator WorkStation		
PID	Proportional-Integral-Derivative Control		
SCADA	Supervisory Co ntrol an d Da ta Acquisition		
SSP	SCADA System Programmer		
TVSS Transient Voltage Surge Suppression			
RTU	Remote Telemetry Unit		
PLC	Programmable Logic Controller		

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS:

- A. All ma terials, equipment and devices shall, as a minimum, m eet t he requirements of U L, where UL Standards are established for those items, and the requirements of NFPA-70. All it ems shall have t he U.L. seal where possible and all control panels shall be U.L. lab eled. All i tems shall be new unless specified or indicated otherwise.
- B. Properly s tore, adeq uately pr otect and carefully handle equ ipment and materials to p revent d amage before and during installation. Handle, store and protect equi pment and mat erials in accor dance with the m anufacturer's re commendations. Replace all damaged or defective items.

- C. All equipment shall be the latest and proven design. Specifications and drawings call attention to certain features, but do not purport to cover all details entering into design of the instrumentation system. The com pleted system shall b e compa tible w ith functions required and the equipment furnished by the Contractor.
- D. All electrical components of the system shall operate on 120 volt, single phase, 60 Hz power source, except as otherwise noted in the Specifications. Drawings and Specifications indicate the energy sources that will be provided. An y other devices necessary to obtain proper operation of the instrumentation and control system from these en ergy sources shall be furnished with the system.
- E. All nece ssary f uses or sw itches required by the instrumentation manufacturer for his equipment shall be provided with the equipment. All instruments requiring internal power supply shall have internal on-off switches.
- F. The mecha nical, process an d electr ical dr awings indicate the approximate loc ations of fi eld instruments, control panels, systems and equipment as well as field mounted equipment provided by others. The instrumentation subcontractor shall exa mine the mechanical, pro cess and electrical dr awings to determine ac tual size and lo cations o f proc ess connections and wirin g requir ements fo r instrumentation and con trols fu rnished und er t his CSI shall i nspect all e guipment, Contract. The panels, ins trumentation, controls and ap purtenances either existing or furnished under other Divisions of the Specifications to determine all requirements to interface same with the IC S. The Contractor shall completion of coordinate the any requi red modifications with the associated sup plier of the item furnished.
- G. Instrumentation equipment a nd e nclosures s hall be suitable for ambient conditions specified. All system elements shall operate properly in the p resence of telephone lin es, power line s and electri cal equipment.
- H. Inside co ntrol room s an d clim ate-controlled electrical rooms, the temperature will normally be 20 to 25 °C; relative humidity forty to eighty percent

(40% - 80%) without condensation and the air will be essentially fre e of corr osive contami nants an d moisture. Ap propriate air f iltering sh all be provided to meet environmental conditions (i.e., for dust).

- I. Other indoor areas may not be air conditioned/heated; temperatures may range bet ween 0 and 40 °C wit h relative humi dity between f orty and ninet y-five percent (40% - 95%).
- J. Field equipment, including i nstrumentation and panels, may be subjected to wind, rain, lightning, and corro sives in the envir onment, with am bient temperatures from -20 to 40 °C and relative humidity from ten to one hundred percent (10% - 100%). All supports, brackets and interconnecting hardware shall be aluminum, 316 stainless steel, or as shown on the installation detail drawings.
- K. All software licenses and support contracts shall be registered to Manatee Coun ty. The partic ular contact person and address shall be coordinated with the Owner prior to purchasing of any equipment or software

2.02 TOOLS, SUPPLIES, AND SPARE PARTS:

- A. Provide sp ecial tools, o ther than t hose nor mally found in an electronic technician's toolbox, required to test, diagnose, calibrate, install, wire, connect, disconnect, as semble and disassemble any digi tal equipment, i nstrument, pane 1, rack, ca binet or console mounted equipment for service and maintenance (i.e. connector pin insertion and removal tools, wire crimping t ool, special wr enches, special in strument calibrators, indicator lamp insertion and remo val tools, etc.).
- B. Provide tools and test equipment together with items such as instruction manuals, carrying/storage cases, unit battery charger where applicable, special tools, calibration fixtures, cord extenders, patch cords and test leads, which are not specified but are necessary for che cking field operation of equipment supplied under this Section.
- C. The C SI s hall provide su pplies as n eeded or as required by the Owner during the specified warranty period. All f uses consumed d uring inst allation,

testing, st artup, the system ava ilability demonstration, a nd the warra nty period shal 1 be replaced by the Contractor.

- D. Provide s pare parts for items of ICS equipment as recommended by the manufacturer and in accordance with the Contract Documents.
- E. Furnish all spa res in mois ture-proof boxes designed to provid e ampl e protect ion for their cont ents. Label all boxes to cle arly ide ntify contents and purpose.
- F. Refer to indiv idual pr oduct specif ications for additional requirements specific to those devices.

2.03 SIGNAL TRANSMISSION:

- A. The Contractor shall be responsible for providing a signal tr ansmission syste m fre e from elec trical interference that would be de trimental to the proper functioning of the ICS equipment.
- B. The Contractor shall be responsible for coordinating signal types and transmission requirements between the various parties providing equipment under this Contract. This shall include, but not be limited to, distribution of appropriate shop drawings among the equipment suppliers, the electrical subcontractor, the HVAC subcontractor and the CSI.
- The CSI sh all provide 24 VDC power sup plies for С. signals and ins truments wher e applic able and as required inside control panels, etc. Where two-wire instruments transmit directly to the instrumentation and cont rol sy stem, the C SI s hall pro vide p ower supplies at the PLC-equipped control panels for those instruments. Where four-wire in struments with onboard loop power supplies transmit directly to the instrumentation and control system, the CS I shall provide necessary signal isolators or shall otherwise isolate the input from the ICS loop power supply. Similar provisions shall be made when a third element such as a rec order, in dicator or single lo op controller with integr al loo p power s upply is included in the loop.
- D. Analog s ignal transm ission be tween el ectric or electronic inst ruments, controllers, and a ll equipment and control devices shall be ind ividually

isolated, linear 4-20 mA and shall operate at 24 VDC. Signal output from all transmitters and controllers shall be current regulated and shall not be affected by chang es in load resistance within the unit's rating. All cable shields shall be grounded at one end only, at the control panel, with terminals bonded to the panel ground bus. A nalog signal iso lation and/or conversion shall be provided where necessary to interface with i nstrumentation, equipment controls, panels and appurtenances.

- E. Non-standard a nalog transmission systems such as pulse duration, pulse ra te a nd volt age regu lated shall not be permitted e xcept where sp ecifically noted in the Contract Documents. Where tran smitters with n on-standard outp uts d o oc cur, t heir outputs shall be c onverted to an i solated, linear, 4-20 mA signal prior to transmission to other devices.
- F. All di screte in puts to equ ipment and PLC's, f rom field devices, starters, panels, etc., shall be dry contacts in t he field d evice or equipment, powered from the PLCs, unless specified otherwise. S ensing power (wetting voltage) supplied by the PLC shall be 120 VAC.
- G. All discrete outputs from local control panels and Instrumentation and Control System PL Cs to field devices, starters, panels, etc., shall be 120 VAC / 28 VDC 5A dry contacts. Output contacts may be powered from the field equipment or powered from 24 VDC / 120 VAC sourced from PLCs cabinet power system, as required to interfa ce with field equipment. Outputs to solenoid valves, horns, and strobe lights shall be 120 VAC, powered from the PLC or control panel unless specified or shown otherwise.
- H. Discrete signals between starters, panels, etc. where 120 VAC is u tilized shall be cle arly identified in the starter, pan el, etc. as b eing powe red f rom a different powe r supply, than other star ter/panel components. Where applicable, warning signs shall be affixed inside the starter, panel, etc., stating that the panel is energized from multiple sources. Output contacts i n t he star ter, pan el, etc. wh ich are powered from other locations shall be provided with special ta gs a nd/or c olor cod ing. Disconnecting terminal strips shall be provided for such c ontacts. The above requirements shall apply to al 1 starters and panels, regardless of supplier.

2.04 NAMEPLATES:

- All item s of e quipment lis ted in the inst Α. rument schedule, con trol panels and al l items of digi tal hardware shall be identified with nameplates. Each nameplate shall be located so that it is readable from the normal observation position and is clearly associated with the device or devices it identifies. Nameplates shall be positioned so that removal of the device for maintenance and repair shall not disturb the na meplate. Namep lates shall include the equipment id entification num ber and desc ription. Abbreviations of the description shall be subject to the Engineer's approval.
- B. Control panel nameplates shall be made of 1/16-inch thick m achine e ngraved lam inated pheno lic plastic having white numbers and letters not less than 3/16inch high on a black background.
- C. Field mo unted namepl ates s hall be engrav ed 316 stainless steel, 22 gauge minimum thickness.
- D. Nameplates shall be atta ched to metal e quipment by stainless steel screws and to ot her surfaces by an epoxy based adhesive that is resistant to oil and moisture. In cases where the label cannot be attached by the above me thods, it shall be d rilled and a ttached to the associated device by means of stainless steel wire.

PART 3 EXECUTION

3.01 INSTALLATION:

- A. The CSI shall provide the Contractor a periodic written report detailing progress of startup. T his report shall include specific tabulations of devices on which startup has been completed.
- B. Equipment shall be located so that it is accessible for operation and maintenance. The CSI s hall examine the Contract Drawings and Shop Drawings for various items of equipment in order to determine the best arrangement for the work as a whole, and shall supervise the installation of ICS equipment.
- C. Instrumentation and Control System equipment shall be installed in accordance with the manufacturer's

instructions. The locations of equipme nt, transmitters, alarms and similar devices shown on the Drawings are approximate only. Exact locations shall be as approved by th e Engineer dur ing construction. Obtain in the field, all information relevant to the placing of process control work, and in case of any interference with other work, proceed as directed by the Engineer and furnish all la bor and materials necessary to complete the work in an approved manner.

- D. The CSI shall investigate each space in the building through which equipment must pass to reach its final location. If necessary, the CSI shall be required to ship his mater ial in section s sized to pe rmit passing through restricted areas in the bui lding. The CSI shall al so investigate, and make any fie ld modifications to, the allocated space for each cabinet, enclosure and panel, to assure proper space and access (front, rear, side).
- E. Two (2) complete sets of approved shop drawings shall be kept at t he job site during all on -site construction. Both sets shall be identically marked up to reflect any modifications made during field installation or startup. All markings shall be verified and i nitialed by th e Engineer or his designated representative. Fo llowing completion of installation and the operational readiness test, one (1) set of the marked up drawings shall be provided to the Engineer, the other retai ned by the CSI for incorporation of the mark -ups into final as -built documentation.
- F. All work shal 1 be in strict ac cordance with co des and local rulings. Should any work be performed contrary to said rulings, ordinances and regulations, the CSI shall bear full responsibility for such violat ions and assume all costs aris ing there from.
- G. Brackets and hang ers required for mounting of equipment shall be provided. They shall be installed in a workmanlike manner and not interfere with any other equipment.
- H. The Contractor shall take steps to keep e lectrical and control enclosures clean and free of contaminants throughout installation. Cleaning after installation only is not acceptable. Under no circumstances are electrical and control enclosures to be cleaned using

compressed air to blow out dust, causing contaminants to be forced into sensitive electronics.

- I. Provisions s hall be made to completely c apture filings (metal, etc.) when drilling into enclosures, to prevent contamination of electrical equipment.
- J. Upon completion of the in strumentation and control work, the Contractor shall the roughly clean all soiled surfaces of installed equipment and materials and remove all surplus materials, rubbish and debris that has accumulated during the construction work. The entire a rea shall be left neat, clean and acceptable to the Owner.

3.02 WIRING AND GROUNDING:

- A. The following wiring practice guidelines shall be used in order to minimize ground loops, to minimize electromagnetic interf erence/radio fre quency interference (EMI/RFI) to this equip ment, and to provide maxi mum practic alimm unity from dam age resulting from lightning-induced transients.
- B. Common wir es or condu ctors sha ll not be u tilized (either with in panels or e xternal to panel s or for grounding of fi eld de vices) for sign al sh ield o r signal grounding, and for safety grounds.
- C. Exposed wire le ngths extending from within shielded signal cables shall be minimized to reduce pick-up of EMI/RFI by signal circuits. Exposed lengths of less than one i nch are preferred, and a maximum e xposed length of t wo inche s may be per mitted w here necessary. No splicing of signal wires is permitted.
- D. All si gnal wiring shall be shielded, both within panels and external to panels. Unles s otherwise specified, all signal wiring shall be No . 16 AWG stranded tinned two-conductor twisted pair, with one hundred percent (100%) coverage aluminized Mylar or aluminized polyester shield and tinned copper drain wire.
- E. Signal wiring within outdoor or indoor field device enclosures shall conform to the same requirements as panel wiring.
- F. The sh ield on each p rocess i nstrumentation cable shall be continuous from source to destination, and

grounded at one end only. In general, grounding of signal cable shields shall be done at the control panel end. The signal cab le for no signa 1 shall share a common cable shield grounding wire with the signal cable shield for any other signal, and shall not share a c ommon gro unding wire with any o ther circuit. The length of no signal cable s hield grounding wire shall not exceed two (2) inches, with less than one (1) inch maximum length preferred.

G. All out door instruments and a ll outdoor enclosures shall be g rounded using t he p ractice defi ned in Section 800.40 of the National Electric Code.

3.03 TESTING, GENERAL REQUIREMENTS:

- A. The CSI shall test all equ ipment hardware and software at the factory prior to shipment. Unless otherwise specified in the individual specification sections, all equipment provided by the CSI shall be tested at the factory as a single fully integrated system.
- B. As a minimum, testing shall include the following:
 - 1. Operational Readiness Testing (ORT).
 - 2. System Acceptance Testing (SAT).
- C. Each test shall be in the cause and effect form at. The person cond ucting the test shall initiate an input (cause) and, upon the system's or subsystem's producing the correct result (effect), the specific test requirement will have been satisfied.
- D. All tests shall be conducted in accordance with prior Engineer approved procedures, forms and checklists. Each specific test to be performed shall be described and a space provided after it for sign off by the appropriate party afte r its satisfactory completion.
- E. Copies of these sign off test procedures, forms and checklists will constitute the required test documentation.
- F. Provide all special testing materials and equipment. Wherever possible, perform tests using actual process variables, equipment and data. Where it is not practical to test with real process variables, equipment and data, provide suitable means of

simulation. Define these simulations techniques in the test procedures.

- G. The Contractor s hall require the CSI to coordin ate all of his testing with all affected Subcontractors and the Owner.
- H. The Engineer res erves the right to test or ret est all specified functions whether or not explicitly stated in the prior approved test procedures.
- I. The Engineer's decision shall be final regarding the acceptability and completeness of all testing.
- J. The CSI shall f urnish the servi ces of technicia ns, all special calibration and test equipment, and labor to perform the field tests.

3.04 OPERATIONAL READINESS TESTING (ORT):

- A. The entire system shall be certified (inspected, calibrated, tested and documented) that it is re ady for operation. Each specified function shal 1 be verified on a p aragraph by paragraph and loop by loop basis.
- B. The Engineer, or his designated representative(s), reserves the right to witness any test, inspection, calibration or startup activity. Acceptance by the Engineer of any plan, report or documentation relating to any testing or commissioning activity specified herein, shall not relieve the Contractor of his responsibility f or meeting all specified requirements.
- С. provide the services of fa ctory The CSI shall trained technicians, tools and equipment to field calibrate, test, inspect and adjust each instrument to its specified performance requirement in accordance with manufactu rer's specifications and instructions. Any instrument which fails to meet any contract requirements, or any published manufacturer performance specification for functional and operational parameters, shall be repaired or replaced, at the discretion of the Engineer, at no cost to the Owne r. The Contract or shall bear all costs and provide all personnel, equipment and materials necessary to implement all installation tests and inspection activities for equipment specified herein.

- D. Each instrument shall be calibrated at zero, twentyfive, fifty, seventy -five and one hundred percent (0%, 25%, 50%, 75% and 100%) o f span using te st instruments to simulate inputs and read outputs. Test instruments shall be rated to an accuracy of at least five (5) times greater th an the specified accuracy of the instrument being calibrated. Where applicable, such test instruments shall have accuracies as set forth by the National Institute for Standards and Technology (NIST).
- The CSI shall provide a written calibration sheet to Ε. the Engineer for each instrument, certifying that it has been calibrated to its published specified accuracy. The Contractor shall submit proposed calibration sheets for various types of instruments for Engineer a pproval prior to the start of This sheet shall calibration. include but not be limited to date, instrument tag numbers, calibration data for the various procedures described herein, name of person performing the calibration, a listing of the published specified accuracy, permissible tolerance at each point of calibration, calibration reading as finally adjusted within tolerance, defect noted, corrective action required and corrections made.
- F. If doubt exists as to the correct method for calibrating or checking the calibration of an instrument, the man ufacturer's printed recommendations shall be used as an acceptable standard, subject to the approval of the Engineer.
- G. Upon completion of calibration, devices calibrated hereunder shall not be subjected to sudden movements, accelerations or shocks, and sh all be installed in permanent protected positions not subject to moisture, dirt and excessive temperature variations. Cau tion shall be e xercised to prev ent such devices from being subjected to over -voltage, incorrect voltages, overpressure or incorrect ai r. Damaged equipment shall be replaced and recalibrated at no cost to the Owner.
- H. After completion of instrumentation installation and calibration, the CSI shall perf orm a loop chec k. The Contractor shall submit final loop test results with all instruments listed in the loop. Loop test results shall be signed by all representatives involved for each loop test.

- I. Loop/Component Inspections and Tests: The entire system shall be checked for proper installation, calibrated and adjusted on a loop by loop and component by component basis to ensure that it is in conformance with related submittals and the Contract Documents.
 - The Loop/Component Inspections and Tests shall be implemented using Engineer approved forms and check lists.
 - 2. The Contractor shall require the CSI to maintain the Loop Status Reports and Components Calibration sheets at the job-site and make them available to the Engineer/Owner at any time.
 - 3. These inspections and tests do not require witnessing. However, the Engineer will review and initial all L oop Status Sheets and Component Calibration Sheets and spot check their entries periodically and upon completion of the Operational Readiness Tests. Any deficiencies found shall be corrected.

3.05 SYSTEM ACCEPTANCE TEST (SAT):

- A. Successful completion of the ope rational readiness test, as determined by the Engineer, shall be the basis for starting the witnessed system acceptance test. The Eng ineer shall approve the ORT t est results and the Engineer and O wner shall be g iven two (2) weeks' notice prior to the star t of the System Acceptance Test.
- B. The system acce ptance test sha ll repeat loop and functional testing done during the operational readiness test in order to demon strate to the Ow ner and Engineer that the system has been started up, is operating, and is in c ompliance with these Specifications. Each specified function shall be demonstrated on a paragraph by paragraph and loop by loop basis.
- C. The following documentation shall be made available to the Engineer during the test:
 - 1. All Contract Drawings and Specifications, addenda, and change orders.

- 2. Master copy of the test procedure.
- One (1) copy of all O&M Manuals shall be made available to the Engineer at the job-site both before and during testing.
- D. Any malfunction during the tests shall be analy zed and corrections made by the CSI. The Engineer and/or Owner will determine whether any such malfunctions are sufficiently serious to warrant a repeat of this test.
- E. After all functions have been tested and all corrections made, the system shall operate continuously for fifteen (15) days without failure before this test will be considered successful.
- F. The total avai lability of th e system shall be greater than ninety -nine and one -half percent (99.5%) during this test period. Availability shall be defined as " Avail. = (Total Time-Down Time,) / Total Time x 100%". Down times due to power outages or other factors outside the normal protection devices or back -up power supplies provided, shall not contribute to the availability test times above.

3.06 TRAINING:

- A. The CS I s hall provide pr oject speci fic clas sroom training at the Owner's site or designated location. Training s hall be provided for the op eration and maintenance of all equipm ent provided, as we ll as site specific installation configuration training for the system as a whole.
- Β. Each s tudent s hall b e pro vided wit h tra ining materials. All training materials shall be pr ovided in hardcopy as well as on a training CD, with all materials in M icrosoft Offi ce or Adobe P DF f ile format. When a large volume of training materials is to be prov ided (i.e. software documentation, etc.), only ele ctronic copies ne ed t o be provi ded, per Engineer's appr oval. When provid ing training materials as ele ctronic copie s only, the CSI mu st ensure that the training attendees will be a ble to use c omputers duri ng t he training t o a ccess information, whe ther provided by the Own er or n ot. All tra ining C D's sha ll be updated wit h f inal configurations and resubmitted for approval. Fi nal CD media shall be archival quality.

- C. Scheduling for the tra ining sess ions shall be specified by, and at the convenience of, the Owner. The CSI shall coordinate the scheduling, and shall provide written notice of available training dates, with a m inimum of two (2) weeks prior notice. Candidates for training will be selected by the Owner.
- D. Operator training shall be provided to f amiliarize operators with the system as a whole and to instruct on the function and oper ation of each component of the system. Training shall consist of the day-to-day operation of the system and all other operator site specific functions for this project. Instruction shall include a site walk down of installed equipment. Two (2) courses lasting a minimum of two (2) days, with six (6) hours of instruction per day, shall be provided by the CSI.
- E. Maintenance training shall be provided to maintenance personnel so that each c omponent may be ma intained without the assistance of outside organizations. The training shall be extensive so that after training, personnel s hall be able t o identi fy com ponent malfunctions and repair comp onents to the boa rd replacement level. One (1) course lasting a minimum of three (3) days with six (6) hours of instruction per day shall be provided by the CSI.
- F. Under the scope of this project, the CSI will not be responsible for providing PLC and HMI control programming and logic. Specific training should therefore include, but not be limited to the following: system architecture a nd interconnection; wiring; fiber optic systems, including maintenance and repair; f ield panels and equipment; radio systems; and field instrumentation and PLC hardware, including maintenance and troubleshooting.
- G. Refer to rel ated speci fication sectio ns f or additional training requirements.

3.8 WARRANTY:

A. During this warranty period, the CSI shall provide, at no additional cost to the Owner, the services of a trained, competent, field service engineer who shall arrive on site within thirty-six (36) hours of notification by the Owner or Engineer, to re pair and/or replace any faulty device or equipment supplied by the system supplie r as part of t his Instrumentation and Control System.

- B. All preventive and corrective activities shall be documented with service reports, which shall identify the equipment being serviced, state the condition of the equipment, describe all work performed, and list materials us ed. A copy of all service reports shall be delivered to the Owner on or before the next business day.
- C. The CSI shall b e capable of pr oviding, after the warranty period for this system expires, a renewable service contract as specified i n Section 01740 -Warranties and Bonds, whereby a trained, competent field service en gineer shall arr ive on site wit hin thirty-six (36) hours of notification by the Owner. Information relative to charges for such service and availability of service shall be submitted to the Owner and the Engineer.
- D. Components shall be furnished to the manufacturer's standard for service intended, unless otherwise indicated in the Specifications or on the Contr act Drawings.

END OF SECTION

SECTION 13310

INSTRUMENTATION AND CONTROLS, FIELD EQUIPMENT

PART 1 - GENERAL

1.01 THE REQUIREMENT:

- A. The Contractor shall furnish, test, install and place in satisfactory operation all equipment required to provide a comple te and operabl e Instr umentation a nd Contr ol System (ICS) as specified herein and as shown on the Contract Dr awings, even if each needed item is not specifically specified or shown.
- B. The Control System Integrator (CSI) shall provide full onsite supervision of all equipment provided under this section, where installation is provided by others.
- C. Field e quipment (i.e. prim ary elements, mea suring devices, tran smitters, field control lers, char t recorders, ind icators, and oth er ins trumentation and accessories) shall be provided with all components necessary for a fully func tional device whether specifically mentioned in these specifications or not. This shall include, as applicable or recommended by the manufacturer: sample conditioning, sen sors, sens or holder and mounting brackets, transmitter, all required cables, calibration equipment, chemicals, reagents and spare parts.
- D. Specialty c ables betwe en s ensors/probes and thei r electronics/transmitters shall be furni shed with each instrument. Spe cial cables include any type of cable not specified in Division 16 - Electrical.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. In addit ion to the requirements specified in this section, the requirements of specification Section 13300 - Instrumentation and Controls, General Requirements, and the sections referenced therein shall be applied.

1.03 SUBMITTALS:

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and as specified in S ection 133 00 - Instrumentation an d Controls, G eneral Requ irements. In add ition, the following specific submittals items shall be provided:
 - An ISA spe cification sh eet for each inst rument furnished and/or calibrated shall be submitted with the field equipment submittals. The ISA data sheet shall be in accordance with ISA Standards ISA S20 "Specification Forms for Process Meas urement and Control Instruments, Primary Elements, and Control Valves" and ISA TR20.00.01 "Specification Forms for Process Measurement and Control Instruments".
 - 2. The CSI and the field equipment manufacturer shall review the proposed installation and configuration of all fie 1d equipment, pr ior to submittal for approval, and shall identify any condition which shall require corrective measures. The following as a minimum shall be reviewed for the installation configuration of each instrument:
 - a. Listed features
 - b. Material of construction
 - c. Consideration of process fluid
 - d. Environmental conditions
 - e. Installation location
 - f. Process connections
 - g. Ability to perform maintenance
 - 3. Submit in writing in the field equipment submittal, that each piece of equip ment is suitable for the proposed inst allation. Any proposed de viations shall be r eviewed by the En gineer pri or t o execution.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS:

A. Unless oth erwise spe cified, i nstruments sha ll be provided wit h enclos ures t o suit the s pecified environmental conditions. Fi eld-mounted devices shall be rugged and mounted on walls, equipment racks, or pipe stanchions. W here th e fie ld equip ment's in tegral enclosure for a specif ied instrument is not available with the spec ified env ironmental ratin g, the field equipment shall be provided in a control enclosure as specified in Specifi cation Section 13320 -Instrumentation and Controls, Control Enclosures.

- B. Where separate elements and transmitters are required, they shall be fully matched, and unless otherwise noted or shown on the Contract Drawings, installed adjacent or near to the sensor, in a readily accessible location. Special c ables t hat a re required for interconnection between sens ors or probe s and transmitters s hall be furnished w ith the in strumentation de vices by the associated equipment manufacturer. Special cables shall be of the required length for the equipment locations and c onduit ro uting path s sh own o n th e Co ntract Drawings. No splicing of cables will be accepted.
- C. Electronic equipment shall utilize printed circuitry and shall be coated (tropicalized) to prevent contamination by dust, moisture and fungus. Ambient conditions shall be -15 to 50° C and twenty to ninety-five percent (20% -95%) rela tive h umidity, unle ss otherwis e spec ified. Field mounted equipment and system components shall be designed for installation in dusty, humid and corrosive service conditions.
- D. All non-loop-powered instruments and equipment shall be designed to operate on a 60 Hz alternating current power source at a nominal 120 VAC, except where specifically noted. All regulators and power supplies required for compliance with the above shall be p rovided. Where equipment requires voltage regulation, constant voltage transformers shall be supplied.
- E. All analog transmitter and controller outputs shall be isolated, 4-20 mA into a load of 0-750 ohms minimum, unless specifically noted otherwise.
- F. Process taps for primary sensors shall be sized to suit each individual installation and the requirements of the instrument se rved. It is the Contrac tor's responsibility to ensure that the location, supports, orientation and dimensions of the connections and taps for instrumentation furnished under this Division are such as to provide the proper bracing, the required accuracy of measurement, protection of the sensor from accidental dam age, and ac cessibility for mai ntenance

while the plant is in operation. Isolation valves shall be provided at all process taps.

- G. All in strumentation ex posed to sunli ght shal l b e provided with sunshields constructed from 316 stainless steel or epoxy coated a luminum. Sunshield s shall be designed to wit hstand re gional wind and ice loads. Sunshield design shall be submitted for approval.
- H. All outdoor external sample/process piping, including valves and appurtenances, shall be ins ulated with weather-proof in sulation, and h eat-taped to pr event freezing. Heat taping shall be t hermostatically controlled and s elf-regulating, and s hall ad just it s heat output to the temperature of the lines.

2.02 ACCESSORIES:

- A. Instrument tubing shall be 1/ 4 x 0.065 -inch seamless, annealed, ASTM A-269 Type 316L stainless steel with Type 316 - 37° stainless steel flared fittings, or Swagelock or Parker-CPI flareless fittings.
- Diaphragm seals shall be provided to systems as shown on Β. the Contract Drawings, as specified here in and/or for isolation of pressure gauges, switches and transmitters attached to systems containing chemical solutions or corrosive fluids. As a minimum, seals sha ll be of all 316 stainless steel construction. Diaph ragms shall be 316L stainless steel for operating pressures at or above 15 psi, and elastomers for operating pressures below 15 psi. Diaphragm material shall be non-reactive with the process fluid. Refer to the Instrument Schedules for specific materials requirements. Seal shall have fill connection, 1/4-inch NPT valve flush port and capable of disassembly with out lo ss o f f iller fl uid. Where specified, diaphragm seals shall comply with the above requirements, and shall be provided with 316 stainless steel factory f illed capillaries. Sea ls sh all be Helicoid Type 100 HA, Mansfield & Green, Ashcroft, or equal.
- C. Isolating rin g seals sha ll be provided fo r sensin g elements measuring pressure in solids bearing fluids.
- D. For heav y soli ds/slurry ap plications, wher ever th e associated p ressure ins trument is used f or co ntrol purposes, or where shown on the Contract Drawings, the sensor body shall be full line size wafer design, with 316 stainless steel housing and assembly flanges, and

Buna N fle xible cylinder lining for in-line mounting. The wafer shall have through bolt holes or centerline gauge for positive alignment with the associated flanged piping. The captive li quid c hamber and asso ciated instrument(s) shall be furnished with threaded drain tap and plug. Is olating ring seals shall b e RED Valve Series 40, Ronni ngen-Petter Iso-Ring, Moyno RKL Series W, or equal.

- E. For all other solids bearing fluids, pressure shall be sensed via a 1/2" dia meter spool-type iso lating ring seal, mounted on a 1/2" pipe nip ple at 90 degrees from the process piping. An isolat ion ball valve shall be provided between the process piping and the ring seal, and a cleanout ball valve shall be provided between the ring seal and the atmosphere. The pressure instrument shall be back or side mounted to the ring seal such that the gauge or readout may be viewed normally. Isolating ring seals for normal solids service shall be Red Valve Series 42, Ronningen-Petter Iso-Spool, or equal.
- F. Isolation valves shall be 1/2-inch diameter ball valves with 316 stainless steel body, 316 stainless steel ball.

2.03 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS):

A. TVSS shall be supplied for all field equipment power, signal, and communications wires that have any portion extending outside of a building. Refer to Specification Section 13 320 - Instrumentation and Controls, Control Enclosures for requirements.

2.04 PRESSURE GAUGES:

- A. General: Unless otherwise noted or specified, pressure and vacuum gauges shall conform to the following:
- B. Mounting Type: Gauges shall be of the stem -mounting type unless noted otherwise.
- C. Construction: Gauges shall be of the bourdon tube or bellows type with 270 degrees clockwise pointer travel. Dials shall be white face with black numerals. Dial size shall be 4-1/2 inches. Connections for all gauges shall be male 1/2 NPT with square wrench flats. Wetted parts shall be corrosion -resistant to the process fluid shown and unless otherwise specified shall be the manufacturer's best quality standard. The case shall be filled with glycerin and shall be

black phenolic. Accuracy s hall be ± 0 .5 percent of span.

- D. Chemical Seal: Where specified or shown in the drawings, the gauge, with optional locking device, shall be furni shed with a d iaphragm seal. The diaphragm seal shall have a 316 stainless steel (minimum) top and bottom housing and a 316 stainless steel diaphragm welded to the top housing. When the process fluid or pressure is not compatible with 316 stainless steel , the manufacturer shall provide a diaphragm seal compatible with the process fluid. The process connection shall be a 3/4 -inch threaded connection with a flushing connection. The fill fluid shall be glycerin. A locking device shall be included from the factor y on all fluid -filled instruments to prevent inadvertent loosening or removal from the seal.
- E. Where no seal is specified the gauge will be supplied with a pressure limiting snubb er to protect a gainst surges and pulsations.
- F. Manufacturers: The gauges shall be as manufactured by Ashcroft, McDaniels, U.S. Gauge or equal. The diaphragm seals shall be field serviceable for o il filling and as manufactured by Ashcroft, Mansfield and Green, FIT, Ametek or equal.

2.05 GAGE PRESSURE TRANSMITTERS:

- A. Gage pressure transmitters shall be of the capacitance type, with a process isolated diaphragm with silicone oil fill, microprocessor based "smart" electronics, and a field adjustable 30:1 input range.
- B. Span and zero shall be continuously adjustable externally over the entire range. Span and zero adjustments shall be capable of being disabled internally.
- C. Transmitters shall be NEMA 4X weatherproof and corrosion resistant construction with low copper aluminum body and 316 stainless steel process wetted parts.
- D. Accuracy, including nonlinearity, hysteresis, and repeatability errors shall be plus or minus 0.10 percent of calib rated span, zero based. The maximum

zero elevation and maximum zero suppression shall b e adjustable to anywhere within sensor limits.

- E. Output shall be linear isolated 4-20mA 24 VDC. Power supply shall be 24 VDC, two wire design.
- F. Each transmitter shall be furnished with a 4 digit LCD indicator capable of displaying engineering units and/or milliamps, and mounting hardware as required.
- G. Overload capacity shall be rate d at a minimum of 25 MPa. Environmental limits shall be 40 to 85 °C at zero to one hundred percent (0 -100%) relative humidity.
- H. Each transmitter shall have a stainless steel tag with calibration data, attached to body.
- I. The capacitance pressure sensor shall be mechanically, electrically and thermally isolated from the process and the environment, shall include an integral temperature compensation sensor, and shall provide a digital signal to the transmitter's electronics for further processing.
- J. Factory set correction coefficients shall be stored in the sensor's non -volatile memory for correction and linearization of the sensor output in the electronics section.
- K. The electronics section shall correct the digital signal from the sensor, and convert it into a 4 -20 mA analog signal for transmission to receiving devices.
- L. The ele ctronics section shall contain configuration parameters and diagnostic data in non -volatile EEPROM memory, and shall be capable of communicating, via a digital signal superimposed on the 4 -20 mA output signal, with a remote interface device. Output signal damping shall be provided, with an adjustable time constant of 0-36 seconds.
- M. Where scheduled, gage pressure indicating transmitters shall be calibrated in feet of liquid for liquid level service. Ref er to the Co ntract Drawings for installations and applications.
- N. Gage pressure indicating transmitters shall be equal to Rosemount Model 2051CG, Endress + Hauser Cerabar S Series or approved equal.

2.06 LEVEL/FLOW TRANSMITTER, ULTRASONIC TYPE:

- A. Ultrasonic transmitters shall be provided for measurement of tank and wetwell levels or for flow measurement base d on level over a weir or f lume. Equipment shall be provided with features and accessories as described herein, suitable for the application.
- B. Ultrasonic level /flow transmitters shall meet the following specifications as a minimum:
 - 1. NEMA 4X enclosure
 - 2. 120VAC, 60Hz input power
 - Process display with keypad for menu driven configuration
 - 4. One (1) 4-20 mA output
 - 5. One (1) alarm relay output
 - 6. Non-volatile memory
 - 7. Accuracy: 0.25 %
- C. The CSI shall provide all mounting hardware and coordinate the details of the installation so that the instruments are installed in keeping with the best standard and recommended practices of the manufacturer and conforming to the requirements set forth by the Engineer.
- D. Level/flow transmitters shall be fully programmab le and configurable using a key pad. The final 'As-Built' documentation shall be provided with a tabulat ion of the Programming Parameters used in each level/flow transmitter so that the initial calibration can be reproduced if a spare transmitter is installed.
- E. Level/flow transmitters shall be provided with optional integral analog signal isolators, as part of the transmitter assembly. All conduit connections shall be sealed to prevent damage or corrosion due to vapors or wetness.
- F. Ultrasonic Level /Flow Transmitters shall be Siemens Hydroranger 200 with Echomax XPS-15 sensors. Refer to the Instrument ation Schedule Attachment for flange mounting requirements. Tra nsmitters shall be installed using the appropriate transducer, suitable for the range of the installation. The cable provided with the transducer shall be or dered with sufficient

length to provide installation without splicing the cable at any point.

- The CSI shall provide mounting hardware components and G. appropriate mounting assistance to install and secure the transducers in a manner in keeping with the recommendations of the manufacturer of the equipment and in keeping with the general details provide d in All hardware shall be fabricated from the drawings. corrosion resistant materials and shall utilize stainless steel hardware. The mounting system shall be secure and permanent and shall allow easy access to the sensor for servicing. All cables sha ll be installed in su itable rigid co nduit with only short lengths of flex ible conduit al lowed to comple te the installation.
- In cases where the transducer is used to moni tor a Η. water storage tank or other type of location, the CSI shall provide a mounting design and mounting hardware to provide an i nstallation which is appropriat e for the operation of the device and easily mainta ined. For storage tanks, the transducer shall be mounted above the tank or a suitable bracket extending out far enough from the tank sides to receive a strong signal over the entire level range wi thout reflections off the tank sides. The transmitter shal l be mounted outside of the wall at a convenient ground -level working height.
- I. Spare parts: Provide one (1) spare Ultrasonic Level/Flow Transmitter and one (1) spare transducer of each type used (supplied wit h the longest cable utilized in the project).

2.07 LEVEL SWITCH, SUSPENDED FLOAT TYPE:

- A. Float switches shall be of the non-mercury displacement type, encapsulated in polyurethane or vinyl floats.
- B. Units shall be waterproof, shockproof, explosion-proof and equipped with sufficient submersible cable to extend to the control panel or junction box without splicing.
- C. Any required weights shall be provided. Switches shall be suspended on a suitable rack or rail of s tainless steel construction.
- D. Suspended type float switches shall be e qual to Flygt ENM-10, Anchor Scientific Eco-Float or approved equal.

2.08 MAGNETIC FLOW METERS:

- A. Magnetic Flow meters shall consist of a flowmeter with remote signal converter/transmitter that is capable of converting and transmitting a signal from the flow tube. The f low tube shall utilize the charact erized principle of electromagnetic induction and shall produce DC signals directly proportional to the flo w rate
- B. The flowmeter accuracy shall be $\leq \pm 0.5\%$ of reading from 2-100% meter capacity.
- C. The flowmeter shall include but not be limited to the following:
 - 1. NEMA 6P / IP68 accidental submersion enclosure
 - Meter body shall be powder coated aluminum or carbon steel with an epoxy finish
 - 3. Electrical Housing shall be epoxy painted aluminum
 - 4. ANSI Class 150 flanges (minimum)
 - 5. Tefzel or polyurethane liner to suit process requirements
 - 6. Flush type or bullet type (slurry applications) electrodes compatible with process fluid
 - 7. Empty pipe detection
 - 8. SST bolts/nuts, centering device, Teflon gaskets
 - Grounding rings when installed in non -metallic piping. Grounding rings shall be chemically resistant to process, 316SST minimum.
 - 10. The cables for interconnecting the flow tube t o the transmitter shall be furnished by the manufacturer and of sufficient length as to no t require splicing.
- D. The transmitter shall include but not be limited to the following:
 - 1. NEMA 4X enclosure
 - 2. 120VAC, 60Hz input power
 - 3. Process display with keypad for menu driven configuration
 - 4. One (1) 4-20ma output

- 5. HART protocol
- 6. One (1) alarm relay output
- 7. Empty pipe detection
- 8. Lo-flow cutoff
- 9. Damping
- 10. Flow Totalizer
- 11. Non-volatile memory
- Magnetic Flow meters shall include Flow tube and Ε. remote-mounted signal converter/transmitter as provided by Endress + Hauser Promag 53W, Rosemount 8750W, ABB, or approved equal. Size requirements are shown in contract drawings.

2.09 CHECK VALVE LIMIT SWITCH

- General Check valve limit switches shall be provided Α. for all transfer and high service pump c heck valves for providing i ndication of po sitive flow on each pump.
- в. Limit switches shall sense the position of a pump discharge check valve to determine pump flow and operate a SPDT switch to actua te alarms or control circuits. The switch contacts shall be rated for up to 10-ampere maximum load at 120 V AC, 60 Hz. The limit. switch shall con sist of a le ver sensor and operating head. The lever sensor shall be 316 stainless steel or other material suitable for the application.
- С. The lever sensor shall be a roller type or pushpin arm to allow reaction to the movement of the check valve arm and as required based on the specific requirements of the installation. The operating head shall be housed in a NEMA 4 enclosure with an electrical conduit connection.
- D. The switch shall be field adjusted for correct operation. Repeatability of sen sing shall be within 1.0 percent $(\pm 1.0\%)$ of full switch range.
- Ε. Lever type limit switches shall be equal to model 802T type as manufac tured by Allen Bradley or ap proved equal.

2.10 SUNSHIELDS:

Α. All outdoor mounted transmitter s shall be provided with a 316 stai nless steel sunshield. Sunshields are to be sized so that the suns hield will exte nd a minimum of three (3) inches beyond the transmitter enclosure on all sides.

- B. The sunshield shall be sized to include protection for the transmitter and the surge arresting device.
- C. All sunshield and instrument mounting hardware shall be 316 stainless steel.

PART 3 - EXECUTION

3.01 REQUIREMENTS:

A. In add ition to the re quirements spe cified in th is section, refer to Section 13300 - Instrumentation and Controls, General Requirements.

END OF SECTION

Southeast Water Reclamation Facility Manatee County, Florida

Instrumentation Schedule

TAG	DESCRIPTION	SERVICE	RANGE
FE/FIT-204	Magnetic Flow Tube / Transmitter	Low Service Pump Station No. 1 Discharge Flow	0-17000 GPM
FE/FIT-253	Magnetic Flow Tube / Transmitter	Low Service Pump Station No. 2 Discharge Flow	0-17000 GPM
FE/FIT-308	Magnetic Flow Tube / Transmitter	High Service Pump Station Discharge Flow	0-34000 GPM
FE/FIT-309	Magnetic Flow Tube / Transmitter	High Service Pump Station Discharge Flow	0-3500 GPM
LE/LIT-300	Ultrasonic Level Transmitter	Reclaim Water Ground Storage Tank	0-43 Feet
LSL-200	Non-Mercury Float Level Switch	Low Service Pump Station 1 Low Level(Alarm)	
LSH-200	Non-Mercury Float Level Switch	Low Service Pump Station 1 High Level(Alarm)	
LSL-250	Non-Mercury Float Level Switch	Low Service Pump Station 2 Low Level(Alarm)	
LSH-250	Non-Mercury Float Level Switch	Low Service Pump Station 2 High Level(Alarm)	
LSL-300	Non-Mercury Float Level Switch	Reclaimed Water Ground Storage Tank Low Level(Alarm)	
LSH-300	Non-Mercury Float Level Switch	Reclaimed Water Ground Storage Tank High Level(Alarm)	
PE/PI-201	Pressure Gauge	Low Service Pump No. 1 Discharge Pressure	0-100 PSI
PE/PI-202	Pressure Gauge	Low Service Pump No. 2 Discharge Pressure	0-100 PSI
PE/PI-203	Pressure Gauge	Low Service Pump No. 3 Discharge Pressure	0-100 PSI
PE/PI-251	Pressure Gauge	Low Service Pump No. 4 Discharge Pressure	0-100 PSI
PE/PI-252	Pressure Gauge	Low Service Pump No. 5 Discharge Pressure	0-100 PSI
PE/PI-301	Pressure Gauge	High Service Pump No. 1 Discharge Pressure	0-100 PSI
PE/PI-302	Pressure Gauge	High Service Pump No. 2 Discharge Pressure	0-100 PSI
PE/PI-303	Pressure Gauge	High Service Pump No. 3 Discharge Pressure	0-100 PSI
PE/PI-304	Pressure Gauge	High Service Pump No. 4 Discharge Pressure	0-100 PSI
PE/PI-305	Pressure Gauge	High Service Duty Pump No. 1 Discharge Pressure	0-100 PSI
PE/PI-306	Pressure Gauge	High Service Duty Pump No. 2 Discharge Pressure	0-100 PSI
PIT-307	Pressure Transmitter	High Service Discharge Pressure	0-200 PSI
ZSC-201	Check Valve Limit Switch	Low Service Pump No. 1 No Flow Switch	
ZSC-202	Check Valve Limit Switch	Low Service Pump No. 2 No Flow Switch	
ZSC-203	Check Valve Limit Switch	Low Service Pump No. 3 No Flow Switch	
ZSC-251	Check Valve Limit Switch	Low Service Pump No. 4 No Flow Switch	
ZSC-252	Check Valve Limit Switch	Low Service Pump No. 5 No Flow Switch	
ZSC-301	Check Valve Limit Switch	High Service Pump No. 1 No Flow Switch	
ZSC-302	Check Valve Limit Switch	High Service Pump No. 2 No Flow Switch	
ZSC-303	Check Valve Limit Switch	High Service Pump No. 3 No Flow Switch	
ZSC-304	Check Valve Limit Switch	High Service Pump No. 4 No Flow Switch	
ZSC-305	Check Valve Limit Switch	High Service Duty No. 1 No Flow Switch	
ZSC-306	Check Valve Limit Switch	High Service Duty No. 2 No Flow Switch	

SECTION 13320

INSTRUMENTATION AND CONTROLS, CONTROL ENCLOSURES

PART 1 GENERAL

1.01 THE REQUIREMENT:

- A. The Contractor shall furnish, test, install and place in satisfactory ope ration al l cont rol enclo sures (i.e. field panels, control panels, cabinets, consoles, boxes, etc.) required to pro vide a c omplete and ope rable Instrumentation and Control System (ICS) as specified herein and as shown on the Con tract Drawings, even if each needed item is not specifically specified or shown.
- B. The Con tractor shall a lso be responsible t o p rovide modifications to existing control panels as described herein or as indicated in the PLC Input/Output Schedule Attachment and system network diagrams. Modifications to existing control panels shall also c onform to the requirements of these specifications.
- C. All com ponents and all n ecessary acce ssories (e.g. mounting hardware, conditioning equipment, TVSS, fuses, circuit bre akers, term inals, ground bars, r elays, contactors, sta rters, indicators, cont rol o perators, power supplies, signal conditioning, connectors, digital hardware, etc.) that may be r equired to co mplete the system, shall be provided.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

- A. In addition to the requirements specified in this section, the requirements of specification Section 13300 Instrumentation and Control s, General Requirements and the sections referenced therein shall be applied.
- B. Instrumentation and Controls Schedules. R efer to Instrumentation Schedule and PLC Input/Output Schedule Attachments for a listing of major equipment, enclosure construction and signal monitoring requirements.

1.03 SUBMITTALS:

A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and as specified in S ection 133 00 - Instrumentation an d Controls, G eneral Requ irements. In add ition, the following specific submittals items shall be provided: Cabinet sizing in relation to heat dissipation and cooling/heating system sizing calculations shall be submitted for all cabinets containing PLCs, UPSs, VFDs, SCRs and, at the request of the Engineer, for all cabin ets containing se nsitive ele ctronic equipment or chemicals.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS:

- A. Either manufacturer-standard or custom enclosures may be furnished, subject to the requirements of the Contract Documents and favorable review by the Engineer.
- B. All enclosures shall fit within the allocated space as shown on the Drawings. The Contractor shall e xamine plans and/or field inspect new and existing structures as required to determine installation requirements and shall coordinate the instal lation of all enclosures with the Owner and all affected contractors. The Contractor shall be responsible for all costs associated with installation of enclosures, including repair of damage to structures (incidental, accidental or unavoidable).
- C. A minimum estimated size is shown on the Drawings. The Contractor s hall furnis h encl osures of t he size and quantity required to house the manufacturers' equipment supplied and all other electrical components installed in the enclosure. In addition, provide useful space and power supply capacity as spare for future expandability to a minimum of one (1) item per item type installed or twenty percent (20%) of quantity of ea ch type item installed, whichever yields the greater spare space.
- D. Enclosures (cabinets, pa nels, boxes, et c.) shall be formed or welded construction, reinforced with Unistrut, Powerstrut, or equal, to facilitate mounting of internal components or equipment. Sufficient access plates and doors shall be p rovided to faci litate maintenance and testing of the supplier's equipment. Door s shall be removable. Enclosures with any dimension thirty-six (36) inches or greater shall be provided with removable lifting lugs designed to facilitate s afe mo ving and lifting of the panel during installation. No screws or bolts sh all pr otrude t hrough from the in terior enclosure.
- E. All steel enclosures shall be free from dirt, grease and burrs, and shall be treated with a phosphatizing metal conditioner (phosphate conversion coating) before painting. All surfaces shall be filled, sanded, and
finish coated by spraying a 1-2 mil epoxy prime coat and smooth, level, high grade textured finish between flat and semi-gloss shine. The colors shall be selected by the 0 wner from a min imum of si x (6) co lor sam ples provided. All stainles s stee l enclosu res shall be polished to a No. 4 finish.

- F. Enclosures shall be prefabricated cabinets and panels by Hoffman, Rit tal or Vyncki er. The Contra ctor may optionally provide enclosures custom fabr icated by a reputable pa nel fabric ation shop acce ptable t o the Engineer.
- G. Each panel shall incorporate a removable back panel on which control components shall be mounted. Back panels shall be secured to the e nclosures with collar studs. All co mponents shall be of the high est i ndustrial quality and sec urely mou nted t o the remova ble back panels with screw and lock washers. Back panels shall be tapped to accept all mounting screws. Self-tapping screws shall not be used to mount any component.
- H. All enc losures with an y dime nsion twenty-four (24) inches or larger shall be provided with drawing pockets for as-built panel drawings. One (1) laminated copy of the ap propriate panel as -built draw ings sha ll b e furnished and left in the pocket of each panel.
- All meta llic en closures wit h door moun ted equ ipment shall have the door grounded by means of flexible ground strap.
- J. The enclosure and all interior and exterior equipment shall be iden tified with nameplates. The equipment shall be mounted such that service can occur without removal of other equipment. Panel mounted equipment shall be flush or semi-flush mounted with flat black escutcheons. All equipment shall be accessible such that adjustments can be made while the equipment is in service and operating. All enclosures shall fit within the allocated space as shown on the Contract Drawings.
- K. Enclosures sha ll provi de mounting fo r U PS, power supplies, control equipment, input / output subsystems, panel mounted equipment and appurtenances. Ample space shall be provided between equi pment to facilitate servicing and c ooling. Enc losures shall be s ized to adequately dissipate heat generated by equipment mounted inside the panel. Louve red openings fitted with dust filters near the bottom and top of the cabinet shall be provided for NEMA 12 enclosures. If required, cabinets shall be provided with filtered fans, heat exchangers or air con ditioners. Only cl osed loop coo ling systems

shall be provided for NEMA 4X cabinets. Cooling systems shall be by th e cabine t fabr icator, M cLean Midwest, Noren Products, or approved equal.

- L. Enclosures shall be provided with a main circuit breaker and a circuit breaker on each individual branch circuit distributed from the panel. Ma in breaker and branch breaker sizes shall be coordinated such that an overload in a branch ci rcuit will tr ip only the bran ch breaker but not the main breaker. C ircuit breakers shall be provided for the follow ing int ernal br anch ci rcuits distributed within the panel:
 - 1. Receptacles and power strips
 - 2. Lighting
 - 3. UPS
 - 4. HVAC equipment
- M. Enclosures shall be pro vided w ith 12 0 vol t d uplex receptacles for servic e eq uipment an d fl uorescent service lights. Loads not requiring transient voltage surge supp ression (i. e. r eceptacles, ligh ting, HVAC, branch circuits to remot e equ ipment, etc.) shall be connected ahead of the enclosure TVSS device.
- N. Locate equ ipment, dev ices, har dware, power s upplies, instrumentation and con trols, electrical equipment and wiring to be installed inside the enclosures and/or as facial features on the enclosures, so that connections can be easily made and so that there is ample room for servicing each item. Every com ponent in an d on the enclosures s hall be able t o be removed individually without affecting the other components and without the need to move other components. Support and restrain all internally, as well as pane 1 mounted components to prevent any movement.
- O. All cabinets and/or enclosures shall be NEMA rated for the environment in which it is to be instal led and as noted in the Drawings.
- P. Materials and e quipment used shall be U .L. a pproved wherever such a pproved equipment and materials are available.
- Q. Control panels shall be built in accordance with UL508A Industrial Control Panels and NEC Article 409 Industrial Control Panels. Control panels for areas classified as Hazardous s hall be bui lt in accordance with UL69 8 Industrial Control Equ ipment for Use i n Haz ardous Locations. Control panels shall be UL508A and/or UL698

labeled and mark ed as defined in NEC 409.110 with the following:

- 1. Manufacturer's name and contact information (i.e. address, phone, website, email, etc.).
- 2. Supply v oltage, phase, f requency and fu ll-load current.
- 3. Short-circuit cu rrent ra ting o f the indu strial panel based on one of the following:
 - a. Short-circuit current rating of a listed and labeled assembly
 - b. Short-circuit c urrent r ating establi shed utilizing an approved method
- 4. Electrical w iring diagram numb ers or the in dex sheet to the electrical wiring diagrams.
- 5. The enclosure type number (i.e. NEMA 1A, 3 R, 12, 4X, 7, 9, etc.)
- 6. If the ind ustrial control panel is intended as service equipment, it shall be marked to identify it as being suitable for use as service equipment.

2.2 TOOLS, SUPPLIES, AND SPARE PARTS:

- A. Tools, supplies, and spa re parts shall be provided as specified in S ection 13 300 - Instrumentation an d Controls, General Requirements and as specified for each equipment item. In addition, the following items shall be provided:
 - 1. One (1) of each type of panel mounted equipment (i.e., indicators, sig nal co nverters, et c.) provided un der this Co ntract. This do es no t include lar ge LCD dis play electronic op erator interface devices.
 - 2. Three (3) o f each type o f interp osing rela y provided under this Contract.
 - 3. Five (5) of each type of power TVSS device used
 - 4. Ten (10) of each type of signal TVSS device used
 - 5. Two (2) of each type of communication TVSS device used.
 - 6. Three (3) pints of each type or color of touchup paint for th e control en closures provide d unde r this Contract.

2.3 OUTDOOR ENCLOSURES:

- A. All out door e nclosures sh all be rate d NEM A 4X, constructed of 316 stainless steel with a white powder epoxy coating finish unless specif ied othe rwise. Outdoor encl osures shall have a hinged a nd ga sketed door. Door latches shall be all stainless steel, fast operating clamp assemblies (quick release), which do not require bolts or screws to s ecure. Gas kets shall be polyurethane.
- B. Outdoor panels shall be fitted with pad-lockable latch kits.
- C. Outdoor enclosures with internal digital electronics, exterior indicators or exterior indicator lights shall have external sun shields or sun shades, constructed of the same materials as the associated enclosure, unless otherwise specified.
- D. Outdoor en closures sha ll be d esigned fo r am bient conditions of -15 to 50°C and twenty to nine ty-five percent (20% - 95%) relative humidity, unless otherwise specified. Out door enclosures shall be pr ovided with thermostatically cont rolled sp ace he aters to provide condensation protection.

2.4 INDOOR ENCLOSURES:

- A. Indoor enclosures located in the same area (i.e. room, etc.) as open process tanks, open process channels, closed process piping or process equipment containing wet liquids or possible airborne powders, shall be rated NEMA 4X, constructed of 316 stainless steel, fiberglass, fiberglass r einforced p olyester, or poly carbonate, unless specified other wise. Enclosures shall have a hinged and gasketed door. D oor latches shall be all stainless steel, fast operating clamp assemblies (quick release) which do not require bolts or screws to secure. Gaskets shall be polyurethane.
- B. Indoor enclosures located in a dry area (i.e. electrical room, etc.) shall be NEMA 12 st eel, unless specified otherwise. Enclosures shall have a hinged and gasketed door. D oor lat ches shall be three (3) point do or latches with handle for all enclosures with a dimension of twenty-four (24) inches or larger, or otherwise shall be fast operating clamp assemblies which do not require bolts o r scre ws to secu re. Gaskets shall be polyurethane.
- C. Indoor enclosures in a n on-air conditioned space shall be designed for ambient con ditions of 0 to 40° C and twenty to ni nety-five pe rcent (20% - 95%) re lative humidity, unless otherwise specified. Indoor enclosures

in an air cond itioned space s hall be des igned for ambient conditions of 20 to 30° C and twenty to eighty-five perc ent (2 0% - 85%) relative humi dity, unles s otherwise specified.

2.5 PLC, RTU AND OTHER DIGITAL EQUIPMENT ENCLOSURES:

- A. Enclosures shall be prefabricated cabinets and panels by Hoffman, Ri ttal, or Vyn ckier. The C ontractor may optionally provide enclosures custom fabr icated by a reputable pa nel fabric ation shop acce ptable t o the Engineer.
- B. Enclosures sh all be sized to provide a minim um of fifteen percent (15%) spare sub-panel mounting space for future equipment.
- C. A minimum of ten percent (10%) spare terminals for each type of wiring (power, signal, DC control, AC control, etc.) shall be mounted within each control panel.
- D. Outdoor enc losures sha ll be provided wit h th ermal insulation and thermostatically controlled space heaters to provide condensation protection.
- E. Enclosures with any dimension greater than thirty-six (36) inches wh ich cont ain a program mable logi c controller (PLC) shall be provided with a folding laptop programmer shelf on the inside of the door.
- F. NEMA 12 encl osures shall be p rovided with fi ltered louvered openings at the top and bottom of the cabinet, if required for heat dissipation.
- G. Enclosures shall be provided with copper ground bars for terminating cable shields.
- H. The temperature inside each enclosure containing digital hardware (i.e. cabine t, pane 1 or consol e) shall be continuously monitored, and shall generate an alarm to the neare st PL C if the temp erature rises to an adjustable, preset high temperature.

2.6 TERMINALS:

A. Wiring which ent ers or leaves the enclosure shall be terminated to large lug type terminal strips, designed to accommodate minimum 16 AWG wiring, and permanently numbered consistent with the component schematic. These wiring termination strips shall be located with ample room to allow field wiring to be terminated in a neat and workmanlike manner.

- B. Terminal bl ocks shall be as sembled on n on-current carrying galvanized steel DIN mounting rails, securely bolted to the cabinet sub-panel. Terminals shall be of the screw down pressure plate type as ma nufactured by Phoenix Contact, Wieland, Square D, or equal. Power terminal blocks shall be single tier with a minimum rating of 6 00 volts, 30 amps. Signal ter minal blocks shall be single tier with a minimum rating of 600 volts, 20 amps.
- C. Fused terminal blocks or miniature thermal ci rcuit breaker terminal blocks shall be supplied for protection and isolation of enclosed equipment, or as specified in the Contract documents. Blown fuse indicators shall be provided and/or tripped breaker status shall be clearly visible. Fused or m iniature thermal cir cuit b reaker terminal blocks shall be provided for, but not limited to each of the following:
 - 1. Each piece of equipment provided with a power supply (integral, internal or external) with the exception of devices with internal fusing plugged into a receptacle.
 - 2. Each PLC module requiring external power
- D. Terminals shall be marked wit h a black wate rproof, permanent, continuous marking strip. One side of each terminal s hall be r eserved exclusively for f ield incoming conductors. Common connections and jumpers required for internal wiring shall not be made on the field side of the terminal.

2.7 WIRING:

- A. All wiring shall be bundled and run open or enclosed in vented plastic wireway, as required. All conductors run open shall be bundled and bound with nylon cable ties, at regula r inte rvals, wi th int ervals not to excee d twelve (12) inches. Adequately support and restrain all wiring runs to prevent sagging or other movement. Care shall b e take n to separ ate c ommunication, ne twork, electronic s ignal, AC dis crete signal, DC di screte signal and power wiring. Wiring to equipment mounted on doors or where movement of the equipment will take place shall be installed in nylon spiral wrapping sheaths.
- B. Wires shall be color coded as follows:
 - 1. Equipment Ground GREEN
 - 2. 120 VAC Power Distribution BLACK
 - 3. 120 VAC Power Neutral WHITE

- 4. 120 VAC Control (Internally Powered) RED
- 5. 120 VAC Control (Externally Powered) YELLOW
- 6. 24 VAC Control ORANGE
- 7. DC Power (+) RED
- 8. DC Power (-) BLACK
- 9. DC Control BLUE
- 10. Analog Signal (+) BLACK
- 11. Analog Signal (-) WHITE
- C. All wiri ng sha ll compl y with accepte d stan dard instrumentation and electrical practices. Field wiring for power, control and s ignal wires shall comply with Division 16 of the specifications. For each pair of parallel ter minal block s, the field wi ring s hall be between the blocks.
- D. Internal panel wiring shall be as follows:
 - AC power wiring: 14 AW G minimum, stranded copper conductors, THHN/THHW wire rated for 600 volts and 90 °C. For wiring carrying more than 15 amps, use sizes required by NEC.
 - AC control and DC power and control wiring: 16 AWG minimum, stranded copper conductors, THHN/THHW wire rated for 600 volts and 90 °C.
 - 3. Instrument si gnal wiring : 18 AWG stran ded conductors, tinned copper, twisted pair or triad, overall on e hundred percent (100%) aluminum foil shield with 20 AWG stranded d rain wire, plen um rated 300V 60°C FEP insulated wire with FEP jacket, equal to Belden 88760.
 - All stranded wire shall have a minimum of sixteen (16) strands, except for drain wires.

2.8 IDENTIFICATION:

- A. Provide a laminated black nameplate with beveled edges and 1/2-inch white letters to identify each console, panel or cabinet on the front of the enclosure.
- B. Provide laminated, beveled edge, plastic legend plates and nameplates, with 1/4-inch letters, for each front panel mounted device as shown on the Drawings. Legend plates and nameplates shall be the size as shown on the Drawings. C olor shall be bl ack lettering on white background except caution/warning nameplates which shall be white lettering on a red back ground. Attach front

panel n ameplates with bot h a p ermanent adh esive an d stainless steel machine screws into tapped holes.

- C. Tag all interior instruments and other components with engraved, laminated plastic name plates with 1/8-inch, minimum, lettering. Legen ds shall be cons istent with wiring a nd lay out drawi ngs. Namepla tes sh all be attached with permanent adhesive to the panel, near the device or on the device itself or as otherwise approved by the Engineer.
- D. Number and label each wire in the systems. Every unique wiring node shall have its own individual unique number. Numbers shall be shown on all submitted drawings. All wires shall be labeled at each termination and junction of the wire and at 30 -inch intervals along the wire. All multi-conductor cables shall be labeled at each end and at 30 -inch intervals with CBL-XXX and also label each conductor at both ends. Labeling sh all be self-laminating whi te/transparent self-extinguishing vinyl strips (Brady DAT 7 292 or equal) with clear heat shrink tubing over the markers. Length shall be sufficient to provide at least two and one -half (2 1/2) wraps. All labels shall be machine-printed with wire and/or cable numbers.

2.9 ACCESSORIES:

- A. Control o perators such as pushbuttons (PB), selector switches (SS), and pilot lights (PL) shall be Allen Bradley 800H, Square D Company Type SK or equal. Control operators shall be 30.5 mm, round, heavy-duty, oil tight NEMA 4X corrosion resistant.
- B. Pushbuttons and selector sw itches shal 1 be non illuminated, spring release type. Pushbuttons shal 1 include a ful 1 guard. P anic stop/alarm pu shbuttons shall be red mushroom type with manual-pull release. Pilot lights shall be of the proper control voltage, LED type (indoor) and lamp type (outdoor).
- C. Control operators shall have legend plates as specified herein, indicated on the Contract Drawings, or otherwise directed by the Enginee r. Legend pla tes shall be plastic, white field (background) with black lettering. Engraved nameplates shall be securely fastened above each c ontrol o perator. I f ad equate space is not available, the nameplate shall be mount ed be low the operator.
- D. Control op erators for all equ ipment sha ll b e a s specified herein and of the same type and manufacturer unless otherwise specified or indicated on the Contract Drawings. Modifications t o ex isting pane ls u sing

control operators and ind icators of the s ame type and manufacturer shall be allowed with Engineer's approval.

E. Where requi red to interface between motor control centers, e quipment c ontrols, and c ontrol pa nels, interposing re lays a nd a ssociated control w iring circuitry shall be furni shed and installed to pr ovide the mon itoring and/or con trol funct ions sp ecified herein. Interposing relays shall be miniature type with DPDT contacts rated a minimum 10 amp @ 120 VAC, push-to-test button, and status indicator. Relay coils shall be 120/240 VAC or 24 VDC as required. Relays shall be as manufactured by Idec, Square D, Omron, Allen-Bradley or approved equal.

2.10 POWER SUPPLIES:

- A. Power supplies shall be enclosed and s ized per the guidelines of UL508 and UL508A. Power supplies shall be Phoenix Contact, Model Quint-PS-X, or approved equal.
- B. External PLC power supplies provided for loop and/or PLC power shall be redundant and alarm to t he PLC upon failure.

2.11 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS):

- A. Transient voltage surge suppressors shall be provided at the following minimum locations:
 - 1. At any connections between AC power and electrical and ele ctronic equipm ent, i ncluding pan els, assemblies and field mounted instruments.
 - 2. At both ends of all analog signal circuits that have any portion of the circuit extending outside of a protecting building.
 - 3. At the control panel of all discrete signal circuits that have any portion of the circuit extending outside of a protecting building.
 - 4. At both ends of all copper -based communications cables that extend outside of a building.
 - 5. At all specified spare analog inputs and outputs in PLCs and RTUs.
- B. These protective devices shall be external t o and installed in addition to any protective devices built into the equipment. Power and signal protection shall

be installed either in a NEM A 4X enclosure or in the enclosure that houses the equipment to be protected.

- C. All surge arrestors shall be mounted and wired per the manufacturer's recommendations including local grounding for surge energy dissipation. For surge suppressors use No. 8 cable for ground connection o r install suppressor directly on ground bus using grounding screw. Provide 1 -inch wide by 1/8 -inch thick copper ground bus as a minimum.
- D. Panel-mounted power circuit protectors shall be provided in all enclosures powe red by 120 VA C. The protector shall be a 3-stage hybrid, solid-state power line protector with noise filtering, common mode an d normal mode suppression and nanosecond reaction time. The unit shall include a replaceable fuse to remove the load (protected equipment) fr om the line if the unit is either overloaded or the internal protection fails. TVSS devices shall be EDCO HSP -121BT-1RU or approved equal.
- Ε. Panel-mounted signal circuit protectors shall be made for mounting on a terminal block rail. Each TVSS shall include a moveable grounding link to allow each signal cable shield to be individually grounded to the panel via the mounting rail through the TVSS for that cable without the use of any additional grounding wire or to be isolated from ground at the TVSS. Each mounting rail shall be grounded to t he panel by the use of rail mounting s crews at a pproximately on e-foot intervals. Protection shall be from line to line and from each line to ground. Protectio n shall al so be from shie ld to ground wh ere t he shield i s n ot groun ded a t the protector. Each TVSS shall have the ability to protect against surg e current s grea ter than 10,0 00 a mperes. Each TVSS shall add no more than 22 ohms per signal wire to the total signal loop resistance of the analog signal loop in which it is installed. T VSSs shall not introduce error-producing ground loop currents into the instrumentation signal circuits. TVSS devices shall be EDCO DRS-036, Phoenix Contact or approved equal.
- F. Signal circuit TVSS for 2-wire field instruments shall be a conduit connected/pipe nipple type and shall have characteristics equal to t he p anel mounted devices. Units shall be mounted to a transmitter conduit entry point where available. When not available or practical, then thes e devices shall be mounted in N EMA 4X enclosures located at the field devices. TVSS devices shall be EDCO S S65-036, Phoenix Contact or app roved equal.

- G. Signal circuit TVSS for 4-wire field instruments shall be a separate enclosure unit capable of prov iding protection on b oth the power a nd signal side. The unit shall contain the characteristics of the line power protector and signal circuit protectors discussed above . Units s hall be enclosed in a manufacturer assembled NEMA 4X polycarbonate enclosure with a clear polycarbonate cover. TV SS devices shall be EDCO SLAC-12036, Phoenix Contact or approved equal.
- H. TVSS devices antenna cable signal protection shall be an in-line panel mount type unit rated for 50 Ohms and with dc blocking. Un it shall be ra ted for the appr opriate frequency range and have an in sertion loss of 0.1 dB. TVSS device shall be a Polyph aser IS-50 series or approved equal.
- I. TVSS device specifications and ratings for signal or communications types not defined herein shall be as specified elsewhere or of a type recommended by the manufacturer of the device being protected. TVS S devices shall be Phoenix Contact, EDCO, Polyphaser or Innovative Technology.

PART 3 EXECUTION

3.01 REQUIREMENTS:

- A. In add ition to the re quirements spe cified in this section, refer to Section 13300 Instrumentation and Controls, General Requirements.
- B. Floor mounted enclosures shall be installed on 1/4-inch thick rubber type pads. Thes e pads shall completely cover the area of the base that is against the floor.
- C. Keep enclosures clean at all times. Keep enclosure doors closed except when actually working in the enclosure. Protect all equipment during installation, including hole punching for conduit connection. Remove all filings and thread cuttings from enclosures. Careful attention must be paid to provide installations which are both functional and aesthetically acceptable.
- D. All conduits used in conjunction with control p anels or instrumentation of any kind s hall be sealed using a suitable duct -sealing compound to minimize the possible damage caused by vapors or wetness. It shall be the responsibility of the CSI to verify that this is accomplished early in th e project, so that corrosion damage does not oc cur during the time of construction.

- E. The Contractor shall provide the Engineer a per iodic written report detailing construction progress. This report shall include specific tabulations of equipment on which construction/installation has been completed.
- F. Equipment shall be located so that it is accessible for operation and maintenance. The CSI shall examine the Contract Dr awings and Shop Drawings for v arious items of equipment in order to determine the best arrangement for the work as a whole and shall supervise the installation of all equipment.
- G. All UPS units shall be mounted on raised platforms so as to not rest on the panel bottom.

3.02 WIRING AND GROUNDING:

- A. The following wiring practice guidelines shall be used in order to minimize ground loops, minimize the effects of elect romagnetic int erference/radio fr equency interference (EMI/RFI) and to provide maximum practical immunity fr om da mage r esulting f rom lightning-induced transients.
- B. Common wires or conductors shall not be utilized (either within panels or external to panels, or for grounding of field devices) for signal shielding, signal grounding, or safety grounds.
- C. Exposed wire le ngths ex tending from with in shielded signal cables shall be m inimized to redu ce pick-up of EMI/RFI by sign al circuits. Ex posed lengths of less than one inch is preferred with a maximum exposed length of two inch es only per mitted where ne cessary. No splicing of signal wires shall be permitted.
- D. All signal wiring shall be shielded, both within panels and external to panels. Unless otherwise specified, all signal wiring shall be No. 16 AWG stranded tinned twoconductor tw isted pair wi th 10 0 percent cove rage of aluminized M ylar or alum inized polyest er shield and tinned copper drain wire.
- E. The shield on each process instrumentation cable shall be continuous from source to destination, and grounded at one end only. In general, grounding of signal cable shields shall be done at t he control panel end. No signal cable shall share a common cable shield grounding wire with any other signal cable or other circuit. The exposed length of cable shield grounding wires shall not

exceed two inches prior to termination with less than one-inch maximum length preferred.

F. All outdoor instruments and all outdoor enclosures shall be grou nded u sing the practice defined in Se ction 800.40 of the National Electric Code.

END OF SECTION

SECTION 13330

INSTRUMENTATION AND CONTROLS, SCADA HARDWARE

PART 1 GENERAL

1.01 THE REQUIREMENT:

A. The Contractor shall furnish, test, install and place in satisfactory operation all equipment required to provide a comp lete and operable Supervisory Control and Data Acquisition (SCADA) system, as specified herein and as shown on the Contract Drawings, even if each needed item is not specifically specified or shown.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. In addition to the requirements specified in this section, the requirements of specification Section
 13300 - Instrumentation and Control s, General Requirements and the sections referenced therein shall be applied.

1.03 SUBMITTALS:

 A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and as specified in S ection 133 00 - Instrumentation an d Controls, General Requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS:

- A. The SCADA hardware configuration as specified herein, as specified in re lated sections and as show non the Contract Drawings depicts overall system configuration requirements. Unless otherwise specified, designs which vary from this concept will be rejected.
- B. All disc rete a nd analo g data acquisi tion, pre processing, storage and process control functions shall be performed at the PLC level.
- C. PLC-to-PLC communication protocols shall be Ethernet based.

D. All software licenses and support contracts shall be registered to Manatee Coun ty. The partic ular contact person and address shall be coordinated with the Owner prior to purchasing of any equipment or software

2.02 TOOLS, SUPPLIES, AND SPARE PARTS:

- A. Tools, supplies and spare parts shall be provided as specified in S ection 133 00 - Instrumentation and Controls, General Requirements, and as specified for each equipment item. In addition, the following items shall be provided:
 - 1. One (1) of e ach type of CP U modul e for PLC equipment furnished under this Contract.
 - One (1) of each type of communication module for PLC equipment furnished under this Contract.
 - 3. Two (2) of each type of input/output module for PLC equipment furnished under this Contract.
 - 4. Two (2) of each type and size of PLC and equipment power supply furnished under this Contract.

2.03 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS):

- A. Refer to specification Section 13320 Instrumentation and Controls, Control Enclosures for TVSS requirements.
- B. Provide TVSS protection for all specified spare analog inputs and outputs.

2.04 UNINTERRUPTIBLE POWER SUPPLIES (UPS):

- A. Line interactive UPS units shall be provided for all new SCADA panels and computers.
- B. UPS units at sites without ATS and generators shall be sized to provide a minimum of thirty (30) minutes backup time. At sites with ATS and generators, UPS units shall be sized for a minimum of fifteen (15) minutes. Each UPS shall consist of a free standing UPS module and battery modules as required to meet backup runtime requirements.

- C. UPS u nits provided for SCADA computers shall be connected to the computer via a digital c ommunication port to pro vide status and a utomatic shutdown of the computer.
- D. UPS units provided for PLCs shall be provided with a dry contact output to alarm on UPS trouble or failure. This fail output shall be wired into the PLC I/O to represent UPS status.
- E. Each UPS shall be sized to m atch the m aximum power requirements of the as sociated digit alle quipment, control panel power supplies and accessories plus twenty percent (20%) spare capacity. Upon loss of the AC supply, the inverter shall continue to supply normal power to the device, drawing DC power from the batteries.
- F. Each UPS shall meet the following requirements:
 - Input voltage shall be 117 VAC, single ph ase, 60 Hz.
 - 2. Voltage regulation shall be plus or minus five percent (± 5 %) for line and load changes.
 - 3. The output frequency shall be phase-locked to the input AC line on AC operation and shall be 60 hertz $(\pm 0.5\%)$ when on battery operation.
 - The batteries shall be of the sealed, lead acid or lead calcium gelled electrolyte type, suitable for high temperatures.
 - 5. Sound absorbing enclosure.
 - 6. EMI/RF noise filtering.
 - 7. Surge protection shall be provided on the AC input circuit, which shall h ave a UL TVSS c lamping voltage rating of 400 V with a <5 ns response time.</p>
 - 8. Adjustment allowed to p revent UPS fr om g oing offline when on a standby generator supplied power source.
- G. UPS systems shall be APC, Powerware, or approved equal.

2.05 PROGRAMMABLE LOGIC CONTROLLERS (PLC), GENERAL:

- A. The CSI shall f urnish pr ogrammable logic controllers (PLCs) as specified herein and as shown on the Drawings. PLCs shall be provided complete with rack, power supply, I/O cards, special function cards, instructions, memory, input/output capacity and appurtenances to provide all features and fu nctions as described herein. PL C I/O cards may be supplied by third party vendors if approved by the PLC ma nufacturer and the E ngineer. N o substitutions will be permitted.
- B. All components of the PLC sys tem shall be of the same manufacturer, who shall have fully tested units similar to those being furnished, in an industrial environment with associated electrical noise. The PLC system shall have been tested to meet the require ments of NEM A Standard ICS 2-230 (Arc Test) and IEEE C37.90.1 (SWC). The pr ocessing unit shall p erform the ope rations functionally des cribed h erein, based on t he p rogram stored in me mory and the s tatus of the in puts and outputs.
- C. The programmable controller shall be designed to operate in an industrial environment. The PLC shall operate in an ambient temperature range of 0°-60°C and a relative humidity of five to ninety-five percent (5% - 95%), noncondensing. The PLC shall operate on supply voltages of 90-132 VAC at 47-63 Hz, or 24 VDC if pr ovided with a battery b ackup s ystem. Overcurrent and unde rvoltage protection shall be provided on the power supply.
- D. System configuration shall be as shown on the Contract Drawings. PL C types s hall be designated on the Communications S ystem diagram and corre spond to the specifications herein. Only a single type of processor shall be supplied for a ll PLCs of a de signated type. Memory, processor and PLC type shall be adequate for all control functions specified. Memory backup shall be provided during loss of power for the configuration, logic prog ram and curren t operating parameters/addresses.
- E. The proc essor a nd its ass ociated memor y shal 1 be enclosed in a mo dular enclosure. A multiple -position selector switch or equivalent shall be u sed to select processor operating mode. LED-type indicating lights

shall be provided to ind icate processor, memory and battery status. Errors in memory shall be recognized and shall activate the memory error indicating lights. The PLC processor shall monitor the internal operation of the PLC f or failure and provide an alarm. Memory shall consist of battery-backed RAM or EE PROM, which shall retain the control program for at least on e (1) year, in the event of p ower loss. Visu al indication shall be provided if battery charge is insufficient to maintain the program in RAM memory for at least two (2) weeks.

- F. The inst ruction set for the PLC shall include the following, as a minimum:
 - 1. Relay type instructions
 - 2. Counter and timer instructions
 - Comparison instructions (equal, greater than, limit tests, etc.)
 - 4. Integer, 1 ong integ er and floating po int mathematical instructions
 - 5. Advanced math and trigonometric functions
 - 6. Matrix and array instructions
 - 7. Logical instructions (and, not, or, etc.)
 - 8. Bit modification, moving and shift instructions
 - 9. Diagnostic instructions
 - 10. Sequencer instructions
 - 11. Program contr ol instruc tions (jump, goto subroutine, etc.)
 - 12. PID control loops
 - 13. Block read and write capability
 - 14. Master and slave communications capabilities
 - 15. Immediate I /O and co mmunications up date instructions
 - 16. Real-time clock and date
- G. In addition to a communications port for communications as shown on the Cont ract D ocuments, additional communication ports shall be p rovided for any other devices as required (i. e., ope rator in terface unit,

connection to a notebo ok computer for programming and configuration).

2.06 PLC TYPE FOR SCADA PANELS:

- A. PLCs shall be provided for the following: new High Service Pump Station (SP-6).
- B. PLCs, as specified or shown in the Contract Documents, shall meet the following minimum requirements:
 - Two (2) 10/100 Mbps Ethernet IP Port, one (1) USB serial port
 - I/O Module Expansion Capacity: Up to sixteen (16)
 I/O modules, not to inclu de processor or pow er supply.
 - 3. One power supply for each I/O module bank.
 - I/O modules shall be of a dedicated type, i.e. AI,
 AO, DI , DO. No mix ed I/ O m odules shal 1 be acceptable.
 - Two (2) MB of Memory with 1GB SD memory card for memory backup.
- C. The PLC input/output hardware shall be modular DIN-rail mounted units mechanically locked together with a tongue and groove design. Modu les shall include an integral communications b us that is connected f rom module to module with a moveable bus connector. A dditional I/O module banks shall be connected with an expansion cable in a horizo ntal or vertica l configuration, up to two banks, one local bank which includes the controller and one additional bank.
- D. Modules shall be placed to ensure adequate power supply voltage to a ll modules with a maximum of t hree (3) modules on the left of the power supply and eight (8) on the right side of the power s upply, for the b ank with the controller, and maximum of eight (8) modules on both sides of the power supply for additional I/O m odule banks.

- E. Power supply shall be compatible with the Allen-Bradley CompactLogix PL C. Input shall be 120V AC and shall supply power to the PLC, Communication and I/O Modules. Power supply shall be Allen-Bradley 1769-PA4.
- F. PLCs shall be Allen Bra dley Compact Logix 1769 L3 Controller, (1769-L33ER).

2.07 PLC INPUTS/OUTPUTS FOR SCADA PANELS:

- A. Input/output hardware within SCADA panels shall be plugin modules in associated I/O rack assemblies. Each PLC within an enclosure shall handle the required number of process input s and outp uts, plus a minimu m o f ten percent (10%) pre-wired spa res for each I/ O type furnished, with the exception of discrete inputs, which shall have a minimum of twenty percent (20%) pre-wired spares, plus a minimum of twenty percent (20%) spare I/O rack expansion space for the addition of future circuit cards or modules.
- B. PLC input/output systems and processing modules shall be of the same model series.
- C. Discrete inputs (DI) shall be 24 VDC (integral to PLC), developed from dry field contacts. Units shall be Allen Bradley Model 17 69-IQ16, 16 -point discr ete inpu t modules.
- D. Discrete outputs (DO) shall be 16-point, 120 VAC / 24 VDC 5A relay contact modules, for the PLC. Output contacts may be powered from the field equipment or powered from 24 VDC / 120 VAC sourced from PLC control panel's power system, as required to interface with field equipment. Outputs to solenoid valves shall be 120 VAC, powered from the PLC or control panel unless specified or shown otherwise. Provide interposing relays as specified in Section 13430 as required to meet dry contact rating. Units shall be Allen Bradley CompactLogix Model 1769-OW16, 16-point discrete output modules.
- E. Analog input (AI) circuits shall be i solated, 16-bit resolution type. Analog inp ut hardwa re shall be provided as required for all types of an alog inputs being transmitted to the PLC. In general, analog input modules shall be capable of receiving 4-20 mA signals.

Each input circuit shall ha ve optical iso lation to protect the equipment against high voltage transients. Units shall be Allen Bradley CompactLogix Model 1769-IF4I, 4-channel analog input module.

- F. Analog outp uts (AO) shall be coordinated with the receivers but shall generally be isolated 24 VDC, 4-20 mA outputs powered from the PLC, 16-bit resolution type. Each ou tput circuit shall have optical isolation to protect the equipment against high voltage transients. Units shall be A llen Bradley CompactLogix Model 1769-OF4CI, 4-channel analog output module.
- G. Input/output modules shall be configured for ease of wiring and maintenance. The modules shall be connected to wiri ng arms which can be disconnected to permit removal of a module without disturbing field wiring. Covers shall be provided to prevent operator personnel from inadvertently touching the terminals. The process interface mo dules shall be provided with screw-type terminal blocks with barriers between adjacent terminals for connection of field inputs. Ter minals shall be suitable for a ccepting up to and incoluding No. #22...#12 AWG (0.2...4 mm2) wire.
- H. Output failure mode shall be se lectable so that upon station or communication system failure, all outputs shall be placed in the non-conducting mode or remain as they were prior to failure. Light-emitting diodes shall be provided for status ind ication for each i nput and output point.
- I. Signal and control circuitry to individual input/output boards shall be arranged such that board failure shall not disable more than one-half (1/2) of the control loops within any group of controlled equipment (e.g., one pump out of a group of three pumps, two pumps out of four, etc.). Where possible, individual control loops and equipment shall be assigned to individual boards such that failure of the board will disable only one (1) loop or piece of equipment.
- J. External power supplies shall be provided with the PLC as required to meet s pecified insta lled I/O power requirements, plus spares. Po wer supplies shall be modular units, shall be fully redundant and shall alarm to the PLC up on failure. Power supplies shall have a

line regulation of 0.05% and meet the environmental and power requirements specified herein.

- K. Manufactured PLC cabling systems may be used to replace individual wiring of I/O t o terminal blocks. Ca bling system s hall c onsist of a n I/O modul e connector, multiconductor cable and an interface module consisting of terminals. The terminals shall accept 22-12 AWG wire and be rated for the signals carried. If required, an interface mo dule may cons ist o f compo nents (fuses, relays, surg e p rotection, e tc.) and term inals. PLC cabling syste ms shall be as manufa ctured by Allen-Bradley, Phoenix Contact, Weidmüller, or approved equal.
- L. Control circuits and signals entering haz ardous areas shall be provided with intrinsically safe barriers meeting the requirements of the NEC and UL698.

2.08 PLC PROGRAMMING SOFTWARE:

- A. The PLC programming and configuration software shall be the manufacturer's latest version. The software package shall consist of all programming, configuration, and documentation software needed to place the control and information system in satisfactory operation. The software shall allow on-line and off-line program development and documentation. Programming shall be accomplished through the use of ladder logic, function block, structured text and sequential function charts. PLC programming software shall include CD-ROM documentation and RS Linx communications software.
- B. One licensed copy of the Studio 5000 Logix Designer programming software shall be provided and licensed to the Own er for his use for main tenance and troubleshooting. Thi s sh all incl ude programming software, all necessary communications software, and all needed se rial p ort programming cables and US B port adapters for the CompactLogix PLC.

2.09 FIBER OPTIC ETHERNET SWITCHES (CONTROL PANEL MOUNTED):

A. Fiber Optic Ethernet switc hes for mounting within control panels for comm unications connection to the facility Control Console: The CSI shall provide all fiber optic communications equipment and shall install in all contr ol panels, whe ther provide d unde r this section or not.

- B. The switch shall be a managed 10/100 Mbps switch with a minimum of f our (4) Ethernet ports and two (2) Fiber Optic por ts. Ethernet p orts shall be RJ 45 and auto-sensing with indicators for status of ea ch port. Fiber Optic ports shall be multimode, ST connectors.
- C. Switches shall be indus trial grade and s pecifically meant for industrial control use. The switch shall also be compatible for communications to the Ethernet Fiber Optic Switch in the Communications Room.
- D. Subject to compliance with these specifications Ethernet switches for mounting within a control panel shall be Phoenix Contact 2989831 or equal as a pproved by the Engineer.

2.10 FIBER OPTIC CABLE SYSTEM:

- A. Fiber Optic Cables
 - Fiber optic cables shall be heavy -duty, multifiber breakout style cable, designed for high tensile strength and durability, and suitable for installation in aerial runs an d for long pull s through conduit. Cables shall be specially designed for outdoor environments.
 - 2. Cables shall be suitable for installation with a rated pull strength capability in excess of 34 0 lbs. The CSI shall use procedures, measurements and precautions so that no more than 5 0% of the maximum rated pull strength capability of the cable is ever a pplied during a ny point in the installation procedure.
 - 3. Cables shall be suitable for installation with a minimum bend radius of three (3) inches or less. The CSI shall use procedures, measurements and precautions so that the cable is never exposed to a bend radius of less than six (6) inches during any point in the installation procedure.
 - 4. Jacketing shall be polyethylene, with high abrasion and cut -through resis tance. Outer

jacket shall be UV stabilized for outdoor use and overall ruggedness. Jackets shall have low friction resistance and high strength so that long pulls in conduit will not cause damage.

- 5. Fibers shall have a 62.5 -micron core. Multimode fiber core shall utilize low loss fiber, with a typical maximum attenuation of 3.0 dB/km.
- Each sub-channel shall be tight buffered with a 2.5 mm PVC jacket, and internal strength fibers. Subchannels shall be breakout style, for ease of handling.
- 7. Fibers shall be hard silica clad, with a thin hard polymer optical cladding, over a pure fused silica core. Cables shall hav e Kevlar ripcor d and all subchannels shall be color-coded.
- Cables shall have a minimum of twelve (12) fibers or additional fibers as show n in the contract drawings.
- 9. Fiber-optic cables shall be manufactured by Corning, Belden, 3-Com or approved equal.
- B. Fiber Optic Patch Panels
 - Fiber Optic cables shall always be terminated at protected fiber optic patch panels, which shall be designed to protect the terminated cables and provide a fiber -termination terminal strip for connections to local equipment.
 - 2. Each control panel or termination area which connects to fiber optic cables shall be provided with one or more fiber optic patch panels, with sufficient termination points for every fiber in every cable. The installer shall terminate, test and secure every fiber wi thin every cable, even if the add itional fibers are designated as "spare" or "future by others".
 - 3. Patch panel termination connector s shall be STstyle. Connectors are to remain individually booted until used.

- 4. Where fibers are to be connected to local equipment, a pre -terminated fiber jumper of suitable length shall be provided to make the connection between the patch panel and the equipment.
- 5. Patch panels shall be Corning or approved equal.

PART 3 EXECUTION

3.01 REQUIREMENTS:

- A. Fiber optic cables shall be installed in one section without splicing from one designated termination point to the next.
- B. The installed cable shall be terminated on all fibers. Fibers shall be tested in dividually with all s trands providing full light transmission. If any fiber within the cable fails the testing criteria, the entire cable shall be replaced at no additional cost to the Owner.
- C. Cables shall be tested under actual loading conditions using a light source and calibrated digital power meter. The Power Budget of the fiber with connectors shall be calculated and compared to actual measurements. Any significant visual defect or power loss in excess of 2 dB shall be cause for a failed test.
- D. A written report shall be prepared for each fiber test, troubleshooting or maintenance event. The report shall identify th e fi ber se rviced or teste d, de fine t he procedure, describe the results of the testing including comparison to the calculated Power Budget and pr ovide conclusions. T he report shall be subm itted to the Engineer for review.
- E. In add ition to the re quirements spe cified in this section, refer to Section 13300 Instrumentation and Controls, General Requirements.

END OF SECTION

TAG	DESCRIPTION	TYPE	MTN	MAX	EGU	PANEL	COMMENTS
LSL-200	Low Service Pump Station 1 Low Level	DI	NORMAL	ALARM		SP-1B	
LSH-200	Low Service Pump Station 1 High Level	DT	NORMAL	ALARM		SP-1B	
OL-201-1	Low Service Pump No. 1 Running	NDI	STOPPED	RUNNING		SP-1B	
OL-201-2	Low Service Pump No. 1 Remote	NDI	LOCAL	REMOTE		SP-1B	
OA-201	Low Service Pump No. 1 Fail	NDI	OFF	FAIL		SP-1B	
OA-201-2	Low Service Pump No. 1 E-Stop	DI	OFF	FAIL		SP-1B	
OA-201-3	Low Service Pump No. 1 HiHi Temp	NDI	OFF	FAIL		SP-1B	
FSL-201	Low Service Pump No. 1 No Flow	NDI	OFF	FAIL		SP-1B	
HS-201	Low Service Pump No. 1 Run Command	NDO	STOP	RUN		SP-1B	
SI-201	Low Service Pump No. 1 Speed	NAI	0	100	ojo	SP-1B	
SC-201	Low Service Pump No. 1 Speed Command	NAO	0	100	00	SP-1B	
OL-202-1	Low Service Pump No. 2 Running	NDI	STOPPED	RUNNING		SP-1B	
OL-202-2	Low Service Pump No. 2 Remote	NDI	LOCAL	REMOTE		SP-1B	
OA-202	Low Service Pump No. 2 Fail	NDI	OFF	FAIL		SP-1B	
OA-202-2	Low Service Pump No. 2 E-Stop	DI	OFF	FAIL		SP-1B	
OA-202-3	Low Service Pump No. 2 HiHi Temp	NDI	OFF	FAIL		SP-1B	
FSL-202	Low Service Pump No. 2 No Flow	NDI	OFF	FAIL		SP-1B	
HS-202	Low Service Pump No. 2 Run Command	NDO	STOP	RUN		SP-1B	
SI-202	Low Service Pump No. 2 Speed	NAI	0	100	00	SP-1B	
SC-202	Low Service Pump No. 2 Speed Command	NAO	0	100	96	SP-1B	
OL-203-1	Low Service Pump No. 3 Running	NDI	STOPPED	RUNNING	-	SP-1B	
OL-203-2	Low Service Pump No. 3 Remote	NDT	LOCAL	REMOTE		SP-1B	
OA-203	Low Service Pump No. 3 Fail	NDT	OFF	FATL		SP-1B	
OA-203-2	Low Service Pump No. 3 E-Stop	DT	OFF	FATL		SP-1B	
OA-203-3	Low Service Pump No. 3 HiHi Temp	NDT	OFF	FAIL		SP-1B	
FSL-203	Low Service Pump No. 3 No Flow	NDT	OFF	FATL		SP-1B	
HS-203	Low Service Pump No. 3 Run Command	NDO	STOP	RUN		SP-1B	
ST-203	Low Service Pump No. 3 Speed	NAT	0	100	96	SP-1B	
SC-203	Low Service Pump No. 3 Speed Command	NAO	0	100	96	SP-1B	
LSL-250	Low Service Pump Station 2 Low Level	DI	NORMAL	ALARM	-	SP-1B	
LSH-250	Low Service Pump Station 2 High Level	DT	NORMAL	ALARM		SP-1B	
OL-251-1	Low Service Pump No. 4 Running	NDI	STOPPED	RUNNING		SP-1B	
OL-251-2	Low Service Pump No. 4 Remote	NDT	LOCAL	REMOTE		SP-1B	
OA-251	Low Service Pump No. 4 Fail	NDI	OFF	FAIL		SP-1B	
OA-251-2	Low Service Pump No. 4 E-Stop	DI	OFF	FAIL		SP-1B	
OA-251-3	Low Service Pump No. 4 HiHi Temp	NDI	OFF	FAIL		SP-1B	
FSL-251	Low Service Pump No. 4 No Flow	NDI	OFF	FAIL		SP-1B	
HS-251	Low Service Pump No. 4 Run Command	NDO	STOP	RUN		SP-1B	
SI-251	Low Service Pump No. 4 Speed	NAI	0	100	olo	SP-1B	
SC-251	Low Service Pump No. 4 Speed Command	NAO	0	100	olo	SP-1B	
OL-252-1	Low Service Pump No. 5 Running	NDI	STOPPED	RUNNING		SP-1B	
OL-252-2	Low Service Pump No. 5 Remote	NDI	LOCAL	REMOTE		SP-1B	
OA-252	Low Service Pump No. 5 Fail	NDI	OFF	FAIL		SP-1B	
OA-252-2	Low Service Pump No. 5 E-Stop	DI	OFF	FAIL		SP-1B	
OA-252-3	Low Service Pump No. 5 HiHi Temp	NDI	OFF	FAIL		SP-1B	
FSL-252	Low Service Pump No. 5 No Flow	NDI	OFF	FAIL		SP-1B	
HS-252	Low Service Pump No. 5 Run Command	NDO	STOP	RUN		SP-1B	
SI-252	Low Service Pump No. 5 Speed	NAI	0	100	olo	SP-1B	
SC-252	Low Service Pump No. 5 Speed Command	NAO	0	100	olo	SP-1B	
FIT-204	Low Service Pump Station No. 1 Discharge Flow	AI	0	17000	GPM	SP-1B	
FIT-253	Low Service Pump Station No. 2 Discharge Flow	AI	0	17000	GPM	SP-1B	
ZSO-255	Reclaimed Water Ground Storage Tank Influent Valve Opened	DI	OFF	OPEN		SP-6	

ZSC-255	Reclaimed Water Ground Storage Tank Influent Valve Closed	DI	OFF	CLOSED		SP-6	
OA-255	Reclaimed Water Ground Storage Tank Influent Valve Fail	DI	OFF	FAIL		SP-6	
OL-255	Reclaimed Water Ground Storage Tank Influent Valve in Remote	DI	LOCAL	REMOTE		SP-6	
ZCO-255	Reclaimed Water Ground Storage Tank Influent Valve Command to Open	DO	OFF	OPEN		SP-6	
ZCC-255	Reclaimed Water Ground Storage Tank Influent Valve Command to Close	DO	OFF	CLOSE		SP-6	
LSL-300	Reclaimed Water Ground Storage Tank Low Level	DI	NORMAL	ALARM		SP-6	
LSH-300	Reclaimed Water Ground Storage Tank High Level	DI	NORMAL	ALARM		SP-6	
LIT-300	Reclaimed Water Ground Storage Tank Level	AI	0	43	FT	SP-6	
OL-301-1	High Service Pump No. 1 Running	NDI	STOPPED	RUNNING		SP-6	
OL-301-2	High Service Pump No. 1 Remote	NDI	LOCAL	REMOTE		SP-6	
OA-301	High Service Pump No. 1 Fail	NDI	OFF	FAIL		SP-6	
OA-301-2	High Service Pump No. 1 E-Stop	DI	OFF	FAIL		SP-6	
OA-301-3	High Service Pump No. 1 HiHi Temp	NDI	OFF	FAIL		SP-6	
OA-301-4	High Service Pump No. 1 Hi Temp	NDI	OFF	FAIL		SP-6	
FSL-301	High Service Pump No. 1 No Flow	NDI	OFF	FAIL		SP-6	
HS-301	High Service Pump No. 1 Run Command	NDO	STOP	RUN		SP-6	
SI-301	High Service Pump No. 1 Speed	NAI	0	100	00	SP-6	
SC-301	High Service Pump No. 1 Speed Command	NAO	0	100	96	SP-6	
TT-301-A	High Service Pump No. 1 RTD-A	AT	0	XXX	÷	SP-6	
TT-301-B	High Service Pump No. 1 RTD-R	AT	0	XXX		SP-6	
TT-301-C	High Service Pump No. 1 RTD-C	ΔT	0	XXX		SP-6	
TI-301-D	High Service Pump No. 1 ND.C	ΔT	0	XXX		SP-6	
TI-301-E	High Service Dump No. 1 ND D	ΔT	0	VVV		SP-6	
TT-301-F	High Service Pump No. 1 RTD-F	AT AT	0	XXX		SP-6	
01-302-1	High Service Pump No. 2 Pupping	NDT	STOPPED	RUNNING		SP-6	
01-302-1	High Service Pump No. 2 Running	NDI	LOCAL	DEMOTE		SF-0	
01-302-2	High Service Pump No. 2 Fail	NDI	LOCAL	ENTI		SF-0	
0A-302-2	High Service Fump No. 2 Fall	DT	OFF	FAIL		SF-0	
OA-302-2	High Service Pump No. 2 E-Stop	NDT	OFF	FAIL		SF-0	
OA-302-3	High Service Pump No. 2 Hill Temp	NDI	OFF	FAIL		SF-0	
UA-302-4	High Service Funds No. 2 HI Temp	NDI	OFF	FAIL		SP-6	
10 202	High Service Pump No. 2 No Flow	NDI	OFF	PAIL		SF-0	
HS-302	High Service Pump No. 2 Run Command	NDO	SIOP	RUN 1.0.0	0.	SP-6	
51-302	High Service Funds No. 2 Speed	NAI	0	100	0	SP-6	
SC-302	High Service Pump No. 2 Speed Command	NAO	0	100	õ	SP-6	
TI-302-A	HIGH SELVICE Fully NO. 2 RID-A	AI	0	AAA VVV		SP-6	
ПТ-302-В	High Service Funds No. 2 RID-B	AI	0	~~~		SP-6	
T1-302-C	High Service Fump No. 2 KTD-C	AI	0	XXX		SP-6	
T1-302-D	High Service Pump No. 2 KTU-U	AI	Û	XXX		SP-6	
TI-302-E	High Service Fump No. 2 KTD-E	AI	0	XXX		SP-6	
T1-302-F	High Service Fump NO. 2 KTU-F	AI	U	XXX		SP-6	
OL-303-1	High Service Pump No. 3 Running	NDI	STOPPED	RUNNING		SP-6	
OL-303-2	High Service Pump No. 3 Remote	NDI	LOCAL	REMOTE		SP-6	
0A-303	High Service Fump NO. 3 Fall	NDI	OFF	FAIL		SP-6	
OA-303-2	High Service Pump No. 3 E-Stop	DI	OFF	FAIL		SP-6	
OA-303-3	High Service Pump No. 3 HiHi Temp	NDI	OFF	FAIL		SP-6	
OA-303-4	High Service Pump No. 3 Hi Temp	NDI	OFF	FAIL		SP-6	
FSL-303	High Service Pump No. 3 No Flow	NDI	OFF	FAIL		SP-6	
HS-303	High Service Pump No. 3 Run Command	NDO	STOP	RUN		SP-6	
SI-303	High Service Pump No. 3 Speed	NAI	0	100	olo	SP-6	
SC-303	High Service Pump No. 3 Speed Command	NAO	0	100	olo	SP-6	
TI-303-A	High Service Pump No. 3 RTD-A	AI	0	XXX		SP-6	
ТІ-303-В	High Service Pump No. 3 RTD-B	AI	0	XXX		SP-6	
TI-303-C	High Service Pump No. 3 RTD-C	AI	0	XXX		SP-6	

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TI-303-D	High Service Pump No. 3 RTD-D	AI	0	XXX		SP-6	
TI-303-E	High Service Pump No. 3 RTD-E	AI	0	XXX		SP-6	
TI-303-F	High Service Pump No. 3 RTD-F	AI	0	XXX		SP-6	
OL-304-1	High Service Pump No. 4 Running	NDI	STOPPED	RUNNING		SP-6	
OL-304-2	High Service Pump No. 4 Remote	NDI	LOCAL	REMOTE		SP-6	
OA-304	High Service Pump No. 4 Fail	NDI	OFF	FAIL		SP-6	
OA-304-2	High Service Pump No. 4 E-Stop	DI	OFF	FAIL		SP-6	
OA-304-3	High Service Pump No. 4 HiHi Temp	NDI	OFF	FAIL		SP-6	
OA-304-4	High Service Pump No. 4 Hi Temp	NDI	OFF	FAIL		SP-6	
FSL-304	High Service Pump No. 4 No Flow	NDI	OFF	FAIL		SP-6	
HS-304	High Service Pump No. 4 Run Command	NDO	STOP	RUN		SP-6	
SI-304	High Service Pump No. 4 Speed	NAI	0	100	olo	SP-6	
SC-304	High Service Pump No. 4 Speed Command	NAO	0	100	olo	SP-6	
TI-304-A	High Service Pump No. 4 RTD-A	AI	0	XXX		SP-6	
TI-304-B	High Service Pump No. 4 RTD-B	AI	0	XXX		SP-6	
TI-304-C	High Service Pump No. 4 RTD-C	AI	0	XXX		SP-6	
TI-304-D	High Service Pump No. 4 RTD-D	AI	0	XXX		SP-6	
TI-304-E	High Service Pump No. 4 RTD-E	AI	0	XXX		SP-6	
TT-304-F	High Service Pump No. 4 RTD-F	AT	0	XXX		SP-6	
01-305-1	High Service Jockey Pump No. 1 Running	NDT	STOPPED	RUNNING		SP-6	
01-305-2	High Service Jockey Pump No. 1 Remote	NDI	LOCAL	REMOTE		SP-6	
04-305	High Service Jockey Pump No. 1 Fail	NDI	OFF	FATI.		SP-6	
0A-305-2	High Service Jockey Dump No. 1 Faston	DT	OFF	ENTI		SP-6	
0A-305-2	High Service Jockey Pump No. 1 E-Stop	NDT	OFF	FAIL		SP-6	
DA-303-3	High Service Jockey Pump No. 1 Hill Temp	NDI	OFF	FAIL		SF-0	
FSL-305	High Service Jockey Fund No. 1 No Flow	NDI	OFF	FALL		SP-6	
HS-305	High Service Jockey Fump No. 1 kun Command	NDO	STOP	RUN	0	SP-6	
S1-305	High Service Jockey Fump No. 1 Speed	NAL	0	100	*	SP-6	
SC-305	High Service Jockey Pump No. 1 Speed Command	NAO	U	100	ok	SP-6	
OL-306-1	High Service Jockey Pump No. 2 Running	NDI	STOPPED	RUNNING		SP-6	
OL-306-2	High Service Jockey Pump No. 2 Remote	NDI	LOCAL	REMOTE		SP-6	
OA-306	High Service Jockey Pump No. 2 Fail	NDI	OFF	FAIL		SP-6	
OA-306-2	High Service Jockey Pump No. 2 E-Stop	DI	OFF	FAIL		SP-6	
OA-306-3	High Service Jockey Pump No. 2 HiHi Temp	NDI	OFF	FAIL		SP-6	
FSL-306	High Service Jockey Pump No. 2 No Flow	NDI	OFF	FAIL		SP-6	
HS-306	High Service Jockey Pump No. 2 Run Command	NDO	STOP	RUN		SP-6	
SI-306	High Service Jockey Pump No. 2 Speed	NAI	0	100	olo	SP-6	
SC-306	High Service Jockey Pump No. 2 Speed Command	NAO	0	100	go	SP-6	
PIT-307	High Service Discharge Pressure	AI	0	200	PSI	SP-6	
FIT-308	High Service Discharge Flow	AI	0	34000	GPM	SP-6	
FIT-309	Plant Flow	AI	0	3500	GPM	SP-6	
OA-310	High Service HVAC High Temp Alarm	DI	OFF	FAIL		SP-6	
OA-123	East Pond Low Service Influent Valve Fail	DI	OFF	FAIL		RTU-3	DFS RTU
OL-123	East Pond Low Service Influent Valve in Remote	DI	OFF	REMOTE		RTU-3	DFS RTU
ZSC-123	East Pond Low Service Influent Valve Closed	DI	CLOSED	OPEN		RTU-3	DFS RTU
ZSO-123	East Pond Low Service Influent Valve Open	DI	CLOSED	OPEN		RTU-3	DFS RTU
ZCC-123	East Pond Low Service Influent Command to Close	DO	OFF	CLOSE		RTU-3	DFS RTU
ZCO-123	East Pond Low Service Influent Command to Open	DO	OFF	OPEN		RTU-3	DFS RTU
OA-124	South Pond 1 Low Service Influent Valve Fail	DI	OFF	FAIL		RTU-3	DFS RTU
OL-124	South Pond 1 Low Service Influent Valve in Remote	DI	OFF	REMOTE		RTU-3	DFS RTU
ZSC-124	South Pond 1 Low Service Influent Valve Closed	DI	CLOSED	OPEN		RTU-3	DFS RTU
ZSO-124	South Pond 1 Low Service Influent Valve Open	DI	CLOSED	OPEN		RTU-3	DFS RTU
ZCC-124	South Pond 1 Low Service Influent Command to Close	DO	OFF	CLOSE		RTU-3	DFS RTU
ZCO-124	South Pond 1 Low Service Influent Command to Open	DO	OFF	OPEN		RTU-3	DFS RTU

OA-125	South Pond 2 Low Service Influent Valve Fail	DI	OFF	FAIL	RTU-5	DFS RTU
OL-125	South Pond 2 Low Service Influent Valve in Remote	DI	OFF	REMOTE	RTU-5	DFS RTU
ZSC-125	South Pond 2 Low Service Influent Valve Closed	DI	CLOSED	OPEN	RTU-5	DFS RTU
ZSO-125	South Pond 2 Low Service Influent Valve Open	DI	CLOSED	OPEN	RTU-5	DFS RTU
ZCC-125	South Pond 2 Low Service Influent Command to Close	DO	OFF	CLOSE	RTU-5	DFS RTU
ZCO-125	South Pond 2 Low Service Influent Command to Open	DO	OFF	OPEN	RTU-5	DFS RTU

SECTION 13340

INSTRUMENTATION AND CONTROLS, EXISTING TELEMETRY SYSTEM MODIFICAITONS

PART 1 GENERAL

1.01 THE REQUIREMENT:

- A. The Contractor shall engage the servic es of Data Flow Systems (DFS) for the modi fication of exis ting remote and master DFS SCADA locations. The scope shall include furnishing, tes ting, in stalling and pla cing in satisfactory operation all equipment required to provide a complete and operable remote site telemetry system, as spe cified h erein a nd a s sh own on the Con tract Drawings, even if each needed item is not specifically specified or shown.
- B. The Contractor shall perform all hardware and software services to add the monito ring and contro 1 of the motorized reclaim valves for the East Pond and the South Pond 1 to DFS RTU 3.
- C. The Contractor shall perform all hardware and software services to add the monito ring and contro 1 of the motorized reclaim valve for the South Pond 2 to the DFS RTU 5.
- D. The Contractor (DFS) shall configure the existing Hyper SCADA (Modbus) to Allen-Bradley TCP Digi One IAP Protocol converter, located in the control room at the Southeast Regional Water Reclamation Facility, for the new equipment re gisters as part of this pro ject. The register information shall be coordinated with the OWNER and SSP.
- E. In addition to the plant DF S server, control of the equipment noted in Item B and C shall also be available from the in-plant Citect SCADA System over an existing communications 1 ink through the plant control room console PLC. Coordination and configuration services to support this control shall be included as part of the project.

- F. These sp ecifications ar e inte nded to co ver the furnishing, sh op testin g, delivery, comple te installation and field te sting of all eq uipment and appurtenances for the complete system herein specified, whether specifically mentioned in the Specifications or not. This includes all discrete and analog signal surge suppression, loop power supplies and isolation necessary for interfacing to the instrumentation and electronic equipment provided on this project.
- G. For all units there shall be furnished and installed all necessary and desirabl e ac cessory equip ment and auxiliaries whet her speci fically mentione d in thes e specifications or not. This installation shall include field-testing of the entire installation and instruction of th e re gular oper ating per sonnel in the car e, operation, and maintenance of all equipment.

1.02 RELATED WORK SPECIFIED ELSEWHERE:

A. In addition to the requirements specified in this section, the requirements of specification Section 13300 - Instrumentation and Controls, General Requirements and the sections referenced therein shall be applied.

1.03 SUBMITTALS:

 A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and as specified in S ection 133 00 - Instrumentation an d Controls, General Requirements.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS:

- A. The RTU hardware configuration as specified herein, as specified in re lated sections and as show non the Contract Drawings depicts overall system configuration requirements. Unless otherwise specified, designs which vary from this concept will be rejected.
- B. The Remote Terminal Unit (RTU) shall be properly sized and eq uipped t o prov ide comp lete l ocal aut omatic control. In addition to using the existi ng protocol converter for use in the Citect Human Machine Interface

(HMI), all configurable operational parameters shall be selectable f rom the Control Room Hyper SCA DA HMI terminal. The RTU shall incorporate a Radio Transceiver compatible with the owner's existing frequency and Input / Output (I /O) function modules required to me et the monitor and control requirements. Function module card connectors shall be gol d-over-nickel plated to i nhibit corrosion. The RTU shall be ca pable of oper ating in a temperature ranging from -10 to 60 Degrees Celsius (14 to 140 Degrees Fahrenheit).

- C. SERVICE PORT
 - 1. The RTU sh all s upport a l ocal serial interface service port for access to all the functions of the unit and loca l monitoring of the radio communications l ink. Th e RTU s hall su pport a n automatic antenna alignment function utilizing the local serial interface.
- D. POWER SUPPLY MODULE
 - 1. All function modules in the RTU shall run off DC voltage from +7.5 volts to +13 volts. The Power Supply Mo dule (PSM) shall supply +1 2 volts. A battery backup shall be provided to op erate the system in event of power failure. The PSM shall be surge protected. The P SM shall be short circuit protected by current limiting. Normal operation shall automatically resume when the short circuit overload is removed. The PSM shall be sized to operate the system with the battery removed. The PSM shall provide a battery backed, isolated bias voltage source. The circuit breaker for the PSM shall be part of the module. Neither the use of tools nor the disconnection of any wires shall be required to replace the PSM.
- E. SURGE PROTECTION
 - Multiple staged surge protection shall be provided for all power supply and power monitoring circuits. This design shall provide a very high level of nondestructive transient immunity. With the exception of a direc t lightning s trike, the device shall protect the RTU power supply and power monitoring circuits from damage due to voltage transients. The

unit shall provide circuit protection to withstand multiple transients in excess of 6,500 volts, 3,250 amps, without damage. Damage shall be limited to a blown fuse when exposed to larger transients. The device shall be transient-tested to ANSI standard C62.41. The un it shall be the Transie nt Fil ter Shield TFS001 as manufactured by Data Flow Systems. The AC power input protection shall be the Single Phase Suppresser, SPS001 as manufactured by Data Flow Systems. All surge protection shall be UL Listed.

- F. BACKUP BATTERY
 - The RTU shall have the uninterruptible power supply (UPS) function built in. The unit's internal power supply module shall keep the battery at a f loat charge. The battery shall not be damaged by deep discharges.

G. RADIO INTERFACE MODULE

The RTU shall require one radio interface module 1. (RIM). The RIM shall con trol the terminal radio during the polling sequence. The RIM shall have a service port t o provide co mmunications li nk monitoring. The service port shall also provide the capability to directly monitor and/or control each module in the RTU. The RIM utilized at the RTU shall b e int erchangeable w ith the RIM at th e central site. All radio communications shall be in ASCII and utilize an error detecting data transfer protocol. Ea ch RIM shal l ha ve an FM ra dio transceiver mounted to it. Replacement of the RIM shall trigger an automatic configuration of the new module to accommodate the site address and function (plug & play).

H. FUNCTION MODULES

1. The function modules shall be designed so they do not have c onfiguration swit ches or straps . The function mo dules shall b e desi gned wi th sur ge suppression on all inputs and outputs. Replacement of a function module shall not require the use of tools or the removal of any interface wires. There shall be no components associated with the function module m ounted to the mot herboard (pa ssive backplane). The function modules shall be backward compatible with all older modules of same type. All the function mod ules shall support central site computer access to the revision level of the module over the radio communications link.

- I. DIGITAL MONITOR MODULE
 - The digital monitor module (DMM) shall acce pt 12 1. on/off or pulsed inputs of 12 to 30 volts AC or DC. Other AC or DC voltages shall be accommodated with the use of an inline voltage converter de vice. Status reporting of the d igital inputs shall have an accuracy of +-2 seconds to the time the event occurred at the RTU. The D MM shall have LE Ds to indicate: the status of each input point; receive communications; transmit communications; CPU fault; and power status. The configuration of the monitor points as a larm points, monitor points (p ump run time monitors), or pulsed input points shall be operator changeable at the central site. The custom configuration of the DMM sh all not requi re any software or firmware cha nges in the R TU. Replacement of the DMM shall trigger an automatic configuration of the new module by the central site (plug & play).
- J. DIGITAL CONTROL MODULE
 - The digital control module (DCM) shall be available 1. in two configurations, providing eight (8) digital outputs and four (4) digit al inputs, or four (4) digital outputs and eight (8) digital inputs. Each control point shall accommodate 60 to 280 volt AC devices. Each control point shall be c apable of driving a 0.5 amp load @ 280 volts AC (140 VA), with inrush c urrent of 5 am ps. A ny d iscrete control point sh all have the capability of bein q automatically controlled by any disc rete monitor point, at the same RTU or at any other RTU. This shall be accomplished during configuration at the central si te a nd sha ll b e a vailable f or a n unlimited nu mber of contro 1 po ints. Ea ch inp ut shall accept ON/OFF inputs of 12 to 30 volts AC or DC. Other AC or DC voltages shall be ac commodated

with the use of an inline voltage converter device. Status reporting of the digital inputs shall have an accuracy of +- 2 seconds to the time the event occurred at t he RTU. The configuration of the monitor points as alarm points or monitor points (pump run ti me monitors) sha ll be operat or selectable. The configuration shall not require any software of firmware changes in t he system. The DCM shall have LEDs to indicate: the status of each output point; receive communications; transmit communications; CPU fa ult; and power st atus. Replacement of the DCM shall trigger an automatic configuration of the new module by the central site (plug & play).

- K. ANALOG MONITOR MODULE
 - The analog monitor module (AMM) shall monitor up to 1. 4 analog inputs, each capable of accepting 4-20 ma or 0-5 VDC. The analog input shall provide 12-bit accuracy. The analog inputs shall be in dividually optically iso lated. The AMM sha ll have supp ortconfigurable re porting granu larity and al arm thresholds. All configurable parameters shall be operator-controlled. The AMM sha ll have LEDs t o indicate: the s tatus of re ceive communi cations; transmit co mmunications; CP U f ault; a nd po wer status. The AM M shall be c apable of supply ing 24 VDC power so urce for 4 -20 ma transmitters. Replacement of the AMM shall trigger an automatic configuration of the new module by the central site (plug & play).
- L. ANALOG CONTROL MODULE
 - 1. The analog control module (ACM) shall control up to 4 analog outputs, each capable of producing 4-20 ma output driving a 0 to 1000 ohm load. The analog output s hall h ave 12 -bit accu racy. Eac h anal og control shall have configurable engineering units. All con figurable parame ters shall be operator controlled. ACM shall have L EDs to indicate: receive c ommunications; t ransmit comm unications; CPU fault; and p ower status. An y analog c ontrol point s hall have the capability o f bei nq automatically controlled by an y analog m onitor point, at the same RTU or at any other RTU. This
shall be accomplished during configuration at the central si te a nd sha ll b e a vailable f or a n unlimited number of control points. The ACM shall be capable of supplying 24 VDC power source for 4-20 ma tr ansmitters. Re placement of the an alog control mod ule shall trigger an au tomatic configuration of the new module by the central site computer (plug & play).

2.02 TOOLS, SUPPLIES, AND SPARE PARTS:

- A. Tools, supplies and spare parts shall be provided as specified in S ection 133 00 - Instrumentation and Controls, General Requirements, and as specified for each equipment item. In addition, the following items shall be provided:
 - 1. One (1) of each module used in the RTUs under this contract.

2.03 TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS):

- A. Refer to specification Section 13320 Instrumentation and Controls, Control Enclosures for TVSS requirements.
- B. Provide TVSS protection for all specified spare analog inputs and outputs.

PART 3 EXECUTION

3.01 REQUIREMENTS:

A. In add ition to the re quirements spe cified in this section, refer to Section 13300 - Instrumentation and Controls, General Requirements.

3.02 INSTALLATION

A. The Contractor shall install the equipment in accordance with the Contract Documents, manufacturer's instructions and shop drawings. Rigidly support and mount equipment level and plumb, and in su ch a manner a s to p rovide accessibility; protection f rom d amage; isol ation from heat, shock, and vi bration; and fr eedom from interference wi th other equipment, p iping, and electrical components.

- B. Include the services of a factory trained and qualified employee of the equipment manufacturer to inspect the complete e quipment installation to assure that it is installed in accordance with the manufa cturer's recommendations, make all adjustments necessary to place the system into trouble-free operation and instruct the operating personnel in the proper care and operation of the equipment furnished. Provide services at both the field installation site as well as the central site.
- C. All workm anship utilized in the manufac ture and installation of this system shall be of the highest quality and performed in a manner consistent with all accepted industry practices.

END OF SECTION

SECTION 15050

PIPE AND PIPE FITTINGS - GENERAL STATEMENT

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. General:
 - Furnish all labor, materials, tools, equipment, and services for all pipe and pipe fittings as indicated in accordance with provisions of Contract Documents.
 - Completely coordinate with work of all other trades.
 - 3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation.
 - 4. See Division 1 for General Requirements.
- B. Related specification sections include but are not limited:
 - 1. 15062 Ductile Iron Pipe and Fittings
 - 2. 15063 High Density Polyethylene (HDPE) Pipe
 - 3. 15067 Plastic Pipe for Pressure Service
 - 4. 15100 Valves and Appurtenances

1.02 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.
- B. Verify on shop drawings, dimensions, schedule of pipe, linings, coatings, fittings, hangers, supports, and miscellaneous appurtenances. When special fittings are necessary, verify locations of items and include complete details.

- C. Yard piping drawings. Submit scaled drawings showing locations and dimensions to and from fittings, valves, structures, gates, a nd related appurtenances. Provide scaled drawings to a minimum scale of 1/8 -inch equals 1-foot. Provide details to minimum scale of 1/8-inch equals 1 -foot. Information shall include but not necessarily be limited to:
 - 1. Dimensions of piping lengths
 - 2. Invert or centerline elevations of piping crossings
 - 3. Acknowledgment of bury depth requirements
 - 4. Details of fittings, tapping locations, thrust blocks, restrained joint segments, harnessed joint segments, hydrants, and related appurtenances.
 - 5. Line slopes and vents

PART 2 PRODUCTS

2.01 GENERAL PIPING SYSTEMS

- A. Unless otherwise shown on drawings or drawing schedule, piping system materials, fittings, and appurtenances are subject to requirements of specific technical specifications and shall be as follows:
- Β.

	Pipe Size	
Service Category	Range (in)	Piping System
RCW - Reclaimed Water (All Applications, including: Low Service, High Service, Storage Feed, Storage Return)	4 to 24	Above ground - AWWA C115 Class 53 ductile iron, cement-lined, flanged, AWWA C110 and C111 flanged ductile iron fittings with 350 psi rating, cement- lined
	30 to 42	Above ground - AWWA C115 Class 53 ductile iron, cement-lined, flanged, AWWA C110 and C111 flanged ductile iron fittings with 250 psi rating , cement - lined
	4 to 12	Below ground - AWWA C150 and C151 ductile iron pipe, push -on or mechanical joints, cement- lined, 350 psi pressure class

14 to 20	Below ground - AWWA C150 and C151 ductile iron pipe, cement -lined, push - on joints, 250 psi pressure class
24	Below ground-AWWA C150 and C151 DIP cement-lined, push-on joints, 200 psi pressure class
30 to 42	Below ground - AWWA C150 and C151 ductile iron pipe, cement -lined, push - on joints, 150 psi pressure class, AWWA C110 and C111 ductile iron fittings, mechanical joint, 250 psi working pressure, cement-lined
4 to 24	Below ground - AWWA C153 compact ductile iron fittings, mechanical joints, 350 psi working pressure, cement-lined
30 to 32	Below ground - AWWA C110 ductile iron fittings, mechanical joints, 250 psi working pressure, cement - lined

PART 3 EXECUTION

3.01 DELIVERY, INSPECTION AND STORAGE

- A. Inspect materials thoroughly upon arrival. Remove damaged or rejected materials from site.
- B. Observe manufacturer's directions for delivery and storage of materials and accessories.
- C. Store materials on-site in enclosures or under protective coverings above ground to keep them clean and dry.

3.02 HANDLING OF PIPE

- A. Protect pipe coating during handling using methods recommended by manufacturer. Use of bare cables, chains, hooks, metal bars, or narrow skids i n contact with coated pipe is not permitted.
- B. Prevent damage to pipe during transit. Repair abrasions, scars, and blemishes. If repair of

satisfactory quality cannot be achieved, replace damaged material immediately.

C. Erect piping to accurate lines and gra des and support as required on drawings or described in specifications. When temporary supports are used, ensure that sufficient rigidity is provided to prevent shifting or distortion of pipe. Install expansion devices , as necessary, to allow expansion and contraction movements.

3.03 PIPING - GENERAL

A. Minimum bury. Unless otherwise shown on the drawings, provide a minimum of 36-inches earth cover over exterior buried piping systems and appurtenances conveying water, fluids, or solutions.

3.04 PIPING WITHIN BUILDINGS, STRUCTURES AND UNITS

- A. Install piping in vertical and horizontal alignment as shown on drawings. Alignment of piping smaller than 4 inches may not be shown. However, install according to drawing intent and with ample clearance and allowance for:
 - 1. Expansion and contraction
 - Operation and access to equipment, doors, windows, hoists, moving equipment
 - 3. Headroom and walking space for working areas and aisles
 - 4. Install vertical piping plumb and horizontal piping runs parallel with structure walls
- B. Use methods of piping support as shown on the drawings and as required in Section 15141 - Pipe Support Systems. Where pipes run parallel and as same elevation or grade, they may be grouped and supported from common trapeze-type hanger, provided hanger rods are increased in size as specified for total supported weight. The pipe in the group requiring the least maximum distance between supports shall set the distance between trapeze hangers.
- C. Locate and size sleeves required for piping system. Arrange for chases, recesses, inserts, or anchors at proper elevation and location.

- D. Install service piping to provide every plumbing fixture and equipment requiring potable water with suitable supply and soil or waste and vent connection as required by code. Consult manufacturer's data and large scale details of rooms containing plumbing fixtures before roughing in piping. Plug or cap piping immediately after installation.
- E. Use reducing fittings throughout piping systems. Bushings will not be allowed unless specifically approved.
- F. Provide drain pans and piping from items of equipment where condensation may occur. Run drain piping to nearest floor drain or rainwater downspout. Condensate drain piping shall generally be 1 -inch except where otherwise indicated.
- G. Soil, waste, vent and rainwater piping installation:
 - 1. Install horizontal soil or waste lines with fall to produce flow rate of 2-feet per second or 1/8inch per foot. Hold as close to construction as possible to maintain maximum headroom. Make changes of direction with 1/8 bends, and junctions with wye fittings. Use short wye fittings in vertical pipe only. Install handhold test tee at base of each stack. Install cleanouts at dead ends, at changes of direction, and at 50-foot intervals on horizontal runs. Where cleanouts occur in concealed spaces, provide with extensions to floors above or to wall as required.
 - 2. Run vent stack parallel to each soil or waste stack to receive branch vents from fixtures. Each vent stack shall originate from soil or waste pipe at its base. Where possible, combine soil, waste, or vent stacks before passing through roof so as to minimize roof openings. Offset pipes running close to exterior walls away from such walls before passing through roof to permit proper flashing. Provide pipes passing through roofs with cast iron increases minimum of 12 -inches below roof one size larger than pipe but in no case less than 4-inches. Terminate each vent with approved frostproof jacket.
 - 3. Provide each vent pipe passing through roof with 4-lb sheet lead flashing consisting of 18 x 18 inch base with tubular vertical sleeve surrounding pipe with 1-inch minimum spacing and turning in 2-

inches at top. Provide gasket seal between top and lead sleeve.

- 4. Carry vent stacks 4 -inches and larger full size through roof. Extend vent stack s at least 12-inches above roofing.
- 5. Provide each roof drain with 4-lb sheet lead flashing 36 x 36 -inch square clamped under flashing ring of drain.
- H. Potable or service water piping installation:
 - Install drain tees with capped nipples of PIS brass 3-inches long at low points. If low points occur in concealed piping, provide approved flush access panel. These drains are not shown on drawings.
 - Slope water lines down to drain points not less than 1-inch in 60-feet.
 - 3. Wherever threaded piping is installed, pro vide clean-cut tapered threads with ends thoroughly reamed after cutting to remove burrs. Pipe joint cement permitted only on external threads. For screwed nipples for connections to flush valves, lavatory supplies, and other equipment with threaded connections use iron, copper, or brass pipe.
 - 4. Install ball, butterfly, gate, check, and plug valves where indicated or required to adequately service all parts of system and equipment. Unless otherwise indicated, install valves on each branch serving restroom. I nstall valve on inlet and outlet connections of heat exchangers and on other equipment connected to water lines.
 - 5. Install union between valves and connections to each piece of equipment and install sufficient number of unions throughout piping system to facilitate installation and servicing. On copper pipe line, install wrought copper solder -joint copper to copper unions for lines 2 -inches and smaller; for lines 2-1/2-inches and over, install brass flange unions.
 - 6. Construct and equip plumbing fixtures and equipment with anti-siphon devices as to entirely

eliminate any danger of siphoning waste material into potable water supply system.

- 7. Where exposed pipes 6-inches in size and smaller pass through floors, finished walls, or finished ceilings, fit with nickel or chrome-plated plates large enough to close hole completely around pipes. Secure plates to pipe by set screw in approved manner.
- 8. Size supply branches to individual fixtures as scheduled or indicated on drawings.
- 9. Install piping so as to be free to expand with proper loops, anchors, and joints with injury to system or structure.
- 10. Provide branches to wall hydrants or hose bibbs in exterior location with interior shutoff and drain valves.
- 11. Provide approved type vacuum breaker installations indicated or as required by Code.

3.05 PIPING OUTSIDE BUILDINGS AND STRUCTURES

- A. Install piping as shown on drawings with ample clearance and allowance for expansion or contraction.
- B. Install flexible joint within two (2) feet of point where pipe enters or leaves structure. Provide balance of piping with standard laying lengths and in accordance with drawings.

3.06 PIPE INTERSECTIONS WITH STRUCTURES AND UNITS

A. Enter and exit through structure walls by using wall seals specified or as shown on drawings.

3.07 EQUIPMENT PIPE CONNECTIONS

A. Exercise care in bolting flanged joints so that there is no restraint on the opposite end of pipe or fitting which would prevent uniform gasket pressure at connection or would cause unnecessary stresses to be transmitted to equipment flanges. Where push -on joints are used in conjunction with flanged joints, final positioning of push -on joints shall not be made until flange joints have been tightened without strain.

- B. Tighten flange bolts at uniform rate which will result in uniform gasket compression over entire area of joint. Provide tightening torque in accordance with manufacturer's recommendations.
- C. Support and match flange face to uniform contact over their entire face area prior to installation of any bolt between the piping flange and equipment connecting flange.
- D. Permit piping connecting to equipment to move freely in directions parallel to longitudinal centerline when and while bolts in connection flange are tightened. Align, level, and wedge equipment into place during fitting and alignment of connec ting piping. Grout equipment into place prior to final bolting of piping but not before initial fitting and alignment. To provide maximum flexibility and ease of alignment, assemble connecting piping with gaskets in place and minimum of four (4) bolts per joint installed and tightened. Test alignment by loosening flange bolts to see if there is any change in relationship of piping flange with equipment connecting flange. Realign as necessary, install flange bolts, and make equipment connection.
- E. Provide uti lity connections to equipment shown on drawings, scheduled or specified.
- F. Obtain rough -in data from approved shop drawings on equipment. Obtain rough-in data for relocating existing equipment and coordinate with Owner.
- G. Unless otherwise specified, make pip ing connections to equipment, including but not limited to installation of brass and fittings, strainers, pressure -reducing valves, flow control valves, and relief valves provided with or as an integral part of equipment.
- H. Furnish and install sinks, brass, fittings, strainers, pressure-reducing valves, flow control valves, pressure relief valves, and shock absorbers which are not specified to be provided with or an integral part of equipment.
- I. For each potable or service water supply piping connection to equipment, furnish and install union and gate or angle valve. Minimum size to be 1/2-inch.
- J. Furnish and install "P" trap for each waste piping connection to equipment if waste is connected directly

to building sewer system. Size trap as required by Plumbing Code.

K. Stub piping for equipment, sinks, lavatories, supply and drain fittings, key stops, "P" traps, miscellaneous traps, and miscellaneous brass through wall or floor and cap and protect until such time when later installation is performed. Run piping m ains and branches in laboratory benches, built -in counters, and cabinet work if acceptable to Construction Manager.

3.08 ANCHORAGE AND BLOCKING

- A. Block, anchor, or harness exposed piping subjected to internal pressure, in which mechanical, push -on, flexible, or similar joints are installed to prevent separation of joints.
- B. Provide reaction blocking, anchors, joint harnesses, or other acceptable means for preventing movement of piping caused by internal pressure in buried piping tees, wye branches, plugs, or bends.
- C. Place concrete blocking so that it extends from fitting into solid undisturbed earth wall. Concrete blocks shall not cover pipe joints. Provide bearing area of concrete in accordance with drawing detail. In event that adequate support cannot be achieve d against undisturbed soil, install restrained piping joints.
- D. Provide reaction blocking, anchorages, or other supports for fittings as shown on drawings for piping installed in fills, unstable ground, above grade, or exposed within structures.

3.09 CLEANING

- A. Clean interior of piping systems thoroughly before installing. Maintain pipe in clean condition during installation.
- B. Before jointing pipe, thoroughly clean and wipe joint contact surfaces and then properly dress and make joint.
- C. Immediately prior to pressure testing, clean and remove grease, metal cuttings, dirt, or other foreign materials which may have entered the system.

D. At completion of work and prior to final acceptance, thoroughly clean work installed under these specifications. Clean equipment, fi xtures, pipe, valves, and fittings of grease, metal cuttings, and sludge which may have accumulated by operation of system, from testing or from other causes. Repair any stoppage or discoloration or other damage to parts of building, its finish, or furnishings, due to failure to properly clean piping system, without cost to Owner.

3.10 PIGGING, FLUSHING AND CLEANING

- A. All mains and distribution lines shall be pigged, cleaned and flushed to remove all sand and other foreign matter. The Contractor shall be responsible for developing a pigging and flushing plan to be submitted to the Engineer for approval prior to pigging and flushing. The contractor shall dispose of all water used for pigging and flushing without causing a nuisance or property damage. Any permits required for the disposal of flushing water shall be the responsibility of the Contractor.
- C. Flushing water used by the Contractor shall be taken from an approved metered source. The water utility will provide the meter and designate the source . Flushing water shall be at the Contractor's expense. Flushing water shall be potable water for potable water mains.RCW mains may be flushed with potable or reclaimed water.
- The cleaning of the new piping system shall be D. accomplished by the controlled and pressurized passage of a series of hydraulic or pneumatic polyurethane plugs of varying dimensions, coatings, and densities; which shall be selected by the pipe cleaning The Contractor shall provide a means to Contractor. enter the pig into the system , control and regulate flow, monitor flows and pressures, and to remove the piq from the system. The contractor shall maintain a constant surveillance of the system and immediately report to the proper authority any inline problems encountered or any malf unctions discovered in the piping system. A record of pig models, sizes, styles, and other pertinent information shall be kept by the Contractor and turned over to the Owner

3.11 TESTING AND INSPECTION

E. Upon completion of piping, but prior to application of insulation on exposed piping, test all piping systems.

Utilize pressures, media and pressure test duration at specified on piping specification sheets. Isolate equipment which may be damaged by the specified pressure test conditions. Perform pressure test using calibrated pressure gages and calibrated volumetric measuring equipment to determine leakage rates. Select each gage so that the specified test pressure falls within the upper half of the gage's range. Notify the Engineer 24 hours prior to each test.

- F. Unless otherwise specified, completely assemble and test new piping systems prior to connection to existing pipe systems.
- G. Acknowledge satisfactory performance of tests and inspections in writing to Engineer prior to final acceptance.
- H. Provide all n ecessary equipment and perform all work required in connection with the tests and inspections.
- I. Bear the cost of all testing and inspecting, locating and remedying of leaks and any necessary retesting and re-examination.

3.12 DISINFECTING POTABLE WATER PIPELINES

- A. All record drawing requirements must be submitted to the Owner/Engineer prior to starting the bacteriological testing of the water lines.
- B. Prior to being placed in service, all potable water pipe lines shall be chlorinated in accordance with AWWA 651, "Standard Procedure for Disinfecting Water Main". The procedure shall meet Health Department requirements. The location of the chlorination and sampling points shall be determined by the Engineer. Taps for chlorination and sampling shall be uncovere d and backfilled by the Contractor as required.
- C. The general procedure for chlorination shall be to flush all dirty or discolored water from the lines, and then introduce chlorine in approved dosages through a tap at one end while water is being withdrawn at the other end of the line. The chlorine solution shall remain in the pipe line for 24 hours.

Water for flushing, filling and disinfecting the new lines will be provided by the owner and must be obtained without contaminating existing pipe lines. Water obtained from existing pipe lines for this purpose shall pass through an approved air gap or backflow prevention device.

- Following the chlorination period, all treated water D. shall be flushed from the lines at their extremities and replaced with water from the distribution system. Bacteriological sampling (taken by the Contractor and provided to an approved laboratory by the Contractor) and analysis of the replacement water shall then be made by an approved laboratory or the Health Department in full accordance with the AWWA Manual C651. The line shall not be placed in service unt il the requirements of the Florida Department of Environmental Protection (FDEP) and County Public Health Department are met. Results of the bacteriological tests together wi th certified record drawings must be submitted to the Health Department (FDEP) within 30 days of the tests.
- E. Special disinfecting procedures when approved by the County may be used where the method outlined above is not practical.

3.13 LOCATION OF BURIED OBSTACLES

- J. Furnish exact location of buried utilities encountered and any below grade structures. Reference items to definitive reference point locations such as found property corners, entrances to buildings, existing structure lines, fire hydrants, and rela ted fixed structures. Include such information as location, elevation, coverage, supports, and additional pertinent information which will be required by future contractors for replacement servicing, or adjacent construction around any buried facility.
- K. Incorporate information to "Record Drawings".

3.14 SPECIAL REQUIREMENTS AND PIPING SPECIALTIES

- L. Insulating joints : Provide insulating joints where dissimilar metals are joined together and where specifically indicated on drawings. Type of joint shall be as deta iled and in accordance with the following requirements:
 - 1. Insulating flanges: Provide each unit to consist of flat-faced rubber gaskets.
 - Insulating unions: Provide "dielectric" union by Epco or equal.

- 3. Insulating couplings: When joining larger diameter dissimilar metal pipe, use insulating coupling equal to Rockwell No. 416, Dresser Style 39, or equal. When pipes have different outside diameters, use insulating reducing couplings equal to Rockwell No. 417, Dresser Style 39 -62, or equal.
- M. Welding:

 - Use only certified welders meeting proced ures and performance outlined in Section 9 of the ASME other codes and requirements per local building and utility requirements.
 - 3. Have all welds conform to highest industrial practice in accordance with ANSI B31.3 and ANSI B31.1 or other codes and requirem ents per local building and utility requirements.
- N. Protective coatings and linings:
 - 1. Where coatings, linings, paint, tests and other items qualified in applications of service are stated, pipe and fittings shall be included in referenced conditions.
 - 2. Where specified, provide coal -tar epoxy linings and coatings in accordance with AWWA C210 to a minimum thickness of 20 mils in not less than two coats.
 - 3. Where specified, provide cement mortar lining in accordance with AWWA C205.
 - 4. Where specified, provide Protecto 401 lining.
 - 5. Where specified, galvanize surface in accordance with hot -dip method using any grade of zinc acceptable to ASTM B6.
 - 6. Where specified, field paint pipe in accordance with Section 09900 - Painting and Coatings and Section 09902 - Pipe and Equipment Painting.

O. Underground alarming tape. Provide underground warning tape constructed of heavy gage 0.004 -inch polyethylene film to identify all buried utilities except 3-inch and smaller irrigation pipe. Provide 6 -inch wide tape as follows:

Film Legend	Film Color
Electric line below	Red
Telephone line below	Orange
Water line below	Blue
Sewer line below	Green
Nonpotable water below	Brown
Reclaimed Water Below	Purple

P. Install tape directly above each buried utility as shown on the Drawings.

END OF SECTION

SECTION 15062

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Install within the project site all materials and incidentals including flanged joint, mechanical joint, push-on joint, and restrained joint ductile iron pipe and/or ductile iron restrained, flanged, or mechanical joint fittings for potable water mains, reclaimed water mains, wastewater treatment plant process piping, and gravity sewers, complete, as shown on the project drawings.
- B. The Contractor shall coordinate all deliveries with the related Vendor (s) in a manner not to impede construction.

1.02 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.
- B. Except as otherwise shown on the Drawings, either pushon, mechanical or flanged joints shall be used. Prior to commencing work, jointing systems for pipe shall be submitted to the Owner's Representative for approval. The joints of all buried pipe, fittings and valves on the treatment plant site shall be restrained.
- C. All ductile iron pipe and fittings to be installed under this Contract shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Furnish in duplicate to the Owner's Representative sworn certificates of such tests and their results.
- D. Shop Drawings including layout drawings shall be submitted to the Owner's Representative for approval and shall include dimensioning, methods and locations of supports and all other pertinent technical specifications for all piping to be furnished. Layout Drawings shall be to scale, and shall clearly indicate the amount of pipe to be restrained from each fitting.

E. The Contractor shall transmit from the Vendor to the Owner's Representative , the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pipe shall be supplied in lengths not in excess of 21-feet.
- B. Buried Pipe shall conform to ANSI/AWWA C150/A21.50 and ANSI/AWWA C151/A21.51, cur rent editions. Below grade pipe 4 to 12 -inches in diameter shall be rubber -ring type push-on joint or mechanical joint, pressure Class 350. Below grade pipe 14 to 20 -inches in diameter shall be rubber-ring type push-on joint, Pressure Class 250. Below grade pipe 24 -inches in diameter shall be rubber-ring type push -on joint, pressure Class 200. Below grade pipe 30 to 60-inches in diameter shall be rubber-ring type push-on joint, pressure Class 150.
- C. Mechanical joint fittings for 4 to 24 -inch diameter ductile iron pipe shall be compact ductile iron cast in accordance with ANSI/AWWA C153/A21.53. The working pressure rating for the fittings shall be 350 psi.
- D. Mechanical joint fittings for 30 to 60-inch diameter ductile iron pipe shall be standard size duct ile iron cast in accordance with ANSI/AWWA C110/A21.10. The working pressure rating for the fittings shall be 250 psi.
- E. Gaskets shall be EPDM (Ethylene-Propylene Dine Monomer) such as the "Fastite Gasket" of American Ductile Iron Pipe Co., or approved equ al in conformance with ANSI/AWWA C111/A21.11, latest edition.
- F. All mechanical joints and push -on joints for pipe, fittings and valves on the wastewater treatment plant site shall be restrained. Restraints shall be Megalug by EBAA Iron, Romac, or equal. Restraints may also be American Ductile Iron Pipe's Fast Grip Gasket, U.S. Pipe's Field Lok Gasket, or equal.
- G. Below grade pipe shall have a one -mil coal tar enamel coating on the outside. The coal tar enamel shall be in accordance with ANSI/AWWA C151/A21.51.

- H. All buried ductile iron pipe and fittings shall be provided with a 4 -mil thick cross laminated high density polyethylene encasement or an 8 -mil thick polyethylene encasement per ANSI/AWWA C105 /A21.5. Color of encasement shall be in accordance with Manatee County requirements based on the service type of the pipe.
- I. Flanged ductile-iron pipe for above ground piping shall conform to current ANSI/AWWA C115 /A21.15 with factory applied screwed long hub flanges except as otherwise specified hereinafter. Fla nges shall be faced and drilled after being screwed on the pipe with flanges true to 90 degrees with the pipe axis and shall be flush with end of pipe conforming to ANSI B16.1, 125 pounds standard. Flanged pipe shall be special thickness Class 53.
- J. Flanged fittings shall be ductile as specified herein. Flanges and flanged fittings shall be flat face and shall conform to ANSI /AWWA C110/ A21.10 for 350 psi pressure ratings between 4 and 24 -inch diameter pipe and for 250 psi pressure ratings for 30 to 60 -inch diameter pipe. Full face type 1/8-inch thick SBR rubber ring gaskets shall conform to ANSI/AWWA C111/A21.11.
- K. Bolts and nuts on flanged fittings shall be Grade B, ASTM A-307, cadmium plated and conform to ANSI B16.1 for Class 125.
- L. Pipe and fittings exposed to view in the finished work to be painted shall not receive the standard tar or asphalt coat on the outside surfaces but shall be shop primed on the outside with one coat of Koppers No. 621 rust inhibitive primer or approved equal. All other pipe and fittings shall be shop coated on the outside with a 1.0 mil thick bituminous coat in accordance with ANSI/AWWA C151/A21.51.
 - 1. Should portions of the pipe inadvertently be given the outside coating of coal tar enamel instead of the rust inhibitive primer as required for exposed piping, the surfaces shall be sealed with a non bleeding sealer coat such as Kopcoat Inertol Tar Stop, or Mobil Anti -bleeding Aluminum Sealer. Sealing shall be part of the work of this section.

- M. All ductile iron pipe and fittings ca rrying clarifier effluent, effluent, filter effluent, reclaimed water, reject, waste backwash from disk filters, and potable water shall have a standard thickness cement lining and seal coats on their interiors in accordance with ANSI/AWWA C104/A21.4.
- All ductile iron pipe and fittings carrying raw Ν. wastewater, internal recycle, mixed liquor, plant drain wastewaters, return activated sludge, thickened sludge and waste activated sludge shall have an interior lining of Protecto 401 ceramic epoxy applied at a nominal thickness of 40 mils. The Protecto 401 material shall be a high-build, multi-component, Aminecured, Novalac epoxy lining. At least 20% of the volume of the lining material shall be ceramic quartz The linings shall be checked for thickn ess pigment. using a magnetic film thickness gauge and the method outlined in SSPC -PA-2, Film Thickness Rating. The interior lining of all pipe and fittings shall be tested for pinholes with a non -destructive 2,500 volt test. Each pipe and fitting shall be marked with the date of application of the lining system and with its sequence number of application on that date. The pipe and fitting manufacturers shall supply a certificate attesting that the lining material used was as specified, and that the lining material was applied as required by the specifications and the lining material manufacturer.
- O. All interior linings for potable water piping shall be EPA/NSF approved.
- P. Pipe and fitting manufacturers shall be the American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, McWane, Tyler, or approved equal.

PART 3 EXECUTION

3.01 HANDLING PIPE AND FITTINGS

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

- B. All pipe and fittings shall be subjected to a careful inspection and hammer test just prior to being installed.
- C. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional expense to the Owner.

3.02 UNDERGROUND PIPE INSTALLATION

- A. Alignment and Grade: The pipelines shall be laid and maintained to lines and grades established by the Drawings and Specifications, with fittings, valves and hydrants at the required locations unless otherwise approved by the Owner's Representati ve. Valve operating stems shall be oriented to allow proper operation. Hydrants shall be installed plumb.
- Underground Conflicts: Prior to excavation, в. investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised to avoid damage to existing structures. When obstructions that are not shown on the drawings are encountered during the progress of the work and interfere so that an alteration of the Drawings is required, the Owner's Representative will alter the Drawings or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the Owner's Representative, to provide clearance as required by federal, state, or local regulations or as deemed necessary by the Owner's Representative to prevent future damage or contamination of either structure.
- C. Trench Construction:
 - 1. Trench preparation shall proceed in advance of pipe installation for only as far as necessary to allow proper pipe installation. The width of the trench at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and allow the backfill to be placed as specified.
 - 2. Bedding shall be provided and compacted in accordance with the details shown on the Drawings.

- 3. Holes for the bells shall be provided at each joint but shall not be larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Other than noted previously, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that slight depression may be provided to allow withdrawal of pipe slings or other lifting-tackle.
- When excavation of rock is encountered, all rock 4. shall be removed to provide a clearance of at least 6-inches below and on each side of all pipe, valves, and fittings for pipe sizes 24 -inches or smaller, and 9 -inches for pipe 30 - inches and larger. When excavation is completed, a bed of sand, crushed stone or earth that is free from stones, large clods, or frozen earth shall be placed on the bottom of the trench to the previously mentioned depths, leveled, and tamped. These clearances and bedding procedures shall also be observed for pieces of concrete or masonry and other debris or subterranean structures, such as masonry walls, piers, or foundations that may be encountered during excavation.
- 5. This installation procedure shall be followed when gravel formations containing loose boulders greater than 8 inches in diameter are encountered. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point of rock, boulder, or stones of sufficient size and placement which, in the opinion of the Engineer could cause a fulcrum point.
- 6. Should the trench pass over a sewer or other previous excavation, the trench bottom shal 1 be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.
- 7. When the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed, to a minimum of at least 3-inches, or to the depth ordered by the Engineer and replaced under the directions of the Engineer with clean, stable backfill materia 1. The bedding shall be

consolidated and leveled in order that the pipe may be installed as specified.

8. When the bottom of the trench or the subgrade is found to consist of material that is unstable to such a degree that, in the judgment of the Engineer it cannot be removed, a foundation for the pipe and/or appurtenance shall be constructed using piling, timber, concrete, or other materials at the direction of the Engineer.

3.03 PIPE INSTALLATION

- A. Proper implements, tools, and facilities shall be provided and used for the safe and convenient performance of the work. All pipe, fittings, valves, and hydrants shall be lowered carefully into the trench by means of a derrick, ropes, or other suitable tools or equipment in such a manner as to prevent damage to pipeline material and protective coatings and linings. Under no circumstances shall pipeline materials be dropped off or dumped into the trench. The trench shall be dewatered prior to installation of the pipe.
- B. All pipe fittings, valves, hydrants, and other appurtenances shall be examined carefull y for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Owner's Representative who may prescribe corrective repairs or reject the materials.
- C. All lumps, blisters, and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and be free from dirt, sand, grit, or any foreign material before the pipe is laid.
- D. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. During laying operations, no debris, tools, clothing, or other materials shall be placed in the pipe.
- E. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.
- F. At times when pipe laying is not in progress, the open ends of pipe shall be closed by a water tight plug or other means approved by the Owner's Representative.

When practical, the plug shall remain in place until the trench is pumped completely dry. Care shall be taken to prevent pipe flotation should the trench fill with water.

- G. Trench width at the top of pipe, bedding conditions, and backfill placement and compa ction shall be such that design loadings on the pipe will not be exceeded.
- H. Joint Assembly: Pipe joints shall be assembled in accordance with the Manufacturer's instructions and the requirements of ANSI/AWWA C600.
- I. Pipe Deflection: When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed that shown in AWWA C600, latest edition.
- J. Pipe Cutting: Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe or lining. Ductile cast iron may be cut using an abrasive pipe saw, rotary wheel cutter, guillotine pipe saw, milling wheel saw, or oxyacetylene torch. Cut ends and rough edges shall be ground smooth and for push-on joint connections, the cut end shall be beveled.
- K. Thrust Restraint:
 - 1. All pipe joints, plugs, caps, tees, and bends shall be suitably restrained by attaching steel tie rods or restrained joints as specified.
 - 2. Thrust-restraint design pressure shall be equal to the test pressure of the line.
 - 3. Restrained mechanical joints utilizing setscrew retainer glands or steel harness and tie rods shall be used in place of concrete. Steel tie rods or other components of dissimilar metal shall be protected against corrosion by hand application of a bituminous coating or by encasement of the entire assembly with in an 8-mil thick, lo ose polyethylene casing in accordance with ANSI/AWWA C105/A21.5.

3.04 ABOVE GROUND PIPE INSTALLATION

A. Install pipe in horizontal or vertical planes, parallel or perpendicular to building surfaces unless otherwise shown. Support pipe and fittings to prevent strain on joints, valves and equipment. Install flanged joints so that contact faces bear uniformly on the gasket. Tighten bolts with relatively uniform stress.

3.05 TESTING

- A. Hydrostatic pressure and leakage test shall conform to Section 4 of AWWA C600 , with the exception that the Contractor shall furnish all gauges, meters, pressure pumps and other equipment needed to test the line.
- B. The pressure required for the field hydro static pressure test shall be 180 psi for potable water lines and reclaimed water li nes, and shall be 150 psi for force mains. The Contractor shall provide temporary plugs and blocking necessary to maintain the required test pressure of 180 psi or 150 psi. Corporation cocks at least 3/4 -inches in diameter, pipe riser and angle globe valves shall be provided at each pipe dead-end in order to bleed air from the line. Duration of pressure test shall be at least two hours.
- С. The leakage test may be conducted at the same time as the pressure test, and shall be of not less than one hour duration. All leaks evident at the surface shall be repaired and leakage eliminated regardless of total leakage as shown by test. Lines which fail to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced. The pipe lines shall be tested in such sections as may be required. The line shall be filled with water and all air removed and the test pressure shall be maintained in the pipe for the entire test period by means of a force pump to be furnished by the Contractor. Accurate means shall be provided for measuring the water required to maintain this pressure. The amount of water required is a measure of the leakage.
- D. The amount of leakage which will be permitted shall be in accordance with AWWA C600 Standards for all pressure tests. No pipe installation shall be accepted if the leakage is greater than that determined by the following formula:

 $L = \frac{SD(P)1/2}{133,200*}$

- L = Leakage in gallons per hour
- S = Length of pipe in feet
- D = Nominal diameter in inches
- P = Pressure in psi

 * Note: If 20 -foot pipe lengths are used, factor to be 148,000

E. Ductile iron pipe used for gravity sanitary sewers shall be tested for leakage by conducting infiltration tests, exfiltration tests, or low pressure air tests.

3.06 SURFACE PREPARATION AND PAINTING

A. All piping and fittings exposed to view shall have their surfaces prepared and painted with a prime coat as defined in these Specifications. Surface preparation and shop priming is a part of the work of this Section.

END OF SECTION

SECTION 15063

HIGH DENSITY POLYETHYLENE (HDPE) PIPE

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes materials and methods of installation of HDPE pipe. Pipe is intended for use in a reclaimed water system or in a potable water system.

1.02 SUBMITTALS

- A. Provide manufacturer's Certificate of Compliance with specified requirements.
- B. All submittals shall be in accordance with Section
 01340 Shop Drawings, Project Data and Samples.

1.03 HANDLING AND STORAGE

- A. All pipe, fittings, valves and accessor ies shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks o r pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe.
- B. Materials, if stored, shall be kept safe from damage. The interior as well as all sealing surfaces of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves shall be drained and stored in a manner that will protect them from damage or freezing.
- C. Pipe stored outside and exposed to prolonged periods of sunlight shall be covered w ith canvas or other opaque material. Air circulation shall be provided under covering.
- D. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe shall not be stored close to heat sources.

E. Gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis. Mechanical-joint bolts shall be handled and stored in a manner that will ensure proper use with respect to types and sizes.

1.04 REFERENCE DOCUMENTS

- A. Ductile Iron Pipe ANSI/AWWA C151/A21.51
- B. HDPE Pipe AWWA C906.
- C. HDPE Pipe AWWA C901.
- D. Water Resources Act, Chapter 373, F.S.
- E. Chapter 17-40 Florida Administrative Code.
- F. Chapter 17-610 Florida Administrative Code.
- G. American National Standards Institute (ANSI).
- H. American Water Works Association (AWWA).
- I. American Society for Testing Materials (ASTM)
- J. American Association of State Highway Transportat ion Officials (AASHTO).
- K. American Society of Sanitary Engineers (ASSE).
- L. Plastic Pipe Institute (PPI).

1.05 SHOP DRAWINGS AND SUBMITTALS

- A. In general, shop drawings and related manufacturer's product certification shall be made in accordance with the General and Special Conditions of the Contract for approval prior to construction or fabrication of the material by the manufacturer. The following items which require shop drawings are brought to the Contractor's attention. The list may not include all items for which shop drawing submittals are required to meet the requirements of the project.
 - Detail drawings of all classes of pipe, joints, and fittings.

- 2. Detail Drawings of restrained and flexible joints, including test reports to confirm thrust restraint capacities and restraining mechanism application.
- 3. Pipeline laying schedule tabulated and referenced to construction line and grade controls shown on plans, with station, offset and elevations. References shall be provided for pipe fittings, valves, service conn ections and other important features of the pipeline.
- 4. All Appurtenant Items.
- B. Certification and test reports for the materials, manufacturing, and testing of the types of pipe supplied shall be performed and furnished by the pipe manufacturer in accordance with the latest standards of the industry as described in Sub-section 1.2 herein.
- C. Provide a statement in writing from the HDPE pipe manufacturer that it is listed with the Plastic Pipe Institute as a qualified extruder for the polyethylene resin being u sed to manufacture the pipe for this project.

PART 2 PRODUCTS

2.01 REFERENCES

- A. The following documents are a part of this Section. Where this Specification section differs from these documents, the requirements of this section shall apply.
 - 1. ASTM D1248-84, Polyethylene Plastics Molding and Extrusion Materials.
 - 2. ASTM D3350 -84, Polyethylene Plastic Pipe and Fittings Material.
 - 3. ASTM F714-85, Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

2.02 HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS

- A. General:
 - 1. All High Density Polyethylene (HDPE) shall be manufactured by Driscopipe, a subsidiary of Phillips Petroleum Company; PLEXCO, Division of Chevron Chemical Company; or approved equal.

- 2. All HDPE pipe 4-inches in diameter and larger shall have a Ductile Iro n Pipe outside diameter unless otherwise specified in the Contract Documents.
- 3. All HDPE piping system components shall be the products of one manufacturer.
- B. HDPE Pipe Specifications
 - High Density Polyethylene pipe 4 -inches diameter 1. and larger shall conform to material standard ASTM D3350 345464 C/E cell classification rated as PE 3408 by the Plastics Pipe Institute. Minimum pressure rating shall be 160 psi SDR 11 (Standard Dimension Ratio) for pipe sizes 4 inches and greater in diameter. For pipe sizes 3 -inches and smaller in diameter, the minimum pressure rating shall be 200 psi SDR 9. All pipe 4 -inches in diameter and greater shall have a ductile iron pipe O.D. HDPE pipe ½ " to 3 -inches in diameter shall have a steel pipe O.D. Pressure ratings are at s tandard test conditions and temperature of 73.4°F (23°C).
 - 2. The polyethylene compound shall be suitably protected against degradation by ultraviolet light by means of carbon black, well dispersed by precompounding in a concentration of not less than 2 percent.
 - 3. The maximum allowable hoop stress shall be 800 psi at 73.4 degrees F.
 - 4. The pipe manufacturer shall be listed with the Plastic Pipe Institute as meeting the recipe and mixing requirements of the resin manufacturer for the resin used to manufacture the pipe in this project.
- C. Fittings.
 - 1. D.I./HDPE Mechanical Joint Adaptors.
 - a. The manufacturer of the HDPE pipe shall supply all D.I./HDPE mechanical joint adaptors and accessories required to perform the work as shown on the Drawings.

- (1) A molded or fabricated HDPE mechanical joint transition fitting
- (2) A standard rubber gasket for a D.I. mechanical joint.
- (3) A D.I. mechanical joint backup drive ring.
- (4) Cor-Ten mechanical joint tee bolts.
- (5) A stainless steel stiffen er inserted in the MJ end of the HDPE transition fitting.
- c. The D.I./HDPE mechanical joint adaptor shall be connected to the HDPE pipe by a heat-fused joint on one end, and connected to a ductile iron pipe valve, or fitting with a mechanical joint on the other end.
- d. The tee bolts and backup drive ring shall act as a joint restraint to keep the connecting pieces from pulling apart.
- e. The HDPE transition fitting shall be molded or fabricated by the manufacturer of the HDPE pipe. All molded fittings shall be fu lly pressure rated to match the SDR pressure rating for which they are made. Fabricated fittings shall be rated for internal pressure service equivalent to the full pressure rating of the mating pipe.
- f. If rework compounds are required, only those generated in the manufacturer's own plant from resin compounds of the same class and type from the same raw material supplier shall be used.
- g. Solvent epoxy cementing and mechanical joining with bolt on wrap around clamps shall not be used for connections.
- D. HDPE Pipe Jointing Method
 - 1. HDPE pipe shall be jointed by the butt-fusion process in accordance with pipe manufacturer's directions. Contractor shall provide butt -fusion technicians who are trained and certified by the P.E. pipe manufacturer to complete the proje ct. The date of technician certification shall not exceed 12 months before commencing construction.

- 2. All HDPE pipe joined by butt-fusion shall be made from the same class and type of raw material made by the same raw material supplier.
- Butt-fusion means the butt-joining of the pipe by softening the aligned faces of the pipe ends in a suitable apparatus and pressing them together under controlled pressure.
- 4. The internal and external beads resulting from the butt-fusion process shall be visible and examined for penetration 360 degrees around the pipe diameter.
- 5. Short pieces of pipe between valves and fittings shall be DIP with all joints restrained for sizes 4-inches and larger. For 3-inch and smaller HDPE pipe, the short pieces shall be brass or Sch. 80 PVC with IP threads and DI, HDPE or brass fittings with all joints restrained.

PART 3 EXECUTION

3.01 GENERAL

A. All polyethylene pipe shall be cut, fabricated, and installed in strict conformance with the pipe manufacturer's recommendations. Joining, laying, and pulling of polyethylene pipe shall be accomplished by personnel experienced in working with polyethylene pipe. The pipe supplier shall certify in writing that the Contractor is qualified to join, lay, and pull the pipe or representative of the pipe ma nufacturer shall be on site to oversee the pipe joining. Expenses for the representative shall be paid for by the Contractor.

3.02 PIPE INSPECTION

The Contractor shall obtain from the pipe manufacturer Α. a certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. The Contractor shall submit these certificates to the Engineer prior to installation of the pipe materials. All pipe and fittings shall be subjected to visual inspection at time of delivery and before they are lowered into the trench to be laid. Joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor. The entire product of any plant may be rejected when, in

the opinion of the Owner, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

3.03 TRANSPORTATION

A. Care shall be take n during transportation of the pipe that it is not cut, kinked, or otherwise damaged.

3.04 STORAGE

- A. Pipes shall be stored on level ground, preferably turf or sand, free of sharp objects which could damage the pipe. Stacking of the polyethylene pipe shall be limited to a height that will not cause excessive deformation of the bottom layers at pipes under anticipated temperature condition. Where necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths as not to allow deformation of the pipe at the point of contact with the sleeper or between supports.
- B. Pipes shall be stored in such a manner as to limit their exposure to ultraviolet light as the pipe color will fade. Excessive loss of color in the pipe material may result in the rejection of piping material by the Project Representative.

3.05 HANDLING PIPE

- The handling of the joined pipeline shall be in such a Α. manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubberprotected slings and straps shall be used when handling pipes. Chains, cables, or hooks inserted into the pipe ends shall not be used. Two slings spread apart shall be used for lifting each length of pipe. Pipe or fittings shall not be dropped onto rocky or unprepared ground. Slings for handling the pipeline shall not be positioned at butt-fused joints. Sections of the pipes with cuts and gouges exceeding 10 percent of the pipe wall thickness or kinked sections shall be removed and the ends rejoined. The dragging of fused HDPE pipe along asphalt and concrete paving will not be allowed.
- B. The open ends of all sections of joined and/or installed pipe (not in service) shall be plugged at night to prevent animals or foreign material from entering the pipe line or pipe section.
- C. Waterproof nightcaps of approved design may be used but they shall be so constructed that they will prevent the entrance of any type of natural precipitation into the

pipe and will be fastened to the pipe in such a manner that the wind cannot blow them loose.

- D. The practice of stuffing cloth or paper in the open ends of the pipe will not be permitted.
- E. Where possible, the pipe shall be raised and supported at a suitable distance back from the open end such that the open end will be below the level of the pipe at the point of support.

3.06 LAYING PIPE.

- A. Joints:
 - All HDPE pipe shall be jointed by the heat fusion process which produces homogeneous, seal, leak tight joints.
 - 2. Restrained mechanical joints shall be provided at tie-ins with valves and other pipe materials.
- B. Butt Fusion Testing:
 - 1. Contractor shall test the first fusion of the day on a daily basis.
 - 2. In testing, the fusion shall be allowed to cool completely, and then fusion test straps shall be cut out. The test shall be a minimum of 12" or 30 times the wall thickness in length with the fusion in the center, and minimum of 1" or 1.5 times the wall thickness in width. Bend the test strap until the ends of the strap touch. Contractor shall not commence until a fusion test has passed the bent strap test.

3.07 PIGGING, FLUSHING AND CLEANING

- A. All mains shall be pigged, cleaned and flushed to remove all sand and other foreign matter. The Contractor shall be responsible for developing a pigging and flushing plan to be submitted to the Engineer for approval p rior to pigging and flushing. The Contractor shall dispose of all water used for pigging and flushing without causing a nuisance or property damage. Any permits required for the disposal of flushing water shall be the responsibility of the Contractor.
- B. Flushing water used by the Contractor for reclaimed water mains shall be provided by the County at the Southwest Water Reclamation Facility. The flushing water shall consist of plant effluent (reclaimed

water). The Contractor shall be responsible for conveying the reclaimed water to the point of application. Flushing water for potable water mains shall be taken by the Contractor from the potable water system at the Southwest Water Reclamation Facility. The County will provide a water meter and backflow device, the Contractor shall compensate the County for the meter usage and the quantity of potable water used.

3.08 INSPECTION AND TESTING

- A. All HDPE pipelines shall remain undisturbed for 24 hours to develop complete strength at all joints. The Contractor shall conduct two (2) hydrostatic tests on each HDPE pipeline. The first test shall be performed when the pipe is above ground and before it is installed. The second test shall be performed on the pipe when it is below ground after installation.
- B. Hydrostatic Testing for High Density Polyethylene Pipe:
 - HDPE hydrostatic testing shall be done in accordance with ASTM 2164-02 as briefly described below. Testing phase shall last 2-hours.
 - 2. For any test pressure from 1.0 to 1.5 times the system design pressure, the tota l test time including initial pressurization, initial expansion, and time at test pressure, shall not exceed eight (8) hours. If the pressure test is not completed due to leakage, equipment failure or other reason, the test section shall be de pressurized, and allowed to "relax" for at least eight (8) hours before bringing the test section up to test pressure again.
 - 3. The test procedure consists of initial expansion, and the test phase:
 - a. During the initial expansion phase, the test section is pressurized to 1 0 psi above the test pressure (see Table A for Expansion Pressure), and sufficient make -up water is added each hour for three (3) hours to return to the expansion phase pressure.
 - b. After the initial expansion phase, about four
 (4) hours after pressurization, the test phase begins.
 - c. During the test phase, the pipe is stabilized at the test pressure (see Table A). The pressure shall remain steady within 5% of this target value for two (2) hours. If the

pressure falls below 5% of the test pressure (see Table A), leakage or insufficient expansion is indicated, and the test shall be repeated after the pipe is allowed to "relax" as indicated above. Make -up water is not allowed during the test phase.

TABLE A

Pipe Class	Expansion Pressure	Test Pressure	5% Pressure Reduction
SDR 17	150 psi	140 psi	133 psi
SDR 13.5	170 psi	160 psi	152 psi
SDR 11	170 psi	160 psi	152 psi
SDR 9	210 psi	200 psi	190 psi

3.9 CONNECTIONS TO EXISTING SYSTEM

A. Connections to existing pipelines shall be made as shown on the Contract Drawings. Coordination between the Owner and the Contractor shall be required in order to accomplish this task. The Con tractor shall supply connection procedures to the Owner for approval two (2) weeks prior to the proposed connection date.

END OF SECTION
SECTION 15067

PLASTIC PIPE FOR PRESSURE SERVICE

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. This Section includes materials and methods of installation of Plastic Pipe for pressure service as shown on the Drawings and as Specified herein.

1.02 SUBMITTALS

- A. Three certified copies of the tests made by the manufacturer or by a reliable commercial laboratory shall be submitted to the Engineer with each shipment of pipe.
- B. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data a nd Samples.

1.03 HANDLING AND STORAGE

- A. All pipe, fittings, valves, hydrants and accessories shall be loaded and unloaded by lifting with hoists or by skidding in order to avoid shock or damage. Under no circumstances shall materials be dropped. Pipe handled on skidways shall not be rolled or skidded against pipe on the ground. Slings, hooks or pipe tongs shall be padded and used in such a manner as to prevent damage to the exterior surface or interior of the pipe.
- B. Materials, if stored, shall be kept safe fro m damage. The interior as well as all sealing surfaces of all pipe, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times. Valves and hydrants shall be drained and stored in a manner that will protect them from damage or freezing.
- C. Pipe stored outside and exposed to prolonged periods of sunlight shall be covered with canvas or other opaque material. Air circulation shall be provided under covering.
- D. Pipe shall not be stacked higher than the limits recommended by the manufacturer. The bottom tiers shall be kept off the ground on timbers, rails, or concrete. Pipe in tiers shall be alternated: bell, plain end; 15067-1

bell, plain end. Pipe shall not be stored close to heat sources.

E. Gaskets shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis. Mechanical-joint bolts shall be handled and stored in a manner that will ensure proper use with respect to types and sizes.

PART 2 - MATERIALS AND EQUIPMENT

2.01 PLASTIC PIPE

- A. Pipe for pressure service shall be Class 12454 -A or B rigid PVC compound in accordance with the requirements of ASTM D1784. Pipe and appurtenances for use in potable water systems shall bear the seal o f approval for potable water use of the National Sanitation Foundation or other accredited testing laboratory. All pipe shall have markings indicating pipe size, manufacturer's name, AWWA and/or ASTM specification number, working pressure, and production code.
- PVC pressure rated pipe having Β. a nominal diameter between 1.5" and 3 ", shall be made of 2000 psi hydrostatic design stress compounds designated PVC 1120 and shall conform to ASTM D2241. PVC pipe shall be furnished in 20 -foot lengths unless otherwis e noted. PVC pipe shall have a standard dimension ratio of SDR 21 and a water pressure rating of 200 psi. Pipe couplings shall have a dimension ratio of SDR 21 and a water pressure rating of 200 psi. Pipe shall have both ends beveled for use with gasketed couplings or one end beveled and one end with a bell. Couplings and gaskets shall be furnished with each length of pipe. Rubber ring gaskets shall conform to ASTM D3139 Nontoxic gasket lubricant shall be as specified by the manufacturer.
- Pressure pipe 4 -inches through 12 -inches in diameter С. shall conform to the requirements of AWWA C900 for PVC pipe with cast iron pipe equivalent outside diameters. minimum pressure class Pipe shall be 150 unless otherwise shown. Pipe shall have a minimum wall thickness equivalent to a dimension ratio of DR 18 unless otherwise shown. Pipe may be furnished with plain ends for use with elastomeric-gasket couplings or with one end plain and one end with a gasket bell. Couplings and gaskets shall be furnished with the pipe. Gaskets shall conform to ASTM D3139. Nontoxic gasket

lubricant shall be as specified by the manufacturer.

D. Pressure pipe 14 -inches through 48-inches in diameter shall conform to the requirements of AWWA C 905 for PVC pipe with cast iron pipe equivalent outside diameters. Pipe 14-inch through 48-inch shall have a minimum wall thickness equivalent to a dimension ratio of DR 25 unless otherwise shown. Pipe shall be pressure Class 165 unless otherwise shown. Pipe may be furnished with plain ends for use wit h elastometric gasket couplings or with one end plain and one end with a gasket bell. Couplings and gaskets shall be furnished with the pipe. Gaskets shall conform to ASTM 1869. Non-toxic gasket lubricant shall be as specified by the pipe manufacturer.

2.02 FITTINGS

- Fittings for use with PVC pipe 3-inches through Α. 24-inches in diameter shall be compact mechanical joint ductile-iron fittings conforming to the requirements of ANSI/AWWA C153/A21.53. Fittings for use with pipe 30-inches and larger shall be mechani cal joint gray iron or ductile-iron conforming to the requirements of ANSI/AWWA C111/A21.11a. Bolts for use with mechanical joints shall conform to the requirements of the joint standard. Fittings shall be suitable for a working pressure of 150 psi.
- Exterior Coating. Fittings for buried service shall be Β. coated with a 1 mil thick coal-tar enamel coating or a fusion-bonded epoxy coating. The finished coating shall be continuous, smooth, neither brittle when cold nor sticky when exposed to the sun and shall be strongly adherent to the pipe.
- Polyethylene Encasement. All buried ductile iron С. fittings shall be provided with a 4-mil thick cross laminated high density polyethylene encasement or an 8mil thick polyethylene encasement per ANSI/AWWA C105/A21.5.
- Fittings in exposed locations which are to be D. painted shall be primed with a universal shop primer suitable for use under the finish paint specified.
- Ε. Linings. Fittings shall have a cement -mortar lining conforming to the requirements of ANSI /AWWA C104 /A 21.4, a fusion-bonded epoxy lining, or a Protecto 401 ceramic epoxy lining depending upon the type of fluid

being conveyed. Cement mortar linings and fusion-bonded epoxy linings shall be used for all ductile iron fittings conveying potable water, reclaimed water, and waste backwash from the disk filters. Protecto 401 shall be used for all ductile iron fittings conveying wastewater sludge, sand filter backwash water, leachate, mixed liquor, sludge thickening water, and plant drain water.

2.03 RESTRAINED JOINTS

- A. Restrained Joints. Restrained joints for use with PVC pipe shall consist of retainer glands fabricated of ductile-iron conforming to ASTM A536. The gland shall be such that it can replace the standard mechanical joint gland and can be used with the stan dardized mechanical joint bell conforming to ANSI/AWWA A21.11/C111 and ANSI/AWWA A21 -53/C153. The retainer glands shall have a pressure rating equal to that of the PVC pipe on which it is used.
- B. PVC push -on joints adjacent to restrained fittings shall be restrained using harness restraint devices. This harness restraint shall be split to enable installation of the restraint after the spigot has been installed into the bell. The restraint shall consist of a split ring that fits behind the bell, a split restraint ring that installs on the spigot and a number of tie bars to connect the other two parts. Restraint components shall be of ductile -iron conforming to ASTM A536. The restraint ring shall consist of a plurality of individually activated gripping surfaces to hold the spigot and maximize restraint capability.
- C. Twist off nuts, sized same as the tee-head bolts shall be used to insure proper actuating of restraining devices.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Excavation. Excavate trenches as specified in Section
 02221 Trenching, Bedding and Backfill for Pipe.
- B. All pipe and appurtenances shall be examined at the point of delivery. Material found to be defective due to manufacture or damage in shipment shall be rejected. Tests as specified in the applicable material standard

may be performed to ensure conformance with the standard.

3.02 TRENCH CONSTRUCTION

- A. Alignment and Grade. The pipelines shall be laid and maintained to the lines and grades established by the Drawings and Specifications, with fittings, valves and hydrants at the required locations unless otherwise approved by the Engineer. Valve-operating stems shall be oriented to allow proper operation. Hydrants shall be installed plumb.
- Β. Underground Conflicts. Prior to excavation, investigation shall be made to the extent necessary to determine the location of existing underground structures and conflicts. Care shall be exercised to avoid damage to existing structures. When obstructions that are not shown on the drawings are encountered during the progress of work and interfere so that an alteration of the plans is required, the Owner's Representative will alter the Drawings or order a deviation in line and grade or arrange for removal, relocation, or reconstruction of the obstructions. When crossing existing pipelines or other structures, alignment and grade shall be adjusted as necessary, with the approval of the Owner's Representative , to provide clear ance as required by the Owner's Representative to prevent future damage or contamination of either structure.
- C. Trench Construction. The trench shall be excavated to the required alignment, depth, and width. Trench preparation shall proceed in advance of pipe installation for only as far as necessary to allow proper pipe installation. The width of the trench at the top of the pipe shall be ample to permit the pipe to be laid and joined properly and allow the backfill to be placed as specified.
- D. PVC pipe shall be installed with pipe bedding and backfill as shown on the drawings.
- E. Holes for the bells shall be provided at each joint but shall not be larger than necessary for joint assembly and assurance that the pipe barrel will lie flat on the trench bottom. Other than noted previously, the trench bottom shall be true and even in order to provide support for the full length of the pipe barrel, except that a slight depression may be provided to allow withdrawal of pipe slings or other lifting tackle.

- When excavation of rock is encountered, all rock shall F. be removed to provide a clearance of at least 6-inches below and on each side of all pipe, valves and fittings. When excavation is completed, a bed of sand, crushed stone or earth that is free from stones, large clods, or frozen earth, shall be placed on the bottom of the trench to the previously mentione d depths; leveled, and tamped. These clearances and bedding procedures shall also be observed for pieces of of subterranean concrete or masonry and other debris structures, such as masonry walls, piers, or foundations that may be encountered during excavat ion. This installation procedure shall be followed when gravel formations containing loose boulders greater than 8 -inches in diameter are encountered. In all cases, the specified clearances shall be maintained between the bottom of all pipe and appurtenances and any part, projection, or point or rock, boulder, or stones of sufficient size and placement which, in the opinion of the Engineer could cause a fulcrum point.
- G. Should the trench pass over a sewer or other previous excavation, the trench bottom sha ll be sufficiently compacted to provide support equal to that of the native soil or conform to other regulatory requirements in a manner that will prevent damage to the existing installation.
- H. When the subgrade is found to be unstable or to include ashes, cinders, refuse, organic material, or other unsuitable material, such material shall be removed, to a minimum of at least 4-inches, or to the depth ordered by the Engineer and replaced under the directions of the Engineer with clean, stable backfill material. The bedding shall be consolidated and leveled in order that the pipe may be installed as specified.
- I. When the bottom of the trench or the subgrade is found to consist of material that is unstable to such a degree that, in the judgment of the Engineer it cannot be removed, a foundation for the pipe and/or appurtenance shall be constructed using piling, timber, concrete, or other materials at the direction of the Engineer.

3.03 PIPE INSTALLATION

A. The Contractor shall install all pipe in accordance with the recommendations of the pipe manufacturer and as specified herein.

- B. The Contractor shall take care in handling, storage and installation of pipe and fittings to prevent injury to the pipe or coatings. All pipe and fittings shall be examined before installation and pipe which is deemed to be defective by the Owner/Engineer shall not be installed.
- C. The Contractor shall thoroughly clean and keep thoroughly clean, all pipe and fittings prior to , during, and after installation.
- D. The Contractor shall lay the pipe to the lines and grades shown on the Contract Drawings with bedding and backfill as shown on the Drawings or called out in the Contract Documents. Blocking under the pipe shall not be permitted except through casing sleeves.
- E. The Contractor shall k eep the open ends of all pipe closed with a tightly fitting plug when installation is not in progress or the potential exists for dirt or debris to enter the pipe.
- F. The pipe or accessories shall not be dropped into the trench under any circumstances.
- G. The Contractor shall construct all water mains pursuant to the provisions of "Recommended Standards for Water Works", Part 8, incorporated by reference in Rule 17 – 555.330(3), F.A.C.
- H. Proper implements, tools, and facilities shall be provided and used for th e safe and convenient performance of the work. All pipe, fittings, and valves, and hydrants shall be lowered carefully into the trench by means of suitable tools or equipment in such a manner as to prevent damage to pipeline materials. Under no circumstan ces shall pipeline materials be dropped or dumped into the trench. The trench shall be dewatered prior to installation of the pipe.
- I. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grad e. The pipe shall be secured in place with approved backfill material.
- J. Trench width at the top of pipe, bedding conditions, and backfill placement and compaction shall be such that design loadings on the pipe will not be exceeded.

- K. Joint Assembly. Pipe joints shall be assembled in accordance with the manufacturer's instructions.
- L. Pipe Deflection. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount o f deflection shall not exceed 75% of the amount recommended by the manufacturer.
- M. Pipe Cutting. Cutting pipe for the insertion of valves, fittings, or closure pieces shall be done in a neat, workmanlike manner without creating damage to the pipe. Ends shall be cut square and perpendicular to the pipe axis.
- N. Burrs shall be removed from spigots and ends shall be smoothly beveled. Field cut ends shall be marked for proper depth of joint assembly.
- O. Locator Tape. Install all plastic pipe with a locator tape of the type specified.
- P. Electronic Marker. Install electronic markers of the type specified for all buried piping at 24-inches below grade.
- Q. Thrust Restraint. All plugs, caps, tees, and bends, unless otherwise specified, shall be provided with reaction backing, or restrained joints as specified.
- R. Thrust-restraint design pressure shall be equal to 1.5 times the design pressure of the line.

3.04 TESTING

- A 48-hour notice is needed prior to testing. A letter stating the reasons testing should be schedule d ahead of other jobs must accompany all emergency testing requests.
- B. Owner's Representative and Contractor must be present for all testing, except for testing tapping valves and sleeves.
- C. All pressure pipe lines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipe lines shall be subjected to a hydrostatic pressure test for two (2) hours at full working pressure, but not less than 180 psi for water/reclaimed (150 psi for force main). Maximum length of pipe to b e tested at one time is 2,600 feet. If line is longer than 2,600

feet and cannot be sectioned in 2,600 feet (max.) lengths, the allowable leakage will be figured at 2,600 feet.

- D. Allowable leakage shall be determined by AWWA C600 table for hydrostatic tests. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof; to maintain the test pressure after the air in the pipe line has been expelled and the pipe has been filled with water.
- E. All digging on the job site in the right-of-way must be completed before any testing of water or sewer. Any digging or boring across water or sewer lines after they have been tested may result in a retest of the lines at the County's request.
- F. If a ny revisions or changes are made after initial testing, lines will be re -tested at the County's request.
- G. Disconnect water supply during test.
- H. All force mains will be tested from the valves in the valve vault at the lift station to the point of connection, whether it be against a valve on another force main or into a manhole.
- All services to be aboveground during test. The services should be the correct length so they will be one (1) foot inside right-of-way line.
- J. All fire hydrant gate valves to be open during test.
- K. All visible leaks are to be repaired, regardless of the amount of leakage.
- L. Check gauge pressure periodically during test. If test pressure drops to 175 psi for water/reclaimed lines or to 145 psi for force mains during te st, the line must be repumped back to 180 psi for water/reclaimed (150 psi force mains) and the amount of leakage measured. The test will continue on with the remaining time left. At the end of the test, the line must be repumped again back to 180 psi (150 psi for force main) and the amount of leakage measured and added to any previous leakage determined earlier in the test.
- M. After the line passes the test, the pressure will be blown off from the opposite end of line from the gauge location. Fire hydrants, services and end-of-line blow

offs will be opened to demonstrate they were on line during the test.

- N. At end of test, the test gauge must return to zero. The pressure gauge must read 0 psi to a maximum of 300 psi in 5 psi increments.
- O. The section of line being tested must be identified on the charge sheet. The length and size of pipe, the exact area being tested and the valves being tested against, must be identified. Use Station numbers if available.
- Q. A copy of the charge sheet will be given to the Owner's Representative and the Contractor at the end of the test.

END OF SECTION

SECTION 15100

VALVES AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.
- B. All valves and appurtenances shall be of the size shown on the Drawings and to the extent possible, all equipment of the same type shall be from one manufacturer.
- C. All valves and appurtenances shall have the name of the maker and the working pr essure for which they are designed cast in raised letters upon some appropriate part of the body.
- D. The equipment shall include, but may not be limited to, the following:
 - 1. Butterfly Valves
 - 2. Control Valves
 - 3. Air Release Valves
 - 4. Valve Boxes
 - 5. Flange Adapter Couplings
 - 6. Solid Sleeve Couplings
 - 7. Restraining Clamps
 - 8. Manual Valve Actuators
 - 9. Swing Check Valves

1.02 DESCRIPTION OF SYSTEMS

A. All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of potable water, reclaimed wa ter, chemicals, wastewater, etc., depending on the applications.

1.03 QUALIFICATIONS

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 Specifications as applicable.

1.04 SUBMITTALS

- A. Submit to the Engineer within 30 days after execution of the contract a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.
- B. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval in accordance with the requirements of Section 01340 -Shop Drawings, Project Data and Samples.

1.05 TOOLS

A. Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2 PRODUCTS

2.01 BUTTERFLY VALVES

- A. Butterfly valves (4" thru 48" size) shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designated C504, except as hereinafter specified. Valves shall be Class 150A or B, and equal to those manufactured by Henry Pratt Company, DeZurik, Mueller, KOR-FLO or approved equal. All valves shall be factory leak tested at 200 psi.
- B. The face-to-face dimensions of flanged end valves shall be in accordance with AWWA Standard Specification C504 for short-body valves. Adequate two-way thrust bearings shall be provided. Flange drilling shall be in accordance with ANSI B16.1. Mechanical Joint end valve dimensions shall be in accordance with AWWA Standard Specification C504.
- C. Valve seats shall be an EPDM elastomer. Valve seats 24 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material with stainless Nylock screws and be capable of a 1/8 inch adjustment. Valves 20 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C 504. Where rubber seat is mounted on the valve body, the mating edge of the valve disc shall be 18-8 stainless steel or

Nickel-Chrome, 80-20%. Where the EPDM seat is mounted on the valve disc, the valve body shall be fitted with an 18-8 stainless steel seat offset from the shaft, mechanically restrained and covering 360 degrees of the peripheral opening or seating surface.

- D. The valve body shall be constructed of ductile iron or close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housing of the through boss-type. Butterfly valves of the "wafer": or "spool" type will not be accepted.
- E. The valve shaft shall be turned, ground, and polished, constructed of 18 -8, ASTM A -276, Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design. Shaft bearings shall be teflon or nylon, selflubricated type.
- F. All values shall be subject to hydrostatic and leakage tests at the point of manufacture. The Class 150 values shall be tested in conformance with AWWA C504. During the hydrostatic test there shall be no leakage through the metal, the end joints or the value shaft seal. No adjustment of the value disc will be necessary after pressure test for normal operation of value.
- G. In general, the butterfly valve operators shall conform to the requirements of Section 11 of the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable and as herein specified.
- H. Gearing for the operators shall be totally enclosed in a gear case in accordance with the above mentioned AWWA Standard Specification.
- I. Operators shall be capable of seating and unseating the disc against the full design pressure or velocity, as specified for each class, into a dry system downstream, and shall transmit a minimum torque to the valve. Operators shall be rigidly attached to the valve body.
- J. All valve operators shall conform to Section 11 of the AWWA Standard Specification and shall be manual unless otherwise shown or specified and shall have permanently lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure

and velocities. Operators shall be equipped with handwheel, position indic ator, and mechanical stop limiting locking devices to prevent over travel of the disc in the open and closed positions when valve is located above grade. They shall turn counterclockwise to open valves. Manual operators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Operators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 p ounds on the handwheel or chainwheel when valve is located above grade. Operator components shall withstand an input of 450 foot pounds for 30" and smaller and 300 foot pounds for larger than 30" size valves at extreme operator position without damage. Valves located above grade shall have handwheel operators, and valves located below grade shall be equipped with a two-inch (2") square AWWA operating nut located at ground level and cast iron extension type valve box. Valve operators shall conform to AWWA C504, latest revision.

- K. The manufacturer shall certify that the required tests on the various materials and on the completed valves have been satisfactory and that the valves conform to all requirements of the specifications and the AWWA standard.
- L. Where indicated on the Drawings, extension stems, floor stands, couplings, stem guides, and floor boxes as required shall be furnished and installed.

2.02 CONTROL VALVES

Α. The control valve shall be a hydraulically operated, diaphragm actuated, pilot controlled modulating globe valve. The valve shall seal by means of a corrosion resistant seat, and resilient, rectangular seat disc. These and other parts shall be replaceable in the field without removing the valve from the line. The stem shall be guided top and bottom by integral bushings , guides, and bearings. The diaphragm shall not be used as a seating surface, nor shall pistons be used as an operating means. The pilot system shall be furnished complete and installed on the main valve, and shall include one or two solenoid pilot valves, a Y-strainer, separate opening and closing speed controls, and ball valves for isolating the control system from the main valve.

- B. The position transmitter shall be installed on the valve and driven by an extension of the valve stem . It shall be a magnetic, non-contact type with analog output, and shall include terminal strips for the communications link to the PLC and for the solenoid pilots, as well as an LED for zeroing purposes. The enclosure shall be weatherproof per NEMA 4. The valve and controls shall be hydrostatically and operationally tested prior to shipment.
- С. The main valve body and bonnet shall be ductile iron per ASTM A536, Grade 65-45-12. End connections shall be Class 150 flanges per ANSI B16.42 (flat faced), suitable for a maximum working pressure of 250 psi. Main valve bonnet studs and nuts shall be stainless steel. All internal ferrous surfaces shall be coated with 10-12 mils dft of NSF61 certified epoxy, Tnemec Series N140. External surfaces shall be coated with 10-12 mils dft of the same epoxy. The main valve stem shall be stainless steel. The main valve seat ring and seat disc retainer plate shall be stainless steel per ASTM A743. Elastomers (diaphragms, resilient seats and O-rings) shall be Buna-N rubber. The solenoid pilot shall have a stainless steel body with a weatherproof enclosure per NEMA 4, suitable for operation on 120 VAC, 60 Hertz. All speed controls, isolation ball valves, control line tubing, solenoid valves, needle valves, and Y-strainers shall be stainless steel. The orifice plate and its body , shall be 304 Stainless Steel. The body of the orifice plate shall contain two 1/8" NPT sensing ports, one for high pressure and the other for low pressure.
- D. Schedule of Globe Type Control Valves
 - Ground Storage Tank Surge Anticipator Valve

 Quantity: 1
 - b) Size: 16 inches
 - c) Flow Range: 0 to 15,000 (peak) GPM
 - d) Pressure Range: 200 psi (upstream), o to 15 psi (downstream)
 - e) Control Options
 - (1) Surge Control
 - (2) Check Valve
- E. The valve shall be manufactured by Cla -Val, Golden Anderson, Bermad, or approved equal.

2.03 AIR RELEASE VALVES

- A. Automatic Air Release Valves for Plant Effluent or Reclaimed Water Service Pipelines: Provide and install automatic air release valves for pipelines as shown on the drawings.
 - 1. The air release valve shall be of the simple lever type or float operated, compound lever type, and capable of automatically releasing accumulated air from a fluid system while that system is in operation and under pressure.
 - 2. Valves shall be manufactured and tested in accordance with AWWA Standard C512. Manufacturers shall have a quality management system certified to ISO 9001:2000.
 - 3. To assure drop tight shut off, a viton orifice button having an adjustable feature shall be used to seal the valve discharge orifice. The orifice diameter shall be sized for use within a given operating pressure range to insure maximum discharge capacity.
 - 4. The float shall be of all stainless steel construction and capable of withstanding a pressure of 1,000 P.S.I. Floats shall be unconditionally guaranteed against failure, including pressure surges. Mechanical linkages shall provide sufficient mechanical advantages so that the valve will open under full operating pressure. Simple lever designs shall consist of a single pivot arm and a resi lient orifice button. Compound lever designs shall consist of two levers and an adjustable threaded resilient orifice button. Resilient seats shall be replaceable and shall provide drop-tight shutoff to the full valve pressure rating.
 - 5. The valve cover shall be bolted to the valve body and sealed with a flat gasket.
 - 6. The valve body shall be threaded with NPT inlets and outlets. The body inlet connection shall be hexagonal for a wrench connection. The valve shall have two NPT connections for gauges, testing or draining. Each valve shall have an isolation ball valve on its inlet.

7. The body and cover shall be of stainless steel construction with all internal trim to be of stainless steel or viton, consistent with the following specifications:

Body and Cover	ASTM A351 Grade CF8M Stainless Steel						
Float	316 Stainless Steel						
Orifice Button	Viton for simple lever valves ;						
	Buna-N for compound valves						
Lever Mechanisms	316 Stainless Steel						

1. The air release valves shall be manufactured by Val-Matic Corp., Elmhurst, Illinois or approved equal.

2.04 VALVE BOXES

Α. All buried valves shall have cast -iron two or three piece valve boxes as required. Valve boxes shall be provided with suitable heavy bonnets to extend to elevations at or slightly above the finished grade surface as directed by the Engineer. The barrel shall be two or three-piece, screw type, having a 5 1/4-inch inside diameter on the bottom barrel . The bottom barrel shall have a flange at the bottom having sufficient bearing area to prevent settling , v alve boxes shall be complete with cast iron covers. Covers shall have "WATER", "SEWER", or 'RECLAIM', as applicable, cast into the top. All valves shall have actuating nuts extended to within 4' of the lid of the valve boxes. Extension stems shall be attached to the valve operating nut with a stainless steel fastener. Reclaimed valve box lids shall be 9 X 9 inc hes square, load bearing, painted purple and identified as noted above. Grade adjustment risers shall be the same cast iron material as the valve box assemblies. An AFC entering device, Part No. B59434, shall be installed in the valve box. Valve boxes shall be provided with а concrete base and identification disks per the detail on the drawings. The valve boxes shall be Tyler Pipe 6850 Series, Box 461 -S through 668 -S, Russco 461 -S through 668-S or an approved equal.

2.05 RESTRAINED FLANGE ADAPTER

A. Restrained flange adapters shall be of the size and pressure rating required for each installation and

shall be suitable for use on either PVC, Steel, HD PE (with inserts) or ductile iron pipe.

- B. Restrained flange adapters shall be used in lieu of threaded or welded flanged spool pieces. Flange adapters shall be made of ductile iron conforming to ASTM A536, 65-45-12, and have flange bolt circles that are compatible with ANSI/AWWA C110/A21.10.
- C. Restraint for the flange adapter shall consist of a plurality of individual actuated gripping wedges to maximize restraint capability. Torque limited actuating screws shall be used to insure proper initial set of gripping wedges.
- D. The flange adapters hall be capable of deflection during assembly or permit lengths of pipe to be field cut to allow a minimum 0.6" gap between the end of the pipe and the mating flange without affecting the integrity of the seal. The joints shall be capable of deflecting between 5 degrees for 3-inch pipe and 0.5 degrees for 60-inch pipe.
- E. For PVC pipe, the flange adapter will have a pressure rating equal to the pipe.
- F. For Ductile Iron pipe, the flange adapter shall have a safety factor of 2:1 minimum.
- G. The restrained flange adapter is comprised of two rings. The first is the restraint ring which incorporates wedges around the circumference of the ring to grip the pipe firmly and securely. The wedge style of restraint offers enormous pullout strength when compared to set screw restraints. The resiliency of the wedge style restraint allows the flange adapter to withstand severe moment loads.

The second ring is the gasket ring which separates the seals dedicated to each sealing surface. This ring allows pipe to be cut to lengths in the field at a tolerance of 0.6 inch or more. And the gasket ring also enables the joint to deflect during assembly.

- H. The restrained flange adapter shall be coated with fusion bonded epoxy paint at the factory.
- I. The flange adapter shall be the Series 2100 Megaflange adapter as manufactured by EBAA Iron, Inc or approved equal.

J. All flange adapters shall have a sufficient number of factory installed anchor studs to meet or exceed the test pressure rating for this project, 180 psi minimum.

2.06 SOLID SLEEVE COUPLINGS

- A. Solid sleeve couplings shall be used in locations as shown on the Drawings.
 - 1. Solid sleeve type couplings shall be used with all buried piping. The couplings shall be of ductile iron meeting the requirements of ANSI/AWWA C110/A21.10 as manufactured by U.S. Pipe, American Cast Iron Pipe, McWane, or Equal. Solid sleeves shall be furnished with mechanical joint fittings. The solid sleeve coupling shall be provided with 316 stainless steel bolts and nuts unless indicated otherwise.
 - 2. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

2.07 RESTRAINING CLAMPS

M. Restraining clamp assemblies as detailed in the drawings for use at hydrant connections to water mains, or at fittings where shown on the drawings, shall be as manufactured by EBAA Iron Sales, Inc., Eastland, TX, or Equal.

2.08 MANUAL VALVE ACTUATORS

- A. General
 - All manual valve actuators shall conform to Section 3.8 of the AWWA C504 Standard Specification and shall be manually operated.
 - 2. 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.
 - Butterfly valve actuators shall conform to the requirements of Section 3.8 of the AWWA Standard Specifications for Rubber Seated Butterfly Valves,

Designation C504, insofar as applicable and as herein specified.

- 4. Valve actuators shall be provided, mounted and tested by the valve manufacturer.
- B. Manual Actuators
 - Manual actuators shall have permanently 1. lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure and velocities. Actuators shall be e quipped with handwheel, position indicator, and 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. Manual actuators shall be of the traveling nut, self locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Actuators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds in the handwheel or chainwheel. Actuator components shall withstand an input of 450 foot pounds for 30" and smaller and 300 foot pounds for larger than 30" size valves at extreme actuat or positions without damage. Valves located above grade shall have handwheel and position indicator, and valves located below grade shall be equipped with a two inch (2") square AWWA operating nut located at ground level and a cast iron extension type valve box. Valve actuators shall conform to AWWA C504, latest revision.

2.09 SWING CHECK VALVES

- A. Check valves shall be swing-type, flanged with an external hinge arm with outside lever and adjustable weight meeting the requirements of AWWA C508 . Double door, torsional-spring, and internal spring type check valves are not acceptable. Check valves shall be flanged and have a design working pressure of no less than 150 psi.
- B. The outside lever and weight assembly shall be capable of being relocated to the opposite side without requiring modifications to the valve body.
- C. Arms with discs attached shall be hinged at the top of the body and attached to the shaft. Features or

devices to limit arm-travel shall be incorporated into the valve body. Utilization of adj acent pipeline flanges to restrict arm travel will not be allowed. For sizes 6" and larger, the ratio of bolt diameter to arm width shall not exceed 0.3 and the ratio of bolt diameter thickness shall not exceed 0.9.

- D. The disc shall clear the inside of the pipe by 1.125" minimum throughout its entire travel.
- E. Valve materials shall be as follows:
 - Body, cover, disc, weight cast iron, ASTM A126 c1.B.
 - Rubber disc facing, body O -ring, stuffing box O ring, cover gasket, hinge pin O-rings- ASTM D-2000 rubber.
 - 3. Stuffing box- bronze, ASTM 138
 - Seat ring, clapper arm, retaining washer bronze, ASTM B584.
 - 5. Stud nut- bronze, ASTM B62
 - 6. Disc stud- bronze, ASTM B21
 - Stuffing Box Hinge P9n 303 Stainless Steel, ASTM A276
 - 8. Set screw, jam nut- stainless steel, ASTM A194
 - 9. Cover, volt, nut, test plug- steel, ASTM B18.2.1
 - 10. Weight lever- A36 steel
- F. Valves shall be as manufactured by Mueller, Clow, American, Kennedy, M&H, or approved equal.
- G. When there is no flow, the check valve disc shall hang lightly against its seat in an almost ver tical position. When there is flow, the disc shall swing clear of the waterway.
- H. Valves shall be air cushioned to reduce valve slam.
- Valves shall be constructed so that the disc and body seat may be removed and replaced without removing the valve from the line.
- J. Swing Check Valve Locations
 - 1. Effluent Transfer Stations
 - 2. High Service Pump Station

PART 3 EXECUTION

3.01 INSTALLATION

- A. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage t o the above items shall be repaired to the satisfaction of the Engineer before they are installed.
- B. After installation, all valves and appurtenances shall be tested at least two hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the Engineer.
- C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direc t bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.
- D. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections in Division 15.
- E. Flanged joints shall be made with high strength, low alloy Corten bolts, nuts and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe. All buried bolts and nuts shall be heavily coated with two (2) coats of bituminous paint comparable to Inertol No. 66 Special Heavy.
- F. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8 inches. Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over each pipe to a distance of about 6 inches from the end, and the middle ring shall be placed on the substantial completion date unless otherwise requested by the Owner.

G. Valve boxes with concrete bases shall be installed as shown on the Drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place a cast iron box over each stem with the base bearing on compacted fill and the top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on the cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box.

3.02 RESTRAINING CLAMPS AND TIE RODS ON PIPE RUN

A. Restraining clamps and tie rods shall be used on all pipe runs, as directed by the Engineer and/or shown on the Drawings. Restraining devices shall be JCM Industries, Inc. - Sur-Grip, EBAA Iron, Inc. - Megalug, Romac, or approved equal. Other types sh all be submitted to the Owner's Representative for approval.

3.03 SHOP PAINTING

A. Ferrous surfaces of valves and appurtenances shall receive a coating of rust -inhibitive primer. All pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

3.04 FIELD PAINTING

A. All metal valves and appurtenances specified herein and exposed to view will be painted per Section 09900 with a color appropriate to its usage in accordance with the color code.

3.05 INSPECTION AND TESTING

A. Completed pipe shall be subjected to a hydrostatic pressure test for two hours at 180 psi pressure. All leaks shall be repaired and lines retested as approved by the Owner's Representative. Prior to testing, the gravity pipe lines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION

SECTION 15102

POWER-ACTUATING DEVICES FOR VALVES

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. This Section includes furnishing and installing power-actuating devices that are externally mounted on valves as shown on the Drawings and as specified herein. Actuator types included are electric-motor type producing a multi-turn rotary motion.
- B. Related Work specified elsewhere:
 - 1. Sections 133 00, 13310, 13320, 13330 -Instrumentation and Controls
 - 2. Section 15100 Valves and Appurtenances
 - 3. Division 16 Electrical Work

1.02 SUBMITTALS

- A. Coordinate with Instrumentation and Valve suppliers. Check installation arrangements to prevent conflicts with piping and other equipment. Provide three (3) sets of final Shop Drawings to Engineer for use in observing installation and for record purposes.
- B. All submittals shall be in accordance with Section
 01340 Shop Drawings, Project Data and Samples.
- C. Submit certificates from manufacturer showing compliance with specified requirements and standards.

1.03 QUALITY ASSURANCE

- A. Power-actuating devices shall conform to the requirements of ANSI/AWWA C540 except as modified in this Section.
- B. Actuators shall be assembled to new values at the value manufacturer's factory, bench tested for alignment, and shipped to the job site as a complete assembly.

1.04 ACCEPTABLE MANUFACTURERS

- A. Subject to complying with specified requirements, manufacturers offering actuators which are acceptable for use on this project are limited to the following:
 - 1. Rotork IQ/IQT
 - 2. Limitorque MX

1.05 OPERATION AND MAINTENANCE MANUALS

A. Operation and Maintenance manuals shall be submitted as outlined in Specification 01730 - Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 GENERAL

- A. Actuators shall be sized for the required operational characteristics of the valves as listed in the Valve Actuator Data Sheet and for the required torque or thrust, shaft diameter, thread characteristics and keyway dimensions of the valve actually furnished.
- B. Actuators shall be designed for indoor and outdoor service and shall be capable of mounting in any position.
- C. Torque capacity of the actuators shall be sufficient to operate the valves with the maximum pressure differential, as indicated in the Valve Schedule, with a safety factor of 1.5. Actuators in modulating service will be selected such that the required dynamic valve torque is no more than 60% of the electric actuators maximum rated breakaway of torque.
- D. Operating time for full limits of travel shall be not more than 2 seconds per inch diameter of the valve, +/-50 percent through 20 inches; +/- 30 percent for valves 24 inches and larger. Operating time shall not be less than 30 seconds for all modulating valves.
- E. Actuators shall be capable of operating in ambient temperatures ranging from 0 degrees F to 160 degrees F.
- F. For open/close (non-modulating) actuators, the gearing, motor and contactor shall be capable of up to 60 starts per hour without overheating.
- G. For modulating actuators, the gearing, motor and contactor shall be capable of up to 1200 starts per

hour without overheating. This includes both discrete and analog setpoint modulation.

- The actuators shall include, in one integral housing, Η. individual compartments for the motor, gearing, wiring terminals, and control circuits. The terminal compartment shall be separated from the inner electrical components of the actuator by means of a watertight seal. The inner seal shall protect the motor and all other internal electrical elements of the actuator from entrance of moisture and dust when the terminal cover is removed. Double cartridge shaft seals shall be provided on the hand wheel and output shafts for weatherproof protection. All external fasteners shall be stainless steel. Compartments shall be provided with moisture and dust-proof rigid cast covers meeting NEMA 6, certified to submergence in 6 ft of water for 30 minutes. Actuators located in classified areas shall be suitable for use in Class 1, Division 1, Group D environments.
- Ι. Gearing shall consist of a worm shaft and worm gear pinion operating in an oil bath. All gearing shall be hardened alloy steel or bronze. The worm gear pinion shall be alloy bronze. Gears shall be rated at twice the output torque of the operator and shall be designed to withstand the stall torque of the motor without failure. Worm gear drive shall be self -locking to prevent creeping of the valve disc in an intermediate position. Heavy-duty grease shall protect gearing and sealed ball bearings of the main shaft for five years without changing. The gearing shall be designed to allow field repair and change in gear ratio. Overtravel of the operator shall be prevented by internal mechanical stops cast into the actuator.
- J. A mechanical dial position indicator shall be furnished to continuously indicate the position of the valve at and between the fully open and fully closed positions. The indicator shall be driven by gearing driven off of the main worm gear pinion and shall operate when the actuator is in either the electrical mode or manual mode.
- K. A handwheel shall be permanently attached for manual operation. A planetary gear assembly shall be provided between the handwheel and the worm shaft if required to reduce the force necessary to operate the handwheel to less than 40 pounds. A positive declutch mechanism shall engage the handwheel when required. When the actuator is set in the declutched position for

handwheel operation, it shall return automatically to electric operation when the actuator motor is energized. The handwheel shall not rotate during electric operation nor shall a fused motor prevent handwheel operation.

2.02 ACTUATOR ELECTRIC MOTOR AND ACCESSORIES

- A. The drive motor shall be specifically designed for actuator service and shall be characterized by high starting torgue and low inertia.
- B. Motors shall be 460 volts, three phase, 60 Hz AC reversible squirrel cag e induction type motors and shall be specifically designed for modulating service where indicated on the Valve Schedule.
- C. Motors shall be totally enclosed, non -ventilated, with NEMA Class H insulation minimum and a maximum continuous temperature rating of 120 degree C (rise plus ambient). A 120 VAC space heater shall be provided in the motor compartment.
- D. The electric motor shall have a time rating of at least 15 minutes at 104°F (40°C) or twice the valve stroking time, whichever is longer, at an average load of at least 33% of maximum valve torque.
- E. Motor bearings shall be permanently lubricated by premium lubricant. The motor shall have a plug and socket electrical connection to facilitate easy removal and replacement.
- F. The actuator shall include a device to ensure that the motor runs with the correct rotation for the required direction of valve travel with either phase sequence of the three-phase power supply connected to the actuator.
- G. The motor shall include single phase protection. A suitable ther mal protection device shall be incorporated in the motor or motor starter circuits, connected to a tripping device. Fast acting fuses shall be provided to protect solid state components.
- H. The motor shall be capable of starting against the rated load in either the open or closed direction when voltage to the motor terminals is plus or minus ten (10) percent of nameplate rating.
- I. Open/Close actuators shall be furnished with electro mechanical reversing starters. Modulating actuators

shall be furnished with solid state reversing starters utilizing thyristors.

- J. Leads from the motor shall be brought to the control circuit (limit switch) compartment without external piping or conduit box. An adequately sized space heater shall be installed in the control circuit compartment to aid in the prevention of damage resulting from condensation. The following items shall be located in the control circuit compartment.
- K. Torque limit switches shall be provided to de-energize the motor control circuit in the event of a stall when attempting to unseat a jammed valve and when torque is exceeded during valve travel. Each actuator shall have an open direction torque switch and a close direction torque switch. The torque switches shall be mechanically operated and able to be set in torque units. Torque switches shall be calibrated prior to the actuator's assembly to the valve.
- L. Travel limit switches shall be provided to de-energize the motor control circuit when the actuator reaches the limits of travel in the open and close directions. The limit switch drive shall be of the counter gear type and "in step'" with the actuator output drive at all times in either the electrical or manual mode of operation. A minimum of eight (8) contacts, four (4) normally open and four (4) normally closed, shall be supplied at each end of valve travel (total of 16 contacts). Limit switches shall be fully adjustable when power is applied to the actuator.
- M. The electrical terminals shall be housed in a double sealed terminal compartment isolated from th e rest of the actuator components. All control terminations shall have plug and socket connections such that removal of the terminal compartment cover simultaneously disconnects all wiring in the compartment. The actuators shall be designed to operate from a single 480VAC, 3 -phase source. The actuators shall b e furnished with fuses inside the terminal compartment. A quantity of two - ³/₄ inch NPT conduit entries shall be furnished.
- N. Motor enclosures shall be as listed in the Valve Actuator Data Sheet.

2.03 ACTUATOR CONTROLS

- A. Modulating actuators shall have a position feedback potentiometer mounted directly to the valve actuator gearing inside the gearing compartment. The potentiometer shall provide a 4 -20 mA signal corresponding to valve position. Modulating valve actuators shall be designed to respond to either a 4-20 mA DC analog signal or a digital pulse signal as specified herein or as required to coordinate with the requirements of Section 13100.
- B. Modulating valve actuators designed to respond to a 4-20 mA DC signal shall be provided with a valve positioner, which shall position the valve proportional to an externally generated 4 -20mADC signal. The valve positioning control circuitry shall position the valve by comparing the command signal with the present valve position as indicated by the feedback potentiometer. The positioner shall be field adjustable to fail to the "open," "closed," or "last" position on loss of 4-20 mA DC command signal.
- C. Modulating valve actuators designed to respond to "pulse" ope n/close signals shall operate the valve during the time the open or close pulse signal is high. Modulating actuators designed to respond to "pulse" open/close signals shall have the latching circuitry described for open/close actuators disabled.
- D. Actuators shall contain wiring and terminals for the following control functions. All dry contacts shall be rated for 5A at 250VAC.
 - Open, Close, and Stop commands from external dry contacts (utilizing internal 24VDC power supply) and/or from an external signal of 12V to 120V. The inputs for the open, close, stop signals shall be field selectable to respond to either maintained or momentary remote signals. In momentary mode, the actuator shall have internal latching circuitry that causes the operator to drive the valve to its limit of travel upon receipt of the momentary contact signal unless a stop signal is received.
 - 2. Remote Local -Off-Remote selector switch, Open/Close pushbuttons, and Open/Closed pilot lights for a remote manual control station (see below). The r emote Local -Off-Remote selector switch and Open/Close pushbuttons shall be a dry

contact input to the actuator control circuitry. The Open/Closed pilot lights shall be powered from the valve actuator control power.

- 3. Four (4) unpowered contacts shall be pro vided which can be selected to indicate valve "Opened" and "Closed" position, "Remote" status of the actuator, and fail status of the actuator. The fail status contacts shall activate upon motor overtemperature and actuator overtorque as a minimum.
- Terminals for 4 -20mADC position command and 4 -20mADC position feedback as described above for modulating actuators.
- E. Local Controls
 - Actuators shall be furnished with a Local -Off-Remote selector switch; Open, Close, and Stop pushbuttons for local control; a red lamp indicating closed and a green lamp indicating open. L-O-R switch shall be padlockable in any of the three positions.
 - 2. When the LOR is in the "Local" position, open/close control shall be by the open and close pushbuttons on the actuator. The stop push button shall stop the actuator travel.
 - a) When the LOR is in the "Off" position, the actuator shall not operate.
 - b) When the LOR is in the "Remote" position, the actuator shall be controlled by remote inputs from the PLC or from the remote manual controls station.
 - 3. The local controls shall be arranged so that the direction of travel can be reversed without the necessity of stopping the actuator.
- F. Remote Manual Control Station
 - Where indicated in the Valve Schedule , manual actuator controls shall be furnished in a separate NEMA 4X stainless steel enclosure (NEMA 7 if located in a classified area). Manual control station controls shall include Hand -Off-Auto Selector switch; Open, Stop, and Close

pushbuttons; a red lamp indicating closed and a green lamp indicating open.

- a) When the HOA is in the "Hand" position, open/close control shall be by the open and close pushbuttons on the remote manual control station. The stop push button shall stop actuator travel.
- b) When the HOA is in the "Off" position, the actuator shall not operate.
- c) When the HOA is in the "Auto" position, the actuator shall be controlled by remote inputs to the valve actuator from the PLC.

2.04 PAINTING AND COATINGS

A. Actuators shall be painted in accordance with the requirements of the specified Standar d with finish coats and colors conforming to the requirem ents of Section 09900 - Painting and Coatings.

PART 3 EXECUTION

3.01 SHIPPING, HANDLING AND STORAGE

A. Assembled actuators and valves shall be packaged, shipped and stored in accordance with the requirements of the specified Standard.

3.02 INSTALLATION

A. Install new actuators and valves as specified for valve installations. Make necessary piping, electrical and instrumentation connections.

3.03 TESTING

A. After installation , test valves and actuators in accordance with the requirements of Section 1510 0 -Valves and Appurtenances.

VALVE ACTUATOR DATA SHEET

DATA SHEET NOTES

- 1. Valve Designation Number
- 2. Quantity of valves on this project.
- 3. Nominal diameter of valve.
- 4. Type of valve: Gate, Ball, Plug, Butterfly, Motorized Check, V-port Ball.
- 5. Maximum differential pressure across closed valve at time of actuation.
- 6. Stroking time: Time for full travel operation of valve.
- 7. Available Voltage.
- 8. Maximum flow rate through the fully open valve at time of actuation.
- 9. Type of valve operation required: Open-Close; Throttle; Modulate.
- 10. Electric enclosure required: NEMA 4 (Water -tight); NEMA 6 (S ubmersible); NEMA 7 (Hazardous).

	1	2	с С	4	5	6	7	8	9	10
Location	Valve No.	Valve Qty	Valve Diam	Valve Type	Max Diff Pres	Stroking Time	Voltage	Max Flow Rate	Type of Oper	Elec Enc.
Effluent Flowmete r	BFV- 101	1	36	Butterfly	150 psi	90 seconds	480 volts - 3 Phase	36 MGI	Open/ Close	Nema 4
RCWR P.S.	BFV- 102	1	24	Butterfly	150 psi	90 seconds	480 volts - 3 Phase	15 MGI	Open/ Close	Nema 4
RCWR P.S.	BFV- 103	1	12	Butterfly	150 psi	90 Seconds	480 volts - 3 Phase	15 MGI	Open/ Close	Nema 4

END OF SECTION

SECTION 15141

PIPE SUPPORT SYSTEMS

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

- A. General
 - Furnish all labor, materials, tools, equipment and services for all pipe support and anchor systems, in accordance with the provisions of the Contract Documents.
 - Completely coordinate with work of all other trades.
 - 3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.
 - 4. The layout of pipe supports is the responsibility of the Contractor, and must take into consideration pipe material, joint type, location, and other requirements of these specifications.

1.02 QUALITY ASSURANCE

- A. Reference Standards:
 - 1. American National Standards Institute (ANSI)
 - 2. American Society of Mechanical Engineers (ASME)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. ASTM A575 Merchant Quality Hot-Rolled Carbon Steel Bars
 - 5. American Welding Society (AWS)
 - 6. Manufacturer's Standardization Society of the Valve and Fittings Industry (MSS)
 - MSS SP -58 (Latest Edition) Pipe Hangers and Supports - Materials and Design

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- MSS SP -69 (Latest Edition) Pipe Hangers and Supports - Selection and Application
- 9. National Bureau of Standards (NBS)
- 10. NBS Handbook H-28

1.03 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.
- B. Submit itemized list of wall sleeves, anchors, support devices and all other items related to pipe support system.
- C. Submit scale d drawings s howing guides, hangers, supports, anchors, structural members and appurtenances to describe the pipe support system.

PART 2 PRODUCTS

2.01 MATERIALS

A. All structural steel angles, rods, channels and special devices integral to pipe support systems shall be fabricated from ASTM -A-276 Type 304 stainless steel . Locate supports and accessories to support pipe system at concentrated loads and in accordance with minimum suggested by MSS SP-69-66.

2.02 PIPE SADDLES

- A. Provide ASTM-A-276 Type 304 Stainless Steel pipe support saddles for pipe supported from the floor, unless otherwise indicated on the drawings. Pipe saddles equal to B-Line Figure B3092, or equal.
- B. Use Schedule 40 ASTM-A-276 Type 304 stainless steel support pipe risers and floor plate recommended by saddle manufacturer.

2.03 WALL BRACKETS

A. Provide ASTM-A-276 Type 304 stainless steel wall bracket supports for pipe located near walls, including all horizontal pipe and all vertical pipe 8 -feet or more above floor elevation or as indicated on the
drawings. Provide wa ll brackets at all changes of direction and as shown on drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install supports capable of supporting the pipe for all service and testing conditions. Allow free expansion and contraction of the piping to prevent excessive stress resulting from service and testing conditions or from weight transferred from the piping or attached equipment.
- B. Install pipe support system in accordance with highest industry practices, and in full accordance with manufacturer's recommendatio ns. Adjust supports and hangers to allow for proper pitch of pipes.
- C. Ensure design, materials of construction, and installation of pipe hangers, supports, guides, restraints, and anchors for chemical and waste piping are in accordance with ANSI B31.3, and MSS Standard SP-58 and SP -69, except where modified by this specification.
- D. Check all physical clearances between piping, support system, and structure. Provide for vertical adjustment after erection.
- E. Provide piping system exhibiting pulsation, vibration, swaying, or impact with suitable constraints to correct the condition. Movements from trap discharge, water hammer, and similar internal forces are included in this requirement. No system will be accepted until the adequacy and safety of the system is assured under all anticipated conditions of operation.
- F. Weld supports in accordance with the requirements of AWS Code D1.1 Structural Welding.
- G. Locate piping and pipe supports so as to not interfere with open accesses, walkways, platforms, and with maintenance or disassembly of equipment.
- H. After erection of piping systems, and prior to pipe testing and flushing, inspect for adequacy of clearance for piping and supports.
- Support pipes for lateral movement with clamps or brackets.

J. Provide 20 -gauge ASTM-A-276 Type 304 stainless steel pipe saddle for fiberglass and plastic support points to insure minimum contact width of 4 inches.

3.02 SUPPORT SPACING

- A. General: Locate pipe supports at maximum spacing scheduled unless indicated otherwise on the drawings. Provide at least one support for each length of pipe, at each change of direction and at each valve.
- B. Steel, stainless steel, cast -iron, and ductile iron support schedule:

Pipe Size - Inches	<u> Maximum Span - Feet</u>
1-1/2 and less	5.0
2 thru 4	10.0
5 thru 8	15.0
10 and greater	20.0

C. Schedule 40 PVC Pipe, Temperature 100° or Less:

<u> Pipe Size - Inches</u>	<u> Maximum Span - Feet</u>
1	5.0
1.5	5.5
2	6.0
3	7.0
4	7.5
6	9.0
8	9.5
10	10.0
12	10.5
14	11.0

D. Schedule 80 CPVC Pipe, Temperature 140° or Less:

<u> Pipe Size - Inches</u>	Maximum Span - Feet
1	5.0
1.5	5.5
2	6.0
3	7.0
4	7.5
6	8.0
8	9.0
10	9.5
12	10.5

3.03 WELDING

- A. Identify welding rods clearly identified meeting the requirements of ASTM and American Welding Society Standards.
- B. Integral attachments include welded -on ears, shoes, plates, and angle clips. Ensure material for integral attachments is of good weldable quality. Have preheating, welding, and postheat treating in accordance with Chapter V of ANSI B31.3.

3.04 PAINTING

A. All stainless steel items shall not be painted. Painting for all other materials shall c omply with Section 09900 - Painting and Coatings.

END OF SECTION

SECTION 16010

ELECTRICAL BASIC REQUIREMENTS

PART 1 GENERAL

1.01 THE REQUIREMENT

- A. Furnish all labor, materials, equipment and incidentals required for a complete electrical installation for the Work associated with the Contract Documents, as hereinafter specified and shown on the Contract Drawings.
- B. Provide functioning systems in compliance with manufacturer's instructions, performance requirements specified or shown on the Contract Drawings and modifications resulting from reviewed shop drawings and field coordinated drawings.
- C. The work, apparatus and materials which shall be furnished under these Specifications and accompanying Contract Drawings shall include all items listed hereinafter and/or shown on the Contract Drawings. Certain equipment will be furnished as specified in other sections of these Specifications which will require wiring thereto and/or complete installation as indicated. All materials necessary for the complete installation shall be furnished and installed by the Contractor to provide complete power, lighting, communication systems, instrumentation, wiring, and control systems as indicated on the Contract Drawings and/or as specified herein.
- D. Provide complete bonding and/or grounding systems for all equipment as specified herein, shown on the contract documents, and as required for specific pieces of equipment per manufacturer.
- E. The Contractor shall furnish and install the necessary cables, transformers, motor control centers, protective devices, conductors, exterior electrical system, etc., to serve motor loads, lighting loads and miscellaneous electrical loads as indicated on the Contract Drawings and/or as specified hereinafter.
- F. The work shall include complete testing of all equipment and wiring at the completion of the work and making any connection changes or adjustments necessary for the proper functioning of the system and equipment.

- G. Mount and wire control panels and process instruments furnished under other Divisions of these Specifications unless specifically stated otherwise. Mount and make all field connections to process instrument panels and other control panels furnished under other Divisions of these Specifications. For process instrumentation, furnish and install all conduit, wire and interconnections between primary elements, transmitters, local indicators, surge protection devices and receivers.
- H. Mount and wire isolation transformers, operator's stations, and power conversion equipment for all variable speed drive systems furnished under other Divisions of these specifications.
- I. Install and wire all thermostats, aqua -stats and other devices furnished under other Divisions of this Specification directly controlling HVAC equipment or fan motors.
- J. Mount and wire electric heaters, and heat tracing furnished under other Divisions of this Specification.
- K. The scheduling and duration of any power or control interruption for the removal of existing equipment or the installation of new equipment shall be coordinated in advance with the Owner.
- L. It is the intent of these Specifica tions that the electrical system shall be suitable in every way for the service required. All material and all work which may be reasonably implied as being incidental to the work of this Section shall be furnished at no extra cost.
- M. Provide all temporary power as required to facilitate the Contract phased construction plan.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Related Sections include but are not necessarily limited to:
 - 1. Division 1 General Requirements
 - 2. Section 03300 Cast-in-Place Concrete
 - 3. Division 11 Equipment
 - 4. Division 13 Special Construction

1.03 AREA CLASSIFICATIONS

A. Outdoor locations may contain wet, corrosive and hazardous areas.

- 1. Corrosive and hazardous areas are identified on the Contract Drawings. Areas not identified as such shall be considered wet.
- B. Indoor locations may contain unclassified, damp, wet, corrosive and hazardous areas.
 - Damp, wet, corrosive and hazardous areas are identified on the Contract Drawings. Areas not identified as such, but provided with heating shall be considered unclassified. Areas not identified as such, but provided without heating shall be considered damp.
- C. Hazardous Locations
 - 1. Hazardous locations shall be as defined in NFPA 70 NEC, NFPA 820 Standard for Fire Protection in Wastewater Treatment and Collection Facilities, and other applicable standards or codes governing the classification of a particular type of facility or location. In addition, areas are classified as shown on Contract Drawings and as follows:
 - a) Class I Division 1
 - b) Class I Division 2
 - c) Class II Division 1
 - d) Class II Division 2

1.04 DEFINITIONS

- A. Outdoor Areas
 - 1. Those locations on the Project site where the equipment is normally exposed to wind, dust, rain, etc. Outdoor areas include areas protected by a roof or rain/sun shields but not enclosed within a structure.
- B. Indoor Areas
 - Those locations on the Project site where the equipment is normally protected from wind, dust, rain, etc.

1.05 QUALITY ASSURANCE

- A. Referenced Standards
 - 1. American Iron and Steel Institute (AISI)

- 2. American National Standards Institute (ANSI)
 - a) C2, National Electrical Safety Code.
- 3. American Society for Testing and Materials (ASTM)
- 4. Factory Mutual System (FM)
 - a) A Guide to Equipment, Materials and Services.
- 5. Institute of Electrical and Electronics Engineers (IEEE)
 - a) 141, Recommended Practice for Electrical Power Distribution for Industrial Plants.
 - b) 242, Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems.
- 6. National Electrical Contractors Association (NECA)
 - a) NECA 1, Good Workmanship in Electrical Construction
 - b) NECA 200, Recommended Practice for Installing and Maintaining Temporary Electrical Power at Construction Sites.
- 7. National Electrical M anufacturers Association (NEMA)
 - a) 250, Enclosures for Electrical Equipment (1000 V Maximum)
 - b) ICS 6, Enclosures for Industrial Control and Systems
- 8. National Fire Protection Association (NFPA)
 - a) 70, National Electrical Code (NEC).
 - b) 70E, Standard for Electric Safety in the Workplace
 - c) 79, Electrical S tandard for Industrial Machiner
 - d) 820, Standard for Fire Protection in Wastewater Treatment and Collection Facilities

- 9. Underwriters Laboratories, Inc (UL)
 - a) 508, Industrial Control Equipment
 - b) 508A, Industrial Control
 - c) 698, Industrial Control Equipment for Use in Hazardous Locations.
- B. When a specific code or standard has not been cited, the applicable codes and standards of the following code-making authorities and standards organizations shall apply.
 - 1. American Association of State Highway and Transportation Officials (AASHTO)
 - 2. American Iron and Steel Institute (AISI).
 - 3. American National Standard Institute (ANSI).
 - 4. American Society for Testing and Materials (ASTM).
 - 5. ETL Testing Laboratories, Inc (ETL).
 - 6. Insulated Cable Engineers Association (ICEA).
 - 7. Institute of Electrical and Electronic Engineers (IEEE).
 - Illuminating Engineering Society of North America (IES).
 - 9. Instrument Society of America (ISA).
 - 10. Lightning Protection Institute (LPI).
 - 11. National Electrical Manufacturers Association (NEMA).
 - 12. National Fire Protection Association (NFPA).
 - 13. Occupational, Health and Safety Administration (OSHA).
 - 14. Underwriters Laboratories Inc (UL).
- C. In case of conflict or disagreement between codes, standards, laws, ordinances, rules, regulations, drawings and specifications, or within either document itself, the more stringent condition shall govern.

1.06 SUBMITTALS

- A. Shop Drawings All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.
 - Shop drawings shall be arranged and labeled according to specification section and Contract Drawing.
 - Submit shop drawings prior to p urchase or fabrication of equipment. See individual Division 16 sections for additional specific requirements.
 - 3. Prior to submittals of shop drawings, coordinate electrical equipment, particularly motor control equipment, control panels, and instrumentation , with all applicable equipment and systems interfacing with that equipment.
 - 4. Submittals shall be made in the following combinations:
 - a) Conduits, raceways, cable trays, ductbank details, wire and cable 600V and below, medium voltage cable, boxes and fittings.
 - b) Medium voltage switchgear, medium voltage motor starters, distribution transformers and secondary substations.
 - c) Motor control centers and control equipment, low voltage switchboards, safety switches, dry-type (specialty) transformers, panelboards, powe r factor correction capacitors, grounding.
 - Lamps, interior lighting, exterior building lighting, site lighting.
 - e) Wiring devices.
 - f) Alarm systems, communication systems and telephone systems.
 - g) Provide a wire or cable identification schedule for all power, c ontrol, signal, process and protective circuits. The schedule shall be submitted in an electronic

spreadsheet type Excel compatible file format
and include the following information:

- (1) Wire or Cable tag number.
- (2) Number of conductors.
- (3) Conductor size and type.
- (4) Wire or Cable usage description.
- (5) Conduit tag number
- (6) Conduit routing (to and from).
- (7) Conduit size and type.
- (8) Additional notes
- 5. For each product, clearly identify manufacturer by name. When general data sheets are provided as part of the submittal, specifica lly identify the products to be used on this Project. Provide manufacturer's technical information on products to be used, including:
 - a) Product descriptive bulletin.
 - b) Electrical data pertinent to the Project and necessary to assure compliance with Specifications and Contract Drawings.
 - c) Equipment dimensions, where applicable.
 - d) Evidence that the products submitted meet the requirements of the standards referenced.
 - e) Specify part number with explanation of options selected.
- 6. Ensure that all submittals clearly i ndicate the equipment is UL or ETL listed.
- 7. For all equipment, provide manufacturer's installation instructions.
- B. When a quality standard has been established by identification of a specific manufacturer or catalog number, submittals for proposed alternate s and substitutions shall include:
 - 1. Alternate and substitute equipment cross-referenced to the equipment it is replacing. Submittal shall be marked to show how differences will be accommodated.
 - 2. Calculations and other detail data to allow determination of alternate and substitute equipment

equivalency to the equipment it is replacing. Data supplied shall allow detailed comparison of all significant characteristics upon which the design equipment is based.

- 3. Dimensioned drawings, of the same or larger scale as the Contract Drawings, for all alternate and substitute equipment, which differs in size, configuration, service accessibility or in any significant way from the equipment it is replacing.
 - a) Complete system layout, except that portion which is identical to the Contract Drawings.
 - b) Redesign and modifications to all work required by the alternate or substitute equipment.
- C. Operation and Maintenance Manuals.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall unload and handle materials using methods, rigging, and equipment that will prevent damage to the materials. Care shall be used to prevent damage to painted and galvanized surfaces.
 - Bare wire rope slings shall not be used for unloading and handling materials and equipment, except with the specific written permission of the Engineer.
- B. Equipment and materials, in accordance with the manufacturer's recommendations, shall be stored, supported and protected to prevent damage.
 - 1. Stored materials and equipment shall not be allowed to contact the ground.
 - Equipment and materials which incorporate electrical equipment or which have finished painted surfaces, and other items which would be damaged by outdoor exposure, shall be stored indoors.
 - a) Provide covering and shielding for all equipment to protect from damage.
 - b) When such storage would present an unreasonable building space or volume requirement, the equipment or materials may,

when acceptable to the Engineer, be stored under weatherproof coverings on shoring or platforms.

- 3. All small loose items that could be easily lost, stolen, broken, or misused shall not be stored on open platforms or shoring.
- 4. All storage methods and schedules shall be acceptable to the Engineer.
- C. Ensure that equipment is not used as steps, ladders, scaffolds, platforms, or for storage-either inside or on top of enclosures.
- D. Protect nameplates on electrical equipment to prevent defacing.
- E. Repair, restore or replace damaged, corroded and rejected items at no additional cost to the Owner.
- F. Record Drawings
 - The Contractor shall maintain a mar ked up set of Document Drawings showing actual installed circuit numbers, conduit sizes, cable tray routing, number of conductors, conductor sizes (other than #12AWG) and all other deviations from the design drawings.
 - 2. All underground conduit and concealed items shall be dimensioned on the Document Drawings from permanent, visible, building features. Depths to the top of ductbanks shall be recorded.
 - 3. Provide actual motor size, starter size, and heater size, along with all other protective equipment for all motor circuits as part of the one-line record drawings.
 - 4. Revise all wire/cable identification schedules to indicate as installed conditions.
 - 5. Revise all panelboard schedules to indicate as installed conditions.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Refer to related Division 16 sections. All equipment of a similar type shall be by one manufacturer unless otherwise noted in the Specifications.

2.02 MATERIALS

- A. Trade names and catalog numbers may be used in the Contract Drawings or Specifications to establish quality standards and basics of design.
 - Other listed manufacturers in the applicable specification sections with equal equipment may be acceptable.
 - If no other manufacturer is listed then any manufacturer of equal equipment may be acceptable.
- B. Listed: Where UL test procedures have been established for the product type, electrical equipment shall be approved by UL or ETL and shall be provided with the UL or ETL label.

2.03 FABRICATION

- A. When equipment is shop fabricated for the Project, the electrical devices and enclosures utilized shall be UL or ETL listed and labeled or shall be UL recognized.
- B. Shop or Factory Finishes: Interiors of other painted equipment shall be white.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Equipment shall be installed in accordance with the requirements of the NEC.
- B. Enclosures for use with electrical equipment unless specifically shown or specified elsewhere in the Contract Documents:
 - 1. NEMA 1/12
 - a) Acceptable in unclassified indoor locations.
 - 2. NEMA 3/3R

- Acceptable in damp or wet indoor/outdoor noncorrosive locations
- 3. NEMA 4X
 - a) Use in wet indoor/outdoor corrosive locations.
 - b) Enclosures shall be 304 -Stainless-Steel minimum. Enclosures constructed of 316 -Stainless Steel may be required in extremely corrosive areas as shown on the Contract Drawings
 - c) Nonmetallic enclosures shall not be used in areas subject to physical damage or sunlight. Nonmetallic enclosures may be used in interior locations.
- 4. NEMA 6P
 - a) Use in "Accidental Submergence" locations.
- 5. NEMA 7
 - a) Use in all Class I, Division 1, 2, Group A, B, C, D locations.
 - b) Unless other enclosures are approved and UL listed for the application.
- 6. NEMA 9
 - a) Use in all Class II, Division 1, 2, Group E,F, G and Class III, Division 1, 2 locations.
 - b) Unless other enclosures are approved and UL listed for the application.
- 7. Exceptions
 - a) As modified in other Division 16 sections.
 - b) As otherwise indicated on the Contract Drawings.
- C. Coordinate the installation of electrical equipment with other trades.
 - 1. Arrange for the building in of equipment during structure construction.

- 2. Where equipment cannot be built -in during construction, arrange for sleeves, box -outs, openings, etc., as required to allow installation of equipment after structure construction is complete.
- D. Verify that equipment will fit support layouts indicated.
- E. Equipment Dimensions and Clearances
 - 1. Equipment shall fit in the locations shown on the Contract Drawings.
 - 2. Do not use equipment or arrangements of equipment that reduce required clearances or exceed the space allocation.
- F. Install equipment in accordance with the manufacturer's instructions.
- G. Equipment Access
 - 1. Install equipment so it is readily accessible for operation and maintenance.
 - 2. Equipment shall not be blocked or concealed.
 - 3. Do not install electrical equipment such that it interferes with normal maintenance requirements of other equipment.
- H. Equipment shall be installed plumbed, square and true with the building construction and shall be securely fastened.
- I. Outdoor wall -mounted equipment and indoor equipment mounted on earth or water bearing walls shall be provided with corrosion -resistant spacers to maintain 1/4 IN separation between the equipment and the wall.
- J. Screen or seal all openings into outdoor equipment to prevent the entrance of rodents and insects.
- K. Equipment fabricated from aluminum shall not be placed in direct contact with earth or concrete.
- L. Provide all necessary anchoring devices and supports.
 - 1. Use supports as detailed on the Drawings and as specified. Where not detailed on the Drawings or specified, use supports and anchoring devices rated

for the equipment load and as recommended by the manufacturer.

- 2. Supports and anchoring devices shall be rated and sized based on dimensions and weights verified from approved equipment submittals.
- 3. Hardware shall be malleable type, corrosion resistant and shall be supported by heavily plated machine screws or brass, bronze or stainless steel bolts.
- Do not cut, weld to, or modify building structural members without written approval by the Engineer of record.
- 5. Do not mount safety switches and external equipment to other equipment enclosures, unless enclosure mounting surface is properly braced to accept mounting of external equipment.
- M. Contractor shall verify exact rough -in location and dimensions for connection to electrical items to be installed under this Contract.
 - 1. Shop drawings shall be secured from those furnishing the equipment.
 - 2. Proceeding without proper information may require the Contractor to remove and replace work that does not meet the conditions imposed by the equipment supplied.
 - 3. Provide sleeves wherever openings are required through new concrete or masonry members. Place sleeves accurately and coordinate locations with the Engineer.
 - 4. Should any cutting and patching be required on account of failure of the Contractor to coordinate penetrations, such cutting and patching shall be done at the expense of the Contractor.
 - a) Contractor shall not endanger the stability of any structural member by cutting, digging, chasing, or drilling and shall not, at any time, cut or alter the work without the Engineer's written consent.
 - Provide additional reinforcing if required.

- Cutting shall be done neatly using proper tools and methods.
- b) Subsequent patching to restore walls, ceilings, or floors to their original condition shall be done by workmen skilled in their particular field.
- N. Provide concrete foundations or pads required for electrical equipment as indicated or specified.
 - 1. Floor-mounted equipment shall be mounted on a 4IN high concrete housekeeping pad. Pad shall be poured on top of the finished floor or slab.
- O. Material that may cause rusting or streaking on a building surface shall not be used.
- P. Perform excavation and backfill in accordance with Section 02200 Earthwork.
- Q. Contractor shall coordinate the installation of the conduit and wire associated with the HVAC equipment supplied under this Contract.
- R. Enclosed electronic equipment located outdoors shall be provided with sun/rain shields and oriented to minimize sun exposure.
- S. Device Mounting
 - Dimensions are to top of item unless otherwise indicated.
 - 2. Mounting heights as indicated below unless otherwise indicated on the Contract Drawings
 - a) Light switch: 48IN.
 - b) Receptacle in offices and other finished areas: 16IN.
 - c) Receptacle in all other locations: 48IN.
 - d) Telephone outlet for desk-mounted phone: 16IN.
 - e) Telephone outlet for wall-mounted phone: 64IN.
 - f) Bracket light above lavatory: 80IN to bottom of fixture.

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- g) Disconnect / Safety -Switch: 64IN to top of enclosure.
- h) Panelboard: 72IN to top of enclosure.
- i) Motor starter: 64IN to top of enclosure.
- j) Pushbutton motor control station: 48IN to top of enclosure.

3.02 IDENTIFICATION

- A. Identify all major items of equipment including controls, panels, switches, contactors, motor starters/controllers, junction boxes and metering by permanent nameplates, with wording approved by the Engineer. Secure nameplates to equipment with stainless -steel screws or rivets. Adhesives may be used in conjunction with mechanical fasteners.
- B. Nameplates after installation shall be easily visible and shall bear notations corresponding to those shown on the Record Drawings.
- C. All conduits shall be identified with a stamped stainless-steel tag system. Conduit tags shall be permanently attached to each exposed end of conduit runs such as in manholes, pull boxes, panels, motor control centers, junction boxes, etc., and at each point of entry into a structure or building. Each tag shall be stamped with the appropriate conduit number per the conduit and cable schedules.
- D. Each instrument shall be identified with a stamped stainless-steel tag system. Instrument tags shall be permanently attached to each individual instrument and stamped with the appropriate tag number per the instrument specification section.
- E. Each cable shall be identified with a heat -shrinkable polyolefin label printing system. Instrumentation cables shall be labeled with the appropriate instrument tag (Example: FIT -200-1). Multiplex cables, power and control cables shall be labeled with the appropriate cable tag number per the equipment tag number (Example: PP1-CKT-9).
- F. All motor control centers, power panels, lighting panels, control panels, control cabinets, etc., shall be identified with permanently mounted nameplates.

- G. All power and lighting panels shall have matte -finish plastic laminated typed schedules mounted on panel doors.
- H. Identification Types
 - 1. Equipment Nameplates
 - a) Phenolic Resin or Thermoplastic Elastomer
 - 1) Thickness: 3/32IN minimum.
 - 2) Size: As required by text.
 - Letters: White letters on Black background.
 - 4) Mount with stainless-steel screws.
 - 2. Wire and Cable Labels
 - a) Heat shrinkable Polyolefin
 - 1) Size: As required by wire or cable.
 - 2) Letters: Black letters on White background.
 - 3) Heat-shrink after termination.
 - 4) Replace damaged or illegible labels.
 - 3. Raceway Tags
 - a) Material: Stainless-Steel
 - b) Size: As required by text.
 - c) Attach with stainless-steel wire and permanent crimp sleeve
 - 4. Instrument Tags
 - a) Material: Stainless-Steel
 - b) Size: As required by text.
 - c) Attach with stainless-steel wire and permanent crimp sleeve
 - 5. UNDERGROUND WARNING TAPE
 - a) Manufacturers: Brady Company, Seton or as approved.
 - b) Description: 2 -inch wide plastic tape, detectable type, colored red with suitable warning legend describing buried electrical lines.

3.03 FIELD QUALITY CONTROL

A. Do not remove or damage fireproofing materials.

- 1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
- 2. Repair or replace fireproofing removed or damaged.
- B. Make all penetrations through roofs prior to installation of roofing.
- C. All penetrations required after installation of roofing, shall be completed by an authorized roofer to maintain the roof warranty.
- D. Make all penetrations of electrical work through walls water and weather-tight.
- E. Equipment furnished under this Contract for use on future work and all concealed equipment, including conduits, shall be dimensioned, on the Rec ord Drawings, from visible and permanent building features.
- F. After installation, all equipment shall be tested as recommended by the manufacturer.
- G. Verify all components are operational.
- H. Perform ground-fault performance testing as required by NEC Article 230-95(c).
- I. Test Equipment Interface
 - 1. Verify systems coordination and operation.
- J. Set all adjustable trip protective devices as required for system protection and coordination.
- K. Verify all system and equipment ground continuity.
- L. Adjust installed equipment for proper operation of all electrical and mechanical components.
- M. Replace equipment and systems found inoperative or defective and re-test.
 - 1. If equipment or system fails re -test, replace it with products that conform to Contract Documents.
 - 2. Continue reme dial measures and re -tests until satisfactory results are obtained.
 - 3. Remedial measures and re-tests will be done at no cost to the Owner.

- N. The Engineer shall be notified of tests and Engineer may witness individual tests.
- O. Required certificates of testing and test reports shall be presented to the Engineer upon completion of the tests.
- P. At Completion of Installation
 - 1. Test to ensure all equipment is free of short circuits and improper grounds.
 - 2. Test to ensure all equipment is operational.

3.04 CLEANING

- A. Clean dirt and debris from all interior and exterior surfaces.
- B. Apply touch-up paint as required to repair scratches, etc.
- C. Replace nameplates or wire and cable markers damaged during installation.
- D. Thoroughly vacuum the interior of all enclosures to remove dirt a nd debris. Do NOT use pressurized air systems to blow out dirt and debris.

3.05 DEMONSTRATION

A. Demonstrate equipment in accordance with Contract Requirements.

END OF SECTION

SECTION 16015

SHORT-CIRCUIT/COORDINATION STUDY/ARC FLASH HAZARD ANALYSIS

PART 1 - GENERAL

1.01 SCOPE

- A. The contractor shall furnish short -circuit and protective device coordination studies which shall be prepared by the equipment manufacturer.
- B. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.
- C. The contractor sh all provide protective device settings for the soft lo ading automatic power transfer system .in accordance with Progress Energy Power requirements.

1.02 REFERENCES

- A. Institute of Electrical and Electronics Engineers, Inc. (IEEE)
 - IEEE 141 Recommended Practic e for Electric Power Distribution and Coordination of Industrial and Commercial Power Systems
 - IEEE 242 Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems
 - 3. IEEE 399 Recommended Practice for Industrial and Commercial Power System Analysis
 - 4. IEEE 241 Recommended Practice for Electric Power Systems in Commercial Buildings
 - 5. IEEE 1015 Recommended Practice for Applying Low -Voltage Circuit Breakers Used in Industrial and Commercial Power Systems
 - 6. IEEE 1584 Guide for Performing Arc -Flash H azard Calculations
- B. American National Standards Institute (ANSI)

- ANSI C57.12.00 Standard General Requirements for Liquid-Immersed Distribution, Power, and Regulating Transformers
- 2. ANSI C37.13 Standard for Low Voltage AC Power Circuit Breakers Used in Enclosures
- 3. ANSI C37.010 Standard Application Guide for AC High Voltage Circuit Breakers Rated on a Symmetrical Current Basis
- ANSI C 37.41 Standard Design Tests for High Vo ltage Fuses, Distribution Enclosed Single -Pole Air Switches, Fuse Disconnecting Switches and Accessories
- 5. ANSI C37.5 Methods for Determining the RMS Value of a Sinusoidal Current Wave and Normal -Frequency Recovery Voltage, and for Simplified Calculation of Fault Currents
- C. The National Fire Protection Association (NFPA)
 - 1. NFPA 70 National Electrical Code, latest edition
 - 2. NFPA 70E Standard for Elect rical Safety in the Workplace

1.03 SUBMITTALS FOR REVIEW/APPROVAL

A. The short -circuit and protective device coordination studies shall be submitted to the design engineer prior to receiving final approval of the distribution equipment shop drawings and/or prior to release of equipment drawings for ma nufacturing. If formal complet ion of the studies may cause delay in equipment manufacturing, approval from the engineer may be obtained for preliminary submittal of sufficient study data to ensure that the selection of device and characteristics will be satisfactory.

1.04 SUBMITTALS FOR CONSTRUCTION

A. The results of the short -circuit, protective device coordination and arc flash haza rd analysis studies shall be summarized in a final report. No more than five (5) bound copies o f the complete final report shall be submitted. For large system studies, submittals requiring more than five (5) copies of the report will be provided without the section containing the computer p rintout of the short -circuit input and output data. Additional copies, where r equired, shall be provided on CD in PDF format.

- B. The report shall include the following sections:
 - One-line diagram showing protective device amp ere ratings and associated designations, cable size & lengths, transformer kVA & volt age ratings, mo tor & generator kVA ratings, and switchgear/ switchboard/panelboard designations.
 - 2. Descriptions, purpose, basis and scope of the study.
 - 3. Tabulations of the worst-case calculated short circuit duties as a percentage of the applied device rating (automatic transfer switches, circuit breakers, fuses, etc.); the short circuit duties shall be upward adjusted for X/R ratios that are above the device design ratings.
 - 4. Protective device time versus current coordination curves with associated one line diagram identifying the plotted devices, tabulations of ANSI protective relay functions and adjustable circuit breaker trip unit settings.
 - 5. Fault study input data, case des criptions, and current calculations including a definition of terms and guide for interpretation of the computer printout.
 - 6. Incident energy and flash protection boundary calculations.
 - 7. Comments and recommendations for system improvements, where needed.
 - 8. Executive Summary including source of information and assumptions made.

1.05 QUALIFICATIONS

A. The short-circuit, protective device coordination and arc flash hazard analysis studies shall be conducted under the supervision and approval of a Registered Professional Electrical Engineer skilled in performing and interpreting the power system studies. The Registered Professional Electrical Engineer shall be registered in the state where the equipment is to be installed.

PART 2 - PRODUCTS

2.01 STUDIES

- B. Contractor to furni sh short-circuit and protective device coordination studies as prepared by equipment manufacturer. By using the equipment manufacturer the study allows coordination of proper breakers, fuses, an d current transformers. The coordination study shall begin with the utilit y company's fee der protective device and include all of the electrical p rotective devices down to and include the largest feeder circuit breaker and motor starter in the 480 Volt motor control centers and power distribution panelboards. The stu dy shall also include variable frequency drives, harmonic filters, power factor correction equipment, transformers and protective devices associated with variable frequency drives, emergency and standby generators associated paralleling equipment and distribution switchgear.
- C. The contractor shall furnish an Arc Flash Hazard Analysis Study per NFPA 70E - Standard for Electrical Safety in the Workplace, reference Article 130.3 and Annex D.

2.02 DATA COLLECTION

- A. Contractor shall furnish all field data as required by the power system studies. The Engineer performing the short circuit, protective device coordination and arc flash hazard analysis studies shall furnish the Contractor with a listing of required data immediately after award of the contract. The Contrac tor shall expedite collection of the data to eliminate unnecessary delays and assure completion of the studies as required f or final approv al of the distribution equipment shop drawings and/or prior to th e release of the equipment for manufacturing.
- B. Source combination may include present and future utility supplies, motors, and generators.
- C. Load data utilized may include existing and proposed loads obtained from C ontract Document s provided by Owner or Contractor.

D. Include fault contribution of existing motors in the study, with mo tors < 50 hp grouped toget her. The Contractor shall obtain required existing equipment data, if necessary, to satisfy the study requirements.

2.03 SHORT-CIRCUIT AND PROTECTIVE DEVICE EVALUATION STUDY

- A. Use actual conductor impedances if known. If unknown, use typical conductor impedances based on IEEE Standards 141, latest edition.
- B. Transformer design impedances and standard X/R ratios shall be used when test values are not available.
- C. Provide the following:
 - 1. Calculation methods and assumptions
 - 2. Selected base per unit quantities
 - One-line diagram of the system being evaluate d with available fault at each bus, an d interrupting rating of devices noted
 - 4. Source impedance data, including electric utility system and motor fault contribution characteristics
 - 5. Typical calculations
 - 6. Tabulations of calculated quantities
 - 7. Results, conclusions, and recommendations
- - 1. Electric utility's supply termination point
 - 2. Incoming switchgear
 - 3. Unit substation primary and secondary terminals
 - 4. Low voltage switchgear
 - 5. Motor control centers
 - 6. Standby generators and automatic transfer switches

- 7. Branch circuit panelboards
- 8. Local Disconnects
- 9. Other significant locations throughout the system
- E. For grounded systems, provide a bolted line -to-ground fault current st udy for areas a s defined for t he three phase bolted fault short-circuit study.
- F. Protective Device Evaluation:
 - 1. Evaluate equipment and protective devices and compare to short circuit ratings.
 - Adequacy of switchgear, motor control centers, and panelboard bus bracing to withstand short -circuit stresses.
 - 3. Adequacy of transformer windings to withstand short circuit stresses.
 - 4. Cable and busway sizes for ability to withstand shortcircuit heating.
 - 5. Notify Owner in writing, of existing, circuit protective devices improperly rated for the calculated available fault current.

2.04 PROTECTIVE DEVICE COORDINATION STUDY

- A. Proposed protective device coordination time -current curves shall be graphically displayed o n log -log scale paper.
- B. Include on each curve sheet a complete title and one-line diagram with le gend identifying the specific p ortion of the system covered.
- C. Terminate device characteristic curves at a point reflecting maximum symmetrical or asymmetrical fa ult current to which device is exposed.
- D. Identify device associated with each curve by manufacturer type, function, and, if applicable, tap, time delay, and instantaneous settings recommended.
- E. Plot the follow ing characteristics on the curv e sheets, where applicable:

- 1. Electric utility's protective device
- 2. Medium voltage equipment relays
- Medium and low voltage fuses including manufacturer's minimum melt, total clearing, tolerance, and damage bands
- 4. Low voltage equipment circuit breaker trip devices, including manufacturer's tolerance bands
- 5. Transformer full -load current, magnetizing inrush current, and ANSI transformer withstand parameters
- 6. Conductor damage curves
- 7. Ground fault protective devices, as applicable
- 8. Pertinent motor starting characteristics and motor damage points
- 9. Pertinent generator short -circuit decrement curve and generator damage point
- 10. Other system load protective devices for the la rgest branch circuit and the largest feeder circuit breaker in each motor control center
- 11. Provide adequate time margins betw een device characteristics such that selective operation is provided, while providing proper protection.

2.05 ARC FLASH HAZARD ANALYSIS

- A. The arc flash hazard analysis shall be performed according to the IEEE 1584 equations that are presented in NFPA70E, Annex D.
- B. When appropriate, the short cir cuit calculations and the clearing times of the phase overcurrent devices will be retrieved from the short -circuit and coordination study model. Alternative methods shall be presented in the proposal.
- C. The flash prote ction boundary and the inciden t energy shall be calculated at all significant locations in the electrical distribution system (switchboards, switchgear, motor-control centers, panelboards, busway and splitters) where work could be performed on energized parts.

- D. The Arc-Flash Hazard Analysis shall include all MV, 575v, & 480v locations and significant locations in 240 volt and 208 volt systems fed from transformers equal to or greater than 125 kVA.
- E. Safe working distances shall be specified for calculated fault 1 ocations based upon t he calculated arc flash boundary considering an incident energy of 1.2 cal/cm².
- F. The Arc Flash H azard analysis shall include calculations for maximum and minimum contributions of fault current magnitude. The minimum calculation shall as sume that the utility contribution is at a mi nimum and shall assume a minimum motor load. Conversely, the maximum calculation shall assume a maximum contribution from the utility and shall assume m otors to be o perating under full -load conditions.
- G. Arc flash computation shall in clude both line and load side of main breaker calculations, where necessary.
- H. Arc Flash calculations shall be based on actual overcurrent protective device clearing time. Maximum clearing time will be capped at 2 seconds based on IEEE 1584 section B.1.2.

2.06 REPORT SECTIONS

- A. Input Data
 - Utility three -phase and line -to-ground available contribution with associated X/R ratios
 - Short-circuit reactance of rotating machines with associated X/R ratios
 - Cable type, construction, size, # per phase, length, impedance and conduit type
 - 4. Bus duct type, size, length, and impedance
 - 5. Transformer primary & secondary voltages, winding configurations, kVA rating, impedance, and X/R ratio
 - 6. Reactor inductance and continuous ampere rating
 - Aerial line type, construct tion, conductor spacing, size, # per phase, and length

- B. Short-Circuit Data
 - 1. Source fault impedance and generator contributions
 - 2. X to R ratios
 - 3. Asymmetry factors
 - 4. Motor contributions
 - 5. Short circuit kVA
 - 6. Symmetrical and asymmetrical fault currents
- C. Recommended Protective Device Settings
 - 1. Phase and Ground Relays
 - a. Current transformer ratio.
 - b. Current setting.
 - c. Time setting.
 - d. Instantaneous setting.
 - e. Specialty non-overcurrent device settings.
 - Recommendations on improved relaying systems, if applicable.
 - 2. Circuit Breakers
 - a. Adjustable pickups and time delays (long time, short time, ground).
 - b. Adjustable time-current characteristic.
 - c. Adjustable instantaneous pickup.
 - d. Recommendations on improved trip systems, if applicable.
- D. Incident energy and flash protection boundary calculations.
 - 1. Arcing fault magnitude
 - 2. Device clearing time

- 3. Duration of arc
- 4. Arc flash boundary
- 5. Working distance
- 6. Incident energy
- 7. Hazard Risk Category
- 8. Recommendations for arc flash energy reduction

PART 2 - EXECUTION

3.01 FIELD ADJUSTMENT

- A. Adjust relay and protective device settings accord ing to the recommended settings table provided by the coordination study. Field adjustments to be com pleted by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.
- B. Make minor modification s to equipment as required to accomplish conformance with short circuit and protective device coordination studies.
- C. Notify Owner in writing of any required major equipment modifications.
- D. Following completion of all studies, acceptance testing and startup by the field engine ering service di vision of the equipment manufacturer, a 2 -year warranty shall be provided on all components manufactured by the engineering service parent manufacturing company.

3.02 ARC FLASH WARNING LABELS

- A. The vendor shall provide a 3.5 in. x 5 in. thermal transfer type label of high adhesion polyester for each work location analyzed.
- B. The label shall have an orange header with the wording, "WARNING, ARC FLASH HAZARD", and shall include the following information:
 - 1. Location designation
 - 2. Nominal voltage

- 3. Flash protection boundary
- 4. Hazard risk category
- 5. Incident energy
- 6. Working distance
- 7. Engineering report number, revision number and issue date
- C. Labels shall be machine printed, with no field markings
- D. Arc flash labels shall be provided in the following manner and all labels shall be based on recommended o vercurrent device settings.
 - 1. For each 600, 480 and applicable 208 volt panelboards and disconnects, one arc fl ash label shall be provided.
 - 2. For each motor control center, one arc fla sh label shall be provided.
 - 3. For each low voltage switchboard, one arc flash label shall be provided.
 - For each switchgear, one flash label shall b provided.

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- 5. For medium voltage switches one arc flash label shall be provided.
- Labels shall be field installed by the engineering service division of the equipment manufacturer under the Startup and Acceptance Testing contract portion.

3.03 ARC FLASH TRAINING

A. The equipment vendor shall train personnel of th e potential arc flash hazards associated with working on energized equipm ent (minimum of 4 hours). Maintenance procedures in accordance with the requirements of NFPA 70E, Standard for Electrical Safety Requirements for Employee Workplaces, shall be p rovided in the equipment manuals. The tr aining shall be certified for continuing education units (CEUs) by the International Association for Continuing Education Training (IACET).

END OF SECTION

SECTION 16050

MATERIALS AND METHODS

PART 1 GENERAL

1.01 RELATED WORK SPECIFIED ELSEWHERE

- A. In addition to the requirements specified in this section, the requirements of specification Section 16010
 Electrical, Basic Requirements and the sections referenced therein shall be applied.
- B. Specification Section 03300 Cast-in-Place Concrete
- C. Specification Section 09900 Painting and Coatings

1.02 SUBMITTALS

- A. All submittals shall be in accordance with Specification
 01340 Shop Drawings, Project Data and Samples.
- B. In accordance with the procedures and requirements set forth in the Contract requirements, the Contractor shall obtain from the equipment manufacturer and submit shop drawings. Each submittal shall be identified by the applicable Specification Section.
- C. Shop drawings shall include but not be limited to:
 - Equipment specifications and product data sheets identifying all materials used and methods of fabrication.
 - 2. Complete assembly, layout, installation, and foundation drawings with clearly marked dimensions.

1.03 QUALITY ASSURANCE

A. Manufacturers: Firms regularly engaged in manufacture of products for electrical related work of sizes, types, ratings, and materials required, whose products have been in satisfactory use in similar service for not less than three (3) years.

1.04 PROJECT CONDITIONS

A. Protect property from any and all damage that might result from excavating and backfilling.

- B. Protect persons from injury at excavations, by barricades, warnings and illumination.
- C. Coordinate excavations with weather condit ions, to minimize possibility of washouts, settlements and other damages and hazards.
- PART 2 PRODUCTS (NOT USED)
- PART 3 EXECUTION

3.01 EXCAVATING FOR ELECTRICAL WORK

- A. General: Do not excavate for electrical work until the work is ready to proceed without delay, so that total time lapse from excavation to completion of backfilling will be minimized.
- B. Excavate with vertical -sided excavations to greatest extent possible, except where otherwise indicated. Where necessary, provide sheeting and cross-bracing to sustain sides of excavations. Remove sheeting and cross-bracing during backfilling wherever such removal would not endanger the work or other property. Where not removed, cut sheeting off at sufficient distance below finished grade to not interfere with other work.
- C. Depth for sub -base Support: Unless otherwise noted, provide installation of sub-base material(s). Excavate for installation of sub-base material in depth indicated or, if not otherwise indicated, 6IN below bottom of work to be supported.
- D. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
 - Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
 - Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- E. Excavate trenches to the uniform dimensions required for the particular item(s) t o be installed and provide sufficient working clearances. Dig trenches to
approximate depth and hand grade bottom to accurate elevation as required.

- F. Where rock is encountered, carry excavation 6IN below required elevation and backfill with a 6IN layer of sand prior to installation of conduit.
- G. Where soil conditions at bottom of indicated excavation are unsatisfactory, excavate additional depth as directed to reach satisfactory soil-bearing condition. Backfill with sub -base material compacted as directed, to indicated excavation depth.
- H. Unless otherwise noted in the Contract Drawings, store excavated material (temporarily) near excavation, in manner that will not interfere with or damage excavation or other work. Do not store under trees (within drip line).
- I. Retain excavated material that complies with requirements for backfill material.
- J. Dispose of excess or unsatisfactory excavated material(s) as directed by the Contract requirements and site conditions.
- K. Refer to the Contract requirements and site conditions for removal of large subsurface materials.

3.02 DEWATERING

- A. Prevent surface water and subsurface or ground water from flowing into excavations and from flooding project site and surrounding area.
- B. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rain water and water removed from excavations to collecting or run-off areas. Do not use trench excavations as temporary drainage ditches.
- C. Maintain dry excavations for electrical work, by removing water. Protect excavations from inflow of surface water. Pump minor inflow of ground water from excavations; protect excavations from major inflow of ground water, by installing temporary sheeting and waterproofing. Provide adequate barriers that will protect other excavations and below-grade property from being damaged by water, sediment or erosion from or through electrical work excavations.

3.03 BASE PREPARATION

- A. Install subbase material to receive electrical work, and compact by tamping to form a firm base for the work.
- B. Provide finely-graded subbase material for equipment to be buried.
- C. Tamp fill to uniform compacted density.
- D. Where conduit crosses over areas which have been previously excavated to depths greater than required for conduit installation, provide suitable support that comply with details shown and Contract requirements.

3.04 BACKFILLING

- A. Backfill with approved backfill materials.
- B. Backfill with finely-graded subbase material to 6IN above equipment to be buried. Backfill materials shall be soil materials free of clay, rock or gravel larger than 3/4IN, debris, waste, frozen materials, vegetation and other deleterious matter.
- C. Condition backfill material by either drying or adding water uniformly, to whatever extent may be necessary to facilitate compaction to required densities. Do not backfill with frozen soil materials.
- D. Backfill simultaneously on opposite sides of electrical work, and compact simultaneously; do not dislocate the work from installed positions.
- E. Backfill excavations in 8IN high course s of backfill material, uniformly compacted to the following densities (% of maximum density, ASTM D 1557), using power-driven hand-operated compaction equipment.
- F. When backfilling excavations for electrical work, backfill to elevations matching finished grades.
- G. Backfill trenches with concrete where trench excavations pass within 18IN of column or wall footings and which are carried below bottom of such footings, or which pass under wall footings. Place concrete to level of bottom of adjacent footing.
- H. Do not backfill trenches until tests and inspections have been made and backfilling authorized by the Engineer.

Use care in backfilling to avoid damage or displacement of conduit systems.

3.05 INSTALLATION OF CONCRETE WORK

- A. Refer to Specification Section 03300 Cast-in-Place Concrete
- B. Miscellaneous Concrete Work
 - 1. Concrete Grouting: Grout openings and recesses as indicated on the Contract Drawings and around all electrical work and other work that penetrates or adjoins all concrete work. Provide formwork where required, and tamp, screed and trowel surfaces. Cure grout as specified for concrete work.
 - Refer to Specification Sections for grouting of equipment base plates on foundations (with high strength, non -shrinking grout), and similar grouting requirements not defined herein.
- C. Clean-Up: Upon completion of work, clean excess concrete and grout from adjacent areas and surfaces. Remove excess concrete and grout by proper methods of removal, using care not to scratch or otherwise damage finished surfaces.

3.06 SUPPORT AND FASTENERS

- A. The Contractor shall furnish and install structural supports and fasteners for mounting and installing all electrical, lighting, alarm systems, instrumentation, communications and other equipment furnished under this Contract.
- B. Where the weight of equipment exceeds 75LBS and is supported from walls, ceilings, columns and/or beams, such structural supports, methods, and locations shall be approved in writing by a professional engineer currently registered in the State of the projects location.
- C. Concrete or Masonry Inserts
 - 1. The Contractor shall be responsible for the furnishing and installation of all conduit sleeves, anchor bolts, masonry inserts, and similar devices required for installation of equipment furnished under this Contract.

- 2. The Contractor shall furnish leveling channels for all switchgear, switchboards, motor control centers, and similar equipment spanning 60IN, in any direction, along the floor. The leveling channels shall be provided for installation into the equipment supporting pads. Coordination of the installation of these channels within the concrete pad is essential and required. Pad height shall be as required to maintain coverage of the reinforcement bars while not exceeding the maximum mounting heights requirements of the NEC.
- D. Support Fastening and Locations
 - All equipment fastened to structural steel; columns, beams, and trusses shall be made by approved clamps or welded. No holes shall be drilled in structural steel.
 - 2. Where supports or hangers are required for heavy electrical equipment units exceeding 75LBS, the structural engineer of record shall check the structural members. Where required, additional sections shall be provided for a safe installation.
 - 3. All holes in hung ceilings for support rods, conduits, and other equipment shall be made adjacent to ceiling supports where possible, to facilitate removal of ceiling panels.
 - 4. For interior dry areas, a bracket and channel type support of galvanized steel construction shall be provided wherever required for th e support of starters, switches, panel s, and miscellaneous equipment.
 - 5. For outdoor service or in indoor damp/wet process areas, the support system shall be made of either stainless steel, PVC coated rigid galvanized steel, aluminum or as indicated on the Contract Drawings.
 - All fastening hardware (bolts, nuts, washers, etc.) shall be approved stainless steel materials or as indicated on the Contract Drawings.
 - 7. All supports shall be rigidly bolted together and braced to make a substantial supporting framework. Where possible, control equipment shall be grouped together and mounted on a single framework. Wherever this occurs, a provision shall be made for

ready access to the wiring for connections to the equipment by means of boxes with screw covers.

- 8. Aluminum support members shall not be installed in direct contact with concrete. Stainless steel or non-metallic "spacers" shall be used to prevent contact of aluminum with concrete.
- 9. The Contractor is responsible for the design of supporting structures and s hall submit design details to the Engineer for acceptance before proceeding with the fabrication and installation.
- 10. Wherever dissimilar metals come into contact, the Contractor shall isolate these metals as required with nylon washers, 9MIL polyethylene ta pe, or gaskets.

END OF SECTION

SECTION 16111

CONDUIT AND RACEWAY

PART 1 GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish all labor, materials, tools and equipment necessary for furnishing, installing, connecting, testing and placing into service all raceway to include all conduits, conduit fittings, wireway, supports, etc. as required for a complete electric installation as specified herein and indicated on the Contract Drawings.
 - Conduit home runs for lighting, receptacle and other misc. circuits are not necessarily indicated on the Contract Drawings; however, the circuit numbers are shown. Conduit shall be furnished and installed for these circuits.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. In addition to the requirements specified in this section, the requirements of specification Section 16010

 Electrical Basic Requirements, and the sections referenced therein shall be applied.
 - 1. Additional raceway from what is shown on the Contract Drawings may be required. Coordinate with the requirements of equipment provided under other Divisions of the specifications.

1.03 CODES AND STANDARDS

- A. Raceway shall comply with the following applicable codes and standards as well as any others within the specifications and drawings. In the event of any conflict between these codes, regulations, standards, and Contract Documents, the most restrictive shall apply.
 - 1. American National Standards Institute (ANSI)
 - a) C80.4 Fittings for Rigid Metal Conduit and Electrical Metallic Tubing.
 - b) C80.5 Electrical Rigid Aluminum Conduit.

- 2. American Society for Testing and Materials (ASTM):
 - a) A36, Standard Specification for Structural Steel.
 - b) A153, Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
 - c) A307, Carbon Steel Externally Threaded Standard Fasteners.
 - d) A563, Standard Specification for Carbon Steel Nuts.
 - e) A569, Steel Carbon, Hot -Rolled Sheet a nd Strip, Commercial Quality.
 - f) A570, Hot-Rolled Sheet and Strip, Structural Quality.
 - g) A575, Merchant Quality Hot-Rolled Carbon Steel Bars.
 - h) A635, Standard Specification for Steel, Sheet and Strip, Heavy -Thickness Coils, Carbon, Hot-Rolled.
 - D1784, Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
 - j) D1788, Standard Specification for Rigid Acrylonitrile-Butadiene-Styrene(ABS) Plastics.
 - k) D2564, Solvent Cements for (PVC) Plastic Pipe, Tubing, and Fittings.
 - F512, Standard Specification for Smooth -Wall Poly (Vinyl Chloride) (PVC) Conduit and Fittings for Underground Installation.
- 3. ETL Testing Laboratories, Inc (ETL).
- 4. National Electric Manufacturers Association (NEMA):
 - a) RN-1, Polyvinyl -Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.
 - b) TC-2, Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).

- c) TC-6, PVC and ABS Plastic Utilities Duct for Underground Installation.
- 5. National Electric Contractors Association
 - a) NECA 1: Standard Practices for Good Workmanship in Electrical Construction
- 6. National Fire Protection Association (NFPA)
 - a) 70, National Electric Code (NEC)
 - b) 79, Electrical Standard for Industrial Machinery
- 7. Underwriters Laboratories Inc (UL)
 - a) 1, Flexible Metal Conduit
 - b) 6A, Electrical Rigid Metal Conduit Aluminum
 - c) 209, Cellular Metal Floor Raceways and Fittings
 - d) 360, Liquid-Tight Flexible Steel Conduit
 - e) 467, Grounding and Bonding Equipment
 - f) 514, Nonmetallic Outlet Boxes, Flush -Device Boxes, and Covers
 - g) 514B, Conduit, Tubing and Cable Fittings
 - h) 651, Schedule 40 and 80 Rigid PVC Conduit
 - i) 870, Wireways, Auxiliary Gutters, and Associated Fittings
 - j) 886, Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations
 - k) 1242, Intermediate Metal Conduit
 - 1660, Liquid -Tight Flexible Non -Metallic Conduit

1.04 SUBMITTALS

- A. Shop Drawings All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.
 - 1. Proposed routing of all site conduits including direct buried, concrete encased, and long run above ground conduits.
 - 2. Proposed routing of conduits buried under floor slabs.
 - Proposed routing and details of construction, including conduit and rebar, of conduits embedded in floor slabs, columns, etc.
 - Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 - Operation and Maintenance Data.

1.05 WARRANTY

A. Per General Condition Article 9, the Contractor shall provide a 3 year warranty from substantial completion.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

- A. The material covered by this Specification is intended to be standard material of proven performance as manufactured by reputable firms. Raceways and appurtenances shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Drawings.
- B. All equipment shall be UL listed and labeled for its intended service.
- C. Subject to compliance with the Contract Documents, the listed manufacturers are acceptable.

2.02 RIGID ALUMINUM CONDUIT (RAC)

- A. Acceptable Manufacturers
 - 1. Allied Tube and Conduit Corporation

- 2. Western Tube and Conduit Corporation
- 3. Wheatland Tube Company
- B. RAC and associated fittings shall be manufactured from 6063 aluminum alloy in temper designation T-1.
- C. RAC shall be installed for all abov e ground conduit installations indoor or outdoor in non-chemical areas unless otherwise noted on the contract drawings.
- D. Standards
 - 1. ANSI C80.5

2.03 PVC-COATED RIGID GALVANIZED STEEL CONDUIT (PVC-RGS)

- A. Acceptable Manufacturers
 - 1. Thomas & Betts
 - 2. Perma-Cote
 - 3. Rob-Roy Ind.
- B. PVC-RGS shall have a minimum 40MIL polyvinyl chloride exterior coating. The coating shall be bonded to hot-dipped galvanized rigid steel conduit conforming to ANSI C80.1. The bond between the polyvinyl chloride coating and the conduit surface shall be greater than the tensile strength of the coating. PVC -RGS shall have a nominal 2MIL, minimum, urethane interior coating and a urethane coating on threads. The PVC-RGS conduit shall have an epoxy prime coating prior to application of polyvinyl chloride and urethane coatings.
- C. Female ends shall have a plastic sleeve extending a minimum of 1 pipe diameter or 2 inch, whichever is less beyond the opening. The inside diameter of the sleeve shall be the same as the outside diameter of the conduit to be used with it.
- D. Conduit shall be installed in direct buried installations or in corrosive and hazardous areas where vehicle or other impact related occurrences are possible.
- E. Standards
 - 1. ANSI C80.1
 - 2. NEMA RN-1

2.04 RIGID POLYVINYL CHLORIDE CONDUIT (PVC)

- A. Acceptable Manufacturers
 - 1. Allied Tube and Conduit Corporation
 - 2. Carlon
 - 3. Cantex
- B. PVC shall be either Schedule 40 or Schedule -80. The polyvinyl-chloride plastic compound shall meet, as a minimum, ASTM D1784 cell classification PVC 12233-A, B, or C. PVC shall be rated for direct sunlight exposure, 90°C wire, and fire retardant with low smoke emission.
- C. Schedule 40 PVC conduit shall only installed in concrete encased underground conduit installations. Schedule 80 PVC conduit shall be installed for exposed conduit in corrosive areas where protected from vehicle traffic or other impact related occurrences. Direct underground installations per drawings only or at Engineers discretion.
- D. Standards
 - 1. ANSI C33.91
 - 2. NEMA TC-2
 - 3. UL 651

2.05 LIQUID-TIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Acceptable Manufacturers
 - 1. Anamet, Inc.
 - 2. Electri-Flex Company
 - 3. International Metal Hose Company
- B. LFMC shall have a core formed of continuous, spiral wound, hot-dip galvanized steel strip with successive convolutions securely interlocked, contain an interwoven copper strip suitable as a grounding means, and have an extruded vapor and liquid tight polyvinyl chloride outer

jacket positively locked to the steel core.

C. Standard

1. UL 360

2.06 WIREWAY

- A. Acceptable Manufacturers
 - 1. E.M. Wiegmann and Company, Inc.
 - 2. Hoffman Engineering Company
 - 3. Stahlin
 - 4. Square D
- B. Wireway shall have a minimum wall thickness of 0.040 inch, be furnished without knockouts, be designed for continuous grounding, and s uitable for lay -in conductors. Provide Solid and non-removable covers when passing through partitions and solid hinged covers with captive screw fasteners when accessible.
- C. Wireway shall not be smaller than 4-inch x 4-inch unless otherwise indicated on the Contract Drawings.
- D. Types
 - 1. NEMA-1: Wireway shall be steel, finished with rust inhibiting phosphatizing coating and gr ay baked enamel finish on interior and exterior surfaces.
 - 2. NEMA-3/3R/12: Wireway shall be steel, finished with rust inhibiting phosphatizing coating and gray baked enamel finish on interior and exterior surfaces. Cover shall be fully gasketed and provided with captive clamp type latches.
 - 3. NEMA- 4/4X: Wireway shall be type 304 stainless steel for interior or exterior corrosive areas. Cover shall be fully gasketed and provided with captive external screw type clamps.
 - NEMA- 4/4X: Fiberglass or PVC may be utilized for interior corrosive areas only where specifically shown on the Contract Drawings.

- E. Standards
 - 1. NFPA 79
 - 2. UL 870

2.07 CONDUIT FITTINGS AND ACCESSORIES

- A. Acceptable Manufacturers
 - 1. Appleton
 - 2. Carlon
 - 3. Crouse-Hinds
 - 4. Killark
 - 5. OZ Gedney Company
 - 6. Perma-Cote
 - 7. RACO
 - 8. Rob-Roy Ind.
 - 9. Steel City
 - 10. Thomas and Betts
 - 11. Western Plastics Company
- B. Fittings for Use with RAC
 - 1. Materials: Following minimum requirements unless otherwise noted.
 - a) Body: Copper -free aluminum with aluminum lacquer or aluminum enamel finish.
 - b) Covers: Copper-free aluminum and gasketed.
 - c) Gaskets: Neoprene or PVC.
 - d) Insulators-phenolic, thermosetting: minimum 105 Deg C UL rating.
 - e) Grounding saddles tin-plated copper or bronze suitable for use with copper and aluminum

conductors.

- f) Bonding jumpers: Tinned copper flexible braid.
- g) Locknuts: Malleable iron, zinc plated.
- 2. All fittings: Threaded unless otherwise noted.
- 3. Conduit Hubs shall be cast aluminum with insulated throat.
- 4. Straight couplings: Same material and finish as the conduit with which they are used.
- 5. Mogul pulling elbows and tees:
 - a) Die cast copper free aluminum
 - b) Rain tight
- 6. Conduit seals
 - a) Drain and breather: Stainless steel or brass
 - b) Fiber and sealing compound: UL listed for use with the sealing fitting
- 7. Standards
 - a) UL 467
 - b) UL 514B
- C. Fittings for Use with PVC
 - Fittings shall be of the same material, thickness, and construction as the conduits with which they are used.
 - a) Standards
 - 1) UL 651
 - 2) NEMA TC-2-1978
 - 2. Solvent cement for welding fittings shall be supplied by the same manufacturer as the conduit and fittings.
 - a) Shall not be more than 1 year past date of manufacture.

- b) Standard: ASTM D2564
- D. Fittings for Use with LFMC
 - 1. Fittings shall meet the following minimum requirements unless otherwise noted:
 - a) Body: Malleable iron, zinc-plated
 - b) Ferrule: Steel, zinc-plated
 - c) Locknuts and compression nuts: Malleable iron, zinc-plated
 - d) Sealing ring: Neoprene
 - 2. Fittings shall be compression type
 - 3. Standard: UL 514

2.08 STRUT CHANNEL SUPPORT SYSTEMS

- A. Acceptable manufacturers:
 - 1. Allied Power-Strut Products
 - 2. B-Line Systems
 - 3. Rob-Roy Industries
 - 4. Thomas & Betts
 - 5. Unistrut Building Systems
- B. All strut -channel, clamps, fittings and fastener materials shall conform to the following unless otherwise noted on the Contract Drawings.
 - 1. Indoor Wet/Dry Areas:
 - a) Aluminum 6063-T6
 - 2. Indoor Corrosive Areas:
 - a) Fiberglass (ASTM D-4385)
 - b) Stainless Steel Type-316 (ASTM A240)

- c) PVC Coated Hot-Dipped Galvanized Steel (ASTM D1151, D2247)
- 3. Outdoor Wet Areas:
 - a) Stainless Steel Type-304 (ASTM A240)
 - b) Aluminum 6063-T6
- 4. Outdoor Corrosive Areas:
 - a) Stainless Steel Type-316 (ASTM A240)
 - b) PVC Coated Hot-Dipped Galvanized Steel (ASTM D1151, D2247)
- C. Strut-channel shall not be bent, drilled, cut or otherwise modified to produce fittings, braces or brackets for conduit and equipment supports.
- D. Manufactured strut-channel braces, brackets, fittings and post-bases shall be provided and installed with associated hardware and fasteners as a complete system for conduit and equipment supports.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. All conduit, raceway, wireway and associated fittings shall be stored in accordance with the manufacturer recommendations and shall not be stored exposed to sunlight or other UV rays.

3.02 INSTALLATION

- A. The Contractor shall plan the layout of conduit and raceway systems so that when the work is complete it will exhibit good workmanship practices in accordance with NECA-1.
- B. Routing of Conduits and Raceways
 - Conduit and Raceway runs, where shown, indicate the preferred location. Site conditions may affect actual routing. Contractor shall coordinate routing and measurement with other trades and with equipment suppliers.

- Shall not interfere with, o r prevent access to, piping, valves, ductwork, or other equipment for operation, maintenance and repair.
- Wherever possible avoid routing conduits and raceways through areas of high ambient temperature or radiant heat.
- C. Size of Conduits and Raceways
 - The size of conduits and raceways are normally shown on the Contract Drawings. If a size is not shown on the Contract Drawings, or if a minimum size is not stated in the Specifications, then the size of conduits and raceways shall be in accordance with the NEC.
 - Conduits shall not be smaller than 1 inch for underground installations and 3/4 inch elsewhere, unless otherwise shown on the Contract Drawings.
- D. Types of Conduits and Raceways
 - 1. Shall be installed as defined in the Contract Drawings.
 - 2. As required by NFPA.
 - 3. Flexible Conduit
 - a) Install as the final conduit to motors, electrically operated valves, primary elements (instrumentation), and electrical equipment that is liable to vibrate.
 - b) Shall not be used as a conduit run:
 - c) Maximum length shall not exceed:
 - (1) 36 inch to motors.
 - (2) 24 inch to all other equipment.
 - 4. PVC-RGS
 - a) Contractor shall use tools, clamps, dies, equipment, etc. designed specifically for the cutting, bending and threading of PVC-RGS.

- b) Contractor shall follow the recommendations and methods of the manufacturer for installing PVC-RGS.
- E. Provide openings in walls, floors, and ceilings for all required raceway penetrations.
 - 1. Sleeves and block outs: Set in masonry walls during erection.
 - 2. Sleeves and block outs: Set in concrete during forming.
 - a) Material: Not harmful to the concrete.
 - b) Not considered to replace structurally the displaced concrete.
- F. Conduit Runs
 - All conduits within a structure shall be installed concealed unless otherwise noted on the Contract Drawings.
 - 2. Total of Bends in a Conduit Run
 - a) Less than 270 degrees.
 - b) Provide pu ll boxes, condu its, or pulling elbows or tees as needed.
 - 3. Run in straight lines parallel to or at right angles to structural members or building lines.
 - 4. Maintain minimum 2 -inch separation between all conduits.
 - 5. Maintain minimum 6 -inch separation between instrumentation and power conduits.
 - Maintain minimum 12-inch separation from process, gas, air and water pipes.
 - 7. Conduits and accessories embedded in concrete:
 - Shall not be larger in outside diameter than one-third the thickness of the slab, column or beam.
 - b) Place conduit and accessories after reinforcing steel has been laid.

- c) Shall not displace the reinforcement steel.
- d) Provide a minimum of 1-1/2 inches of concrete cover around conduit.
- e) Do not run against reinforcing steel.
- f) Provide 2 inch minimum of spacing between conduits.
- g) Install expansion/deflection fittings wherever conduit spans structural or expansion joint.
- G. Field Bending of Conduits
 - Utilize tools, equipment, methods and recommendations by the manufacturer to make all field bends.
 - 2. The internal diameter of con duit shall not be reduced or distorted.
- H. Field Cutting and Threading Conduits
 - Utilize tools, equipment, methods and recommendations by the manufacturer to field cut and thread conduit.
 - All field cut conduit shall be smooth and evenly chamfered on the inside.
 - 3. All field threaded conduit shall be clean and degreased before applying a zinc rich paint.
- I. Terminating Conduits
 - 1. NEMA 1 enclosures
 - a) Top: Locknuts and insulated bushings.
 - b) Side: Locknuts and insulated bushings.
 - c) Bottom: Locknuts and insulated bushings.
 - 2. NEMA 2/12/12K enclosures
 - a) Top: Sealing locknuts and insulated bushings.
 - b) Side: Locknuts and insulated bushings.
 - c) Bottom: Locknuts and insulated bushings.

- 3. NEMA 3/3R/3S/13 enclosures
 - a) Top: Threaded conduit hubs with insulated throats.
 - b) Side: Sealing locknuts and insulated bushings.
 - c) Bottom: Locknuts and insulated bushings.
- 4. NEMA 4/4X enclosures
 - a) Top: Threaded conduit hubs with insulated throats or approved cable gland fittings.
 - b) Side: Threaded conduit hubs with insulated throats or approved cable gland fittings.
 - c) Bottom: Threaded conduit hubs with insulated throats or approved cable gland fittings.
- 5. NEMA 5 enclosures
 - a) Top: Sealing locknuts with insulated throats.
 - b) Side: Sealing locknuts and insulated bushings.
 - c) Bottom: Locknuts and insulated bushings.
- 6. NEMA 6/6P enclosures
 - a) Top: Th readed conduit hubs with insulated throats or approved cable gland fittings.
 - b) Side: Threaded conduit hubs with insulated throats or approved cable gland fittings.
 - c) Bottom: Threaded conduit hubs with insulated throats or approved cable gland fittings.
- 7. NEMA 7/8/9 enclosures
 - a) Enclosures shall be provided with integral conduit hubs
- J. Conduit Seal Installation
 - 1. In each conduit entering or leaving a Class I area.
 - In each conduit in a Class I Division 1 area entering or leaving an enclosure containing switches, circuit breakers, fuses, relays,

resistors or other apparatus which may produce arcs, sparks or high temperature.

- 3. In each conduit 2 -inch or larger in a Class I Division 1 area entering or leaving an enclosure containing terminals, splices and taps.
- In each conduit in a Class I Division 2 area entering or leaving an enclosure required to be approved for use in Class I environments.
- 5. In each conduit in a Class II location between an enclosure required to be dust ignition-proof and an enclosure that is not required to be dust ignition-proof.
- 6. In each conduit in a corrosive area entering or leaving that area and entering or leaving an electrical equipment enclosure in that area.
- 7. So that the filler plug and drain is accessible.
- 8. Complete with approved sealing fiber and compound.
- K. Conduit Moisture Sealing
 - All conduits terminated into enclosures located outdoors or routed from interior t o exterior locations shall have non-hardening conduit sealing putty packed into and around conductors within each conduit opening.
- L. Conduit Coatings
 - 1. The protective coating of metallic conduits, fittings, and accessories shall be maintained.
 - a) Repair PVC-RGS utilizing a patching compound, of the same material as the coating, provided by the manufacturer of the conduit.
 - (1) The total nominal thickness: 40 MIL.
 - b) Repair surfaces that will be inaccessible after installation prior to installation.
 - 2. All metallic raceways installed in direct contact with concrete, masonry or soils shall be:
 - a) PVC-RGS

- b) Installed with 40 MIL minimum coating of cured coal-tar bitumastic paint.
- 3. All metallic raceway transitions through concrete, masonry or soils shall be:
 - a) PVC-RGS
 - b) Installed with heavy -wall heat -shrink polyolefin tubing extending 6-inch minimum on each side of transition.
 - c) Installed with 40 MIL minimum coating of cured coal-tar bitumastic paint.
- M. Power Cable Pulling Preparation
 - 1. Remove water and debris from conduit prior to installation of power cables.
 - 2. Pull mandrel with diameter nominally 1/4 inches smaller than the interior of the conduit, to ensure circular cross-section and removal of obstructions.
 - 3. Swab conduit by pulling a clean, tight-fitting rag through the conduit.
 - Tightly plug ends of conduit with manufactured pipe plugs or plastic conduit inserts until power cables are pulled.
 - Only nylon or polyethylene rope shall be us ed to pull power cables in rigid non -metallic conduit systems.

END OF SECTION

SECTION 16115

UNDERGROUND DUCT BANKS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes manholes; handholes; pull -boxes; and underground power, control, and instrumentation conduits and ductbanks.
- B. In addition to the requirements specified in this section, the requirements of specification Section 16010
 Electrical, Basic Requirements and the sections referenced therein shall be applied.

1.02 QUALITY ASSURANCE

- A. Referenced Standards
 - American Association of State Highway & Transportation Officials (AASHTO).
 - 2. American Society for Testing Materials (ASTM):
 - a) A536, Standard Specification for Ductile Iron Castings.
 - 3. National Fire Protection Association (NFPA):
 - a) NFPA 70, National Electrical Code (NEC), 2008 Edition.
- B. Miscellaneous
 - Contract Drawings indicate the intended location of manholes, handholes and pull-boxes; and routing of ductbanks and direct buried conduit. Field conditions may affect actual routing.

1.03 DEFINITIONS

- A. Direct-buried conduit means individual (single) underground conduits without concrete encasement.
- B. Direct-buried du ctbank means multiple underground conduits, in a common trench, without concrete encasement.

C. Concrete encased ductbank means any underground conduit or combination of underground conduits encased in a common concrete envelope.

1.04 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and 16010
 - Electrical Basic Requirements.
- B. Fabrication and layout drawings
 - 1. Provide cross-sectioned sketch of each ductbank.
 - a) Dimension spacing between conduits
 - b) Dimension concrete envelope and reinforcing, where applicable
 - 2. Provide ductbank and direct-buried conduit profile.
 - a) Dimension from grade to duc tbank and direct buried conduit
 - b) Dimension from ductbank and direct buried conduit to other utilities in the route
 - 3. Certifications
 - 4. Test reports
- C. Operation and Maintenance Manuals
 - Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 -Operating and Maintenance Data.

1.05 WARRANTY

A. Per General Condition Article 9, the Contractor shall provide a 3 year warranty from substantial completion.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Precast manholes, handholes and pull-boxes
 - a) Hanson Pipe & Products, Inc.

- b) Oldcastle Precast
- c) Utility Vault Co.
- 2. Manhole and handhole covers
 - a) Neenah
 - b) Utility Vault Co.
- 3. Cable racks
 - a) Unistrut
 - b) B-Line
 - c) Condux International, Inc.
 - d) Underground Devices, Inc.
- 4. Cable pulling irons
 - a) Condux International, Inc.
- 5. Ground rods and grounding equipment
 - a) See Section 16450 Grounding and Bonding
- 6. Ground wire
 - a) See Section 16450 Grounding and Bonding
- 7. Duct terminators
 - a) Carlon
 - b) Condux International, Inc.
- 8. Conduit
 - a) See Section 16111 Conduit and Raceway
- 9. Duct spacers
 - a) Underground Devices, Inc.
 - b) Condux International, Inc.
- 10. Warning Tape
 - a) W. H. Brady Company
 - b) Seton Nameplate Company

2.02 MATERIALS

- A. Handholes and Pull-Boxes
 - 1. Pre-Cast steel reinforced concrete

- a) Boxes are required to meet ASTM C 858 with 4,000 PSI minimum compressive strength concrete and designed for AASHTO H-20 loading unless otherwise noted on the Contract Drawings.
- b) Tongue-and-grove double sealed joints on mating edges of pre -cast components. The joints shall firmly interlock adjoining components and provide waterproof junctions and adequate shear transfer. Joints shall be sealed with approved watertight joint sealant as prescribed in the manufacturer's installation specifications and conforming to AASHTO M198, Type B. Sealing material shall be installed in strict accordance with manufacturer's printed instructions.
- c) Knockout panels or pre-cast individual conduit openings may be used. Blockout panels are not acceptable.
- d) Cover
 - Heavy-duty type frames and covers made of cast iron, suitable for H-20 loading, and having machined bearing surfaces shall be used.
 - (2) The covers shall be of indented type with solid top design.
 - (3) The upper side of each cover shall have the letters "Electrical", "Control", or "Communication" cast in integral letters no less than 2 -inches high as indicated on the Contract Drawings.
- 2. Cast-In-Place
 - a) Comply with Section 03300 Cast-In-Place Concrete unless otherwise specified herein.
 - b) Constructed as detailed on the Contract Drawings.
 - c) Cover
 - Heavy-duty type frames and covers made of cast iron, suitable for H-20 loading, and

having machined bearing surfaces shall be used.

- (2) The covers shall be of indented type with solid top design.
- (3) The upper side of each cover shall have the letters "Electrical", "Control", or "Communication" cast in integral letters no less than 2 -inches high as indicated on the Contract Drawings.
- d) Shall have an AASHTO live load rating of H-20, unless otherwise noted in the Contract Drawings or Specifications.

B. Manholes

- 1. Pre-Cast Steel Reinforced Concrete
 - a) Boxes are required to meet ASTM C 858 with 4,000 PSI minimum compressive strength concrete and designed for AASHTO H-20 loading unless otherwise noted on the Contract Drawings.
 - b) Tongue-and-grove double sealed joints on mating edges of pre -cast components. The joints shall firmly interlock adjoining components and provide waterproof junctions and adequate shear transfer. Joints shall be sealed with approved watertight joint sealant as prescribed in the manufacturer's installation specifications and conforming to AASHTO M198, Type B. Sealing material shall be installed in strict accordance with manufacturer's printed instructions.
 - c) Knockout panels or pre-cast individual conduit openings may be used. Blockout panels are not acceptable.
 - d) Minimum interior dimensions shall be 4 feet wide x 4 feet long x 6 feet tall
 - e) Cover
 - (1) Minimum access opening dimensions
 - (a) Rectangular 26-inch x 22-inch
 - (b) Round 26-inch Diameter

- (2) Heavy-duty type frames and covers made of cast iron, suitable for H-20 loading, and having machined bearing surfaces shall be used.
- (3) The covers shall be of indented type with solid top design.
- (4) The upper side of each cover shall have the letters "Electrical", "Control", or "Communication" cast in integral letters no less than 2-inch high as indicated on the Contract Drawings.
- 2. Cast-In-Place
 - a) Comply with Section 03300 Cast-In-Place Concrete unless otherwise specified herein.
 - b) Constructed as detailed on the Contract Drawings.
 - c) Shall have an AASHTO live load rating of H-20, unless otherwise noted on the Drawings.
 - d) Minimum interior dimensions shall be 4 -feet wide x 4-feet long x 6-feet tall.
 - e) Cover
 - (1) Minimum access opening dimensions
 - (a) Rectangular 26-inch x 22-inch
 - (b) Round 26-inch Diameter
 - (2) Heavy-duty type frames and covers made of cast iron, suitable for H-20 loading, and having machined bearing surfaces shall be used.
 - (3) The covers shall be of indented type with solid top design.
 - (4) The upper side of each cover shall have the letters "Electrical", "Control", or "Communication" cast in integral letters no less than 2 -inches high as indicated on the Contract Drawings.
 - f) Cable Racks

- Hot-dipped galvanized hot -rolled steel; or Lexan.
- (2) 120 Lbs. minimum loading capacity.
- (3) Three-point locking to resist twisting.
- g) Cable Pulling Irons
 - (1) Hot-dipped galvanized steel
 - (2) 6,000 Lbs. minimum pulling load
- h) Ground Rods and Grounding Equipment
 - (1) See Section 16450 Grounding and Bonding
- i) Ground Wire
 - (1) See Section 16120 Wire and Cable: 600 Volt and Below
- j) Duct Terminators
 - (1) Window type
 - (2) ABS plastic
 - (3) Provide for conduit entrance
 - (4) Designed for installation into manhole, handhole or pull -box walls for a watertight seal.
 - (5) Sufficient space between terminator walls to allo w for placement of rebar and concrete.
- k) Conduit
 - (1) See Section 16111 Conduit and Raceway
- 1) Duct Spacers
 - (1) High density polyethylene or high impact polystyrene.
 - (2) Interlocking
 - (3) Provide 2 -inch minimum spacing between conduits.

- m) Warning Tape
 - (1) Material: Polyethylene
 - (2) Thickness: 3.5 MIL
 - (3) Tensile strength: 1,750 PSI
 - (4) Size: 6-inches wide (minimum)
 - (5) Legend: Preprinted and permanently imbedded:
 - (a) Message continuously printed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. General
 - 1. Install products in accordance with manufacturer's instructions.
 - Comply with Section 16050 Materials and Methods for trenching, backfilling and compacting.
 - 3. Buried conductor warning tape
 - a) See Section 16010 Electrical Basic Requirements.
- B. Manholes, Handholes and Pull-Boxes
 - 1. Shape: Manholes, handholes and pull-boxes may be either square or rectangular.
 - 2. Size
 - Manholes shall have minimum interior dimensions of 48-inch x 48-inch with a minimum interior height of 72 -inches unless other dimensions are detailed on the Contract Drawings.
 - b) Handholds shall be sized for the number of conduits entering unless other dimensions are detailed on the Contract Drawings.
 - Minimum interior dimensions shall be 24-inch x 17-inch with a minimum depth of 36-inches.

- c) Pull-Boxes shall be sized for the number of conduits entering unless other dimensions are detailed on the Contract Drawings.
- 3. Precast or Cast-In-Place
 - a) Optional unless otherwise noted in the Contract Drawings or Specifications.
- 4. Precast manholes, handholes and pull-boxes shall be installed in accordance with the manufacturer's instructions for "subject to occasional heavy vehicles."
- 5. For cast-in-place construction, comply with Section 03300-Cast-In-Place Concrete.
- 6. Provide minimum 12-inches of tamped crushed rock or gravel prior to setting manhole, handhole or pull box.
- 7. Construct manholes, handho les and pull -boxes approximately where shown on the Contract Drawings. Determine the exact locations after careful consideration has been given to location of other utilities, grading, and paving.
 - Locations are to be approved by the Engineer prior to excav ation and construction of manholes, handholes and pull-boxes.
- 8. Grout or seal all joints
 - a) For precast construction, comply with the manufacturer's instructions.
 - b) For cast -in-place construction, comply with Section 03300 - Cast-In-Place Concrete.
- 9. Set frames and covers
 - a) For manholes, handholes and pull-boxes located in roadways, paint with two coats asphaltic paint before setting and set top of covers flush with finished surface of paving.
 - b) For manholes, handholes and pull -boxes not located in roadways, set top of covers 2-inches above finished grade. Slope surrounding grade away from edge to insure water drains away from opening.

- c) Install sufficient number of concrete extensions between top of manhole, handhole or pull-box frame as required to elevate cover to existing grade level.
- 10. Support cables on walls by cable racks
 - a) Equip cable racks with adjustable hooks
 - (1) Quantity of hooks as requi red by the number of conductors
 - (2) Minimum of two (2) cable hooks per rack
 - b) Install a minimum of two (2) racks on each wall in each manhole, handhole and pull-box.
 - c) Space cable racks so that both ends of cable splices will be supported horizontally.
 - d) In manholes, install one (1) spare hook on each rack.
 - e) Install a cable -pulling iron in each wall opposite each ductbank entrance.
- 11. Grounding: In each manhole, drive copper ground rod into the earth and extend ground rod approximately 6-inches above finished floor.
 - a) In precast structures, drill openings in floor for ground rod.
 - b) Connect all metallic conduits, racks, and other metallic components to gro und rod by means of #8AWG minimum tinned copper wire and approved grounding clamps.
- 12. Provide an 18-inch diameter sump in the bottom of each manhole and handhole.
- 13. After installation is complete, backfill and compact soil around manholes and handholes.
- C. Underground Duct Banks
 - 1. Concrete encased ductbank
 - Provide electrical duct system consisting of conduits completely encased in a minimum of 2inches of concrete.

- b) For circuits 600V and below, install so that top of concrete encased duct, at any point, is not less than the minimum depths established by the NEC (Table 300-5 and exceptions):
 - (1) RGS conduit: 24-inch
 - (2) PVC sch-40 conduit: 24-inch
 - (3) Under areas subject to vehicular traffic
 - (a) All applications: 24-inch
 - (4) Unless a greater depth is detailed on the Contract Drawings.
- c) Under traffic areas (roadways, parking lots, etc.) and for a distance 10 feet either side of the traffic area, and elsewhere as defined on the Contract Drawings or specified, the concrete shall be reinforced in accordance with Section 03300-Cast-In-Place Concrete.
- 2. Direct-buried ductbank
 - a) Provide electrical duct system consisting of conduits directly buried in earth.
 - (1) Lay conduits on minimum 2-inch sand base completely encased by 2-inch of selected backfill containing no stones or other hard material larger than 1/2-inch diameter.
 - b) For circuits 600V and below, install so that the top selected backfill at any point, is not less than the minimum depths established by the NEC (Table 300-5 and exceptions).
 - (1) RGS conduit: 24-inch
 - (2) PVC sch-80 conduit: 24-inch
 - (3) Under areas subject to vehicular traffic
 - (a) All applications: 24-inch
 - (4) Unless a greater depth is detailed on the Contract Drawings.
- 3. Direct-buried conduit

- a) Provide electrical duct system consisting of conduits directly buried in earth.
 - (1) Lay conduit on minimum 2 -inch sand base completely encased by 2 -inches of selected backfill containing no stones or other hard material larger than 1/2-inch diameter.
- b) For circuits 600V and below, install so that top of the selective backfill, at any point, is not less than the minimum dept hs established by the NEC (Table 300 -5 and exceptions).
 - (1) RGS conduit: 24-inch
 - (2) PVC sch-80 conduit: 24-inch
 - (3) Under areas subject to vehicular traffic
 - (a) All applications: 24-inch
 - (4) Unless a greater depth is detailed on the Contract Drawings.
- 4. Underground conduits an d ductbanks shall comply with the following:
 - a) Minimum grade shall be 4 -inches per 100 feet or as detailed on the Contract Drawings.
 - (1) Low point shall be at one end of the conduit run.
 - b) During construction and after conduit installation is complete; plug the ends of all conduits.
 - c) Provide conduit supports and separators of concrete, plastic, or other suitable nonmetallic, non -decaying material designed for that purpose.
 - (1) Concrete encasement supports shall provide a uniform minimum clearance of 2 inches between the bottom of the trench and the bottom row of conduit.
 - (2) Separators shall provide a uniform minimum clearance of 2-inches between conduits.
- (3) Place supports and separators for PVC conduit on maximum centers as indicated for the following trade sizes:
 - (a) 1 inches and less: 2 feet
 - (b) 1-1/4 to 3 inches: 4 feet
 - (c) 3-1/2 to 6 inches: 6 feet
- (4) Place supports and separators for RGS conduit on maximum centers as indicated for the following trade sizes:
 - (a) 1-inch and less: 8 feet
 - (b) 1-1/4 to 2-1/2 inches: 10 feet
 - (c) 3-inches and larger: 12 feet
- (5) Securely anchor conduits to supports and separators to prevent movement during placement of concrete or soil.
- (6) Do not place concrete or soil until conduits have been observed by the Engineer.
- d) Stagger conduit joints at intervals of 6-inches horizontally.
- e) Make conduit joints watertight and in accordance with manufacturer's recommendations.
 - (1) Make plastic conduit joints by uniformly brushing a plastic solvent cement on inside of plastic coupling fitting and outside of conduit ends. Slip conduit and fitting together with a quick one-quarter turn twist to set joint tightly.
 - (2) Accomplish changes in direction of runs exceeding a total of 5 degrees by long sweep bends having a minimum radius of 25-inches.
 - (3) Sweep bends shall be made up of one curved section.
- f) Furnish manufactured bends at end of runs.

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- Minimum radius of 18-inches for conduits less than 3-inch trade size and 36-inches for conduits 3 -inch trade size and larger.
- g) After the conduit run has been completed, pull a standard flexible mandrel having a length of not less than 12 -inches and a diameter approximately 1/4-inch less than the inside diameter of the conduit through each conduit. Then pull a brush with stiff bristles through each conduit to remove any foreign material left in conduit.
- Pneumatic rodding may be used to draw in pullcords.
 - (1) Install a 1/8 -inch polypropylene pullcord free of kinks and splices in all unused new ducts.
 - (2) Extend pull-cord 3-feet beyond ends of conduit and fasten to prevent loss of pull-cord in conduits.
- Transition from PVC to R GS conduit with a minimum of 3 -feet prior to entering a structure or going above ground.
 - (1) Unless otherwise indicated on the Contract Drawings.
 - (2) PVC conduit may be extended directly to pull, junction and transformer boxes; manholes and handholes.
- j) Where condui ts enter transformer boxes; manholes and handholes:
 - (1) Terminate PVC conduits in end bells.
 - (2) Terminate RGS conduits in insulated bushings.
- B. Warning Tape
 - Place warning tape in trench directly over ductbanks, direct-buried conduit, and direct-buried wire and cable.

- a) 6-inches below finished grade where conduit or ductbank is 12-inches or more below finished grade.
- b) 3-inches below finished grade where conduit or ductbank is less than 12-inches below finished grade.
- 2. Provide warning tape as follows:
 - a) Electrical trenches and ductbanks or directly buried conduit
 - (1) Legend: "CAUTION CAUTION CAUTION" (1st line), "BURIED ELECTRIC LINE" (2nd line).
 - (2) Letters: 1-1/4-inch minimum
 - (3) Interval: Continuous
 - (4) Color: Red and black letters.
 - b) Trenches and direct-buried or conduit encased telephone lines:
 - (1) Legend: "CAUTION CAUTION CAUTION" (1st line), "BURIED TELEPHONE LINE" (2nd line).
 - (2) Letters: 1-1/4-inch minimum
 - (3) Interval: Continuous
 - (4) Color: Orange with black letters
 - c) Trenches with direct-buried or conduit encased computer or SCADA system communications lines:
 - (1) Legend: "CAUTION CAUTION CAUTION" (1st line), "BURIED COMPUTER LINE" (2nd line).
 - (2) Letters: 1-1/4-inch minimum
 - (3) Interval: Continuous
 - (4) Color: Orange with black letters

3.02 MAINTENANCE

A. Provide the Owner with two (2) sets of man hole cover, underground pull-box cover or precast cable trench cover removal tools.

END OF SECTION

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SECTION 16120

WIRE AND CABLE: 600 VOLT AND BELOW

PART 1 GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish, install, connect, test, and place in satisfactory operating condition, ready for service, all cables and wires indicated on the Contract Drawings and as specified herein or required for proper operation of the installation, with the exception of internal wiring provided by electrical equipment manufacturers. The work of connecting cables to equipment, machinery, and devices shall be considered a part of this Section. All hardware, junction boxes, bolts, clamps, insulators, and fittings required for the installation of cable and wires system shall be furnished and installed by the Contractor
- B. The Contractor shall submit Shop Drawings and other material required to substantiate conformance with the requirements set forth on the Contract Drawings and in Section 16010 - Electrical Basic Requirements, and Section 01340 - Shop Drawings, Project Data and Samples. Shop drawings shall include, but not be li mited to, detailed specifications and product data sheets for the power, control, and instrumentation cable required for this project.
- C. The wire and cable to be furnished and installed for this project shall be the product of manufacturers who have been in the business of manufacturing wire and cable for a minimum of ten (10) years.
- D. Reference Section 16010 Electrical Basic Requirements.

1.02 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples , the Contractor shall obtain from the wire and cable manufacturer and submit the following:
 - 1. Shop Drawings
 - 2. Reports of Certified Shop and Field Tests
 - 3. Wiring Identification Methods.

Each submittal shall be identified by the applicable specification section.

1.03 SHOP DRAWINGS

- A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed material's compliance with the Contract Documents.
- B. Partial, incomplete, or illegible Submittals will be returned to the Contractor without review for resubmittal.
- C. Shop drawings shall include but not be limited to:
 - Material specifications and product data sheets identifying all materials used and methods of fabrication
 - 2. Cable and wire identification methods and materials

1.04 IDENTIFICATION

A. Each cable or wire shall be identified as specified in Section 16010 - Electrical Basic Requirements.

PART 2 PRODUCTS

2.01 600V POWER WIRE AND CABLE

- A. All 600V rated power wire and cable shall cons ist of stranded, copper conductor with insulation type XHHW-2, 90°C.
- B. Circuits within the interior spaces of buildings may utilize 600V rated insulation, type THHN/THWN, 75°C.
- C. Conductors shall be stranded copper per ASTM-B8, B-33 and B-189, Class B or C str anding contingent on the size unless otherwise specified. Minimum size wire shall be #12AWG.
- D. 600V rated individual or multi-conductor power wire and cable shall be manufactured by the Okonite Company, BICC Industrial Cable Company or approved equal.

2.02 600V CONTROL CABLE

- A. All 600V rated control cable shall consist of stranded, copper conductor with insulation type XHHW-2, 90°C.
- B. Control circuits within the interior spaces of buildings may utilize 600V rated insulation, type THHN/THWN, 75°C.
- C. The individual conductors of the multiple conductor cable shall be color coded for proper identification. Color coding shall be equal to ICEA S-68-514, Table K -1. Cables shall meet requirements of IEEE-383.
- D. Conductors shall be stranded copper per ASTM B-8, B-33 and B-189, Class B or C stranding contingent on the size unless otherwise specified. Minimum wire size shall be #14AWG.
- E. 600V rated individual or multi -conductor control wire shall be manufactured by the Okonite Company, BICC Industrial Cable Company or approved equal.

2.03 600V SHIELDED MOTOR POWER CABLE FOR VARIABLE FREQUENCY DRIVES

- A. Where indicated on the Contract Drawings, the power connection between the variable frequency drive (VFD) and the associated motor shall utilize a shielded threeconductor plus ground conductor VFD output cable.
- B. Shielded motor power cables with #2AWG and smaller conductors shall have an overall polyvinyl chloride jacket, utilize XLPE conductor insulation with 100 percent rated ground conductor, overall foil shield, 85% TC braid and drain wire.
- C. Shielded motor power cables with #1AWG and larger conductors shall have an overall polyvinyl chloride jacket, utilize XLPE conductor insulation with three symmetrical BC grounds, two spiral copper tape shields.
- D. Shielded Motor cable shall meet the fo llowing requirements:
 - 1. Utilize high-strand tined copper conductors
 - 2. Lower capacitance suitable for longer runs
 - 3. Sunlight and oil resistant

- 4. Suitable for Class I and II; Division 2 hazardous locations
- 5. Rated for 90°C temperature for wet or dry locations
- 6. Pass UL 1685 vertical tray flame test
- E. All VFD cables shall be terminated with approved VFD cable connectors and/or termination kits.
- F. 600V rated shielded motor power cable shall be:
 - 1. Belden: 29500 Series Cable
 - 2. Lapp Cable: ÖLFLEX®
 - 3. General Cable: CVTC VFD Cable
 - 4. Service Wire Company: ServiceDrive ASD/VFD Cable
 - 5. Southwire Armor-X VFD Cable
 - 6. Approved equal

2.04 LIGHTING AND RECEPTACLE WIRE AND CABLE

- A. All exterior lighting and receptacle branch circuit wire and cable shall consist of stranded, copper conductors with 600v rated insulation, type XHHW-2, 90°C.
- B. Interior lighting and receptacle branch circuit wire and cable may utilize stranded, copper conductors with 600v rated insulation, type THHN/THWN 75°C.
- C. Conductors shall be stranded copper per ASTM-B8, B-33 and B-189, Class B o r C stranding contingent on the size unless otherwise specified. Minimum size wire shall be #12AWG.
- D. Lighting and receptacle cables and wire shall be manufactured by the General Cable Company, Southwire Cable Company or approved equal.

2.05 INSTRUMENTATION SIGNAL CABLE (STP)

A. The instrumentation cable for analog signals shall be individually shielded twisted pair cable (STP) or individually shielded twisted multi -pair cable (M#STP, where # = number of pairs). Conductors shall be tin or alloy coated, soft, annealed copper, #16AWG minimum with a minimum of 19 strands with 600V rated insulation for 75° C. Pairs shall have 100% coverage foil shields with a #18AWG tinned copper drain wire. Outer jackets shall be chromed polyvinyl chloride.

- B. The instrumentation cable shall be Belden, Okonite or approved equal for single and multiple pair applications or approved equal.
- C. Instrumentation cables shown on the Contract Drawings to be direct buried shall be UL labeled for direct buried service.

2.06 TELEPHONE/DATA CABLE (CAT-6)

A. All interior telephone/data cables shall be ANSI/TIA/EIA 568 (Category 6e), #24AWG copper, plenum rated and ETL Type-CMP.

PART 3 EXECUTION

3.01 600V CABLE INSTALLATION

- A. The cable and wires shall be installed as specified herein and shown on the Contract Drawings.
- B. The cables shall be terminated in accordance with the cable and/or termination product manufacturer's instructions for the particular type of cable.
- C. To minimize oxidation and corrosion, wire and cable shall be terminated using an oxide -inhibiting joint compound recommended for "copper -to-copper" connections. The compound shall be Penetrox E as manufactured by Burndy Electrical, or approved equal.
- D. Splices are normally not permitted in the underground duct, manhole and handhole systems. If splices are required, the Contractor shall obtain approval in writing from the Engineer prior to splicing.
 - 1. Splicing material shall be a two -part insulating and encapsulating resin.
- B. Cable and Wire Sizes
 - 1. The sizes of cable and wire shall be as shown on the Contract Drawings, or if not shown, as approved by the Engineer. If required due to field routing, the size of conductors and respective conduit shall be shall be coordinated with and approved by the Engineer.

- Minimum wire size within control panels, motor control centers, switchboards and similar equipment shall be #12AWG for power and #14AWG for control.
- C. Number of Wires
 - 1. The number of wires indicated on the Contract Drawings for the various control, indication, and metering circuits were determined for general schemes of control and for particular indication and metering systems.
 - 2. The actual number of wires installed for each circuit shall, in no case, be less than the number required; however, the Contractor shall add as many wires as may be required for control and indication of the actual equipment selected for installation at no additional cost to the Owner. The addition of conductors shall be coordinated with and approved by the Engineer.
- D. Wiring Identification
 - 1. Wiring Identification shall meet the requirements of Section 16010 Electrical Basic Requirements.
- E. Cable Installation
 - 1. All interior cable not protected by a compartment enclosure shall be run in conduit.
- F. Training of Cable
 - 1. The Contractor shall furnish all labor and material required to train cables around cable vaults within buildings and in manholes in the outdoor underground duct system. Sufficient length of cable shall be provided in each manhole and vault so that the cable can be trained and racked in an approved manner. In training or racking, the radius of bend of any cable shall be not less than the manufacturer's recommendation. All manhole cables shall be arc and fire-proofed. The training shall be done in such a manner as to minimize chaffing.
- G. Connections at Control Panels, Limit Switches, and Similar Devices
 - 1. Where stranded wires are terminated at panels, and/or devices, connections shall be made by

solderless lug, crimp type ferrule or solder dipped.

- 2. Where enclosure sizes and sizes of terminals at limit switches, solenoid valves, float switches, pressure switches, temperature switches, and other devices make 7 -strand, #12AWG, wire terminations impractical, the Contractor shall terminate external circuits in an adjacent junction box of proper size and shall install #14AWG stranded wires from the device to the junction box in a conduit. The #12 AWG field wiring shall also be terminated in the same junction box to complete the circuit.
- H. Pulling Temperature
 - 1. Cable shall not be flexed or pulled when the temperature of the insulation or of the jacket is such that damage will occur due to low temperature embrittlement. When cable will be pulled with an ambient temperature within a three day period prior to pulling of 40 °F or lower, cable reels shall be stored during the three day period prior to pulling in a protected storage area with an ambient temperature not lower than 55°F and pulling shall be completed during the work day for which the cable is removed from the protected storage.
- I. Color Coding
 - Unless otherwise noted on the Contract Drawings, conductor i nsulation shall be color coded as follows:
 - a) 480V AC Power
 - (1) Phase A BROWN
 - (2) Phase B ORANGE
 - (3) Phase C YELLOW
 - (4) Neutral GREY
 - b) 120/208V or 120/240V AC Power
 - (1) Phase A BLACK
 - (2) Phase B RED
 - (3) Phase C BLUE

- (4) Neutral WHITE
- c) 120VAC Control
 - (1) Ungrounded conductors RED
 - (2) Ungrounded conductors, foreign source -YELLOW.
- d) 24VAC Control
 - (1) All wiring ORANGE
- e) 24VDC Power
 - (1) Positive Lead RED
 - (2) Negative Lead BLACK
- f) 24VDC Control
 - (1) Ungrounded conductors BLUE
 - (2) Grounded conductors BLUE w/WHITE stripe
- g) Equipment Grounding Conductor:
 - (1) All wiring GREEN
- 2. Conductors #4AWG and smaller shall be factory color coded with a separate color for each phase and neutral, which shall be used consistently throughout the system. Larger cables shall be coded by the use of colored tape.

3.02 INSTRUMENTATION / TELEPHONE / DATA CABLE INSTALLATION

- A. Grounding of cable shield shall be accomplished at one end point only.
- B. Raceways exceeding 5 feet and containing instrumentation / telephone / data cable shall be installed to provide the following clearances:
 - 1. Raceway installed parallel to raceway conductors energized at 480 through 208V shall be 18 inch and 208/120V shall be 12 inch.
 - 2. Raceway installed at right angles to conductors energized at 480V or 120/208V shall be 6 inch.

- C. Where practical, raceways containing instrume ntation / telephone / data cable shall cross raceway containing conductors of other systems at right angles.
- D. Where instrumentation / telephone / data cables are installed in panels, etc., the Contractor shall arrange wiring to provide maximum clearance between cables and other conductors. Instrumentation / telephone / data cables shall not be installed in same bundle with conductors of other circuits.
- E. Additional pullboxes shall be furnished and installed for ease of cable pulling and the cable manufacturer's recommended conduit fill factor shall be followed.
- F. All cable, insulation and jacket shall have adequate strength to allow for it to be pulled through the conduit systems. Sufficient conductors shall be installed to provide space and serve future equipment where shown and specified. All conductors shall be color coded and all wires shall be suitably tagged with permanent markers at each end.

3.03 TESTING

- A. All testing shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:
 - 1. Shop Test
 - Prior to the first shipment of each size of a) power, control, and telephone / data cable to be furnished and installed under this Contract, samples of each size of cable shall be subjected to complete physic al and electrical factory production tests at the manufacturer's plant. Other cable and wiring shall be tested in accordance with the applicable ICEA Standards. Six copies of certified test data sheets shall be submitted to the Engineer for approval prio r to installation at the site. Subsequent shipment of each size of wire shall be covered by certificates of compliance which shall list Contractor's name, point of delivery, reel numbers, size of wire, length of wire, and date of shipment. Certificates s hall attest the wires and cables comply with specification requirements and that wires and cables are

equal in every respect to wires and cables which have been successfully tested.

- b) All test data or certificates shall be notarized and submitted.
- 2. Field Tests
 - a) Field testing shall be done in accordance with the requirements specified in the General Conditions, Division 1, and Section 16010 -Electrical-Basic Requirements.
 - b) After installation, all wires and cables shall be tested for insulation levels and continuity. Insulation resistance between conductors of the same circuit and between conductor and ground shall be tested. Testing for insulation levels shall be as follows:
 - (1) For all cables test for continuity using
 "test light" or "buzzer".
 - (2) For 600V rated power and control cable, apply 1,000VDC at 30 and 60sec intervals from a Megaohmeter for all 600V wires and cables installed in lighting, control, power, indication, alarm and motor feeder circuits.
 - (3) 600V rated instrumentation signal cable shall be tested from c onductor to conductor, conductor to shield, and conductor to ground using a 260 volt ohmmeter, or approved equal. The resistance value shall be 200 megaohms or greater.
- B. Low voltage wires and cables shall be tested before being connected to motors, devices or terminal blocks. Voltage tests shall be made successively between each conductor of a circuit and all other conductors of the circuit grounded.
- C. If tests reveal defects or deficiencies, the Contractor shall make the necessary repairs or shall replace th e cable as directed by the Engineer, without additional cost to the Owner.
- **D.** All tests shall be made by and at the expense of the Contractor who shall supply all testing equipment.

END OF SECTION

SECTION 16130

OUTLET PULL AND JUNCTION BOXES

PART 1 GENERAL

1.01 SUMMARY

- A. Section includes:
 - 1. Outlet pull and junction boxes
- B. Related Sections include but are not necessarily limited to:
 - 1. Contract and Bidding Requirements
 - 2. Section 16010 Electrical Basic Requirements

1.02 QUALITY ASSURANCE

- A. Referenced Standards
 - 1. Refer to Section 16010 Electrical Basic Requirements

1.03 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples, Shop Drawings
- B. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 Operation and Maintenance Data.

1.04 DELIVERY, STORAGE, AND HANDLING

A. See Section 16010 - Electrical Basic Requirements

1.05 WARRANTY

A. Per General Condition Article 9, the Contractor shall provide a 3 year warranty from substantial completion.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Galvanized Steel Boxes
 - (a) Appleton Electric Co.
 - (b) Steel City
 - (c) Raco
 - 2. Corrosion-Resistant Boxes
 - (a) Hoffman Engineering Co.
 - (b) Crouse-Hinds
 - 3. Hazardous Location Boxes (Class I, II & III)
 - (a) Appleton Electric Co.
 - (b) Crouse-Hinds
 - (c) Killark
 - (d) O-Z/Gedney
 - 4. Raintight and Watertight Boxes
 - (a) Appleton Electric Co.
 - (b) Crouse-Hinds
 - 5. Terminal Boxes
 - (a) Hoffman Engineering Co.
 - 6. Exposed Switch and Receptacle Boxes
 - (a) Appleton Electric Co.
 - (b) Crouse-Hinds
 - (c) Killark

2.02 MATERIALS

- A. Pull and Junction Boxes (smaller than 100 cubic inch)
 - 1. Wet Areas
 - (a) Material: Malleable-Iron or 14 gage steel with polyester powder coating inside and out over phosphatized surfaces.
 - (b) 14 gage steel
 - (1) Continuously welded seams, ground smooth, no conduit punch-outs
 - (2) Stainless steel clamps on four sides
 - (3) Flat cover with oil resistant gasket
 - (4) NEMA 4 classification
 - (5) UL listed
 - 2. Corrosive Areas:
 - (a) Material: Nylon, PVC or fiberglass reinforced polyester material.
 - (1) Neoprene door gasket
 - (2) Grounding bushing(s)
 - (3) NEMA 4X classification
 - (4) UL listed
 - 3. Hazardous Areas
 - (a) Material: Cast gray iron alloy or copper-free cast aluminum
 - (b) Drilled and tapped openings o r tapered threaded hub equipped
 - (c) Flat bolted -down or threa ded cover with neoprene gasket
 - (d) Stainless steel hex head screws
 - (e) Explosion-proof, UL listed for Class 1 Groups C and D

- B. Large Pull and Junction Boxes (100CU-IN and larger)
 - 1. Wet and Corrosive areas
 - (a) NEMA 4X with stainless steel screws
 - (1) Type 304 L welded stainless steel
 - (2) Continuously welded seams, ground smooth, no conduit punch-outs
 - (3) Rolled lip around all sides
 - (b) Termination Boxes
 - Galvanized 16 GA steel box provided with plain blank screw cover, subpanel, and terminal points.
 - (2) Terminal blocks shall be screw -cage barrier-type with white marker strip.
 - (3) Refer to Contract Drawings for dimensions, number of terminals and ratings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Use listed and labeled boxes with threaded conduit hubs for use in hazardous areas.
- C. Use malleable iron Type FS and FD boxes in wet areas and where exposed rigid steel conduit is required.
- D. Use stainless steel, fiberglass, nylon or PVC boxes for corrosive areas.
- E. Fill unused punched, tapped, or threaded hub o penings with insert plugs of like material to maintain enclosure NEMA rating.
- F. Use boxes sized to accommodate the quantity of conductors and devices enclosed.

- G. Set all outlet pull and junction boxes plumb and vertical to the finish floor or grade.
- H. Provide and install pull boxes or junction boxes in conduit runs as required to facilitate pulling of wires or making connections.
- I. Make covers of boxes accessible.
- J. Install pull boxes or junction boxes rated for the area classification.
- K. Install all conduits squarely into all outlet pull and junction boxes.
- L. Terminate all conduits as required in Specification Section 16111-Conduit and Raceway.
- M. Large pull and junction boxes shall NOT be mounted to hand-rail or safety rail.
- N. Do not install "back-to-back" boxes anywhere within this Project.
- O. Support outlet boxes for lighting fixtures and other ceiling-mounted devices in lay -in acoustical tile ceilings by bar hangers anchored to ceiling construction members which do not interfere with tile removal.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - Light switches, receptacles, device plates, dimmers, plug-in strips.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 1 General Requirements
 - 2. Section 16010 Electrical Basic Requirements

1.02 QUALITY ASSURANCE

- A. Referenced Standards
 - 1. Refer to Section 16010 Electrical Basic Requirements

1.03 SUBMITTALS

- A. Shop Drawings
 - All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and 16010 - Electrical Basic Requirements.

1.04 WARRANTY

A. Per General Condition Article 9, the Contractor shall provide a 3 year warranty from substantial completion.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Subject to compliance with the Contract Documents, the following manufacturers are acceptable:
 - 1. Light switches (except explosion-proof)

- a) Hubbell
- b) Slater
- C) P&S
- d) Arrow Hart
- e) General Electric
- f) Leviton
- 2. Explosion-proof light switches
 - a) Crouse-Hinds
 - b) Appleton Electric Co.
 - c) Killark
- 3. Door switches
 - a) General Electric
 - b) Slater
 - c) P&S
 - d) Arrow Hart
 - e) Micro-switch
- 4. Receptacles (except explosion-proof)
 - a) Hubbell
 - b) Slater
 - c) P&S
 - d) Arrow Hart
 - e) General Electric
 - f) Leviton
- 5. Explosion-proof Receptacles
 - a) Crouse-Hinds
 - b) Appleton Electric Co.

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- c) Killark
- 6. Dimmers
 - a) Lutron
 - b) General Electric
 - c) P&S
- 7. Plug-in Strip
 - a) Wiremold
 - b) Walker

2.02 MATERIALS

- A. Light Switches for Unclassified Areas
 - Toggle type, quiet action, and specification grade with grounding terminal
 - 2. Back and side wired
 - 3. Solid silver cadmium oxide contacts
 - 4. One-piece switch arm rated 20A, 120/277VAC
 - 5. UL listed
 - 6. Color: Ivory
 - 7. Wall plate: Type 304 stainless steel
 - 8. Type: As indicated on Contract Drawings
- B. Receptacles for Unclassified Areas
 - 1. Straight blade, grounding type, specification grade
 - 2. Back and side wired with Wrap-around Bridge
 - 3. Rated 20A, 125 VAC
 - 4. UL listed
 - 5. Color
 - a) For use on normal power: IVORY

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- b) For use on UPS systems: RED
- c) For use on isolated ground systems: ORANGE
- 6. Wall plate: Type 304 stainless steel
- 7. Type: As indicated on Contract Drawings
- C. Light Switches for Wet Areas
 - 1. Press-switch type, quiet action, specification grade, with grounding terminal
 - 2. Back and side wired
 - 3. Solid silver cadmium oxide contacts
 - 4. One-piece switch arm rated 20A, 120/277VAC
 - 5. UL listed
 - 6. Color: IVORY
 - 7. Wall plate: GREY weatherproof press-switch type
 - 8. Type: As indicated on Contract Drawings
- D. Receptacles for Outdoor and Wet Areas
 - 1. Straight blade, grounding type, GFIC specification grade
 - 2. Back and side wired with wrap around bridge
 - 3. Rated 20A, 125VAC
 - 4. UL listed
 - 5. Color: IVORY
 - 6. Wall plate: Weatherproof, cast aluminum, UL listed "IN USE" cover
 - 7. Type: As indicated on Contract Drawings
- E. Ground Fault Circuit Interrupter (GFCI) Receptacles
 - 1. Straight blade, grounding type, specification grade
 - 2. Rated 20A, 125VAC

- 3. UL listed
- 4. Test and reset buttons
- 5. Wall plate: Indoor or weatherproof "IN USE" as required
- 6. Feed-thru type
- F. Light Switches for Corrosive Areas
 - 1. Corrosion-resistant NEMA 4X enclosure with switch consisting of:
 - a) Fiberglass reinforced polyester enclosure
 - b) Fiberglass reinforced polyester gasketed wall plate with built-in toggle lever switch with stainless steel shaft
 - c) Grounding bushing
 - d) Rated 20A, 125VAC
 - e) UL listed
 - f) Type: As indicated on Contract Drawings
 - g) Color: YELLOW
 - 2. Optional: Corrosion-resistant enclosure and switch consisting of:
 - Cast copper-free aluminum "FS" or "FD" ridge type hub box
 - Toggle type, quiet action, and specification grade with grounding terminal
 - c) Rated 20A, 125 VAC with solid silver cadmium oxide contacts
 - d) UL listed
 - e) Neoprene gasket
 - f) Cast aluminum cover with stainless steel screws and lever to activate switch
 - g) Type: As indicated on Contract Drawings

- h) Color: YELLOW
- G. Receptacles for Corrosive Areas
 - 1. Corrosion-resistant straight blade, grounding type, specification grade
 - 2. Back and side wired with Wrap-around Bridge
 - 3. Rated 20A, 125VAC
 - 4. UL listed
 - 5. Color: YELLOW
 - 6. Box: "FS" or "FD" ridge type cast hub box of copper-free aluminum
 - 7. Gasket: Neoprene
 - Wall plate: Weatherproof, cast aluminum, UL listed "IN USE" cover
 - 9. Type: As indicated on Contract Drawings
- H. Explosion-proof Light Switches for Use in Hazardous Areas:
 - Explosion-proof, UL listed for Class I, Division 1 and 2, Groups B, C, and D; and Class II, Division 1 and 2 areas, Groups E, F, and G.
 - 2. EDS factory sealed
 - 3. Malleable iron body and cover
 - 4. Aluminum sealing chamber
 - 5. Front operated handle with stainless steel shaft
 - 6. Rated 20A, 125VAC
 - 7. With grounding screw
 - 8. Type: As indicated on Contract Drawings
- I. Explosion-proof Receptacles for Use in Hazardous Areas
 - Explosion-proof, UL listed for Class I, Division 1 and 2, Groups B, C, and D; and Class II, Division 1 and 2, Groups F and G

- 2. Factory-sealed malleable iron receptacle with spring-loaded cover
- 3. Malleable iron mounting box
- 4. Rated 20A, 125VAC
- 5. "Dead-front" construction requiring plug to be inserted and rotated to activate receptacle
- 6. Type: As indicated on Contract Drawings
- J. Plug-In Strip: Surface steel raceway plug-in strip with single 15A, 125VAC, 3 wire grounding -type receptacles spaced 18 inch on center.
 - 1. Pre-wired with two #12 TW and one #12 TW green insulated ground
 - 2. Minimum 1-1/4 inch wide x 3/4 inch deep
 - 3. Suitable fittings and snap-in cover
 - 4. Finish
 - a) Stainless steel
 - 5. Receptacle color
 - a) For use on normal power: Ivory
 - b) For use on UPS systems: Red
 - c) For use on isolated ground systems: ORANGE
- K. Door Switches
 - 1. Rated 5A, 120VAC
 - 2. Mode of operation: Door open lights on
 - 3. UL listed
- L. Lighting Dimmers
 - 1. Electronic solid state type, rated for load, 120 and 277VAC
 - Circuit design: Silicon symmetrical gate to provide full wave dimming and withstand current and inverse voltage surges

- 3. Controls: Linear slide with positive off
- 4. Provide built -in filter to minimize noise interference in nearby audio lines
- 5. Rated 100°F maximum, ambient
- 6. UL listed
- 7. Finish: IVORY or WHITE
- M. Pedestal-Type Floor -Mounted or Counter -Mounted Duplex Receptacles
 - 1. Straight blade, grounding type, specification grade
 - 2. Back and side wired with Wrap-around Bridge
 - 3. Rated 15A, 125VAC
 - 4. Horizontal design housing with threaded conduit fittings in base with satin chromium finish
 - 5. Install on adjustable 4-inch flush floor box
 - 6. Color
 - a) For use on normal power: IVORY
 - b) For use on UPS systems: RED
 - c) For use on isolated ground systems: ORANGE

N. Thermostats

- 1. Contacts close on falling temperature to cycle unit heater on rising temperature to cycle exhaust fan motor
- 2. Rated 20A, 120VAC
- 3. Range: 46-84 Degrees F scale.
- 4. Switch: AUTO/OFF/ON
- 5. Provide sub-base and mounting plate.
- 6. Provide standard outlet box for mounting thermostat

PART 3 EXECUTION

- A. Installation
 - 1. Install products in accordance with manufacturer's instructions.
 - Mount devices where indicated on the Contract Drawings.
 - 3. Surface-mount receptacles and light switches in concrete construction.
 - In masonry and metal stud construction, recess mount receptacles and light switches unless device precludes recessed mount ing or unless otherwise noted on the Contract Drawings.
 - 5. Where more than one receptacle is installed in a room, they shall be symmetrically arranged.
 - 6. Set all wiring devices including covers plumb and vertical to the floor.
 - 7. Set recess-mounted switches and receptacles flush with face of walls.
 - 8. Do not connect dimmers to loads in excess of 80 percent of the rating of the dimmer.
 - 9. Provide blank plates for empty outlets.
 - 10. Securely attach top to ceiling grid and base to mating surface.

END OF SECTION

SECTION 16150

MOTORS

PART 1 GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish all labor, materials, tools and equipment necessary for furnishing, installing, connecting, testing and placing into service all Motors as specified herein and indicated on the Contract Drawings.
- B. All Motors shall be sufficient size for the duty to be performed and shall not exceed their full rated load when the driven equipment is operating at specified capacity. Unless otherwise noted, motors driving pumps shall not be overloaded at any head or discharge condition of the pump.

1.02 CODES AND STANDARDS

- A. Motors shall comply with the following applicable codes and standards as well as any others within the Specifications and Contract Drawings. In the event of any conflict between these codes, regulations, standards, and Contract Documents, the most restrictive shall apply.
 - 1. American National Standards Institute (ANSI/NEMA)
 - a) MG1-2011, Motors and Generators
 - 2. National Fire Protection Association (NFPA)
 - a) 70, National Electric Code (NEC)
 - b) 79, Electrical Standard for Industrial Machinery

1.03 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.
- B. The Motor manufacturer shall submit to the Engineer certified dimensional drawings showing nameplate data and outline dimensions.
- C. Guarantee: All motors and associated equipment furnished and installed under this Section shall be guaranteed

against defects of workmanship, materials and improper installation for a period of three years from date of acceptance. All such motors, equipment or parts proven defective, due to the above noted causes, shall be replaced and installed by the Contractor at no expense to the Owner.

 D. Operation and Maintenance Manuals shall be submitted as outlined in Specificat ion 01730 - Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 RATINGS

- A. All three-phase motors shall be "premium efficiency" type.
- B. Unless otherwise noted, all Motors shall be of the low voltage type (600V or less). All Motors 2HP through 100HP shall be rated 230/460VAC, 3-PH, 60Hz. All Motors 125HP through 500HP shall be rated 460VAC, 3-PH, 60Hz. Motors below 2HP shall be rated 115/230VAC, 1-PH, 60Hz.
- C. All Motors controlled by a Variable Frequency Drive (VFD) shall indicate on the motor nameplate that it is suitable for the intended application (inverter duty rated) and shall be provided with an integral temperature switch that opens on high temperature. All Motors operated by a VFD shall meet the requirements of ANSI/NEMA MG1 Class II Part 32.

2.02 CONSTRUCTION

- A. General
 - 1. Unless otherwise noted in these Specifications, all motors shall be totally enclosed fan cooled (TEFC).
 - 2. TEFC motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.
 - 3. All motors shall have 1.15 service factor unless otherwise noted.
 - 4. The output shaft shall be suitable for mechanical connection as required.
 - 5. Space heaters shall be provided on motors 25 HP and larger for moisture control. Space heaters shall

operate at 120 VAC, single-phase with leads brought out to terminal blocks enclosed within a NEMA -12 accessory box. Motors shall be provided with a metallic or plastic warning plaque, permanently fixed to motor casing, with red background and white letters which has the following legend:

WARNING-ELECTRICAL SHOCK HAZARD Motor Equipped with Strip-Heaters Strip-Heater remains Energized when Local Disconnect is OFF

- B. Three-Phase Motors
 - 1. Motors shall be Premium Efficiency, squirrel-cage induction type, 1.5 service factor, NEMA design B, TEFC. Horizontal, vertical solid shaft, vertical hollow shaft, normal thrust and high thrust types shall be furnished as specified herein. All Motors shall be built in accordance with current NEMA, IEEE, ANSI and AFBMA standards where applicable. Motors shall be of the type and quality described by these Specifications, fully capable of performing in accordance with manufacturer's nameplate rating, and free from defective material and workmanship.
 - Motors shall have normal or high starting torque (as required), low starting current (not to exceed 600 percent full load current), and low slip.
 - 3. Motors shall have a minimum Class F insulation. Motors using Variable Frequency Drives shall be "inverter duty" rated with class H insulation.
 - 4. All machine surfaces shall be coated with rust inhibitor for easy disassembly.
 - 5. All Motors shall have a final coating of chemical resistant corrosion and fungus protective epoxy fortified enamel finish sprayed over red primer over all interior and exterior surfaces. Stator bore and rotor of all motors shall be epoxy coated.
 - Motors installed outdoors shall be mill and chemical duty suitable for operation in moist air with hydrogen sulfide gas present.
 - All fittings, bolts, nuts, and screws shall be 316 stainless steel. Bolts and nuts shall hav e hex heads.

- 8. For motors over 200Hp, provide nickel sheathed Resistance Temperature Detector (RTD) two sensors on each phase winding (total 6). RTD to be 3-wire 100ohm type.
- 9. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be sup plied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.
- 10. Conduit boxes shall be gasketed. Lead wires between motor frame and conduit box shall be gasketed.
- Three-Phase Motors shall be manufactured by Baldor, General Electric, U.S. Motors, Westinghouse or approved equal.
- C. Fractional Horsepower Motors
 - 1. Fractional Horsepower Motors shall be rigid, welded-steel, designed to maintain accurate alignment of Motor components and provide adequate protection. End shields shall be reinforced, lightweight die-cast aluminum. Windings shall be of varnish-insulated wire with slot insulation of polyester film, baked-on bonding treatment to make the stator winding strongly resistant to heat, aging, moisture, electrical stresses and other hazards.
 - 2. Motor shaft shall be made from high -grade, cold-rolled shaft steel with drive-shaft extensions carefully machined to standard NEMA dimensions for the particular drive connection.
 - 3. For light to moderate loading, bearings shall be quiet all -angle sleeve type with large oil reservoir that prevents leakage and permits motor operation in any position.
 - 4. For heavy loading, bearings shall be carefully selected precision ball bearings with extra quality, 1 ong-life grease, and large reservoir providing 10 years' normal operation without relubrication.
- D. Integral Horsepower Motors
 - 1. Motor frames and end shields shall be cast iron or
heavy fabricated steel of such design and proportions as to hold all Motor components rigidly in proper position and provide adequate protection for the type of enclosure employed.

- 2. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.
- 3. The shaft shall be made of high-grade machine steel or steel forging of size and design adequate to withstand the load stresses normally encountered in Motors of the particular rating. Bearing journals shall be ground and polished.
- 4. Rotors shall be made from high -grade steel laminations adequately fastened together, and to the shaft. Rotor squirrel -cage windings may be copper or bar -type construction with brazed end rings.
- Motors shall be equipped with vacuum -degassed 5. antifriction bearings made to AFBMA Standards, and be of ample capacity for the Motor rating. The bearing housing shall be large enough to hold sufficient lubricant to minimize the need for frequent lubrication, but facilities shall be provided for adding new lubricant and draining out old lubricant without Motor disassembly. The bearing housing shall have long, tight, running fits or rotating seals to protect against the entrance of foreign matter into the bearings, or leakage of lubricant out of the bearing cavity.
- 6. Bearings of high thrust Motors will be locked for momentary upthrust of 30% downthrust. All bearings shall have a minimum B10 life rating of 100,000 hours in accordance with AFBMA life and thrust values.
- 7. Vertical hollow-shaft motors will have non-reverse ratchets to prevent backspin.
- E. Single-Phase Motors
 - Single-Phase Motors shall be split -phase and capacitor-start induction types rated for continuous horsepower at the RPM as called for on the Contract Drawings. Motors shall be rated 115/230VAC, 1-PH, 60Hz, TEFC with temperature rise in accordance with NEMA Standards for Class B

insulation.

- 2. TEFC Motors shall be designed for severe-duty.
- 3. Motors shall have corrosion and fungus protective finish on internal and external surfaces. All fittings shall have corrosion-protective plating.
- 4. Mechanical characteristics shall be t he same as specified for Fractional Horsepower Motors.

PART 3 EXECUTION

3.01 DELIVERY, STORAGE, AND HANDLING

A. All Motors and associated equipment shall be stored in accordance with the manufacturer recommendations and shall not be stored exposed to weather.

3.02 INSTALLATION

- A. The Contractor shall plan the layout of the raceway systems so that when the work is complete it will exhibit good workmanship practices.
- B. All Motors and their peripheral devices shall be connected to the raceway system by means of a short section of flexible conduit, 18IN minimum and 60 -inch maximum, unless otherwise indicated on the Contract Drawings.
- C. The Contractor shall install a grounding conductor in the conduit and terminate at the Motor Controller with an approved grounding clamp for all motor connections.
- D. Connection to Motor leads shall be made with high compression type lugs with heat -shrinkable insulating boots.
- E. Phase rotation corrections shall be made within the Motor connection box.

3.03 TESTING

- A. The Contractor shall check each Motor for corr ect clearances and alignment and for correct lubrication, and shall lubricate, if required, in accordance with manufacturer's instructions.
- B. The Contractor shall utilize a 1000V meg-ohmmeter to test each Motor winding before energizing the Motor. If the

Motor insulation resistance is at or below the manufacturer's allowable limit, the Contractor shall notify the Engineer and shall not energize the Motor. The Contractor shall confirm the direction of rotation of all Motors with a phase rotation meter and reverse the connections, as required, at the Motor connection box.

END OF SECTION

SECTION 16450

GROUNDING AND BONDING

PART 1 GENERAL

1.01 THE REQUIREMENTS

- A. The Contractor shall furnish and install grounding systems complete in accordance with the minimum requirements established by Article 250 of the NEC. Article 250 of the NEC shall be considered as a minimum requirement for compliance with this Specification.
- B. Grounding of all instrumentation and control systems shall be furnished and installed in accordance with the manufacturer/system requirements and IEEE 1100 -92, Powering and Grounding of Sensitive Electronic Equipment. Conflicts shall be promptly brought to the attention of the Engineer.
- C. In addition to the NEC requirements, building structural steel columns shall be permanently and effectively grounded.
- D. Reference Section 16010 Electrical Basic Requirements.
- E. Additional requirements for grounding are shown on the Contract Drawings.

1.02 CODES AND STANDARDS

- A. All grounding components and the completed system shall comply with the following codes and standards as well as within the Specifications or as shown on the Contract Drawings:
 - 1. American National Standards Institute (ANSI/IEEE)
 - a) C2, National Electrical Safety Code (NESC)
 - Institute of Electrical and Electronic Engineers (IEEE)
 - a) IEEE 81, Guide for Measuring Earth Resistivity.
 - b) IEEE 142, Recommended Practice for Grounding of Industrial and Commercial Power Systems.
 - 3. National Fire Protection Association (NFPA)

- a) NFPA 70, National Electric Code (NEC)
- 4. Underwriters Laboratories Inc (UL)
 - a) 588, Grounding Equipment

1.03 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.
- B. In accordance with the procedures and requirements set forth in the General Conditions and Division 1, the Contractor shall obtain from the equipment manufacturer and submit the following:
 - 1. Shop Drawings
 - 2. Reports of certified field tests. Each submittal shall be identified by the applicable Specification section.

1.04 SHOP DRAWINGS

- A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.
- B. Partial, incomplete, or illegible submittals will be returned to the Contractor without review for resubmittal.
- C. Shop drawings shall include but not be limited to:
 - Equipment specifications and product data sheets identifying all materials used and methods of fabrication.
 - 2. Drawings and written description of how the Contractor intends to furnish and install the grounding system.
 - 3. Final testing results. To be part of O&M.

1.05 WARRANTY

A. Per General Condition Article 9, the Contractor shall provide a 3 year warranty from substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. The equipment covered by these specifications shall be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed, and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.

2.02 GROUNDING CONDUCTOR

- A. A green, insulated equipment grounding conductor, which shall be separate from the electrical system neutral conductor, shall be furnished and installed for all circuits. Equipment grounding conductors shall be furnished and installed in all conduits. Use of conduits as the NEC required equipment grounding conductor is not acceptable.
- B. Where specified or shown a 3-inch strap shall be furnished and installed as the grounding conductor.

2.03 EQUIPMENT GROUND CONDUCTOR

A. Equipment ground conductors shall be solid and continuous from a connection at earth to all distribution panelboards. Ground connections at panelboards, outlets, equipment, and apparatus shall be made in an approved and permanent manner.

2.04 BONDING FITTINGS

A. Grounding con nections to equipment shall be bolted. Cable end connections may be made by use of the crucible weld process or bolted type connectors. Bolted type connectors for this application shall consist of corrosion resistant copper alloy with silicone bronze bolts, nuts and lock-washers which are designed for this purpose.

2.05 GROUND RODS

A. Ground rods shall be rolled to a commercially round shape from copper-clad steel manufactured by the molten-welding process or by the electro -formed process (molecularly bonded). They shall have an ultimate tensile strength of 75,000 PSI and an elastic limit of 49,000 PSI. The rods shall be not less than 3/4-inch diameter by 20 feet in length; and the proportion of copper shall be uniform throughout the length of the rod. The copper shall have a minimum wall thickness of 0.013 inch at any point on the rod.

B. The maximum resistance to ground of a driven ground rod shall not exceed 5-OHM under normally dry conditions. Where the resistance obtained with one (1) ground rod exceeds 5-OHM, additional ground rods shall be coupled, by exothermic welds. Except where specifically indicated otherwise, all exposed non current -carrying metallic parts of electrical equipment, metallic raceway systems, grounding conductors in nonmetallic raceways and neutral conductors of wiring systems shall be grounded.

The ground connection shall be made at the main service equipment and shall be extended to the point of entrance of the metallic water service. Connection to the water pipe shall be made by a su itable ground clamp or lug connection to a plugged tee. If flanged pipes are encountered, connection shall be made with the lug bolted to the street side of the flanged connection. If there is not suitable metallic water service to the facility, the ground connection shall be made to the driven ground rods on the exterior of the building.

Where ground fault protection is employed, care shall be taken so that the connection of the ground and neutral does not interfere with the correct operation of the ground fault protection system.

2.06 GROUNDING GRID

A grounding grid shall be provided for each structure and interconnected between structures. The grounding grid shall be installed such that the ground resistance does not exceed 5 -OHM. The grounding grid shall be interconnected by bare copper conductors sized to the largest service entrance ground, spliced and connected to ground rods by exothermic welds. The grounding conductors shall be installed after the excavations for the building have been completed and prior to the pouring of concrete for the footings, mats, etc. Copper "pigtails" shall be connected to the grounding grid system; shall enter the buildings and structure from the outside; and shall be connected to steel structures and equipment as described in this Section and as shown on the Contract Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Metal surfaces where grounding connections are to be made shall be clean and dry. Steel surfaces shall be ground or filed to remove all scale, rust, grease, and dirt. Copper and galvanized steel shall be cleaned with emery cloth to remove oxide before making connections.
- B. Grounding conductors shall be continuous between points of connection; splices shall not be permitted.
- C. Where conductors are exposed and subject to damage from personnel, traffic, etc., conductors shall be installed in PVC sch-80 raceway.
- D. Mechanical connections shall be permitted to ground rods in "Ground Test Wells" and shall be exposed to permit maintenance and inspection for continuity and effectiveness of grounding system.
- E. Where subsurface conditions do not permit use of driven ground rods to obtain proper ground resistance, rods shall be installed in a trench or plate electrodes shall be provided, as applicable and necessary to obtain proper values of resistance.
- F. Conduit
 - Conduit that enters equipment such as motor control centers, switchboards, switchgear, variable frequency drives, instrument and control panels, and similar equipment shall be bonded to the ground bus, where provided, and as otherwise required by the NEC.

3.02 TESTING

- A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:
 - 1. Witnessed Shop Tests: None required
 - 2. Field Tests
 - a) Ground resistance shall be measured with a three-point, fall of potential instrument.

Testing should be performed at multiple rod locations, at distances of five 10' increments, in perpendicular directions to rod. Provide Engineer with results. Testing results to be included in O&M.

- b) All ground rods shall be tested after being driven and prior to connection to the grounding system. Where test results show resistance-to-ground is greater -than 10-OHM, additional ground rods shall be driven by coupling with exothermic welds. The compliance shall be demonstrated by retesting ground rod.
- c) Upon completion of installation of the grounding and bonding system, the entire system shall be tested at the ground test well(s), as indicated on the Contract Drawings. The completed system shall have less-than 5-OHM of ground resistance.
- 3. Documentation
 - All tests shall be completely documented indicating time of day, date, temperature, weather conditions, measuring instrument and all pertinent test information.
 - b) All required documentation of readings indicating non-compliance, shall be submitted to the Engineer prior to and required for final acceptance of the project.

END OF SECTION

SECTION 16475

SAFETY DISCONNECT SWITCHES

PART 1 GENERAL

1.01 THE REQUIREMENT

- A. The Contractor shall furnish and install separately mounted, individual disconnect switches as specified herein and indicated on the Contract Drawings.
- B. 16010 Electrical Basic Requirements.
- C. 16111 Conduit and Raceway

1.02 TESTING

- A. All tests shall be performed in accordance with the requirements of the General Conditions and Division 1. The following tests are required:
 - 1. Witnessed Shop Tests: None required.
 - Field Tests: Field testing sh all be done in accordance with the requirements specified in the General Conditions, Division 1, and Section 16010 -Electrical Basic Requirements.

1.03 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and the Contractor shall obtain from the equipment manufacturer and submit the following:
 - 1. Shop Drawings
 - 2. Spare Parts List
- B. Each submittal shall be identified by the applicable specification section.

1.04 SHOP DRAWINGS

A. Each submittal shall be complete in all respects, incorporating all information and data listed herein and all additional information required for evaluation of the proposed equipment's compliance with the Contract Documents.

- B. Partial, incomplete or illegible submittals will be returned to t he Contractor without review for resubmittal.
- C. Shop drawings shall include but not be limited to:
 - Equipment specifications and product data sheets identifying all materials used and methods of fabrication.
 - 2. Complete layout and installation drawings with clearly marked dimensions for each type/size/rating of disconnect switch.
 - 3. Assembled weight of each unit.
- D. The shop drawing information shall be complete and organized in such a way that the Engineer can determine if the requirements of these Specifications are being met. Copies of technical bulletins, technical data sheets from "soft -cover" catalogs, and similar information which is "highlighted" or somehow identifies the specific equipment items that the Contractor intends to provide are acceptable and shall be submitted.

1.05 TOOLS, SUPPLIES, AND SPARE PARTS

- A. The equipment shall be furnished with all special tools necessary to disassemble, service, repair, and adjust the equipment, and with all spare parts as recommended by the equipment manufacturer.
- B. One complete set of spare fuses for each ampere rating installed shall be furnished and delivered to the Owner at the time of final inspection.
- C. Spare parts lists, included with the shop drawing submittal, shall indicate specific sizes, quantities, and part numbers of the items to be furnished. Terms such as "1 lot of packing material" are not acceptable.
- D. Parts shall be completely identified with a numerical system to facilitate parts inventory control and stocking. Each part shall be properly identified by a separate number. Those parts which are identical for more than one size shall have the same parts number.

1.06 IDENTIFICATION

A. Each equipment item shall be identified with a nameplate. The nameplate shall be engraved indicating the operating voltage, panel and circuit number of the power source and the equipment name with which it is associated.

1.07 OPERATIONS AND MAINTENANCE MANUALS

A. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 - Operation and Maintenance Data.

1.08 WARRANTY

A. Per General Condition Article 9, the Contractor shall provide a 3 year warranty from substantial completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The equipment covered by this Specification is intended to be standard equipment of proven performance as manufactured by reputable concerns. Equipment shall be designed, constructed and installed in accordance with the best practices of the trade, and shall operate satisfactorily when installed as shown on the Contract Drawings.
- B. Disconnect switches shall be manufactured by:
 - 1. Square-D
 - 2. Eaton/Cutler-Hammer
 - 3. General Electric
 - 4. Siemens
 - 5. Approved equal

2.02 DISCONNECT SWITCHES

- A. Disconnect switches shall be heavy-duty type and/or as specified in these Specifications. Switches shall be furnished and installed as shown on the Contract Drawings and as required by the NEC. Handles shall be lockable.
- B. Disconnect switches shall be NEMA Type HD, single throw, externally operated, non-fused, fused or provided with circuit breakers as required. Disconnect switches shall have the poles, voltage, and ampere ratings as shown on the Contract Drawings.

- C. Disconnect Switches shall be provided in NEMA 4X stainless steel enclosures.
- D. Disconnect switches shall be quick-make, quick-break and with an interlocked cover which cannot be opened when switch is in the "O N" position and capable of being locked in the "OPEN" position.
- E. Disconnect switches shall be quick-make, quick-break and with an interlocked cover which cannot be opened when switch is in the "ON" position and capable of being locked in the "OPEN" position.
- F. A complete set of fuses for all switches shall be furnished and installed as required. Time -current characteristic curves of fuses serving motors or connected in series with circuit breakers shall be coordinated for proper operation. Fuses shall have voltage rating not less than the circuit voltage.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All disconnect switches to be mounted 60-inches above the floor, at the equipment height where appropriate, or as shown on the Contract Drawings.
- B. Disconnect switches shall NOT be mounted to any hand-rail or safety rail.
- C. The Contractor shall furnish and install fuses or circuit breakers as required or shown on the Contract Drawings.

END OF SECTION

SECTION 16481

MOTOR CONTROL CENTERS

PART 1 GENERAL

1.01 SUMMARY

- A. Section Includes:
 - Motor Control Centers, (MCC) separately mounted motor starters (including those supplied with equipment), manual motor starters, control equipment. MCC to be provided by one manufacturer as a complete unit.
- B. Related Sections include but are not necessarily limited to:
 - 1. Division 1 General Requirements
 - 2. Section 16010 Electrical Basic Requirements

1.02 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. American National Standards Institute (ANSI)
 - a) C62.41, Guide for Surge Voltages in Low Voltage AC Power Circuits
 - 2. Canadian Standards Association (CSA)
 - Institute of Electrical and Electronics Engineers (IEEE)
 - National Electrical Manufacturers Association (NEMA)
 - a) ICS 2, Industrial Control Devices, Controllers, and Assemblies
 - b) 250, Enclosures for Electrical Equipment (1000 Volt Maximum)
 - 5. National Fire Protection Association (NFPA)

- a) 70, National Electrical Code (NEC)6. Underwriters Laboratories, Inc (UL)
 - a) 845, Electric Motor Control Centers
- B. Miscellaneous
 - Verify motor horsepower loads, other equipment loads and controls from approved shop drawings and notify Engineer of any discrepancies.
 - Verify the required instrumentation and control wiring for a complete system and notify Eng ineer of any discrepancies.

1.03 SUBMITTALS

- A. Shop Drawings:
 - All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples and Section 16010 - Electrical Basic Requirements.
 - 2. MCC elevation drawings and complete de scription of units in the MCC
 - 3. Typical MCC unit wiring diagrams
 - 4. Typical wiring diagrams for all control equipment

1.04 OPERATIONS AND MAINTENANCE MANUALS

 A. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 - Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

- A. Motor control centers:
 - 1. Square D
 - 2. Cutler Hammer
 - 3. General Electric

- 4. Allen-Bradley
- B. Separately mounted motor starters:
 - 1. Square D
 - 2. Cutler Hammer
 - 3. General Electric
 - 4. Allen-Bradley
- C. Control relays:
 - 1. Square D
 - 2. Cutler Hammer
 - 3. General Electric
 - 4. Allen-Bradley
- D. Programmable controllers:
 - 1. Refer to Division 13
- E. Manual motor starters:
 - 1. Square D
 - 2. Cutler Hammer
 - 3. General Electric
 - 4. Allen-Bradley
- F. Submit requests for substitution in accor dance with Specification Section 01600 Material and Equipment.

2.02 COMPONENTS

- A. Motor Control Centers:
 - 1. Design:
 - a) Service voltage: 480 V, 3 PH, 4 W, 60 HZ, unless otherwise indicated on the Drawings.

- b) Main horizontal bus: 800 A
 - Unless otherwise indicat ed on the Drawings
- c) Vertical bus: 600 A Minimum
 - Unless otherwise indicated on the Drawings
- d) Short circuit withstand rating: 65,000 AIC symmetrical
 - Unless otherwise indicated on the Drawings
- e) Provide main horizontal bus in each structure; full capacity, full-length, with provisions for extension.
 - 1) Bus bars:
 - (a) Plated copper
 - (b) Rectangular cross section
 - (c) Support in each structure by means of bus supports
- f) Provide each structure with full -length vertical bus to distribute incoming power to each circuit br eaker and starter in structure:
 - Starters NEMA size 5 and larger and certain other components may be cable connected to the main bus with the approval of the Engineer.
 - Vertical bus shall be extended to spaces provided for future equipment.
- g) Provide ground bus:
 - 1) Continuous
 - 2) 14" x 2" copper
 - 3) Solidly grounded to each structure

- 4) Locate near bottom of structure
- 5) Provide for lug connection of equipment ground wires
- h) Provide guides for supporting and aligning starters
- 2. Construction:
 - a) NEMA Class I, Type B
 - b) NEMA 1G, free standing
 - c) Unit structures:
 - 1) Totally enclosed
 - 2) Joined together to form one (1)
 assembly:
 - (a) Each unit structure will be nominal 20" wide, 20" deep, and 90" high, unless otherwise indicated on the Drawings.
 - d) Fabricate of not less than 1 4 GA steel with16 GA steel doors in standardized units
 - e) Provide each structure with two (2) horizontal wiring spaces.
 - 1) One (1) at top
 - 2) One (1) at bottom
 - 3) Spaces will line up with adjacent units to form convenient wiring raceway entire length of control center.
 - f) Provide each structure with one (1) vertical wireway for unit wiring.
 - With cable tie su pports to hold wiring in place
 - 2) With a separate door

- g) Bottom shall have ample unrestricted space for conduit entry.
- h) Doors:
 - 1) Formed round corners and rolled edges
 - 2) Gasketed
 - Minimum of two (2) heavy -duty hinges or continuous piano hinge
 - Held closed by means of captive fasteners.
- i) Fabricate doors to be a pa rt of the structure and not part of the starter.
- j) Cubicles:
 - 1) Totally enclosed
 - Effectively baffle d to isolate any ionized gases which may occur within unit starter.
- k) Assemblies effectively ventilated, to allow relocation of starters and other components:
 - Within the assembly and with the same load.
 - 2) Without having to compensate for changes in location.
- 3. Combination full voltage magnetic starters mounted in MCC:
 - a) Circuit breaker:
 - 1) Motor circuit protector (MCP) type.
 - b) Contactor NEMA rated.
 - c) Line plug-in, pull-out, lock-out type
 - 1) Except starters NEMA size 5 and larger

- (a) Fixed mounted with the app roval of the Engineer.
- Provide guides in structure for supporting and aligning unit starter during removal or replacement.
- 3) Plug-in units:
 - (a) Silver-plated
 - (b) Pressure type line disconnecting stabs
 - (c) High-strength copper alloy
- 4) Lock-out latch to padlock unit in "pull-out" position and at same time isolate stubs and entire unit from bus. Hold each unit in place by m eans of quick-captive fasteners.
- d) Operating handle shall clearly indicate whether circuit breaker is ON, OFF or TRIPPED.
 - Provide means to lo ck each circuit breaker handle in OFF position with cover closed by means of up t o three (3) padlocks. Interlock so that circuit breaker must be in OFF position before door can be opened:
 - (a) Provide defeater mechanism for use by authorized personnel.
- Provide starter unit with ambient compensated, external manually reset table, three (3) bimetallic type overload relays. Coordinate size with actual motor full load current.
 - For motors with power factor correction capacitors, size heater elements to compensate for the capacitors effect on load current.

- f) Provide heavy-duty devices:
 - 1) NEMA 4K 30mm selector switches
 - 2) NENA 4K 30mm pushbuttons
 - 3) NEMA 4X 30mm pilot lights:
 - (a) Push-to-test type
 - (b) LED Lamps
 - Other devices as indicated on the Drawings
 - 5) Devices will b e accessible with the door closed
- g) Provide each starter with two (2) extra field reversible N.O. auxiliary contacts for future use.
- h) Provide each starter with bus voltage to 120 V control power transformer:
 - 480/120 V. Provide two of each size as spare.
 - Fused on primary and secondary sides

 (a) Provide one set of spare fuses for each transformer.
 - 3) Rated for minimum of one hundred forty percent (140%) of required load suitable for operating controls and power motor winding space heaters as per the drawings and specifications.
 - 4) For all motor starters
- i) Provide six-digit readout elapsed time meter
- j) Starter units will have the same fault current withstand rating as the main bus fault current withstands rating.
- k) Provide each starter with the following status signals, wired to terminal boards:

- 1) Motor run contact (N.O.)
- 2) Motor stop contact (N.C.)
- 3) Auxiliary overload relay contact (N.O.)
- B. Feeder Circuit Breakers in MCC and Separately Mounted:
 - Molded case thermal magnetic or solid -state trip type, with minimum interrupting rating equal to the main bus fault current rating:
 - 2. Circuit breaker frame sizes 150 A and less:
 - Non-interchangeable, non -adjustable thermal magnetic trip units.
 - 3. Circuit breaker frame sizes 225 A and higher:
 - a) Interchangeable and adjustabl e thermal magnetic trip units.
 - 4. Circuit breaker frame sizes 600 A and greater:
 - a) Solid state trip units, unless otherwise noted on the Drawings.
 - b) Current sensor or rating plug.
 - c) Adjustable current setting: Minimum range seventy to one hundred percent (7 0% - 100%) of current sensor or rating plug.
 - d) Adjustable instantaneous pickup: Minimum range three (3) to eight (8) times.
 - e) On circuit breakers 1000 A and larger provide ground fault protector.
 - 1) Adjustable pick-up
 - 2) Adjustable delay
 - 5. Provide main circui t breaker with service entrance label.

- All circuit breakers to be provided with padlocking provision in the OFF position for u p to three padlocks.
- 7. Circuit breakers rated 400 A or above: On e hundred percent (100%) rated.
- C. Provide ambient compensated devices
- D. Manual Starters with Thermal Element:
 - 1. Quick-make, quick-break toggle mechanism
 - 2. Trip free
 - 3. Clearly indicate ON, OFF and TRIPPED position.
 - 4. NEMA rated enclosure per area classification unless otherwise indicated on the Drawings.
- E. Separately Mounted Starters:
 - Circuit breaker shall be motor circuit protector (MCP) type.
 - 2. Contactor shall be NENA rated.
 - a) One-half (1/2) size and IEC sized starters not permitted.
 - 3. Operating handle shall clearly indicate whether circuit breaker is ON, OFF, or TRIPPED.
 - a) Provide means to lock each circuit breaker handle in OFF position with cover closed by means of up to three padlocks.
 - b) Interlock so that circuit breaker must be in OFF position before door can be opened. Provide defeater mechanism for use by authorized personnel.
 - 4. Provide starter unit with ambient compensated, external manually resettable, three (3) bimetallic type overload relays. Coordinate size with actual motor full load current.

- a) For motors with power factor correction capacitors size heater elements to compensate for the capacitors effect on load current.
- 5. Provide heavy-duty oil tight selector switches, pushbuttons, push-to-test pilot lights with LED lamps, or other devices as indicated on the Drawings. These devices will be accessible with the door closed.
- 6. Provide each starter with two (2) extra field reversible NO auxiliary contacts for future use.
- 7. Provide each starter with 480/120 V control power transformer fused on secondary side and rated for a minimum of one hundred forty percent (140%) of required load suitable for operating controls and motor winding space heaters as per the drawings and specifications.
- 8. Provide six-digit readout elapsed time meter.
- 9. Starter units w ill have the sa me fault curren t withstand rating as the MCC main bus fau lt current withstand rating from which they are fed.
- 10. Provide each starter with the following status signals, wired to terminal boards.
 - a) Motor run contact (N.O.)
 - b) Motor stop contact (N.C.)
 - c) Auxiliary overload relay contact (N.O.)
- F. MAIN METERING DEVICE Provide a main meter device as shown or indicated on the Drawings.
 - 1. Microprocessor based monitoring device shall include complete electrical metering in one package. Device shall include self -contained potential transformers and self-protected internal fuses.
 - Device shall be mounted on compartment door to allow operations and maintenance personnel access to meter menu and display.

- 3. Device shall include trend analysis, event logging, and recording. Device shal l also include the following direct-reading metered values:
 - a. Volts: 0.2 percent accuracy
 - b. Amperes: 0.2 percent accuracy
 - c. Watts, Vars and VA: 0.5 percent accuracy
 - d. Power Factor: 1.0 percent accuracy
 - e. Frequency: 0.05 percent accuracy
 - f. Watt, and VA Hours: 0.5 percent accuracy
 - g. Var Hours: 1.0 percent accuracy
 - h. Watt, Var and VA Demand:0.4 percent accuracy
 - i. THD-Voltage: 50th harmonic
 - j. THD-Current: 50th harmonic
 - k. Individual Ampere Harmonics: 50th harmonic
 - 1. Individual Voltage Harmonics:50th harmonic
- 4. Metering device shall have the following additional features:
 - a. Trend analysis that displays minimum and maximum values for each metered parameter with date an d time of each occurrence.
 - b. Input range of device shall accommodate external current transformers with ranges from 100/5 to 5000/5 and potential transformers from a ratio of 120:120 to 500,000:120. Three curren t transformers suitably rated shall be included.
 - c. Alarm contacts rated five amps at 120 VAC.
 - d. Three analog outputs programmable to reflect the metered parameters, except kilo watt hours and kilovar hours.

- e. Communication ca pability, using RS-485, Modbus RTU Protocol.
- 5. Control power shall be drawn from monitored incoming AC line. Device shall have non-volatile memory and not require batt ery backup. Dur ing power failur e, device shall retain preset parameters.
- G. Selector Switches, Indicating Lights, and Pushbuttons:
 - 1. NEMA 4X for all areas
 - 2. NEMA 4X/7 and 4X/9 for Class I, Division I Groups C and D; and Class II, Divis ion I, Groups E, F, and G hazardous locations.
 - 3. Selector switches shall have standard gloved operator.
 - 4. Pushbuttons shall have standard flush operator.
 - 5. Provide switch positions and contacts:
 - a) As specified on Contract Drawings or as necessary for proper control.
 - 6. Switch contacts shall be NEMA A600 rated.
 - 7. Indicating lights with LED lamps , unless specified otherwise.
 - 8. Provide fifty percent (50%) replacement lamps for indicating lights.
 - 9. Provide ten percent (10%) percent replacement caps for indicating lights.

H. Alarm Horns

- 1. Siren type
- 2. Sheet metal housing
 - a) Primer and finish coat of paint shall be suitable for use in corrosive areas.
- 3. Adjustable mounting bracket

- 4. For use on 120 V AC
- 5. Universal motor
- 6. Nominal 106 dE at 10' from source
- 7. Federal Signal Model ATT or approved equal
- I. Control Relays:
 - 1. Provide industrial control relays as specified on the Drawings and as required for proper operation and control of supplied equipment.
 - All control relays shall have 120 V coils capable of operating on line voltage fluctuations of plus or minus ten pe rcent (+/- 10%) unless specified otherwise.
 - Relays shall be provided with NEMA A600 rated contacts, and s hall be capable of supporting a minimum of eight contacts.
 - 4. Provide relays with all N.O. contacts u nless otherwise specified.
 - a) Contacts shall be field reversible.
 - 5. Provide contacts for all required control plus two (2) spares.
- J. Remote Operator Stations:
 - 1. NEMA 12 for unclassified areas unless specified otherwise.
 - 2. NEMA 4X for we t areas, outdoo rs or equipment specified WP, and control panel enclosures not covered under Div 11.
 - 3. NEMA 4X for corrosive areas.
 - NEMA 7 and 9 for Class I, Division I, Groups C and D; and Class II, Division I, Groups E, F, and G hazardous locations.

- 5. Construction and insta llation shall be in accordance with NEC Article 373.
- 6. Provide barrier -type terminal strips for termination of all control and 120 V power field wiring plus twe nty percent (20 %) spare for al 1 control panels.
- 7. Control panel construction:
 - a) 14 GA steel
 - b) Continuously welded seams
 - c) Manufacturer's standard gray
- K. Time Delay Relays:
 - 1. Provide time delay relays with delayed pickup or release as specified on Drawings.
 - 2. All time delay relays shall operate at 115 V AC plus or minus ten percent (+/- 10%)
 - 3. Heavy duty, solid-state construction
 - 4. Contact rating: 10 amps.
 - Provide external adjust dial with 0 -9.99/99.9/999 second selectable range unless specified otherwise.
 - 6. Operating temperature ranges: -18 to +50 °C
 - Repeat accuracy: plus or minus three percent (+/-3%) plus ±10ms over specified voltage range.
 - Provide all required contacts plus two (2) N.O spares.
 - 9. Provide auxiliary relays as required to perform functions specified on Drawings.
- L. Terminal Strips:
 - 1. 600 V
 - 2. Full size

- 3. Rated for 20 A continuous current
- M. Enclosures and Control Panels:
 - 1. NEMA 12 for unclassified areas
 - 2. NEMA 4X for outdoor or wet areas
 - a) Except MCCs, which sh all be NEMA 3R non walk-in type
 - 3. NEMA 4X for corrosive areas
 - 4. NEMA 7 for Class I hazardous locations

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install as indicated and in accordance with manufacturer's recommendations and instructions.
- B. Mount MCC on 4" high concrete pad:
 - Install two (2) 4" wide channel sills flush in pads to support and maintain alignment of the MCC.
 - 2. Align front of MCC with top edge of pad chamfer.
- C. Mount other equipment as scheduled in Section 16010 Electrical Basic Requirements.

3.02 FIELD QUALITY CONTROL

A. Field-test and verify operation of the equipment.

END OF SECTION

SECTION 16483

VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This section provides specification requirements for adjustable frequency drives, variable speed drives or herein identified as AC Drives for use with NEMA B design AC motors.
- B. The AC D rive manufacturer shall furnish, field test, adjust and certify all installed AC Drives for satisfactory operation.
- C. Any exceptions/deviations to this specification shall be indicated in writing to the specifying engineer in the submittal documentation.
- D. AC Drives shall fit in locati ons as shown i n the contract documents.
- E. AC Drives shall operate auxili ary equipment s uch as seal water valv es, motor space heaters, and i nclude safety and equipment protection interlocks as shown in the contract documents.
- F. The AC Drive manufacturer shall be responsible for providing all equipment specified under this section, and furnishing the equipment to the Contractor for installation.
- G. The AC drives shall operate the motors utilizing individual THWN or XHHW conductors routed in new and existing metallic and non -metallic conduit to the pumps as shown on the contract documents..

1.02 REFERENCES

- A. NFPA-70 "National Electric Code (NEC)"
- B. ANSI C84.1 "Electric Power Systems and Equipment Voltage Ratings (60Hz)"

- C. CSA[®] C22.2 No.14-95 "Industrial Control Equipment"
- D. UL508A "Standa rd for Safety f or Industrial C ontrol Panels"
- E. UL508C "Standa rd for Safety for Power Conve rsion Equipment"
- F. NFPA 79 "Electrical Equipment of Industrial Machines/Industrial Machinery
- G. NEMA ICS7 "Industrial Contro 1 and Systems: Adjustable Speed Drives
- H. NEMA ICS7.1 "Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems
- I. NEMA 250 "Enclosures for Electrical Equipment (1000V maximum
- J. IEC 61800 -2 "Adjustable speed electrical power drive systems - Part 2: General r equirements - rating specifications for low voltage adjustable frequency AC power drive systems"
- K. IEC 61800 -3 "Adjustable speed electrical power drive systems - Part 3: EMC product standard inc luding specific test methods"
- L. IEC 61800-5-1 "Adjustable speed electrical power drive systems - Part 5-1: Safety requirements - Electrical, thermal and energy
- M. IEC 61800 -6 "Adjustable speed electrical power drive systems - Part 6: Guide for determination of types of load duty and corresponding current ratings."
- N. EGSA 101P "Engine Driven Generator Sets Performance Standard"
- O. IEEE 519 "Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems"

1.03 SUBMITTALS

A. All submittals shal l be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.

- B. Approval drawings shall be furnished for Engineer's approval prior to factory assembly of the AC Drives. These drawings shall consist of elementary power an d control wir ing diagrams and enclosure outline drawings. The enclosure drawings shall include front and side views of the encl osures with overall dimensions and weights shown, conduit entrance locations and nameplate legend details.
- C. Standard catalog sheets showing vol tage, horsepower, maximum current ratings and recommended replacement parts with part numbers shall be furnished for each different horsepower rated AC Drive provided.

1.04 WARRANTY

A. The equipment manufacturer shall provide a two (2) year warranty beginning from substantial completion of the project, and shall guarantee that the equipment furnished is suitable for the purpose intended and free from defects of design, material and workmanship. In the event the equipment fails to perform as specified, the equipment manufacturer shall promptly repair or replace the defective equipment without any cost to the Owner (including handling, shipment, labor, travel time and expense costs).

1.05 QUALITY ASSURANCE

- A. The manufacturer of the AC Drive shall be a cert ified ISO 9001 facility.
- B. The AC Drive and all associated optional equipment shall be UL LISTED according to UL508C Power Conversion Equipment. A UL label shall be attached inside each enclosure as verification.
- C. The AC Drive shall be designed constructed and tested in accordance with NEMA, NEC, VDE, IEC standards.
- D. Every power converter shall be tested with an actual ac induction motor, 100% load a nd temperature cycled within an environmental chamber at 104°F. Documentation shall be furnished to verify successful completion at the request of the engineer.

- E. All Drive door mounted pilot de vices shall be tested to verify successful operation. Documentation shall be furnished upon written request of the engineer.
- F. The AC Drive shall undergo QA test procedures and be submitted to a hi-pot test with all enclosed devices mounted and wired, prior to shipment.

1.06 OPERATIONS AND MAINTENANCE MANUALS

A. Operations and maintenance Manuals shall be submitted as outlined in Specification 01730 - Operation and Maintenance Data.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The AC Drive shall be provided by ABB, Yaskawa or approved equal.
- B. AC drive shall be, direct torque controls, including the following features: NEMA 12 enclosure, Input Circuit Breaker, 480 volt with factory authorized start-up.
- C. Drive output rat ing shall be a minimum at 480 Volts and shall be s uitable for ope ration with Vertical Turbine Pump Motors as shown on the Contract drawings. Drive full load Current shall match N.E.C. Table 430.250 or the associated motor, whichever is greater.
- D. Drive shall include control interfaces as shown on the drawings and as specified
- E. Drive enclosure shall be a standard manufactured assembly by the drive manufacture with NEMA 12 with front ventilation. Drives assembled into an enclosure by an OEM are not acceptable. There shall be no restriction on space requirements between the sides and rear of the floor mounted enclosures.
- F. Alternate control techniques other than pulse width modulated (PWM) are not acceptable.

2.02 GENERAL DESCRIPTION

A. The Drive shall be solid state, variable torque, with a MINIMUM 12-PULSE Width Modulated (PWM) output. The drive shall be a Direct Torque Control (DTC) AC to AC converter utilizing the latest isolated gate bipolar transistor (IGBT) technology. The Drive shall employ Direct Torque Control (DTC). At a minimum, an inner loop torque control strategy that mathematically determines motor torque and flux every 25 micros econds (μ s) (40,000 tim es per second). The drive must also provide an optional operational mode for scalar or V/Hz operation.

B. Ratings

- The Drive shall be rated to operate from 3 -phase 1. power at 230VAC to 500VAC +10/-10%, 48Hz to 63Hz. The Drive shall employ a f ull wave rectifier t o prevent input 1 ine notching an d operate at a fundamental (displacement) input power factor of 0.97 at a ll speeds and loads. The Drive efficiency shall be 98% or better at full speed and load. An internally mou nted 5% AC lin e reactor or DC choke shall be provided to reduce input current harmonic content, provide protection from power line transients such a S utility power factor correction capacitor switching transients and reduce RFI emissions.
- 2. The overvoltage trip level shall be a minimum of 30% over nominal, and the undervoltage trip level shall be a minimum 35% under the nominal voltage.
- 3. Output voltage a nd current ratings shall match the adjustable frequency operating requirements of standard 460V AC, 3ph, 60Hz, NEMA design A or NEMA design B motors. The overload current capacity shall be 110% of r ated current for one (1) minute out of five (5). Output f requency shall be adjustable between OHz and 300Hz. Operation above motor nameplate shall require programming changes to prevent inadvertent high speed operation. The drive's switching pattern shall be continually adjusted to provide optimum motor flux a nd avoid the high -pitched audible noise produced by motors energized by conventional PWM drives. The drive shall be furnished in a UL Type 1 l isted enclosure rate d for operation at ambient tempera tures between 0 $^{\circ}$

and 40 °C at an altitude not exceeding 3300 feet, with relative humidity less than 95% and no condensation allowed. The drive shall be protected from atmospheric contamination by chemical gasses and solid particles pre IEC 721 -3-3, classes 3C 2 and 3S2. The drive shall be protected from vibration p er IEC 68 -2-6 (max. sinusoidal displacement 1 mm, 5 Hz to 13.2Hz an d max. acceleration $7m/s^2$, 13.2Hz to 100Hz).

- C. Control Functions and Adjustments
 - An intelligent start-up assistant shall be provided as standard. The Start-up assistant will guide the user through all necessary adjustments to optimize operation and will include "plug and produce" operation, which recognizes the addition of options/fieldbus adapters and provides the necessary adjustment assistance.
 - Start-up data entries shall include motor nameplate power, speed, voltage, frequency and current.
 - 3. A motor parameter ID function shall automatically define the motor equivalent circuit used by the sensorless vector torque controller.
 - A PID speed/torque loop regulator shall be provided with an autotune function as well as manual adjustments.
 - 5. A selection of six (6) preprogrammed application macro parameter sets shall be provided to minimize the number of different parameters to be set during start-up. Macros included as standard are as follows: Factory Default, Hand/Auto, PID Control, Sequential Control, and Torque Control. A selection of two (2) user defined macros shall are also be available.
 - Start/Stop control functions shall include two
 (2) or three-(3) wire start/stop, coast/ramp stop selections, optional dynamic braking and flux braking.
 - 7. The AFD shall be capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to reference without safety tripping or component damage (flying start). The AFD shall also be capable of flux braking at start to stop a reverse spinning motor prior to ramp.
- 8. The AFD shall have the ability to automatically restart after an overcurrent, overvoltage, undervoltage, or loss of input signal protective trip. The number of restart attempts, trial time, and time between reset attempts shall be programmable.
- Accel/Decel control functions shall include two
 (2) sets of ramp time adjustments with linear and three (3) s-curve ramp selections.
- 10. Speed/Torque control functions shall include:
 - a) Adjustable min./max. speed and/or torque limits
 - Selection of up to 15 preset speed settings or external speed control
 - c) Three (3) sets of critical speed lockout adjustments.
 - d) A built-in PID controller to control a process variable such as pressure, flow or fluid level.
 - e) Reference signal processing shall include increase/decrease floating point control and control of both speed/torque and direction using a "joystick" reference signal. Two
 (2) analog inputs shall be programmable to form a reference by addition, subtraction, multiplication, minimum selection or maximum selection.
- 11. Output control functions shall include:
 - a) Flux optimization to limit the audible noise produced by the motor and to maximize efficiency by providing the optimum magnetic flux for any given speed/torque operating point.
 - b) Current and torque limit adjustments to limit the maximum Drive output current and the maximum torque produced by the motor. These limits shall govern the inner loop torque regulator to provide tight conformance with the limits with minimum overshoot.
 - c) A torque regulated operating mode with adjustable torque ramp up/down and speed/torque limits.
- 12. The Drive shall be capable of sensing a loss of load (broken belt / broken coupling) and signal the loss of load condition. The drive shall be

programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus. Relay output shall include programmable time delays that will allow for drive acceleration from zero speed without signaling a false underload condition.

- 13. The Drive shall have programmable "Sleep" and "Wake up" functions to allow the drive to be started and stopped from the level of a process feedback signal.
- 14. Two (3) programmable critical frequency lockout ranges to prevent the AFD from operating the load continuously at an unstable speed.
- D. Static and Dynamic Performance
 - 1. Open loop static speed regulation shall be 0.1% to 0.3% (10% of motor slip). When motor speed feedback is provided from a suitable encoder, closed loop speed regulation shall be 0.01% or better. Dynamic speed accuracy shall be 0.3-0.4 %-sec or better open loop and 0.1-0.2 %-sec or better-closed loop.
 - 2. Torque response time shall be 5ms or less. In the torque regulating mode, torque regulating accuracy shall be 4% or better.
- E. Operator Control Panel (Keypad)
 - Each Drive shall be equipped with a front mounted operator control panel (keypad) consisting of a four- (4-) line by 20-character back-lit alphanumeric display and a keypad with keys for Run/Stop, Local/Remote, Increase/Decrease, reset, menu navigation and parameter select/save.
 - 2. All parameter names, fault messages, warnings and other information shall be displayed in complete English words or standard English abbreviations to allow the user to understand what is being displayed without the use of a manual or crossreference table.
 - 3. Other languages selectable in addition to American English (Am) shall be as follows: English (European), French, Spanish, Portuguese, German, Italian, Dutch, Danish, Swedish, Finnish, Czech and Polish.
 - The Display shall have contrast adjustment provisions to optimize viewing at any angle.
 - 5. The control panel shall include a feature for uploading parameter settings to control panel

memory and downloading from the control panel to the same drive or to another drive.

- 6. All Drives throughout the entire power range shall have the same customer interface, including digital display, and keypad, regardless of horsepower rating.
- 7. The keypad is to be used for local control, for setting all parameters, and for stepping through the displays and menus.
- 8. The keypad shall be removable and insertable under drive power, capable of remote mounting, and shall have it's own non-volatile memory.
- 9. During normal operation, one (1) line of the control panel shall display the speed reference, and run/stop forward/reverse and local/remote status. The remaining three (3) lines of the display shall be programmable to display the values of any three (3) operating parameters. At least 26 selections shall be available including the following:
 - a) Speed/torque in percent (%), RPM or userscaled units
 - b) Output frequency, voltage, current and torque
 - c) Input voltage, power and kilowatt hours
 - d) Heatsink temperature and DC bus voltage
 - e) Status of discrete inputs and outputs
 - f) Values of analog input and output signals
 - g) Values of PID controller reference, feedback and error signals
 - h) Control interface inputs and outputs shall include:
- F. I/O Capabilities
 - Six (6) discrete inputs (expandable with additional modules), all independently programmable with at least 25 input function selections. Inputs shall be designed for "dry contact" inputs used with either an internal or external 24 VDC source.
 - 2. A minimum of three (3) form C relay contact outputs, all independently programmable with at least 30 output function selections. Relay contacts shall be rated to switch 2 Amps at 24VDC or 115/230VAC. Function selections shall include indications that the drive is ready, running, reversed and at set speed/torque. General and

specific warning and fault indications shall be available. Adjustable supervision limit indications shall be available to indicate programmed values of operating speed, speed reference, current, torque and PID feedback.

- Three (3) analog inputs, one (1) +/- OVAC 10VAC 3. and two (2) 4mA - 20mA, all independently programmable with at least ten (10) input function selections. A differential input isolation amplifier shall be provided for each input. Analog input signal processing functions shall including scaling adjustments, adjustable filtering and signal inversion. If the input reference (4-20mA or 2-10V) is lost, the AFD shall give the user the option of the following: (1) stopping and displaying a fault, (2) running at a programmable preset speed, (3) hold the AFD speed based on the last good reference received, or (4) cause a warning to be issued, as selected by the user. The drive shall be programmable to signal this condition via a keypad warning, relay output and/or over the serial communications bus.
- 4. Two (2) analog outputs providing 4mA to 20mA signals. Outputs shall be independently programmable to provide signals proportional to at least 12 output function selections including output speed, frequency, voltage, current and power.
- G. Serial communications
 - Serial communication interface modules shall be provided for Ethernet IP communication protocol. Communications modules shall be connected to the drive by Cat 5 cables. I/O shall be accessible through the serial communications adapter.
 - 2. Ethernet IP communication capabilities shall include, but not be limited to, run-stop control; speed set adjustment, high temp (including shutdown), E-Stop, proportional/integral/derivative PID control adjustments, current limit, and accel/decel time adjustments. The drive shall have the capability of allowing the Distributed Drive Controller (DDC) to monitor feedback such as process variable feedback, output speed/frequency, current (in amps), % torque, power (kW), kilowatt hours (resettable), operating hours (resettable), relay outputs, and diagnostic warning and fault

information. Additionally, remote Local Area Network (LAN) VFD fault reset shall be possible. A minimum of 15 field parameters shall be capable of being monitored. The DDC system shall be able to monitor if the motor is running in the AFD mode or bypass mode (if bypass is specified) over serial communications.

- The AFD shall allow the DDC to control the 3. drive's digital and analog outputs via the serial interface. The serial communications interface shall allow for Digital Output DO (relay) control and Analog Output (AO) control. This control shall be independent of any AFD function. Examples of possible DO usage are as follows: Opening check valves, opening discharge valves, starting auxiliary equipment, etc. In addition, the status of the DO's is available over the communications link. Examples of possible AO usage are as follows: Controlling a bypass valve position, throttling valve position, etc. In addition, the status of the AO's is available over the communications link.
- 4. The AFD shall have built-in to its logic fifteen (15) blocks of adaptive programming capable of twenty (20) different functions. These blocks shall be connectable to drive actual signals and functions allowing the user to tailor the drive to the specific application requirements without additional hardware. These blocks shall be programmable through the standard operator panel and through the use of a DriveAP Microsoft Windows®-based software.
- H. A Ethernet communication port shall also be provided for personal computer interface. Microsoft Windows®based software shall be provided for drive setup, diagnostic analysis, monitoring and control. The software shall provide real time graphical displays of drive performance.
- I. Protective Functions
 - For each programmed warning and fault protection function, the drive shall display a message in complete English words or Standard English abbreviations. The five (5) most recent fault messages and times shall be stored in the drive's fault history.

- The drive shall include internal MOV's for phase to phase and phase to ground line voltage transient protection.
- 3. Output short circuit and ground fault protection rated for 65,000 amps shall be provided per UL508C without relying on line fuses. Motor phase loss protection shall be provided.
- 4. The drive shall provide electronic motor overload protection qualified per UL508C.
- 5. Protection shall be provided for AC line or DC bus overvoltage at 130% of maximum rated voltage or undervoltage at 65% of min. rated voltage and input phase loss.
- 6. A power loss ride through feature will allow the drive to remain fully operational after losing power as long as kinetic energy can be recovered from the rotating mass of the motor and load.
- 7. Stall protection shall be programmable to provide a warning or stop the drive after the motor has operated above a programmed torque level for a programmed time limit.
- 8. Underload protection shall be programmable to provide a warning or stop the drive after the motor has operated below a selected underload curve for a programmed time limit.
- 9. Over-temperature protection shall provide a warning if the power module temperature is less than 5°C below the over-temperature trip level.
- 10. Input terminals shall be provided for connecting a motor thermistor (PTC type) to the drive's protective monitoring circuitry. An input shall also be programmable to monitor an external relay or switch contact (klixon).

2.03 OPERATOR CONTROLS

A. Industrial rated control operators and pilot devices shall be door mounted and used independently of the keypad display control modes of Hand-Off-Auto, VFD-OFF-BYPASS, etc. as required. The Keypad Di splay shall be mounted on front of the drive cabinet.

Control modes shall function as follows:

- 1. Hand The Hand mode shall allow manual operation of start, stop and speed control. The AC drive shall start when the control operator is in the Hand mode and run and at low speed setting of the drive or higher as required by the position of the manual speed potentiometer. This mode shall function as 2 -wire control and automatically restart after a power ou tage or auto restart after fault.
- 2. Off The "Off" position of the control operator shall stop the AC drive and prevent it from restarting while in the "Off" position. This position shall also reset the AC Drive after a fault condition has occurred.
- 3. Auto The Automatic mode shall receive an auto start contact to control start and stop of the AC Drive. In Automatic mode the user shall remotely reset the AC Drive by opening and closing the Auto-start contact. Speed control shall be from a customer supplied 4-20mA signal.
- B. The AC Drive shall include door -mounted "VFD Run", "VFD Fault", and "External/MOL Fault" pilot lights. All pilot lights shall Utilize LED lamps.

2.04 SYSTEM CONTROL AND INTERFACE REQUIREMENTS

- A. The following additional controls and interface requirements shall be provided:
 - 1. Provide N.C. Contacts and 120V AC power sourc e for motor winding space heater.
 - 2. Auxiliary Contacts The AC Dri ve shall provide the following auxiliary contacts to indicate the following conditions:
 - 1 N.O. contact to indicate DRIVE RUN
 - 1 N.O. contact to indicate VFD FAULT
 - 1 N.O. contact to indicate AUTO MODE
 - 1 N.O. contact to indicate HAND MODE

2.06 HARMONIC MITIGATION EQUIPMENT REQUIREMENTS

- A. The AC Drive shall be provided with a 5% input line reactor mounted inside the enclosure.
- **2.02** OUTPUT FILTERS

A. Provide output dv/dt filtration for transient spike voltages. Filter shall limit spikes to less than 800 volts. Filter shall reside inside enclosure.

PART 3 EXECUTION

3.01 INSPECTION

- A. Verify that the location is ready to receive work and the dimensions are as indicated.
- B. Do not install AC Drive equipme nt until the building environment can be maintained within the service conditions required by the manufacturer.

3.02 PROTECTION

A. Before and during the installation, the AC Drive equipment shall be protect ed from site contaminants and debris in accordance with the manufacturer's recommendations.

3.03 INSTALLATION

- A. The Drive manufacturer shall provide adequate drawings and instruction material to facilitate installation of the Drive by the Contractor. Installation shall comply with manufacturer's instructions, drawings and recommendations.
- The AC Drive m anufacturer shal | provide a fa ctory Β. certified technical representative to supervise the Contractor's installation, testing and start -up of the AC Drives furnished under this specification as required. The technical representative shall certify in writing that the equipment has been inst alled, adjusted and tested in accordance with the manufacturer's recommendations. A Certified factory start-up shall be provided for each drive by a factory authorized service center. A c ertified start-up form shall be filled out for each drive with a copy provided to the owner, and a copy kept on file at the manufacturer. A copy of all drive configuration parameters and their associa ted settings programmed into each VFD shall be provided to the Owner at the completion of start -up and shall be included in the final O&M.

3.04 TRAINING

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A. The AC Drive manufacturer shall arrange for an on-site training course of a minim um of 2 training days, provided by a representative of the AC Drive manufacturer plant and/or maintenance personnel.

END OF SECTION

SECTION 16671

SURGE SUPPRESSION DEVICES (SPD) 1kV OR LESS

PART 1 GENERAL

1.01 THE REQUIRMENT

- A. The Contractor shall furnish and install the Transient Voltage Surge Suppression (SPD) equipment having the electrical characteristics, ratings and modifications as specified herein and as shown on the Contract Drawings.
- B. The SPD equipment shall provide effective high -energy protection against transient surges, temporary over voltages, voltage swells and high -frequency noise attenuation for power, control and telephone/d ata circuits 1kV or less and as shown on the Contract Drawings.
- C. The SPD units and all components shall be designed, manufactured and tested in accordance with the latest applicable UL standards.
- D. The SPD equipment installation shall conform to local code requirements and the National Electric Code (NEC).
- E. All materials and workmanship shall be of the highest quality.

1.02 DEFINITIONS

- A. EMI: ElectroMagnetic Interference
- B. NTRL: Nationally Recognized Testing Laboratory
- C. SCCR: Short Circuit Current Rating
- D. SPD: Surge Protection Device
 - 1. Type-I: Permanently connected between the secondary of the utility transformer and the line or load side of the service entrance overcurrent device and intended to be installed without an external overcurrent device.
 - Type-II: Permanently connected to the load side of the service entrance overcurrent device including branch circuit panels.

- Type-III: Connected from the electrical service panel to the point of utilization with a minimum conductor length of 30 FT.
- 4. Type-IV: Component and/or component assemblies.
- E. SVR: Suppressed Voltage Rating
- F. TOV: Temporary Over Voltage
- G. SPD: Transient Voltage Surge Suppressor

1.03 QUALITY ASSURANCE

- A. Referenced Standards:
 - 1. Institute of Electrical and Electronics Engineers
 (IEEE):
 - a) C62.41, IEEE Guide for Surge Voltages in Low Voltage AC Power Circuits.
 - b) C62.43, IEEE Certified by NRTL as "Secondary Surge Arrestor"
 - c) C62.45, IEEE Guide for Surge Testing for Equipment Connected to Low-Voltage AC Power.
 - 2. International Electrotechincal Commission (IEC):
 - a) 61024, Protection of Structur es against Lightning.
 - 3. National Electrical Manufacturers Association
 (NEMA):
 - a) LS-1 (1992), Low Voltage Surge Protection Devices
 - 4. National Fire Protection Association (NFPA):
 - a) NFPA 70, National Electrical Code (NEC) Article 285.
 - 5. Underwriters Laboratories, Inc (UL):
 - a) 1283, Electromagnetic Interference Filters
 - b) 1449, Surge Protective Devices

1.04 SUBMITTALS

- A. All submittals shall be in accordance with Specification
 01340 Shop Drawings, Project Data and Samples.
- B. Product Data: For each type of product indicated, include unit dimensions, weights, installation instructions, wiring details, rated capacities, operating characteristics, furnish specialties and accessories. Include the following documents:
 - 1. Suppressed Voltage Rating
 - 2. Symmetrical Fault Current Withstand Ratings
 - 3. Provide independent third-party testing lab report indicating device is capable of surviving the specified number of 8x20 micro-second waveforms.
 - Spectrum Analysis based on MIL -STD-220A test procedures between 50 kHz and 200 kHz verifying the device noise attenuation equals or exceeds 50 dB at 100 kHz.
 - 5. Survivability of multiple TOV events for Type-I and Type-II devices.
- C. Product Certificates: For SPD/SPD devices, signed by third-party NRTL testing agencies certifying compliance with the following standards:
 - 1. UL 1283
 - 2. UL 1449 Most recent edition
 - 3. IEEE C62.34 Secondary Surge Arrestor
 - 4. NEMA LS -1 (1992) Low Voltage Surge Protective Devices
- D. Qualification Data: Third -Party testing lab or U.S. Department of Labor/OSHA approved NRTL.
- E. Field Quality -Control test reports, inc luding the following:
 - Test procedures used. Include single impulse testing data that matches label rating, including fuses or upstream breaker.
 - 2. Test results that comply with requirements.

- 3. Failed test results and corrective actions taken to achieve requirements.
- F. Operation and Maintenance Manuals shall be submitted as outlined in Specification 01730 - Operation and Maintenance Data. For each type or series of SPD/SPD devices to include emergency, operation and maintenance manuals.
- G. Warranties: The manufacturer shall provide a full ten (10) year warranty from the date of installation against any SPD/SPD device part failure when installed in compliance with manufacturer's written instructions and any applicable national or local codes.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Subject to compliance with requirements, provide products by one of the following manufacturers:
 - 1. Advanced Protection Technologies Inc.
 - 2. Current Technology
 - 3. Eaton/ Cutler Hammer
 - 4. Innovative Technology
 - 5. General Electric
 - 6. Square-D
 - 7. Approved Equivalent

2.02 SERVICE ENTRANCE SPD (TYPE-I)

- A. Surge Protection Device Description: Modular design with field-replaceable module with EMI filtering and the following features:
 - 1. The SPD unit tested at 200kA interrupting capacity (AIC).
 - 2. The SPD unit shall provide overvoltage protecti on as follows:
 - a) >1800 cycles at 180% of rated voltage to 0.7 OHM load
 - b) Test Report included

- 3. Fabrication using bolted compression lugs for internal wiring.
- Utilizing copper bus bars, wire connections and bolted connections to phase buses, neutral bus and ground bus.
- 5. Integral disconnect switch capable of passing full rated surge current.
- 6. Multiple suppression circuits with current sharing.
- 7. LED indicator lights for power and protection status.
- 8. Monitoring system capable of the following:
 - Number of transient surges, overvoltages and undervoltages
 - b) Neutral-to-ground voltage and current
 - c) EMI filter status
 - d) Percentage of protection available
- 9. Audible alarm with silencing switch to indicate when protection has failed.
- 10. Dual set of dry contacts rated at 5A and 250VAC for remote monitoring of protection status.
- 11. Field testable with test data from factory provided comparison.
- 12. Field replaceable surge protection modules.
- B. Peak Single-Impulse Surge Current Rating of 200kA per mode.
- C. Connection Means: Permanent
- D. Protection modes and UL 1449 SVR for voltages of 480/277V, 3-Phase, 4-Wire, grounded wye circuits shall be as follows:
 - 1. Line to Neutral: 800V
 - 2. Line to Ground: 1000V
 - 3. Neutral to Ground: 900V

E. EMI noise rejection or attenuation values shall be in compliance with test and evaluation procedures outlined in NEMA LS-1 1992.

2.03 MOTOR CONTROL CENTER (MCC) SPD (TYPE-II)

- A. Surge Protection Device Description: Modular design with field-replaceable module mounted externally to the MCC with EMI filtering and the following features:
 - 1. Supplied with fuses rated at 200kA interrupting capacity (AIC).
 - Fabrication using bolted compression lugs for internal wiring.
 - Utilizing wire connections to phase buses, neutral bus and ground bus.
 - 4. Multiple suppression circuits with current sharing.
 - 5. LED indicator lights for p ower and protection status.
 - 6. Monitoring system capable of the following
 - a) Number of transient surges, overvoltages and undervoltages
 - b) Neutral-to-ground voltage and current
 - c) Percentage of protection available
 - 7. Audible alarm with silencing switch to indicate when protection has failed.
 - 8. Dual set of dry contacts rated at 5A and 250VAC for remote monitoring of protection status.
 - 9. Field testable with test data from factory provided comparison.
 - 10. Field replaceable surge protection modules.
- B. Peak Single-Impulse Surge Current Rating of 100kA per mode.
- C. Connection Means: Permanent
- D. Protection modes and UL 1449 SVR for voltages of 480/277V, 3-Phase, 4-Wire, grounded wye circuits shall be as follows:

- 1. Line to Neutral: 900V
- 2. Line to Ground: 900V
- 3. Neutral to Ground: 900V
- E. EMI noise rejection or attenuation values shall be in compliance with test and evaluation procedures outlined in NEMA LS-1 1992.

2.04 LIGHTING PANELBOARD SPD (TYPE-II)

- A. Surge Protection Device Description: Modular design with field-replaceable module mounted externally to the panelboard with EMI filtering and the following features:
 - Supplied with fuses rated at 200kA interrupting capacity (AIC).
 - Fabrication using bolted compression lugs for internal wiring.
 - Utilizing wire connections to phase buses, neutral bus and ground bus.
 - 4. Multiple suppression circuits with current sharing.
 - 5. LED indicator lights for power and protection status.
 - 6. Monitoring system capable of the following
 - Number of transient surges, overvoltages and undervoltages
 - b) Neutral-to-ground voltage and current
 - c) Percentage of protection available
 - 7. Audible alarm with silencing switch to indicate when protection has failed.
 - 8. Field testable with test data from factory provided comparison.
 - 9. Field replaceable surge protection modules.
- B. Peak Single-Impulse Surge Current Rating of 80kA per mode.
- C. Connection Means: Permanent

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- D. Protection modes and UL 1449 SVR for voltages of 208/120V, 3-Phase, 4-Wire, grounded wye circuits shall be as follows:
 - 1. Line to Neutral: 400V
 - 2. Line to Ground: 500V
 - 3. Neutral to Ground: 500V
- E. EMI noise rejection or attenua tion values shall be in compliance with test and evaluation procedures outlined in NEMA LS-1 1992.

PART 3 EXECUTION

3.01 INSTALLATION OF SURGE PROTECTION DEVICE (SPD)

- A. For Dual Rated Surge Protection (listed as both Surge Arrestor and SPD) for service entrance, product can be placed on either Line or Load side of the Service Entrance Equipment.
 - 1. Provide and install circuit breakers or fuses as shown on the Contract Drawings.
- B. For all remaining SPD devices:
 - 1. Provide and install circuit breakers or fuses as shown on the Contract Drawings.
- C. Install SPD devices for panelboards and auxiliary panels with conductors or buses between suppressor and points of attachment as short and straight as possible. Do NOT exceed manufacturer's recommended lead length. Do NOT connect neutral and ground leads together.
- D. SPD devices shall NOT be integrated with Switchgear or Panelboards as recommended by IEEE-1100, Section 8.4.2.5.
- E. All SPD devices shall have the raceway between the SPD and the switchgear enclosure sealed with approved fire sealant. The sealant shall prevent vapors from entering the switchgear enclosure.

3.02 PLACING EQUIPMENT INTO SERVICE

A. Do not energize or connect service entrance equipment, panelboards, control panels or telephone/data equipment to their sources until surge prot ection devices are installed and connected.

3.03 FIELD QUALITY CONTROL

- A. Manufacturer's Field Service: Contractor shall engage a factory-authorized service representative to perform inspections, field tests and adjustments to the equipment including all connections. Service Representative shall report results in writing to the Engineer.
 - Verify that the electrical wiring installation complies with manufacturer's written installation instructions and requirements.
 - After installation of SPD devices but before circuitry has been energized, test for compliance with requirements.
 - Complete installation checks according to manufacturer's written instructions.
 - 4. Remove and replace malfunctioning SPD devices and retest as specified as above.

END OF SECTION

SECTION 16960

ELECTRICAL EQUIPMENT TESTING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions, Supplementary Conditions (if included), and Division 1 Specifications Sections, apply to this Section.

1.02 SECTION INCLUDES

A. Electrical equipment test reports.

1.03 SUBMITTALS

- A. All submittals shall be in accordance with Specification 01340 - Shop Drawings, Project Data and Samples.
- B. All testing shall be performed by a t hird party independent testing company certified by the International Electrical Testing Association (NETA).
- C. Motor Circuit Test Reports: Complete Motor Circuit Test Report for each three-phase motor 5 HP and above.
- D. Low Voltage Feeder Insulation Test Report s: Complete the Low Voltage Feeder Insulation Test Report for each single-phase and three -phase feeder rated 100 amperes and above.
- E. Ground Resistance Test Reports: Complete the Ground Resistance Test Report for each structure that receives a service or a feeder.
- F. Manufacturer's insulation testing instructions for medium and high voltage cable.

1.04 OPERATION AND MAINTENANCE MANUALS

 A. Operations and Maintenance Manuals shall be submitted as outlined in Specification 01730 - Operation and Maintenance Data.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Use an ohmmeter for motor winding resistance testing. Perform in accordance with ohmmeter manufacturer's instructions.
- B. Use a ground resistance test instrument for ground resistance testing. Perform testing in acco rdance with test instrument manufacturer's instructions. Perform test in normally dry weather, not less than 48 hours after rainfall.
- C. Use a 1000 V DC megohms met er for low v oltage insulation testing. Perform testing in accordance with megohms meter manufacturer's instructions.
- D. Use suitable te st instruments for medium and high voltage insulation testing. Perform testing in accordance with test instrument manufacturer's instructions.
 - Individually test each conductor with all other conductors and all shields grounded.
 - Provide proper corona suppression at each termination using a guard ring or other suitable method.
 - 3. Apply DC hypote ntial in at le ast eight equal increments until maximum test voltage is reached. Record the DC leakage current at each step after a constant stabilization time consistent with system charging current decay.
 - 4. Hold the test voltage at the maximum level for 10 minutes. Record the DC leakage current every 30 seconds for the first 2 mi nutes, and then every minute thereafter.
 - 5. Reduce the test voltage to zero and apply ground to tested condu ctor for a per iod adequate to drain all potential stored in the insulation.
 - 6. Make a graphic plot of the leakage current versus the test voltage at each st ep and continue plot

with leakage current versus time based upon the recorded values.

- 7. Maximum Test Voltage: IEEE and manufacturer's stated levels.
- 8. Use an ohmmeter to test shield continuity and record values measured.
- Replace conductors and cable which indicate poor insulation levels as determined by the ENGIN EER. Do not splice as a means of repair.
- Install additional ground rods as required to achieve specified ground resistance. See Section 16450 - Grounding and Bonding.

3.02 REPORT FORMS

Equipment I		Locat	Location		
Manufacturer			Frame		
Horsepower	Phase	RPM	Sei	rvice Voltage _	
Motor Overload		Manufa	acturer	<u> </u>	
Nameplate Volts*		Runnir	ng Volt	.s*	
Nameplate Amperes*		Runnir	ng Ampe	eres*	
Nameplate Locked Rotor Amps	Name Fact	plate Power .or _	00	Nameplate Efficiency	010
Insulation Class		Sta	arting	Code	
Feeder runs from					
Feeder Wire Size	Insula Rating	ting Voltage		Insulation _ Type	
* Give armature/fie	eld for DC	motors.			

A. Motor Circuit Test Report

Winding	Resistance (ohms)
A to B	
B to C	
C to A	

- Motor Feeder/Winding Insulation Te st (Megohm Meter)
 - a) Perform the following test AFTER connecting the feeder to the motor.
 - b) Test from load side of motor controller.
 - c) Readings must be greater than 50 Megohms.

Phase	Megohms at 1000 VCD
A to Ground	
B to Ground	
C to Ground	

Testing performed by Date:

Testing Witnessed by

- B. Feeder Insulation Test Report
 - 1. Perform test BEFORE terminating feeder to equipment.

Feeder runs	from			
Feeder runs	to			
Wire Size		Insulation Voltage Rating	 Insulation Type	

Readings must be greater than 50 Megohms.

Phase	Megohms at 1000 VDC
A to Ground	
B to Ground	
C to Ground	

Testing performed	by	Date:
Testing Witnessed	by	

COMMENTS

C. Grounding Test Report

Type of Ground		
	(Single Rod or Multiple Rod -	- Provide Quantity)
Location		
Date Installed		
Weather Condition	s(Temp,Humidity)	
Date of Last Rain	1	
Ground Resistance	e(ohms)	
Testing Performed	l by	Date:
Testing Witnessed	l by	
COMMENTS		

END OF SECTION



FLORIDA DEPARTMENT OF Environmental Protection

SOUTHWEST DISTRICT OFFICE 13051 NORTH TELECOM PARKWAY TEMPLE TERRACE, FLORIDA 33637-0926

April 18, 2014

RICK SCOTT GOVERNOR

CARLOS LOPEZ-CANTERA LT. GOVERNOR

HERSCHEL T. VINYARD JR. SECRETARY

Manatee County c/o Mike Gore, Utilities Director 4410 66th Street West Bradenton, FL 34210 mike.gore@mymanatee.org

Dear Mr. Gore:

Enclosed is the Environmental Resource Permit, DEP Project No. 41-0149008-007, issued pursuant to Part IV of Chapter 373, Florida Statutes, and Title 62, Florida Administrative Code.

Appeal rights for you and for any affected third party are described in the text of the permit along with conditions that must be met when authorized activities are undertaken.

You, as the applicant, are responsible for all aspects of permit compliance. You should therefore review this permit document carefully to ensure compliance with the general conditions and specific conditions contained herein.

Please be aware of permit General Condition number 4, which states, "At least 48 hours prior to beginning the authorized activities, the permittee shall submit to the Agency a fully executed Form 62-330.350(1), "Construction Commencement Notice"."

If you have any questions about this document, please contact me at <u>ryan.p.martin@dep.state.fl.us</u> or (813) 470-5944.

Thank you for your participation in the permit process and in managing the natural resources of the State of Florida.

Sincerely, P. Mate

Ryan P. Martin, P.E. Engineering Specialist IV Submerged Lands and Environmental Resource Program Southwest District

cc: Matthew Love, McKim & Creed Inc., <u>mlove@mckimcreed.com</u> Andre Rachmaninoff, Manatee County, <u>andre.rachmaninoff@mymanatee.org</u>

Enclosure: Environmental Resource Permit, with Attachments (57 Pages)

www.dep_state.fl.us



FLORIDA DEPARTMENT OF Environmental Protection

SOUTHWEST DISTRICT OFFICE 13051 NORTH TELECOM PARKWAY TEMPLE TERRACE, FLORIDA 33637-0926 RICK SCOTT GOVERNOR

CARLOS LOPEZ-CANTERA LT. GOVERNOR

HERSCHEL T. VINYARD JR. SECRETARY

Permittee/Authorized Entity:

Manatee County c/o Mike Gore, Utilities Director 4410 66th Street West Bradenton, Florida 34210

Manatee County SEWRF - 10 MG Storage Tank Addition

Authorized Agent: McKim & Creed Inc. c/o Matthew S. Love, Project Manager 3903 Northdale Blvd, Suite 140W Tampa, Florida 33624

Individual Environmental Resource Permit

State-Owned Submerged Lands Authorization – Not Applicable

U.S. Army Corps of Engineers Authorization – Separate Corps Authorization Not Required

Permit No.: 41-0149008-007

Permit Issuance Date: April 18, 2014 Permit Construction Phase Expiration Date: April 18, 2019



FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

SOUTHWEST DISTRICT OFFICE 13051 NORTH TELECOM PARKWAY TEMPLE TERRACE, FLORIDA 33637-0926 RICK SCOTT GOVERNOR

CARLOS LOPEZ-CANTERA LT. GOVERNOR

HERSCHEL T. VINYARD JR. SECRETARY

Environmental Resource Permit

Permittee: Manatee County Permit No: 41-0149008-007

PROJECT LOCATION

The activities authorized by this permit are located at the Manatee County Southeast Water Reclamation Facility (SEWRF), 3321 Lena Road, Bradenton, Florida 34211, in Sections 1 & 12, Township 35 South, Range 18 East, in Manatee County.

PROJECT DESCRIPTION

The permittee is authorized to install a new 10 MG above ground storage tank and pump station that will result in impacts to the permitted configuration of Stormwater Pond No. 2 authorized by Environmental Resource Permit No. 41-0149008-001. The proposed 10 MG storage tank is designed such that rainfall runoff from the tank roof will be directed into the tank and incorporated into the treatment process without overtopping the tank. Therefore, the 10 MG storage tank will not generate stormwater runoff for any storm event. As a result of the additional impervious surface and the modified configuration, Pond No. 2 will be reshaped and storage volume will be added to maintain compliance with the permitted discharges from the site. Authorized activities are depicted on the attached exhibits.

No impacts to wetlands or other surface waters are authorized. The project site is located outside of the 100-year floodplain.

The project described above may only be conducted in accordance with the terms, conditions and attachments contained in this permit. The issuance of this permit does not infer, nor guarantee, nor imply that future permits or modifications will be granted by the Department.

AUTHORIZATIONS

Environmental Resource Permit

The Department has determined that the activity qualifies for an Environmental Resource Permit. Therefore, the Environmental Resource Permit is hereby granted, pursuant to Part IV of Chapter 373, Florida Statutes (F.S.), and Chapter 62-330, Florida Administrative Code (F.A.C.).

Sovereignty Submerged Lands Authorization

As staff to the Board of Trustees of the Internal Improvement Trust Fund (Board of Trustees), the Department has determined the activity is not on submerged lands owned by the State of

Florida. Therefore, your project is not subject to the requirements of Chapter 253, F.S., or Rule 18-21, F.A.C.

Federal Authorization

Your proposed activity as outlined on your application and attached drawings has been reviewed for compliance with the State Programmatic General Permit IV-R1 and it has been determined to not be within the jurisdiction of the Corps. No further permitting for these activities is required by the Corps.

Authority for review - an agreement with the USACOE entitled "Coordination Agreement Between the U. S. Army Corps of Engineers (Jacksonville District) and the Florida Department of Environmental Protection, or Duly Authorized Designee, State Programmatic General Permit", Section 10 of the Rivers and Harbor Act of 1899, and Section 404 of the Clean Water Act.

Coastal Zone Management

Issuance of this authorization also constitutes a finding of consistency with Florida's Coastal Zone Management Program, as required by Section 307 of the Coastal Zone Management Act.

Water Quality Certification

This permit also constitutes a water quality certification under Section 401 of the Clean Water Act, 33 U.S.C. 1341

Other Authorizations

You are advised that authorizations or permits for this activity may be required by other federal, state, regional, or local entities including but not limited to local governments or municipalities. This permit does not relieve you from the requirements to obtain all other required permits or authorizations.

The activity described may be conducted only in accordance with the terms, conditions and attachments contained in this document. Issuance and granting of the permit and authorizations herein do not infer, nor guarantee, nor imply that future permits, authorizations, or modifications will be granted by the Department.

PERMIT CONDITIONS

The activities described must be conducted in accordance with:

- The Specific Conditions
- The General Conditions
- The limits, conditions and locations of work shown in the attached drawings
- The term limits of this authorization

You are advised to read and understand these conditions and drawings prior to beginning the authorized activities, and to ensure the work is conducted in conformance with all the terms, conditions, and drawings herein. If you are using a contractor, the contractor also should read and understand these conditions and drawings prior to beginning any activity. Failure to comply

with these conditions, including any mitigation requirements, shall be grounds for the Department to revoke the permit and authorization and to take appropriate enforcement action.

Operation of the facility is not authorized except when determined to be in conformance with all applicable rules and this permit, as described.

SPECIFIC CONDITIONS

1. Submittals required herein (e.g., progress reports, as-built drawings, etc.) shall include the permittee's name and permit number 41-0149008-007 and shall be directed by e-mail to SW_ERP@dep.state.fl.us with a subject line of "Compliance: permit number 41-0149008-007", or by mail to:

> Department of Environmental Protection Southwest District ATTN: ERP Compliance Assurance 13051 North Telecom Parkway Temple Terrace, FL 33637-0926

- 2. The structure/work authorized by this permit shall not be placed/conducted on any property, other than that owned by the permittee, without the prior written approval of that property owner.
- 3. In the event the permittee files for bankruptcy prior to completion of work permitted and required by this permit, the permittee must notify the Department within 30 days of filing. The notification shall identify the bankruptcy court and case number and shall include a copy of the bankruptcy petition.

SPECIFIC CONDITIONS - PRIOR TO ANY CONSTRUCTION

4. Best management practices for erosion control shall be implemented prior to construction commencement and shall be maintained at all times during construction to prevent siltation and turbid discharges in excess of State water quality standards (>29 NTU's above background, pursuant to Rule 62-302, F.A.C. Methods may include, but are not limited to the use of staked hay bales, staked filter cloth, sodding, seeding, staged construction and the installation of turbidity screens around the immediate project site. Erosion control methods shall be implemented as depicted in Sheet C-1.3 of the attached permit drawings.

SPECIFIC CONDITIONS – CONSTRUCTION ACTIVITIES

5. Wetland areas or waterbodies that are outside the specific limits of construction authorized by this permit, must be protected from erosion, sedimentation, siltation, scouring, excess turbidity, and/or dewatering. There shall be no discharge in violation of the water quality standards in Chapter 62-302, F.A.C. Turbidity/erosion controls shall be installed prior to clearing, excavation or placement of fill material, shall be maintained until construction is completed, disturbed areas are stabilized, and turbidity levels have fallen to less than 29 NTU's above background. The turbidity and erosion control devices shall be removed within 14 days once these conditions are met.

- 6. Areas of exposed soils shall be isolated from wetlands or other surface waters to prevent erosion and deposition of these soils into wetlands or other surface waters during construction and operation of permitted activities.
- 7. Grass seed, or sod shall be installed and maintained on exposed slopes and disturbed soil areas within 48 hours of completing final grade, and at other times as necessary, to prevent erosion, sedimentation or turbid discharges into waters of the state and/or adjacent wetlands.
- 8. The permittee shall be responsible for ensuring erosion control devices/procedures are inspected and maintained daily during all phases of construction authorized by this permit until areas disturbed during construction are sufficiently stabilized to prevent erosion, siltation, and turbid discharges.
- 9. Staked filter cloth shall be positioned at the edge of the permitted fill slopes adjacent to wetlands to prevent turbid run-off and erosion.
- 10. Excavation of the retention/detention pond(s) is limited to the permitted design specifications as depicted on Sheets C-1.10, C-1.11, C-1.12 & C-1.13 of the attached permit drawings. If limestone bedrock is encountered during construction, the permittee shall notify the Department immediately and shall cease construction in the affected area. The permittee shall submit a design revision to the Department for review and approval that will demonstrate compliance with Rule 5.4.1.b. of the Applicant's Handbook, Volume II prior to proceeding with construction.
- 11. The authorized surface water management system shall be completed prior to or simultaneously with associated upland development.
- 12. All enclosed structures shall be flood-proofed to be watertight and capable of resisting the effects of the regulatory flood. The flood-proofed design shall take into account flood velocities, duration, rate of rise, hydrostatic and hydrodynamic forces, the effect of buoyancy, and impacts from debris. Flood proofing measures should be operable without human intervention and without an outside source of electricity.
- 13. This permit does not authorize the entrenchment of water, sewer, cable or utility lines within wetlands or waterbodies.
- 14. The wetland buffer boundaries, as shown on sheet C-1.10 of the approved construction drawings, shall be clearly flagged or otherwise delineated on site prior to initial clearing or grading activities. The delineation shall endure throughout the construction period and be readily discernible to construction and Department personnel.

- 15. Unauthorized impacts to wetlands as a result of the authorized construction shall be reported to the Department within 24 hours.
- 16. Storage or stockpiling of tools and materials (i.e., lumber, pilings, debris) within wetlands or other surface waters is prohibited.

SPECIFIC CONDITIONS – CONSTRUCTION COMPLETION

(The permittee shall comply with the following conditions prior to the transfer to operation phase of the facility. All documentation required below shall be included with the permittee's request to transfer the project to the operation phase [Form No. 62-330.310(2), F.A.C.].)

17. The permittee shall submit a signed, dated and sealed as-built drawings to the Department for review and approval within 30 days of completion of construction. The as-built drawings shall be based on the Department permitted construction drawings, which should be revised to reflect changes made during construction. Both the original design and constructed elevations must be clearly shown. The plans must be clearly labeled as "as-built" or "record" drawings. Surveyed dimensions and elevations required shall be verified and signed, dated and sealed by a Florida registered surveyor or engineer. Asbuilts shall be submitted to the Department regardless of whether or not deviations are present.

In addition to the As-built drawings, the permittee shall submit the "As-built Certification and Request for Conversion to Operation Phase" form as required in General Condition #6.

The following information shall be verified on the as-built drawings from the engineering drawings signed and sealed by Matthew S. Love, P.E., #66118, on January 28, 2014:

Plan View/Cross-Section	Drawing Number
Paving, Grading and Drainage Plan (Plan 1 of 2)	C-1.10
Paving, Grading and Drainage Plan (Plan 2 of 2)	C-1.11
Paving, Grading and Drainage Sections	C-1.12
Paving, Grading and Drainage Details	C-1.13

SPECIFIC CONDITIONS - OPERATION AND MAINTENANCE

18. A minimum of 35 percent of the area of the pond(s) shall be comprised of a vegetated littoral shelf as shown on Sheet C-1.14 of the attached permit drawings. The littoral shelf shall be vegetated with native wetland species as defined by Rule 62-340, F.A.C. Should the establishment of native vegetation not be accomplished within 24 months of construction of the wet detention pond, the permittee shall plant the littoral shelf to achieve the required coverage. Periodic replanting is required if the areal coverage of the littoral shelf falls below the 35 percent coverage during the life of the facility. Details on the size of the littoral shelf in relation to the pond shall be included with the inspection certification reports required in specific condition 27.

- 19. The maintenance of the SWMS shall be in accordance with the attached "Operation & Maintenance Plan". It is the responsibility of the permittee to ensure that that the surface water management system is functioning as designed.
- 20. The SWMS conveyance pipes shall be maintained free of blockage and ponds must be kept free of obstructions or blockage by sediment. Any scouring or erosion at these locations must be repaired.
- 21. All ditches and swales from the point at which they receive runoff from the project area and through their entire downstream length shall be well maintained and stabilized to ensure that they are not subject to erosion.
- 22. The permitted SWMS shall only be used for the purpose of controlling surface water runoff from the site, and shall not be used to dispose of or store any solid/liquid waste or products generated or used during operation or construction of the facility.
- 23. The permittee shall notify the Department of any sinkhole development in the SWMS within 24 hours after discovery, and must submit a detailed sinkhole evaluation and repair plan for approval by the Department within 30 days of discovery.
- 24. The operation and maintenance entity shall provide for the inspection of the permitted project after conversion of the permit to the operation and maintenance phase. For systems utilizing wet detention, the inspections shall be performed five (5) years after operation is authorized and every five (5) years thereafter.

The operation and maintenance entity must maintain a record of each inspection, including the date of inspection, the name and contact information of the inspector, whether the system was functioning as designed and permitted, and make such record available upon request of the District.

Within 30 days of any failure of a stormwater management system or deviation from the permit, an inspection report shall be submitted using Form 62-330.311(1), "Operation and Maintenance Inspection Certification" describing the remedial actions taken to resolve the failure or deviation.

GENERAL CONDITIONS FOR INDIVIDUAL PERMITS

The following general conditions are binding on all individual permits issued under chapter 62-330, F.A.C., except where the conditions are not applicable to the authorized activity, or where the conditions must be modified to accommodate project-specific conditions.

1. All activities shall be implemented following the plans, specifications and performance criteria approved by this permit. Any deviations must be authorized in a permit modification in accordance with Rule 62-330.315, F.A.C. Any deviations that are not so authorized may subject the permittee to enforcement action and revocation of the permit under Chapter 373, F.S.
- 2. A complete copy of this permit shall be kept at the work site of the permitted activity during the construction phase, and shall be available for review at the work site upon request by the Agency staff. The permittee shall require the contractor to review the complete permit prior to beginning construction.
- 3. Activities shall be conducted in a manner that does not cause or contribute to violations of state water quality standards. Performance-based erosion and sediment control best management practices shall be installed immediately prior to, and be maintained during and after construction as needed, to prevent adverse impacts to the water resources and adjacent lands. Such practices shall be in accordance with the *State of Florida Erosion and Sediment Control Designer and Reviewer Manual (Florida Department of Environmental Protection and Florida Department of Transportation June 2007)*, and the *Florida Stormwater Erosion and Sedimentation Control Inspector's Manual (Florida Department of Environmental Protection, Nonpoint Source Management Section, Tallahassee, Florida, July 2008)*, which are both incorporated by reference in subparagraph 62-330.050(9)(b)5., F.A.C., unless a project-specific erosion and sediment control plan is approved or other water quality control measures are required as part of the permit.
- 4. At least 48 hours prior to beginning the authorized activities, the permittee shall submit to the Agency a fully executed Form 62-330.350(1), "Construction Commencement Notice," [October 1, 2013], which is incorporated by reference in paragraph 62-330.350(1)(d), F.A.C., indicating the expected start and completion dates. A copy of this form may be obtained from the Agency, as described in subsection 62-330.010(5), F.A.C. If available, an Agency website that fulfills this notification requirement may be used in lieu of the form
- 5. Unless the permit is transferred under Rule 62-330.340, F.A.C., or transferred to an operating entity under Rule 62-330.310, F.A.C., the permittee is liable to comply with the plans, terms and conditions of the permit for the life of the project or activity.
- 6. Within 30 days after completing construction of the entire project, or any independent portion of the project, the permittee shall provide the following to the Agency, as applicable:
 - a. For an individual, private single-family residential dwelling unit, duplex, triplex, or quadruplex "Construction Completion and Inspection Certification for Activities Associated With a Private Single-Family Dwelling Unit" [Form 62-330.310(3)]; or
 - b. For all other activities "As-Built Certification and Request for Conversion to Operational Phase" [Form 62-330.310(1)].
 - c. If available, an Agency website that fulfills this certification requirement may be used in lieu of the form.
- 7. If the final operation and maintenance entity is a third party:
 - a. Prior to sales of any lot or unit served by the activity and within one year of permit issuance, or within 30 days of as-built certification, whichever comes first, the permittee shall submit, as applicable, a copy of the operation and maintenance documents (see sections 12.3 thru 12.3.3 of Volume I) as filed with the Department of State, Division of

Corporations and a copy of any easement, plat, or deed restriction needed to operate or maintain the project, as recorded with the Clerk of the Court in the County in which the activity is located.

b. Within 30 days of submittal of the as- built certification, the permittee shall submit "Request for Transfer of Environmental Resource Permit to the Perpetual Operation

Entity" [Form 62-330.310(2)] to transfer the permit to the operation and maintenance entity, along with the documentation requested in the form. If available, an Agency website that fulfills this transfer requirement may be used in lieu of the form.

- 8. The permittee shall notify the Agency in writing of changes required by any other regulatory agency that require changes to the permitted activity, and any required modification of this permit must be obtained prior to implementing the changes.
- 9. This permit does not:
 - a. Convey to the permittee any property rights or privileges, or any other rights or privileges other than those specified herein or in Chapter 62-330, F.A.C.;
 - b. Convey to the permittee or create in the permittee any interest in real property;
 - c. Relieve the permittee from the need to obtain and comply with any other required federal, state, and local authorization, law, rule, or ordinance; or
 - d. Authorize any entrance upon or work on property that is not owned, held in easement, or controlled by the permittee.
- 10. Prior to conducting any activities on state-owned submerged lands or other lands of the state, title to which is vested in the Board of Trustees of the Internal Improvement Trust Fund, the permittee must receive all necessary approvals and authorizations under Chapters 253 and 258, F.S. Written authorization that requires formal execution by the Board of Trustees of the Internal Improvement Trust Fund shall not be considered received until it has been fully executed.
- 11. The permittee shall hold and save the Agency harmless from any and all damages, claims, or liabilities that may arise by reason of the construction, alteration, operation, maintenance, removal, abandonment or use of any project authorized by the permit.
- 12. The permittee shall notify the Agency in writing:
 - a. Immediately if any previously submitted information is discovered to be inaccurate; and
 - b. Within 30 days of any conveyance or division of ownership or control of the property or the system, other than conveyance via a long-term lease, and the new owner shall request transfer of the permit in accordance with Rule 62-330.340, F.A.C. This does not apply to the sale of lots or units in residential or commercial subdivisions or condominiums where the stormwater management system has been completed and converted to the operation phase.

- 13. Upon reasonable notice to the permittee, Agency staff with proper identification shall have permission to enter, inspect, sample and test the project or activities to ensure conformity with the plans and specifications authorized in the permit.
- 14. If any prehistoric or historic artifacts, such as pottery or ceramics, stone tools or metal implements, dugout canoes, or any other physical remains that could be associated with Native American cultures, or early colonial or American settlement are encountered at any time within the project site area, work involving subsurface disturbance in the immediate vicinity of such discoveries shall cease. The permittee or other designee shall contact the Florida Department of State, Division of Historical Resources, Compliance and Review Section, at (850) 245-6333 or (800) 847-7278, as well as the appropriate permitting agency office. Such subsurface work shall not resume without verbal or written authorization from the Division of Historical Resources. If unmarked human remains are encountered, all work shall stop immediately and notification shall be provided in accordance with Section 872.05, F.S.
- 15. Any delineation of the extent of a wetland or other surface water submitted as part of the permit application, including plans or other supporting documentation, shall not be considered binding unless a specific condition of this permit or a formal determination under Rule 62-330.201, F.A.C., provides otherwise.
- 16. The permittee shall provide routine maintenance of all components of the stormwater management system to remove trapped sediments and debris. Removed materials shall be disposed of in a landfill or other uplands in a manner that does not require a permit under Chapter 62-330, F.A.C., or cause violations of state water quality standards.
- 17. This permit is issued based on the applicant's submitted information that reasonably demonstrates that adverse water resource-related impacts will not be caused by the completed permit activity. If any adverse impacts result, the Agency will require the permittee to eliminate the cause, obtain any necessary permit modification, and take any necessary corrective actions to resolve the adverse impacts.
- 18. A Recorded Notice of Environmental Resource Permit may be recorded in the county public records in accordance with subsection 62-330.090(7), F.A.C. Such notice is not an encumbrance upon the property.

NOTICE OF RIGHTS

This action is final and effective on the date filed with the Clerk of the Department unless a petition for an administrative hearing is timely filed under Sections 120.569 and 120.57, F.S., before the deadline for filing a petition. On the filing of a timely and sufficient petition, this action will not be final and effective until further order of the Department. Because the administrative hearing process is designed to formulate final agency action, the hearing process may result in a modification of the agency action or even denial of the application.

Petition for Administrative Hearing

A person whose substantial interests are affected by the Department's action may petition for an administrative proceeding (hearing) under Sections 120.569 and 120.57, F.S. Pursuant to Rule 28-106.201, F.A.C., a petition for an administrative hearing must contain the following information:

- (a) The name and address of each agency affected and each agency's file or identification number, if known;
- (b) The name, address, any email address, any facsimile number, and telephone number of the petitioner; the name, address, and telephone number of the petitioner's representative, if any, which shall be the address for service purposes during the course of the proceeding; and an explanation of how the petitioner's substantial interests are or will be affected by the agency determination;
- (c) A statement of when and how the petitioner received notice of the agency decision;
- (d) A statement of all disputed issues of material fact. If there are none, the petition must so indicate;
- (e) A concise statement of the ultimate facts alleged, including the specific facts that the petitioner contends warrant reversal or modification of the agency's proposed action;
- (f) A statement of the specific rules or statutes that the petitioner contends require reversal or modification of the agency's proposed action, including an explanation of how the alleged facts relate to the specific rules or statutes; and
- (g) A statement of the relief sought by the petitioner, stating precisely the action that the petitioner wishes the agency to take with respect to the agency's proposed action.

The petition must be filed (received by the Clerk) in the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000. Also, a copy of the petition shall be mailed to the applicant at the address indicated above at the time of filing.

Time Period for Filing a Petition

In accordance with Rule 62-110.106(3), F.A.C., petitions for an administrative hearing by the applicant must be filed within 21 days of receipt of this written notice. Petitions filed by any persons other than the applicant, and other than those entitled to written notice under Section 120.60(3), F.S., must be filed within 21 days of publication of the notice or within 21 days of receipt of the written notice, whichever occurs first. Under Section 120.60(3), F.S., however, any person who has asked the Department for notice of agency action may file a petition within 21 days of receipt of such notice, regardless of the date of publication. The failure to file a petition within the appropriate time period shall constitute a waiver of that person's right to request an administrative determination (hearing) under Sections 120.569 and 120.57, F.S., or to intervene in this proceeding and participate as a party to it. Any subsequent intervention (in a proceeding initiated by another party) will be only at the discretion of the presiding officer upon the filing of a motion in compliance with Rule 28-106.205, F.A.C.

Extension of Time

Under Rule 62-110.106(4), F.A.C., a person whose substantial interests are affected by the Department's action may also request an extension of time to file a petition for an administrative hearing. The Department may, for good cause shown, grant the request for an extension of time.

Manatee County/Manatee County SEWRF – 10 MG Storage Tank Addition Permit No. 41-0149008-007 Page 10 of 13 Requests for extension of time must be filed with the Office of General Counsel of the Department at 3900 Commonwealth Boulevard, Mail Station 35, Tallahassee, Florida 32399-3000, before the applicable deadline for filing a petition for an administrative hearing. A timely request for extension of time shall toll the running of the time period for filing a petition until the request is acted upon.

Mediation

Mediation is not available in this proceeding.

FLAWAC Review

The applicant, or any party within the meaning of Section 373.114(1)(a) or 373.4275, F.S., may also seek appellate review of this order before the Land and Water Adjudicatory Commission under Section 373.114(1) or 373.4275, F.S. Requests for review before the Land and Water Adjudicatory Commission must be filed with the Secretary of the Commission and served on the Department within 20 days from the date when this order is filed with the Clerk of the Department.

Judicial Review

Once this decision becomes final, any party to this action has the right to seek judicial review pursuant to Section 120.68, F.S., by filing a Notice of Appeal pursuant to Rules 9.110 and 9.190, Florida Rules of Appellate Procedure, with the Clerk of the Department in the Office of General Counsel, 3900 Commonwealth Boulevard, M.S. 35, Tallahassee, Florida 32399-3000; and by filing a copy of the Notice of Appeal accompanied by the applicable filing fees with the appropriate District Court of Appeal. The Notice of Appeal must be filed within 30 days from the date this action is filed with the Clerk of the Department.

Executed in Hillsborough County, Florida.

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

Kelley M. Boratur

Kelley M. Boatwright Program Administrator Submerged Lands and Environmental Resource Program Southwest District

Enclosures: V. Maintenance Instructions for Stormwater Facilities

Attachments:

Project Drawings and Design Specs. Construction Commencement Notice/Form 62-330.350(1) As-Built Certification and Request for Conversion to Operational Phase/Form 62-330.310(1) Request for Transfer to the Perpetual Operation Entity/Form 62-330.310(2) Request to Transfer Permit/Form 62-330.340(1) Operation and Maintenance Inspection Certification/Form 62-330.311(1)

Copies Furnished To:

U.S. Army Corps of Engineers, <u>tampareg@usace.army.mil</u> Matthew S. Love, McKim & Creed, <u>MLove@mckimcreed.com</u> Andre Rachmaninoff, Manatee County Utilities, <u>andre.rachmaninoff@mymanatee.org</u>

CERTIFICATE OF SERVICE

The undersigned hereby certifies that this permit, including all copies, were mailed before the close of business on <u>April 18, 2014</u> to the above-listed persons.

FILING AND ACKNOWLEDGMENT

FILED, on this date, under 120.52(7) of the Florida Statutes, with the designated Department Clerk, receipt of which is hereby acknowledged.

Clerk Trinea Bueler Date April 18, 2014

V. MAINTENANCE INSTRUCTIONS FOR STORMWATER FACILITIES

- A. Pipes shall be kept free of trash and silt, and shall be inspected annually.
- B. Oils, paints, or other harmful chemicals shall be kept from the facilities. Any such materials inadvertently entering shall be immediately removed.
- C. During the earthwork, grading, landscaping, planting, etc., erosion protection such as inlet socks, turbidity curtains, etc., shall be placed at inlets and outlet pipes to control stormwater quality and turbidity. Excessive compaction of pervious areas should be avoided.
- D. Inspections shall be made at least annually to check invert pipe for major build-up of sedimentation or trash. The pipe shall be cleaned if sedimentation level in the bottom is 2 inches or greater. The sediment may be vacuumed, pumped, or manually removed from the basin.
- E. Pond should be cleared of nuisance species such as cattails as necessary.



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CONSTRUCTION COMMENCEMENT NOTICE

Instructions: In accordance with Chapter 62-330.350(1)(d), F.A.C., complete and submit this form at least 48 hours prior to commencement of activity authorized by permit.

Permit No.	Application No	
Name	Phase	
Construction of the system authorize	d by the above referenced Environmental Reso	urce
Permit and Application, is expected t	o commence on	, 20
and will have an estimated completic	on date of	. 20

PLEASE NOTE: If the actual construction commencement date is not known within 30 days of issuance of the permit, District staff should be so notified in writing. As soon as a construction commencement date is known, the permittee shall submit a completed construction commencement notice form.

Permittee's or Authorized Agent's Signa	ature	Company	
Print Name		Title	Date
E-mail			Phone Number
	Reset Form	Save & Print	
RONDA			

Form 62-330.350(1) Construction Commencement Notice Incorporated by reference in subsection 62-330.350(1), F.A.C. (October 1, 2013)

AS-BUILT CERTIFICATION AND REQUEST FOR CONVERSION TO OPERATION PHASE

Instructions: Complete and submit this page within 30 days of completion of the permitted activities, as required by the permit conditions. Any components of the permitted activities that are not in substantial conformance with the permit must be corrected or a modification of the permit will be required in accordance with Rule 62-330.315, Florida Administrative Code (F.A.C.). The operation phase of the permit is effective when the construction certification for the entire permit/application is approved by the Agency. If the final operation and maintenance entity is not the permittee, the permittee shall operate the system, works or other activities temporarily until such time as the transfer to the operation entity is finalized (use Form 62-330.310(2)).

Permit No.:	Application No(s).	Permittee:
Project Name:		Phase (if applicable):

I HEREBY CERTIFY THAT (please choose accurately and check only one box):

I hereby notify the Agency of the completion of construction of all the components of the system, works or other activities for the above referenced project and certify that it has been constructed in substantial conformance with the plans specifications and conditions permitted by the Agency. Any minor deviations will not prevent the system from functioning in compliance with the requirements of Chapter 62-330, F.A.C. Attached is documentary evidence of satisfaction of any outstanding permit conditions, other than long term monitoring and inspection requirements.

At the time of final inspection, the works or activities were NOT completed in substantial conformance with the plans and specifications permitted by the Agency. (The registered professional shall describe the substantial deviation(s) in writing, and provide confirming depiction on the as-built drawings and information.)

If there were substantial deviations, plans must be submitted clearly labeled as "as-built" or "record" drawings reflecting the substantial deviations. If there are no substantial deviations, do not submit "as built" drawings.

For activities that require certification by a registered professional:

Signature	Print Name	Fla. Lic. or Reg. No
! AFFIX SEAL !	Company Name	
	Company Address	Date
tivities that do not require ce	ertification by a registered professional:	
r		
Signature	Print Name	
Signature	Print Name Company Name	
Signature	Print Name Company Name Company Address	Date
Signature	Print Name Company Name Company Address	Date

Form 62-330.310(1) – As-Built Certification & Request for Conversion to Operation Phase Incorporated by reference in paragraph 62-330.310(4)(a), F.A.C. (10-1-2013)

DRAWINGS AND INFORMATION CHECKLIST

Following is a list of information that is to be verified and/or submitted by the Registered Professional or Permittee:

- 1. All surveyed dimensions and elevations shall be certified by a registered Surveyor or Mapper under Chapter 472, F.S.
- 2. The registered professional's certification shall be based upon on-site observation of construction (scheduled and conducted by the registered professional of record or by a project representative under direct supervision) and review of as-built drawings, with field measurements and verification as needed, for the purpose of determining if the work was completed in accordance with original permitted construction plans, specifications and conditions.
- 3. If submitted, the as-built drawings are to be based on the permitted construction drawings revised to reflect any substantial deviations made during construction. Both the original design and constructed condition must be clearly shown. The plans need to be clearly labeled as "as-built" or "record" drawings that clearly highlight (such as through "red lines" or "clouds") any substantial deviations made during construction. As required by law, all surveyed dimensions and elevations required shall be verified and signed, dated and sealed by an appropriate registered professional. The following information, at a minimum, shall be verified on the as-built drawings, and supplemental documents if needed:
 - a. Discharge structures Locations, dimensions and elevations of all, including weirs, orifices, gates, pumps, pipes, and oil and grease skimmers;
 - b. Detention/Retention Area(s) Identification number, size in acres, side slopes (h:v), dimensions, elevations, contours or cross-sections of all, sufficient to determine stage-storage relationships of the storage area and the permanent pool depth and volume below the control elevation for normally wet systems,
 - c. Side bank and underdrain filters, or exfiltration trenches locations, dimensions and elevations of all, including clean-outs, pipes, connections to control structures and points of discharge to receiving waters;
 - System grading dimensions, elevations, contours, final grades or cross-sections to determine contributing drainage areas, flow directions and conveyance of runoff to the system discharge point(s);
 - e. Conveyance dimensions, elevations, contours, final grades or cross-sections of systems utilized to divert off-site runoff around or through the new system;
 - f. Benchmark(s) location and description (minimum of one per major water control structure);
 - g. Datum- All elevations should be referenced to a vertical datum clearly identified on the plans, preferably the same datum used in the permit plans.
- 4. Wetland mitigation or restoration areas Show the plan view of all areas, depicting a spatial distribution of plantings conducted by zone (if plantings are required by permit), with a list showing all species planted in each zone, numbers of each species, sizes, date(s) planted and identification of source of material; also provide the dimensions, elevations, contours and representative cross-sections depicting the construction.
- 5. Any additional information or outstanding submittals required by permit conditions or to document permit compliance, other than long-term monitoring or inspection requirements.

REQUEST FOR TRANSFER OF ENVIRONMENTAL RESOURCE PERMIT TO THE PERPETUAL OPERATION ENTITY

Instructions: Complete this form to transfer the permit to the operation and maintenance entity. This form can be completed concurrently with, or within 30 days of approval of the As-Built Certification and Request for Conversion to Operation Phase (Form 62-330.310(1)). Please include all documentation required under Section 12.2.1(b) of Applicant's Handbook Volume 1. (see checklist below). Failure to submit the appropriate final documents will result in the permittee remaining liable for operation and maintenance of the permitted activities.

Permit No.:	Application No(s)		
Project Name:		Phase (if applicable):	

A. REQUEST TO TRANSFER: The permittee requests that the permit be transferred to the legal entity responsible for operation and maintenance (O&M).

Signature of Permittee	Name and Title
Company	Company Address
Phone	City, State, Zip

B. AGREEMENT FOR SYSTEM OPERATION AND MAINTENANCE RESPONSIBILITY: The belownamed legal entity agrees to operate and maintain the works or activities in compliance with all permit conditions and provisions of Chapter 62-330, Florida Administrative Code (F.A.C.) and Applicant's Handbook Volumes I and II in perpetuity. Authorization for any proposed modification to the permitted activities shall be applied for and obtained prior to conducting such modification.

By:	Signature of Representative of O&M Entity	Name of Entity for O&M
	Name and Title	Address
	Email Address	City, State, Zip
	Phone	Date

Enclosed are the following documents, as applicable:

Copy of recorded transfer of title to the operating entity for the common areas on which the stormwater management system is located (unless dedicated by plat)

Copy of all recorded plats

Copy of recorded declaration of covenants and restrictions, amendments, and associated exhibits

Copy of filed articles of incorporation and documentary evidence of active corporate status with the Department of State, Division of Corporations (for corporations)

A completed, signed, and notarized affidavit attesting that the operating entity meets the requirements of Section 12.3 of Environmental Resource Permit Applicant's Handbook Volume I.(Note- this is optional, but aids in processing of this request)



Form 62-330.310(2) – Request for Transfer of Environmental Resource Permit to the Perpetual Operation Entity Incorporated by reference in paragraph 62-330.310(4)(a), F.A.C. (10-1-2013)

REQUEST TO TRANSFER PERMIT

Instructions: Submit this form to the Agency within 30 days after any transfer of ownership or control of the real property where the permitted activity is located.

Note: Use of this form is not required when a valid permit is in the operation and maintenance phase. In such case, the owner must notify the Agency in writing within 30 days of a change in ownership or control of the entire real property, project, or activity covered by the permit. The notification may be letter, e-mail, or using this form, sent to the office that issued the permit. A processing fee is not required for this notice. The permit shall automatically transfer to the new owner or person in control, except in cases of abandonment, revocation, or modification of a permit as provided in Sections 373.426 and 373.429, F.S. (2012). If a permittee fails to provide written notice to the Agency within 30 days of the change in ownership or control, or if the change does not include the entire real property or activity covered by the permit, then the transfer must be requested using this form.

Permit No.:	Application No(s).:	Date Issued:
Identification or Name of Surfac	e Water Management Syste	em:
Phase of Surface Water Manage	ement System (if applicable)):

PART 1: PROPOSED PERMIT HOLDER

The undersigned hereby notifies the Agency that I have acquired ownership or control of the land on which the permitted system is located through the sale or other legal transfer of the land. By signing below, I hereby certify that I have sufficient real property interest or control in the land in accordance with subsection 4.2.3 (d) of Applicant's Handbook Volume I; attached is a copy of my title, easement, or other demonstration of ownership or control in the land, including any revised plats, as recorded in the Public Records. I request that the permit be modified to reflect that I agree to be the new permittee. By so doing, I acknowledge that I have examined the permit terms, conditions, and drawings, and agree to accept all rights and obligations as permittee, including agreeing to be liable for compliance with all of the permit terms and conditions, and to be liable for any corrective actions required as a result of any violations of the permit after approval of this modification by the Permitting Agency. Also attached are copies of any recorded restrictive covenants, articles of incorporation, and certificate of incorporation that may have been changed as a result of my assuming ownership or control of the lands. As necessary, I agree to furnish the Agency with demonstration that I have the ability to provide for the operation and maintenance of the system for the duration of the permit in accordance with subsection 12.3 of Applicant's Handbook Volume I.

Name of Proposed Permit Holder:			
Mailing Address:			
City:	State:	Zip Code:	
Telephone:	Fax:	E-mail:	<u> </u>
Signature of Proposed Permi	ttee	Date	
FLORIDA			
Form 62-330.340(1) – Request Transf	er Permit		

Incorporated by reference in subsection in 62-330.340(3), F.A.C. (10-1-2013)

Title (if any)

PART 2: RESPONSIBLE REGISTERED PROFESSIONAL

Name of Registered Professional who will be responsible for system inspections and reporting as required by Chapter 62-330, F.A.C. (if applicable):

Mailing Address:		
City:	State:	Zip Code:
Telephone:	Fax:	E-mail:
Enclosures: Copy of recorded trans Copy of plat(s) Copy of recorded restri	fer of title for surface water ma ctive covenants, articles of inco	nagement system orporation, and certificate of incorporation

OPERATION AND MAINTENANCE INSPECTION CERTIFICATION

Instructions: Submit this form to the Agency within 30 days of completion of the inspection after any failure of a stormwater management system or deviation from the permit. This form may also be used to document inspections required under Section 12.4 of Applicant's Handbook Volume I, however submittal to the Agency is not required unless requested by the Agency.

Permit No.:	Application No.:	Issued:	
Identification or Name	of Stormwater Management System:		
Phase of Stormwater M	fanagement System (if applicable):		
Inspection Date:			

Inspection results: (check all that apply)

- The undersigned hereby certifies that the works or activities are functioning in substantial conformance with the permit. This certification is based upon on-site observation of the system conducted by me or my designee under my direct supervision and my review of as-built plans.
- The following maintenance was conducted since the last inspection (attach additional pages if needed):

The undersigned hereby certifies that I or my designee under my direct supervision has inspected this surface water management system and the system does not appear to be functioning in substantial conformance with the permit. I am aware that maintenance or alteration is required to bring the system into substantial compliance with the terms and conditions of the permit. As appropriate, I have informed the owner of the following:

- (a) The system does not appear to be functioning properly;
- (b) That maintenance or repair is required to bring the system into compliance; and
- (c) If maintenance or repair measures are not adequate to bring the system into compliance, the system may have to be replaced or an alternative design constructed subsequent to approval by the agency below.

The following components of the system do not appear to be functioning properly (attach additional pages if needed):

Any components of the constructed system that are not in substantial conformance with the permitted system shall require a written request to modify the permit in accordance with the provisions of Rule 62-330.315, F.A.C. If such modification request is not approved by the agency below, the components of the system that are not in conformance with the permit are subject to enforcement action under Sections 373.119, .129, .136, and .430, F.S.



Form 62-330.311(1) – Operation and Maintenance Inspection Certification Incorporated by reference in subsection in 62-330.311(2), F.A.C. (10-1-2013)

Name of Inspector:	Florida Registration Number:
Company Name:	
Mailing Address:	
City: State: _	Zip Code:
Phone: Fax:	Email:
Signature of Inspector	Date

Report Reviewed by Permittee:

Name of Permittee:

Signature of Permittee

Date

Title (if any)



FLORIDA DEPARTMENT OF

ENVIRONMENTAL PROTECTION

Southwest District Office 13051 North Telecom Parkway Temple Terrace, Florida 33637-0926 RICK SCOTT GOVERNOR

CARLOS LOPEZ-CANTERA LT. GOVERNOR

HERSCHEL T. VINYARD JR. SECRETARY

STATE OF FLORIDA DOMESTIC WASTEWATER FACILITY PERMIT

PERMITTEE:

March 5, 2014

Manatee County Government

PERMIT NUMBER: PA FILE NUMBER: ISSUANCE DATE: PA FILE NUMBER: REVISION DATE: EXPIRATION DATE: FLA474029 FLA474029-002-DW1R/NR December 17, 2012 FLA474029-005-DW1/MR March 5, 2014 December 16, 2017

RESPONSIBLE AUTHORITY:

Mr. Mike Gore Utilities Operation Director 4410 - 66th Street West Bradenton, FL 34206 <u>mike.gore@mymanatee.org</u> (941) 792-8811

FACILITY:

Manatee County Master Reuse System (MCMRS) 4410 - 66th Street West Bradenton, FL 34206 Manatee County

This permit is issued under the provisions of Chapter 403, Florida Statutes, and applicable rules of the Florida Administrative Code. This permit does not constitute authorization to discharge wastewater other than as expressly stated in this permit. The above named permittee is hereby authorized to operate the facilities in accordance with the documents attached hereto and specifically described as follows:

REUSE:

Land Application: An existing 33.5 MGD annual average daily flow (AADF) permitted capacity slow-rate public access system (R-001) consisting of a general service area located in Manatee County as defined by the map titled Manatee County Master Reuse and MARS System Service Area, dated February 13, 2006.

Reclaimed water meeting Part III public access standards is provided by an existing, separately-permitted Manatee County Utilities-operated wastewater treatment facility, as follows:

Southwest WRF - FLA012619 - up to 15.0 MGD AADF Southeast WRF - FLA012618 - up to 11.0 MGD AADF North WRF - FLA012617 - up to 7.5 MGD AADF

Effluent quality is continuously monitored at the source wastewater treatment plants for turbidity as a measure of TSS and chlorine residual as a measure of disinfection effectiveness. For all source plants, the on-site and off-site storage is controlled, sequenced, and operated during staffed periods according to procedures set forth in an

Operating Protocol established for each source plant in order to assure maximum reliability and safeguards on the quality of the reclaimed water.

Modification

Construction at the Southeast Water Reclamation Facility to include: a new 10 million gallon (MG) ground storage tank (GST), a new high service pump station, associated piping and appurtenances, and the conversion of two existing high service pump stations to low service stations to transfer water to the storage tank and storage ponds.

The following locations, under the control of the Manatee County Government, provide storage:

Storage Basin	Storage Capacity (MG)	Description of Storage
Southwest WRF	257.5	Reservoir
Southwest WRF	20.0	Ground Storage Tanks
Southeast WRF	487.16	Reservoir
Southeast WRF	10.0	Ground Storage Tank
North WRF	466.0	Reservoir
North WRF	0.75	Ground Storage Tank
Spencer Parish Pump Station	3.0	Ground Storage Tank
Total	1244.41	*

DISPOSAL:

Underground Injection: An existing underground injection well system U-001 consisting of one Class I underground injection well permitted under Department permit number 0039512-006-UO discharging to Class G-IV ground water. U-001 has a permitted capacity of 15.0 MGD maximum daily flow (MDF) and 10.0 MGD AADF. Underground injection well system U-001 is located approximately at latitude 27 ° 28' 10" N, longitude 82 ° 40' 51" W. Reuse water from the plant is pumped to U-001 via the public access reuse (PAR) distribution system.

The parameters required to be monitored for the UIC well, CBOD (5 day), Total Suspended Solids, and pH, are sampled at the individual source wastewater facility and reported on their Discharge Monitoring Report (DMR).

IN ACCORDANCE WITH: The limitations, monitoring requirements, and other conditions set forth in Pages 1 through 22 of this permit.

RECLAIMED WATER AND EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS Ϊ.

A. Underground Injection Control Systems

During the period beginning on the effective date and lasting through the expiration date of this permit, the permittee is authorized to discharge effluent to Underground Injection Well U-001. Such discharge shall be limited and monitored by the permittee as specified below and reported in accordance with Condition I.D.7: 1.

				Effluent Li	mitations			Monitoring Requirements		
Parameter	Units	Max/Min	Annual Average	Monthly Average	Weekly Average	Single Sample	Monitoring Frequency	Sample Type	Monitoring Location Site Number	Notes
Flow (U-001, Underground Injection Well)	MGD	Maximum	10.0	Report	r.	15.0	Continuous	Recording flow meter and totalizer	FLW-05	See Cond.I.A.3, 5
BOD, Carbonaceous 5 day, 20C	MG/L	Maximum	20.0	30.0	45,0	60.0	7 Days/Week	24-hour FPC	EFA-01	
Solids, Total Suspended	MG/L	Maximum	20.0	30.0	45.0	60.0	7 Days/Week	24-hour FPC	EFA-01	
Hq	SU	Range		•	•	6.0 to 8.5	Continuous	Meter	EFA-01	See Cond I.A.4

2. Effluent samples shall be taken at the monitoring site locations listed in Permit Condition I. A. 1. and as described below:

Monitoring Location Site Number	Description of Monitoring Location
EFA-01	Filtered effluent sampling point after disinfection at the MC Southwest Water Reclamation Facility
FLW-05	Flow to U-001, measured by a meter at the well site. Flow to U-001 is transported via the public access reuse distribution system.

- 3. The daily flow to Underground Injection Well Facility U-001 shall not exceed 15.0 MGD.
- 4. Hourly measurement of pH during the period of required operator attendance may be substituted for continuous measurement. [Chapter 62-601, Figure 2]
- 5. Recording flow meters and totalizers shall be utilized to measure flow and calibrated at least annually. [62-601.200(17) and .500(6)]
- 6. Disinfection is not required for discharge to Class G-IV waters using Class I wells. However, the permittee must maintain the capability for disinfection at a level that is consistent with the alternate disposal mechanism approved for this facility pursuant to Rule 62-600.540(5), F.A.C. [62-600.540(1)]
- 7. Under normal operating conditions only water meeting PAR standards, as identified in permit condition I.B of permit number FLA012619-018, may be sent to U-001. Water that does not meet PAR standards can be sent to U-001 only in accordance with the approved Operating Protocol.

FACILITY: Manatee County Master Reuse System (MCMRS) PERMITTEE: Manatee County Government

B. Reuse and Land Application System

1. During the period beginning on the effective date and lasting through the expiration date of this permit, the permittee is authorized to direct reclaimed water to Reuse System R-001. Such discharge shall be limited and monitored by the permittee as specified below and reported in accordance with Condition I.B.7:

			Re	claimed Water Limitations	W	unitoring Requirement	S	
Parameter	Units	Max/Min	Limit	Statistical Basis	Frequency of Monitoring	Sample Type	Monitoring Site Number	Notes
Flow (Total Flow, MCMRS) to R-001	MGD	Max	33.5 Report	AADF Monthly Average	Monthly	Calculation	FLW-01	See Cond.I.B.2
Flow (Southwest WRF) Permit FLA012619	MGD	Max	15.0 Report	AADF Monthly Average	Continuous	Meter	FLW-02	See Cond.I.B.2
Flow (Southeast WRF) Permit FLA012618	MGD	Max	11.0 Report	AADF Monthly Average	Continuous	Meter	FLW-03	See Cond.I.B.2
Flow (North WRF) Permit FLA012617	MGD	Max	7.5 Report	AADF Monthly Average	Continuous	Meter	FLW-04	See Cond.I.B.2

2. Reclaimed water samples shall be taken at the monitoring site locations listed in Permit Condition I. B. 1. and as described below:

Monitoring Location	Description of Monitoring Location
FLW-01	Total flow to R-001, Calculated [(FLW-02 + FLW-03 + FLW-04) - (FLW-05)]
FLW-02	Total flow contribution from Southwest WRF
FLW-03	Total flow contribution from Southeast WRF
FLW-04	Total flow contribution from North WRF
FLW-05	Total flow to deep injection well U-001

- 3. Recording flow meters and totalizers shall be utilized to measure flow and calibrated at least every twelve months. [62-601.200(17) and .500(6)]
- 4. The source treatment facilities shall be operated in accordance with all approved operating protocols. Only reclaimed water that meets the criteria established in the approved operating protocols may be released to system storage or to the reuse system. Reclaimed water that fails to meet the criteria in the approved operating protocols shall be directed to each facility's permit designated reject location. The operating protocols shall be reviewed and updated periodically to ensure continuous compliance with the minimum treatment and disinfection requirements. Updated operating protocols shall be submitted to the Department for review and approval upon revision of the operating protocols and with each permit application. [62-610.320(6), 62-610.463(2)]
- 5. Parameters which must be monitored as a result of a surface water discharge shall be analyzed using a sufficiently sensitive method to assure compliance with applicable water quality standards and effluent limitations in accordance with 40 CFR (Code of Federal Regulations) Part 136. Parameters which must be monitored as a result of a ground water discharge (i.e., underground injection or land application system) shall be analyzed in accordance with Chapter 62-601, F.A.C. All monitoring shall be representative of the monitored activity. [62-620.320(6)]
- 6. The permittee shall provide safe access points for obtaining representative influent, reclaimed water, and effluent samples which are required by this permit. [62-601.500(5)]
- 7. Monitoring requirements under this permit are effective on the first day of the second month following permit issuance. Until such time, the permittee shall continue to monitor and report in accordance with previously effective permit requirements, if any. During the period of operation authorized by this permit, the permittee shall complete and submit to the Department Discharge Monitoring Reports (DMRs) in accordance with the frequencies specified by the REPORT type (i.e., monthly, quarterly, semiannual, annual, etc.) indicated on the DMR forms attached to this permit. Monitoring results for each monitoring period shall be submitted in accordance with the associated DMR due dates below, unless specified elsewhere in the permit.

REPORT Type	Monitoring Period	Due Date
Monthly	first day of month – last day of month	28th day of following month
	January 1 - March 31	April 28
Quarterly	April 1 – June 30	July 28
Quarterry	July 1 – September 30	October 28
	October 1 – December 31	January 28
Comionnual	January 1 – June 30	July 28
Semiannual	July 1 – December 31	January 28
Annual	January 1 – December 31	March 28

The permittee may submit either paper or electronic DMRs. The permittee must use the attached DMR as a template, without altering the original format or content unless approved by the Department. Completed DMRs shall be submitted to the Department's Southwest District Office at the address specified in Permit Condition I.B.10 by the 28th day of the month following the month of operation. Paper copies postmarked by the 28th meet the intent of this requirement. If submitting electronic DMRs, portable document format (pdf) is preferred. Data submitted electronically is equivalent to data submitted on signed paper DMRs only when bearing an original signature. DMRs shall be submitted for each required monitoring period including months of no discharge.

[62-620.610(18), 62-601.300(1), (2), and (3)]

- 8. The permittee shall submit an Annual Reuse Report using DEP Form 62-610.300(4)(a)2. on or before January 1 of each year. [62-610.870(3)]
- 9. The permittee shall maintain an inventory of storage systems. The inventory shall be submitted to the Department at least 30 days before reclaimed water will be introduced into any new storage system. The inventory of storage systems shall be attached to the annual submittal of the Annual Reuse Report. [62-610.464(5)]
- 10. Unless specified otherwise in this permit, all reports and other information required by this permit, including 24hour notifications, shall be submitted to or reported to, as appropriate, the Department's Southwest District Office at the address specified below:

Florida Department of Environmental Protection Compliance Assurance Program Attention: Domestic Wastewater Southwest District Office 13051 North Telecom Parkway Temple Terrace, Florida 33637-0926 Email Address: <u>swd_dw@dep.state.fl.us</u>

Phone Number - 813-470-5700 FAX Number - 813-470-5995

All reports and other information shall be signed in accordance with the requirements of Rule 62-620.305, F.A.C. [62-620.305]

II. BIOSOLIDS MANAGEMENT REQUIREMENTS

This section is not applicable to this facility.

III. GROUND WATER REQUIREMENTS

A. Construction Requirements

- 1. The permittee shall give at least 72-hours notice to the Department's Southwest District Office, prior to the installation of any monitoring wells detailed in this permit. [62-520.600(6)(h)]
- The QUARTERLY sampling and analysis of all new ground water monitoring wells shall begin upon proper completion of the GWMP well system. The wells shall be sampled for the parameters identified in Permit Condition III.B.5 and in accordance to the Department's "Standard Operating Procedures For Laboratory Operations and Sample Collection Activities," DEP-SOP-001/01, FS 2200 Ground water Sampling, January 1, 2002. [62-520.600(11)(b)]

- 3. Prior to construction of new ground water monitoring wells, a soil boring shall be made at each new monitoring well location in order to establish the well depth and screen interval.) [520.600(6)(g)]
- 4. Within sixty days after completion of construction of the ground water monitoring wells, a properly scaled figure depicting monitor well locations (active and abandoned) with identification numbers shall be submitted. The figure shall also include (or attached) the monitoring well, top of casing and ground surface elevations referenced to National Geodetic Vertical Datum (NGVD) to the nearest 0.1 foot, along with monitor well location latitude and longitude to the nearest 0.1 second. [62-520.600(6)(i)]
- 5. Within thirty days after completion of construction of the ground water monitoring wells, well completion reports shall be sent to the Domestic Wastewater Section, FDEP Southwest District Office. The information is to be submitted on the attached form for each well, DEP Form 62-520.900(3), Monitor Well Completion Report. [62-520.600(6)(j)]
- 6. In Districts where applicable, within 30 days of completion of construction of new ground water monitor wells, the Department requests that the permittee submit the following information for each monitor well:
 - a. A copy of the Florida Water Management District (WMD), State of Florida Permit Application to Construct, Repair, Modify or Abandon a Well, Form [LEGR.040.01(June2010) 40D-3.101(1), F.A.C.], and
 - b. A copy of the WMD Well Completion Report, Form [LEGR.005.02(June 2010) 40D-3.411(1)(a), F.A.C.,]
- 7. The permittee shall coordinate any expansion of the Part III reclaimed water reuse system with the Southwest District Domestic Waste Permitting Section and shall propose additional ground water monitoring that may be required due to such expansion.

B. Operational Requirements

- 1. For the Part III Public Access system, all ground water quality criteria specified in Chapter 62-520, F.A.C., shall be met at the edge of the zone of discharge. The zone of discharge shall extend horizontally 100 feet from the application site or to user's site property line, whichever is less, and vertically to the base of the surficial aquifer. [62-520.200(27)] [62-520.465]
- 2. The ground water minimum criteria specified in Rule 62-520.400 F.A.C., shall be met within the zone of discharge. [62-520.400 and 62-520.420(4)]
- During the period of operation authorized by this permit, the permittee shall sample ground water in accordance with this permit and the approved ground water monitoring plan prepared in accordance with Rule 62-520.600, F.A.C. [62-520.600, 62-610.463(3)]
- 4. The following monitoring wells shall be sampled in accordance with the monitoring frequencies specified in Permit Condition III.5. for Reuse System R-001. Quarterly sampling must be reasonably spaced to be representative of potentially changing conditions.

Monitoring Well ID	Alternate Well Name and/or Description of Monitoring Location	Aquifer Monitored	New or Existing
MWB-01	59 th and Cortez Water Tower (SW-B1)	Surficial	New
MWI-01	SW WRF onsite ponds (MW-1, SW-2, 102320)	Surficial	Existing
MWC-10	SW WRF onsite ponds (MW-C1, SW-3, 102321)	Surficial	Existing

Monitoring Well ID	Alternate Well Name and/or Description of Monitoring Location	Aquifer Monitored	New or Existing
MWC-11	SW WRF onsite ponds (MW-C2, SW-4, 102322)	Surficial	Existing
MWB-05	G.T. Bray Park (replacement well for PR-1, 13189)	Surficial	Existing
MWI-02	G.T. Bray Park (PR-4A, 13163 MWC-09)	Surficial	Existing
MWC-03	G.T. Bray Park (PR-C1)	Surficial	New
MWB-02	SE WRF (BGW-1)	Surficial	Existing
MWI-05	SE WRF (SE 8, 13143 MWC-05)	Surficial	Existing
MWC-06	SE WRF (SE 4, 13147)	Surficial	Existing
MWB-03	Schroeder Manatee Ranch (SM-B1)	Surficial	New
MWI-04	Schroeder Manatee Ranch (SM 16, 13122 MWC-02)	Surficial	Existing
MWC-01	Schroeder Manatee Ranch (SM-C1)	Surficial	New
MWC-02	Schroeder Manatee Ranch (SM-C2)	Surficial	New
MWB-04	Buffalo Creek Golf Course (P-B1)	Surficial	New
MWI-06	Buffalo Creek Golf Course (P-5B, 35477 MWB-P5B)	Surficial	Existing
MWC-04	Buffalo Creek Golf Course (P-C1)	Surficial	New

MWB = Background; MWI = Intermediate; MWC = Compliance

[62-520.600, 62-610.463]

5. The following parameters shall be analyzed for each of the monitoring wells identified in Permit Condition III. 4:

Parameter	Compliance Well Limit	Units	Sample Type	Monitoring Frequency
Water Level Relative to NGVD	Report	FEET	In-situ	Quarterly
Nitrogen, Nitrate, Total (as N)	10	MG/L	Grab	Quarterly
Solids, Total Dissolved (TDS)	500	MG/L	Grab	Quarterly
Arsenic, Total Recoverable	10	UG/L	Grab	Quarterly
Chloride (as Cl)	250	MG/L	Grab	Quarterly
Cadmium, Total Recoverable	5	UG/L	Grab	Quarterly
Chromium, Total Recoverable	100	UG/L	Grab	Quarterly
Lead, Total Recoverable	15	UG/L	Grab	Quarterly
Coliform, Fecal	4	#/100ML	Grab	Quarterly
pH*	6.5 to 8.5	SU	In-Situ	Quarterly
Sulfate, Total	250	MG/L	Grab	Quarterly
Turbidity*	Report	NTU	In-Situ	Quarterly
Sodium, Total Recoverable	160	MG/L	Grab	Quarterly
Specific Conductance*	Report	UMHO/CM	In-Situ	Quarterly
Temperature (C), Water*	Report	DEG.C	In-Situ	Quarterly
Oxygen, Dissolved (DO)*	Report	MG/L	In-Situ	Quarterly

* The field parameters shall be sampled per DEP-SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The field parameters to be reported on Part D of GW DMR shall be the last sample recorded.

[62-520.600(11)(b), 62-601.300(3), 62-601.700, and Figure 3 of 62-601, 62-601.300(6), 62-520.310(5)]

- 6. If the concentration for any constituent listed in Permit Condition III. 5. in the natural background quality of the ground water is greater than the stated maximum, or in the case of pH is also less than the minimum, the representative natural background quality shall be the prevailing standard. [62-520.420(2)]
- In accordance with Part D of Form 62-620.910(10), water levels shall be recorded before evacuating wells for sample collection. Elevation references shall include the top of the well casing and land surface at each well site (NGVD allowable) at a precision of plus or minus 0.1 foot. [62-520.600(11)(c)]
- 8. Ground water monitoring wells shall be purged prior to sampling to obtain representative samples. [62-601.700(5)]
- Analyses shall be conducted on unfiltered samples, unless filtered samples have been approved by the Department's Southwest District Office as being more representative of ground water conditions. [62-520.310(5)]
- 10. Ground water monitoring parameters shall be analyzed in accordance with Chapter 62-601, F.A.C. [62-610.320(3) and 62-620.610(18)]
- 11. For permit renewal, the permittee shall submit, to the Southwest District Office, the results of sampling monitoring wells specified in the Department-approved monitoring plan for the primary and secondary drinking water parameters included in Chapter 62-550, F.A.C., (excluding asbestos, acrylamide, Dioxin, butachlor, epichlorohydrin, pesticides, and PCBs, unless reasonably expected to be a constituent of the discharge or an artifact of the site). Additional volatile and semivolatile parameters as specified in the ground water monitoring plan or permit shall be analyzed. Sampling shall occur no sooner than 180 days before submittal of the renewal application. [62-520.600(5)(b)]
- 12. Ground water monitoring test results shall be submitted on Part D of Form 62-620.910(10). For reuse or land application projects, results shall be submitted with the DMR for each month listed in the following schedule. The submitted results shall be for each year during the period of operation allowed by this permit in accordance with Permit Condition I.A.18. [62-520.600(11)(b), 62-601.300(3), 62.601.700, and Figure 3 of 62-601, 62-620.610(18)]

SAMPLE PERIOD	REPORT DUE DATE
January - March	April 28
April - June	July 28
July - September	October 28
October - December	January 28

- 13. If any monitoring well becomes inoperable or damaged to the extent that sampling or well integrity may be affected, the permittee shall notify the Department's Southwest District Office within two business days from discovery, and a detailed written report shall follow within ten days after notification to the Department. The written report shall detail what problem has occurred and remedial measures that have been taken to prevent recurrence or request approval for replacement of the monitoring well. All monitoring well design and replacement shall be approved by the Department before installation. [62-520.600(6)(l)]
- 14. All piezometers and wells that are not reasonably expected to be used are to be plugged and abandoned in accordance with subsection 62-532.500(4), F.A.C. The permittee shall submit a written report to the Department's office that issued the permit providing verification of the plugging including the well abandonment log when available; [62-520.600(6)(k)]

IV. ADDITIONAL REUSE AND LAND APPLICATION REQUIREMENTS

Part III Public Access System (R-001)

- Use of reclaimed water is authorized within the general service area identified in the map titled <u>Service Area</u>, <u>South Master Reuse System</u>, <u>dated January 2009</u>. The following uses of reclaimed water are authorized within this general service area: Aesthetic Purposes (decorative ponds, pools, and fountains), Athletic Complexes and Parks, Business, Commercial and Industrial Parks, Construction Dust Control, Fire Protection, Golf Course Irrigation, Golf Courses, Other Landscape Irrigation, Residential Developments, Residential Irrigation, Retail Nurseries, Ferneries, and Sod Farms, Toilet Flushing. [62-620.630(10)(d)]
- 2. This reuse system includes the following major users (i.e., using 0.1 MGD or more of reclaimed water):

User Name	Capacity (mgd)	Acreage
Southwest Region	and a second second	
	5.0	1(00
Manatee Fruit	5.0	1600
Manatee County Golf Course	0.58	100
G.T. Bray Park	0.81	140
Bradenton County Club	0.75	125
El Conquistador Golf Course	0.55	94
Wild Oaks	0.4	67
Mt. Vernon Condominiums	0.26	45
Manatee Community college	0.58	100
IMG Academies	0.23	194
Seabreeze Mobile Estates	0.23	40
Colonial Realty Limited	0.27	46
Perico Island	0.26	45
Vizcaya Condominium	0.1	172
Villas of El Conquistador	0.21	37
Wildwood Springs	0.2	85
Ironwood/Pinebrook	0.58	100
George Ball, Inc.	0.45	78
Duke & Benedict, Inc.	1.1	191
Sara Bay Country Club	0.33	57
Reasoner's Nursery	0.41	71
Bud Jones Nursery	0.1	17
Bay Lake Estates	0.23	40
Tidy Island	1.26	217
Cambridge Village West	0.16	27
Meadowcroft South	0.14	24
Country Village	0.14	25
Tanglewood Subdivision	0.25	43
Palma Sola Harbour	0.56	96
Manasota Airport Post Office	0.116	20
Hawthorne Park	0.215	37
Morton Village	0.19	33
Lakebridge	0.35	61
Mirror Lake	0.215	37
Vivienda I & II	0.133	23
Valencia	0.116	20
Huntington Woods	0.145	25

Cordova Lakes	0.75	129
Glenn Lakes	0.58	100
West Glenn	0.29	50
Heritage Pines	0.4	70
Horizons Subdivision	0.14	24
Pan Am Nursery	0.174	30
Pursley, Inc	1.21	30
Orban's Nursery	0.145	25
San Remo Shores	0.278	48
Taylor Woodrow Homes	0.23	89
Highland Lakes		
Southeast Region		
Schroeder-Manatee Ranch	80	4000
Rosedale GC & Residential	0.0	4000
Country Creek	0.94	3/1
Grevhawk Landing	0.754	210
Heritage Harbour	13	040
Mill Creek	87	2301
The Links @ Greenfield Plan	0.3	747
Crossing Creek Village	0.5	/0
Missionary Village	0.37	318
Creekwood Master	0.247	212
King Ranch	0.1	106
Lawrence Reagan	0.422	363
Rye Wilderness	0.37	319
North Region		
Buffalo Creek GC	0.8	120
Blossom Groves	1.3	923
McClure Farms	3.7	955
GCI Imperial Golf Course	0.4	67
Twin Rivers	1.46	1800
George Hooper	0.115	99
R & J Acres	0.217	187
Reeder Ranch & Dairy	1.6	916
Robinson Farms	0.525	300
Robert Saltsman	1.4	1210
Claude Young	0.321	276
Tom Chapman Jr.	0.39	225
Hecht Properties	2.62	2250

[62-610.800(5)][62-620.630(10)(b)]

- 3. New major users of reclaimed water (i.e., using 0.1 MGD or more) may be added to the reuse system using the general permit described in Rule 62-610.890, F.A.C., if the requirements in this rule are complied with. Application for use of this general permit shall be made using Form 62-610.300(4)(a)1. [62-610.890]
- 4. Cross-connections to the potable water system are prohibited. [62-610.469(7)]

- 5. A cross-connection control program shall be implemented and/or remain in effect within the areas where reclaimed water will be provided for use. [62-610.469(7)]
- 6. The permittee shall conduct inspections within the reclaimed water service area to verify proper connections, to minimize illegal cross-connections, and to verify the proper use of reclaimed water. Inspections are required when a customer first connects to the reuse distribution system. Subsequent inspections are required as specified in the cross-connection control and inspection program. [62-610.469(7)(h)]
- 7. If a cross-connection between the potable and reclaimed water systems is discovered, the permittee shall:
 - a. Immediately discontinue potable water and/or reclaimed water service to the affected area.
 - b. If the potable water system is contaminated, clear the potable water lines.
 - c. Eliminate the cross-connection.
 - d. Test the affected area for other possible cross-connections.
 - e. Within 24 hours, notify the Southwest District Office's domestic wastewater and drinking water programs.
 - f. Within 5 days of discovery of a cross-connection, submit a written report to the Department detailing: a description of the cross-connection, how the cross-connection was discovered, the exact date and time of discovery, approximate time that the cross-connection existed, the location, the cause, steps taken to eliminate the cross-connection, whether reclaimed water was consumed, and reports of possible illness, whether the drinking water system was contaminated and the steps taken to clear the drinking water system, when the cross-connection was eliminated, plan of action for testing for other possible cross-connections in the area, and an evaluation of the cross-connection control and inspection program to ensure that future cross-connections do not occur. [62-555.350(3), 62-555.360, 62-620.610(20)]
- 8. Maximum obtainable separation of reclaimed water lines and potable water lines shall be provided and the minimum separation distances specified in Rule 62-610.469(7), F.A.C., shall be provided. Reuse facilities shall be color coded or marked. Underground piping which is not manufactured of metal or concrete shall be color coded using Pantone Purple 522C using light stable colorants. Underground metal and concrete pipe shall be color coded or marked using purple as the predominant color. [62-610.469(7)]
- 9. In constructing reclaimed water distribution piping, the permittee shall maintain a 75-foot setback distance from a reclaimed water transmission facility to public water supply wells. No setback distances are required to other potable water supply wells or to any nonpotable water supply wells. [62-610.471(3)]
- 10. A setback distance of 75 feet shall be maintained between the edge of the wetted area and potable water supply wells, unless the utility adopts and enforces an ordinance prohibiting potable water supply wells within the reuse service area. No setback distances are required to any nonpotable water supply well, to any surface water, to any developed areas, or to any private swimming pools, hot tubs, spas, saunas, picnic tables, barbecue pits, or barbecue grills. [62-610.471(1), (2), (5), and (7)]
- 11. Reclaimed water shall not be used to fill swimming pools, hot tubs, or wading pools. [62-610.469(4)]
- 12. Low trajectory nozzles, or other means to minimize aerosol formation shall be used within 100 feet from outdoor public eating, drinking, or bathing facilities. [62-610.471(6)]
- 13. A setback distance of 100 feet shall be maintained from indoor aesthetic features using reclaimed water to adjacent indoor public eating and drinking facilities. [62-610.471(8)]

- 14. The public shall be notified of the use of reclaimed water. This shall be accomplished by posting of advisory signs in areas where reuse is practiced, notes on scorecards, or other methods. [62-610.468(2)]
- 15. All new advisory signs and labels on vaults, service boxes, or compartments that house hose bibbs along with all labels on hose bibbs, valves, and outlets shall bear the words "do not drink" and "no beber" along with the equivalent standard international symbol. In addition to the words "do not drink" and "no beber," advisory signs posted at storage ponds and decorative water features shall also bear the words "do not swim" and "no nadar" along with the equivalent standard international symbols. Existing advisory signs and labels shall be retrofitted, modified, or replaced in order to comply with the revised wording requirements. [62-610.468, 62-610.469]
- 16. The permittee shall ensure that users of reclaimed water are informed about the origin, nature, and characteristics of reclaimed water; the manner in which reclaimed water can be safely used; and limitations on the use of reclaimed water. Notification is required at the time of initial connection to the reclaimed water distribution system and annually after the reuse system is placed into operation. A description of on-going public notification activities shall be included in the Annual Reuse Report. [62-610.468(6)]
- 17. Routine aquatic weed control and regular maintenance of storage pond embankments and access areas are required. [62-610.414, 62-610.464]
- 18. Overflows from emergency discharge facilities on storage ponds shall be reported as an abnormal event to the Department's Southwest District Office within 24 hours of an occurrence. The provisions of Rule 62-610.800(9), F.A.C., shall be met. [62-610.800(9)]

V. OPERATION AND MAINTENANCE REQUIREMENTS

A. Staffing Requirements

1. During the period of operation authorized by this permit, the Manatee County Master Reuse System shall be operated under the supervision of a(n) operator(s) certified in accordance with Chapter 62-602, F.A.C. In accordance with Chapter 62-699, F.A.C. The Manatee County Master Reuse System shall be operated under the supervision of the Manatee County Utilities' Operations Division and in accordance with the requirements of the approved Operating Protocol.

[62-620.630(3), 62-699.310, 62-610.462]

B. Capacity Analysis Report and Operation and Maintenance Performance Report Requirements

- 1. The application to renew this permit shall include an updated capacity analysis report prepared in accordance with Rule 62-600.405, F.A.C. [62-600.405(5)]
- 2. The application to renew this permit shall include a detailed operation and maintenance performance report prepared in accordance with Rule 62-600.735, F.A.C. [62-600.735(1)]

C. Recordkeeping Requirements

- 1. The permittee shall maintain the following records and make them available for inspection on the site of the permitted facility.
 - a. Records of all compliance monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation and a copy of the laboratory

certification showing the certification number of the laboratory, for at least three years from the date the sample or measurement was taken;

- b. Copies of all reports required by the permit for at least three years from the date the report was prepared;
- c. Records of all data, including reports and documents, used to complete the application for the permit for at least three years from the date the application was filed;
- d. A copy of the current permit;
- e. A copy of the current operation and maintenance manual as required by Chapter 62-600, F.A.C.;
- f. A copy of any required record drawings;
- g. Copies of the licenses of the current certified operators;
- h. Copies of the logs and schedules showing plant operations and equipment maintenance for three years from the date of the logs or schedules. The logs shall, at a minimum, include identification of the plant; the signature and license number of the operator(s) and the signature of the person(s) making any entries; date and time in and out; specific operation and maintenance activities, including any preventive maintenance or repairs made or requested; results of tests performed and samples taken, unless documented on a laboratory sheet; and notation of any notification or reporting completed in accordance with Rule 62-602.650(3), F.A.C. The logs shall be maintained on-site in a location accessible to 24-hour inspection, protected from weather damage, and current to the last operation and maintenance performed;

[62-620.350, 62-602.650]

VI. SCHEDULES

1. The permittee shall adhere to the following schedule:

Implementation Step		Completion Date
А.	Provide all new well construction documents per permit conditions III. A. Conditions 1-7.	As required by permit conditions III. A. Conditions 1-7.
В.	Provide formal abandonment documents per Section III. B. Condition 14, for all wells scheduled to be abandoned.	Within 30 days of well abandonment.
C.	The permittee shall submit a plan for approval to evaluate each of the representative sites in the revised GWMP under this permit and determine the appropriateness each site and of each wells designation (background, intermediate or compliance) and any other outstanding issues. It should also address which monitoring wells will be monitored as required by Section III. B. Condition 11 and should include timelines for completion and report submittal.	Within 180 days of minor revision permit issuance.
D.	The permittee shall submit a report for the activities in D. above.	As required by the approved plan.
E.	Submit an application for renewal as required in permit Conditions VIII. 1.	At least 180 days before the permit expiration date.
F.	Provide appropriate documentation as required in permit conditions VI. 2 & 3 for the proposed ground storage tank identified in permit revision FLA474029-005.	As required by permit conditions VI. 2 & 3.

- Prior to placing the new facilities into operation or any individual unit processes into operation, for any purpose other than testing for leaks and equipment operation, the permittee shall complete and submit to the Department DEP Form 62-620.910(12), Notification of Completion of Construction for Domestic Wastewater Facilities. [62-620.630(2)]
- 3. Within six months after a facility is placed in operation, the permittee shall provide written certification to the Department on Form 62-620.910(13) that record drawings pursuant to Chapter 62-600, F.A.C., and that an operation and maintenance manual pursuant to Chapters 62-600 and 62-610, F.A.C., as applicable, are available at the location specified on the form. [62-620.630(7)]

VII. INDUSTRIAL PRETREATMENT PROGRAM REQUIREMENTS

This facility is not required to have a pretreatment program at this time. [62-625.500]

VIII. OTHER SPECIFIC CONDITIONS

- 1. The permittee shall apply for renewal of this permit at least 180 days before the expiration date of the permit using the appropriate forms listed in Rule 62-620.910, F.A.C. and in the manner established in the Department of Environmental Protection Guide to Permitting Wastewater Facilities or Activities Under Chapter 62-620, F.A.C., including submittal of the appropriate processing fee set forth in Rule 62-4.050, F.A.C. An application filed in accordance with this section shall be considered timely and sufficient. When an application for renewal of a permit is timely and sufficient, the existing permit shall not expire until the Department has taken final action on the application for renewal or until the last day for seeking judicial review of the agency order or a later date fixed by order of the reviewing court. The late submittal of a renewal application shall be considered timely and sufficient for the purpose of extending the effectiveness of the expiring permit only if the renewal application is submitted and made complete before the permit expiration date. [62-620.335(1)-(4)]
- 2. Reuse and land application projects shall not cause or contribute to violations of water quality standards in surface waters and shall be designed and operated to ensure compliance with ground water quality standards contained in Chapter 62-520, F.A.C. [62-610.850(1)(a) and (2)(a)]
- 3. In the event that the treatment facilities or equipment no longer function as intended, are no longer safe in terms of public health and safety, or odor, noise, aerosol drift, or lighting adversely affects neighboring developed areas at the levels prohibited by Rule 62-600.400(2)(a), F.A.C., corrective action (which may include additional maintenance or modifications of the permitted facilities) shall be taken by the permittee. Other corrective action may be required to ensure compliance with rules of the Department. Additionally, the treatment, management, use or land application of residuals shall not cause a violation of the odor prohibition in Rule 62-296.320(2), F.A.C. [62-600.410(8), 62-640.400(6)]
- 4. The deliberate introduction of stormwater in any amount into collection/transmission systems designed solely for the introduction (and conveyance) of domestic/industrial wastewater; or the deliberate introduction of stormwater into collection/transmission systems designed for the introduction or conveyance of combinations of storm and domestic/industrial wastewater in amounts which may reduce the efficiency of pollutant removal by the treatment plant is prohibited, except as provided by Rule 62-610.472, F.A.C. [62-604.130(3)]
- 5. Collection/transmission system overflows shall be reported to the Department in accordance with Permit Condition IX. 20. [62-604.550, 62-620.610(20)]
- 6. The operating authority of a collection/transmission system and the permittee of a treatment plant are prohibited from accepting connections of wastewater discharges which have not received necessary pretreatment or which contain materials or pollutants (other than normal domestic wastewater constituents):
 - a. Which may cause fire or explosion hazards; or

- b. Which may cause excessive corrosion or other deterioration of wastewater facilities due to chemical action or pH levels; or
- c. Which are solid or viscous and obstruct flow or otherwise interfere with wastewater facility operations or treatment; or
- d. Which result in the wastewater temperature at the introduction of the treatment plant exceeding 40°C or otherwise inhibiting treatment; or
- e. Which result in the presence of toxic gases, vapors, or fumes that may cause worker health or safety problems.

[62-604.130(5)]

- The treatment facility, storage ponds, rapid infiltration basins, and/or infiltration trenches shall be enclosed with a fence or otherwise provided with features to discourage the entry of animals and unauthorized persons. [62-600.400(2)(b)]_
- Screenings and grit removed from the wastewater facilities shall be collected in suitable containers and hauled to
 a Department approved Class I landfill or to a landfill approved by the Department for receipt/disposal of
 screenings and grit. [62-701.300(1)(a)]
- 9. The Permittee shall provide verbal notice to the Department as soon as practical after discovery of a sinkhole within an area for the management or application of wastewater, wastewater residuals (sludges), or reclaimed water. The Permittee shall immediately implement measures appropriate to control the entry of contaminants, and shall detail these measures to the Department in a written report within 7 days of the sinkhole discovery. [62-4.070(3)]
- 10. The permittee shall provide adequate notice to the Department of the following:
 - a. Any new introduction of pollutants into the facility from an industrial discharger which would be subject to Chapter 403, F.S., and the requirements of Chapter 62-620, F.A.C. if it were directly discharging those pollutants; and
 - b. Any substantial change in the volume or character of pollutants being introduced into that facility by a source which was identified in the permit application and known to be discharging at the time the permit was issued.

Adequate notice shall include information on the quality and quantity of effluent introduced into the facility and any anticipated impact of the change on the quantity or quality of effluent or reclaimed water to be discharged from the facility.

[62-620.625(2)]

IX. GENERAL CONDITIONS

- 1. The terms, conditions, requirements, limitations and restrictions set forth in this permit are binding and enforceable pursuant to Chapter 403, Florida Statutes. Any permit noncompliance constitutes a violation of Chapter 403, Florida Statutes, and is grounds for enforcement action, permit termination, permit revocation and reissuance, or permit revision. [62-620.610(1)]
- 2. This permit is valid only for the specific processes and operations applied for and indicated in the approved drawings or exhibits. Any unauthorized deviations from the approved drawings, exhibits, specifications or

conditions of this permit constitutes grounds for revocation and enforcement action by the Department. [62-620.610(2)]

- 3. As provided in Subsection 403.087(6), F.S., the issuance of this permit does not convey any vested rights or any exclusive privileges. Neither does it authorize any injury to public or private property or any invasion of personal rights, nor authorize any infringement of federal, state, or local laws or regulations. This permit is not a waiver of or approval of any other Department permit or authorization that may be required for other aspects of the total project which are not addressed in this permit. [62-620.610(3)]
- 4. This permit conveys no title to land or water, does not constitute state recognition or acknowledgment of title, and does not constitute authority for the use of submerged lands unless herein provided and the necessary title or leasehold interests have been obtained from the State. Only the Trustees of the Internal Improvement Trust Fund may express State opinion as to title. [62-620.610(4)]
- 5. This permit does not relieve the permittee from liability and penalties for harm or injury to human health or welfare, animal or plant life, or property caused by the construction or operation of this permitted source; nor does it allow the permittee to cause pollution in contravention of Florida Statutes and Department rules, unless specifically authorized by an order from the Department. The permittee shall take all reasonable steps to minimize or prevent any discharge, reuse of reclaimed water, or residuals use or disposal in violation of this permit which has a reasonable likelihood of adversely affecting human health or the environment. It shall not be a defense for a permittee in an enforcement action that it would have been necessary to halt or reduce the permitted activity in order to maintain compliance with the conditions of this permit. [62-620.610(5)]
- 6. If the permittee wishes to continue an activity regulated by this permit after its expiration date, the permittee shall apply for and obtain a new permit. [62-620.610(6)]
- 7. The permittee shall at all times properly operate and maintain the facility and systems of treatment and control, and related appurtenances, that are installed and used by the permittee to achieve compliance with the conditions of this permit. This provision includes the operation of backup or auxiliary facilities or similar systems when necessary to maintain or achieve compliance with the conditions of the permit. [62-620.610(7)]
- 8. This permit may be modified, revoked and reissued, or terminated for cause. The filing of a request by the permittee for a permit revision, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance does not stay any permit condition. [62-620.610(8)]
- 9. The permittee, by accepting this permit, specifically agrees to allow authorized Department personnel, including an authorized representative of the Department and authorized EPA personnel, when applicable, upon presentation of credentials or other documents as may be required by law, and at reasonable times, depending upon the nature of the concern being investigated, to:
 - a. Enter upon the permittee's premises where a regulated facility, system, or activity is located or conducted, or where records shall be kept under the conditions of this permit;
 - b. Have access to and copy any records that shall be kept under the conditions of this permit;
 - c. Inspect the facilities, equipment, practices, or operations regulated or required under this permit; and
 - d. Sample or monitor any substances or parameters at any location necessary to assure compliance with this permit or Department rules.

[62-620.610(9)]

10. In accepting this permit, the permittee understands and agrees that all records, notes, monitoring data, and other information relating to the construction or operation of this permitted source which are submitted to the

Department may be used by the Department as evidence in any enforcement case involving the permitted source arising under the Florida Statutes or Department rules, except as such use is proscribed by Section 403.111, Florida Statutes, or Rule 62-620.302, Florida Administrative Code. Such evidence shall only be used to the extent that it is consistent with the Florida Rules of Civil Procedure and applicable evidentiary rules. [62-620.610(10)]

- 11. When requested by the Department, the permittee shall within a reasonable time provide any information required by law which is needed to determine whether there is cause for revising, revoking and reissuing, or terminating this permit, or to determine compliance with the permit. The permittee shall also provide to the Department upon request copies of records required by this permit to be kept. If the permittee becomes aware of relevant facts that were not submitted or were incorrect in the permit application or in any report to the Department, such facts or information shall be promptly submitted or corrections promptly reported to the Department. [62-620.610(11)]
- 12. Unless specifically stated otherwise in Department rules, the permittee, in accepting this permit, agrees to comply with changes in Department rules and Florida Statutes after a reasonable time for compliance; provided, however, the permittee does not waive any other rights granted by Florida Statutes or Department rules. A reasonable time for compliance with a new or amended surface water quality standard, other than those standards addressed in Rule 62-302.500, F.A.C., shall include a reasonable time to obtain or be denied a mixing zone for the new or amended standard. [62-620.610(12)]
- 13. The permittee, in accepting this permit, agrees to pay the applicable regulatory program and surveillance fee in accordance with Rule 62-4.052, F.A.C. [62-620.610(13)]
- 14. This permit is transferable only upon Department approval in accordance with Rule 62-620.340, F.A.C. The permittee shall be liable for any noncompliance of the permitted activity until the transfer is approved by the Department. [62-620.610(14)]
- 15. The permittee shall give the Department written notice at least 60 days before inactivation or abandonment of a wastewater facility and shall specify what steps will be taken to safeguard public health and safety during and following inactivation or abandonment. [62-620.610(15)]
- 16. The permittee shall apply for a revision to the Department permit in accordance with Rules 62-620.300 and the Department of Environmental Protection Guide to Wastewater Permitting at least 90 days before construction of any planned substantial modifications to the permitted facility is to commence or with Rule 62-620.325(2) for minor modifications to the permitted facility. A revised permit shall be obtained before construction begins except as provided in Rule 62-620.300, F.A.C. [62-620.610(16)]
- 17. The permittee shall give advance notice to the Department of any planned changes in the permitted facility or activity which may result in noncompliance with permit requirements. The permittee shall be responsible for any and all damages which may result from the changes and may be subject to enforcement action by the Department for penalties or revocation of this permit. The notice shall include the following information:
 - a. A description of the anticipated noncompliance;
 - b. The period of the anticipated noncompliance, including dates and times; and
 - c. Steps being taken to prevent future occurrence of the noncompliance.

[62-620.610(17)]

18. Sampling and monitoring data shall be collected and analyzed in accordance with Rule 62-4.246, Chapters 62-160 and 62-601, F.A.C., and 40 CFR 136, as appropriate.

- a. Monitoring results shall be reported at the intervals specified elsewhere in this permit and shall be reported on a Discharge Monitoring Report (DMR), DEP Form 62-620.910(10).
- b. If the permittee monitors any contaminant more frequently than required by the permit, using Department approved test procedures, the results of this monitoring shall be included in the calculation and reporting of the data submitted in the DMR.
- c. Calculations for all limitations which require averaging of measurements shall use an arithmetic mean unless otherwise specified in this permit.
- d. Except as specifically provided in Rule 62-160.300, F.A.C., any laboratory test required by this permit shall be performed by a laboratory that has been certified by the Department of Health Environmental Laboratory Certification Program (DOH ELCP). Such certification shall be for the matrix, test method and analyte(s) being measured to comply with this permit. For domestic wastewater facilities, testing for parameters listed in Rule 62-160.300(4), F.A.C., shall be conducted under the direction of a certified operator.
- e. Field activities including on-site tests and sample collection shall follow the applicable standard operating procedures described in DEP-SOP-001/01 adopted by reference in Chapter 62-160, F.A.C.
- f. Alternate field procedures and laboratory methods may be used where they have been approved in accordance with Rules 62-160.220 and 62-160.330, F.A.C.

[62-620.610(18)]

- 19. Reports of compliance or noncompliance with, or any progress reports on, interim and final requirements contained in any compliance schedule detailed elsewhere in this permit shall be submitted no later than 14 days following each schedule date. [62-620.610(19)]
- 20. The permittee shall report to the Department any noncompliance which may endanger health or the environment. Any information shall be provided orally within 24 hours from the time the permittee becomes aware of the circumstances. A written submission shall also be provided within five days of the time the permittee becomes aware of the circumstances. The written submission shall contain: a description of the noncompliance and its cause; the period of noncompliance including exact dates and time, and if the noncompliance has not been corrected, the anticipated time it is expected to continue; and steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance.
 - a. The following shall be included as information which must be reported within 24 hours under this condition:
 - 1. Any unanticipated bypass which causes any reclaimed water or effluent to exceed any permit limitation or results in an unpermitted discharge,
 - 2. Any upset which causes any reclaimed water or the effluent to exceed any limitation in the permit,
 - 3. Violation of a maximum daily discharge limitation for any of the pollutants specifically listed in the permit for such notice, and
 - 4. Any unauthorized discharge to surface or ground waters.
 - b. Oral reports as required by this subsection shall be provided as follows:
 - 1. For unauthorized releases or spills of treated or untreated wastewater reported pursuant to subparagraph a.4 that are in excess of 1,000 gallons per incident, or where information indicates that public health or the environment will be endangered, oral reports shall be provided to the Department
by calling the STATE WARNING POINT TOLL FREE NUMBER (800) 320-0519, as soon as practical, but no later than 24 hours from the time the permittee becomes aware of the discharge. The permittee, to the extent known, shall provide the following information to the State Warning Point:

- a) Name, address, and telephone number of person reporting;
- b) Name, address, and telephone number of permittee or responsible person for the discharge;
- c) Date and time of the discharge and status of discharge (ongoing or ceased);
- d) Characteristics of the wastewater spilled or released (untreated or treated, industrial or domestic wastewater):
- e) Estimated amount of the discharge;
- f) Location or address of the discharge;
- g) Source and cause of the discharge;
- h) Whether the discharge was contained on-site, and cleanup actions taken to date;
- i) Description of area affected by the discharge, including name of water body affected, if any; and
- j) Other persons or agencies contacted.
- 2. Oral reports, not otherwise required to be provided pursuant to subparagraph b.1 above, shall be provided to the Department within 24 hours from the time the permittee becomes aware of the circumstances.
- c. If the oral report has been received within 24 hours, the noncompliance has been corrected, and the noncompliance did not endanger health or the environment, the Department shall waive the written report.

[62-620.610(20)]

- 21. The permittee shall report all instances of noncompliance not reported under Permit Conditions IX. 17, 18, and 19 of this permit at the time monitoring reports are submitted. This report shall contain the same information required by Permit Condition IX. 20 of this permit. [62-620.610(21)]
- 22. Bypass Provisions
 - a. Bypass is prohibited, and the Department may take enforcement action against a permittee for bypass, unless the permittee affirmatively demonstrates that:
 - 1. Bypass was unavoidable to prevent loss of life, personal injury, or severe property damage; and
 - 2. There were no feasible alternatives to the bypass, such as the use of auxiliary treatment facilities, retention of untreated wastes, or maintenance during normal periods of equipment downtime. This condition is not satisfied if adequate back-up equipment should have been installed in the exercise of reasonable engineering judgment to prevent a bypass which occurred during normal periods of equipment downtime or preventive maintenance; and
 - 3. The permittee submitted notices as required under Permit Condition IX. 22. b. of this permit.
 - b. If the permittee knows in advance of the need for a bypass, it shall submit prior notice to the Department, if possible at least 10 days before the date of the bypass. The permittee shall submit notice of an unanticipated bypass within 24 hours of learning about the bypass as required in Permit Condition IX. 20. of this permit. A notice shall include a description of the bypass and its cause; the period of the bypass,

including exact dates and times; if the bypass has not been corrected, the anticipated time it is expected to continue; and the steps taken or planned to reduce, eliminate, and prevent recurrence of the bypass.

- c. The Department shall approve an anticipated bypass, after considering its adverse effect, if the permittee demonstrates that it will meet the three conditions listed in Permit Condition IX. 22. a. 1. through 3. of this permit.
- d. A permittee may allow any bypass to occur which does not cause reclaimed water or effluent limitations to be exceeded if it is for essential maintenance to assure efficient operation. These bypasses are not subject to the provisions of Permit Condition IX. 22. a. through c. of this permit.

[62-620.610(22)]

23. Upset Provisions

- a. A permittee who wishes to establish the affirmative defense of upset shall demonstrate, through properly signed contemporaneous operating logs, or other relevant evidence that:
 - 1. An upset occurred and that the permittee can identify the cause(s) of the upset;
 - 2. The permitted facility was at the time being properly operated;
 - 3. The permittee submitted notice of the upset as required in Permit Condition IX. 20. of this permit; and
 - 4. The permittee complied with any remedial measures required under Permit Condition IX. 5. of this permit.
- b. In any enforcement proceeding, the burden of proof for establishing the occurrence of an upset rests with the permittee.
- c. Before an enforcement proceeding is instituted, no representation made during the Department review of a claim that noncompliance was caused by an upset is final agency action subject to judicial review.

[62-620.610(23)]

Executed in Hillsborough County, Florida.

STATE OF FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION

onala

Mauryn McDonald, P.E. Water Facilities Program Administrator Southwest District



FLORIDA DEPARTMENT OF

ENVIRONMENTAL PROTECTION

Southwest District Office 13051 North Telecom Parkway Temple Terrace, Florida 33637-0926 RICK SCOTT GOVERNOR

CARLOS LOPEZ-CANTERA LT. GOVERNOR

HERSCHEL T. VINYARD JR. SECRETARY

March 5, 2014

Mr. Mike Gore Utilities Operations Director Manatee County 4410 66th Street West Bradenton, FL 34210 mike.gore@mymanatee.org

Re: Minor Revision Manatee County Master Reuse System (MCMRS) PA File No. FLA474029-005-DW1/MR Manatee County

Dear Mr. Gore:

In accordance with Rule 62-620.325(2), Florida Administrative Code, the Department received your request for a minor revision of the above-referenced domestic wastewater treatment facility permit, FLA474029, which expires on December 16, 2017.

The permit was revised to identify construction at the Southeast Water Reclamation Facility, which will include a new 10 million gallon ground storage tank, a new high service pump station, associated piping and appurtenances, and the conversion of two existing high service pump stations to low service stations to transfer water to the storage tank and storage ponds. The permit was also revised to transfer underground injection well U-001 reporting requirements from the Manatee County Southwest Water Reclamation Facility permit (FLA012619) to this Master Reuse System permit.

The revised permit and DMR are attached and replace the previous documents in their entirety. Please note that the original expiration date still applies and monitoring requirements under this revised permit are effective on the first day of the second month following permit revision issuance (per permit condition I.B.7).

If you have any questions, you may contact Jorge Perez, at (813) 470-5734, or via email at jorge.perez@dep.state.fl.us

Sincerely,

McDonald

Mauryn McDonald, P.E. Water Facilities Program Administrator Southwest District

MM/jp

Attachments

cc: Andy Fischer, Manatee County Public Works Dept., andy.fischer@mymanatee.org Chuck Froman, Manatee County Government, <u>chuck.froman@mymanatee.org</u> Jeff Goodwin, Manatee County Utilities, jeff.goodwin@mymanatee.org Sia Mollanazar, P.E., Manatee County Public Works Dept., <u>sia.mollanazar@mymanatee.org</u> Andre Rachmaninoff, Manatee County Utilities, <u>andre.rachmaninoff@mymanatee.org</u> Edward Watson, FDEP SWD, <u>edward.watson@dep.state.fl.us</u> Ilia Balcom, FDEP SWD, <u>ilia.balcom@dep.state.fl.us</u> Elaine Gracik, FDEP SWD, elaine.gracik@dep.state.fl.us



DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

When Completed mail this report to: Department of Environmental Protection, Compliance Assurance Program, Attention: Domestic Wastewater, 13051 North Telecom Parkway, Temple Terrace, FL 33637-0926

PERMITTEE NAME: Man	atee County Governmen	nt	PERMIT NUMBER	FLA47	14029				
Brad	lenton, FL 34206		LIMIT: CLASS SIZE:	Final N/A		REPORT: GROUP:		Monthly Domestic	
FACILITY: Man	atee County Master Reu	use System (MCMRS)							
LOCATION: 441(Brad) - 66th Street West lenton, FL 34206		MONITORING GRO MONITORING GRO	UP NUMBER: R-001 UP DESC: Manate AD:	ee County MRS				
COUNTY; Man OFFICE: Sout	atee hwest District		NO DISCHARGE TC MONITORING PERI	OD From:		To		1	
Parameter		Quantity or Loading	Units	Quality or Concer	ıtration	Units	No. Ex.	Frequency of Analysis	Sample Type
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Flow (To R-001)	Sample Measurement								
PARM Code 50050 1 Mon.Site No. FLW-01	Permit Requirement	Report (Mo.Avg.)	MGD					Monthly	Calculation
Flow (Southwest WRF)	Sample Measurement								
PARM Code 50050 Y Mon Site No FI W-02	Permit Requirement	15.0 (An.Ave.)	MGD					Monthly	Calculation
Flow (Southwest WRF)	Sample Measurement	10							
PARM Code 50050 1 Mon.Site No. FLW-02	Permit Requirement	Report (Mo.Avg.)	MGD		and the second	6		Continuous	Meter
Flow (Southeast WRF)	Sample Measurement								
PARM Code 50050 Y Mon.Site No. FLW-03	Permit Requirement	11.0 (An.Avg.)	MGD			- the second		Monthly	Calculation
Flow (Southeast WRF)	Sample Measurement								
PARM Cede \$0050 1 Mon.Site No. FLW-03	Permit Requirement	Report (Mo.Avg.)	MGD					Continuous	Meter
l certify under penalty of law the information submitted. E knowledge and belief, true, a	/ that this document and 3ased on my inquiry of 1 ocurate, and complete.	a all attachments were prepared und the person or persons who manage t I am aware that there are significan	er my direction or supervi- he system, or those perso t penalties for submitting	ision in accordance with a sy ms directly responsible for g false information, including	vstem designed to ass athering the informat the possibility of fin	ure that qualifi ion, the inform e and imprisor	ed personi ation subr iment for l	ael properly gathe nitted is, to the bo knowing violation	r and evaluate st of my IS.
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COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here):

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FACILITY: Manatee COUNTY: Manatee	Parameter	Flow (North WRF)	PARM Code 50050 Y Mon.Site No. FLW-04	Flow (To the North WRF)	PARM Code 50050 1 Mon.Site No. FLW-04				

PA File No. FLA474029-004-DW1/MR DEP Form 62-620.910(10), Effective November 29, 1994

DISCHARGE MONITORING REPORT - PART A (Continued)

PERMITTEE NAME: N	fanatee County Governn	ment		PERMIT NUM	IBEK	FLAU12019					
MAILING ADDRESS: 4	410 00 Street west tradenton, FL 34210		. •	LIMIT: CLASS SIZE:		Final N/A		REPORT. GROUP:		Monthly Domesti	0
FACILITY: N LOCATION: 4	Aanatee County Master I 410 - 66th Street West radenton, FL 34206	Reuse System (MCMRS)		MONITORING	GROUP NUME	3ER: U-001	Injection Well				
COUNTY: N OFFICE: S	1anatee outhwest District			KE-SUBMITT NO DISCHAR	ed dmk: Ge to U-001:						
				MONITORING	3 PERIOD From	n:	To				
Parameter		Quantity or Loa	ding	Units	Qual	ity or Concentra	ation	Units	No. Fre	equency of Analysis	Sample Type
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Flow	Sample Measurement										
PARM Code 50050 1 Mon.Site No. FLW-05	Permit Requirement	10.0 (AADF)		MGD						Monthly	Calculation
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PARM Code 50050 1 Mon.Site No. FLW-05	Permit Requirement	Report (Mo.Avg.)		MGD					0	ontinuous	Flow Meter and Totalizer
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PARM Code 80082 Y Mon.Site No. EFA-01	Permit Requirement				20.0 (An.Avg.)			WG/L	4	Monthly	Calculation
BOD, Carbonaceous 5 day	r, 20C Sample Measurement										
PARM Code 80082 P Mon.Site No. EFA-01	Permit Requirement				30.0 (Mo.Avg.)	45.0 (Wk.Avg.)	60.0 (Max.)	MG/L	1 2	Days/Week	24-hr. FPC
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Mon.Site No. EFA-01 I certify under penalty of la the information submitted knowledge and helief the	Requirement w that this document an Based on my inquiry accurate and complete	ad all attachments were prep of the person or persons wh a ware that there are s	ared under my ho manage the significant pena	direction or su system, or the	(An.Avg.) apervision in accc se persons direct itting false inform	rdance with a syste tly responsible for f ation, including th	are the second to assu the informed as the informed to a second a second as the informed and the second as the sec	tre that qualif nation, the in and imprison	ied personnel iformation su nment for kno	l properly gath ubmitted is, tc owing violatic	the best of my ons.
NAME/TITLE OF PRINCIPA	L EXECUTIVE OFFICER C	OR AUTHORIZED AGENT	NDIS SIGN	ATURE OF PR	INCIPAL EXECUT	TIVE OFFICER OR A	UTHORIZED AGEN		TELEPHONE	NO DATE	(AT/MM/DD)

DEPARTMENT OF ENVIRONMENTAL PROTECTION DISCHARGE MONITORING REPORT - PART A

COMMENT AND EXPLANATION OF ANY VIOLATIONS (Reference all attachments here);

PA File No. FLA474029-004-DW1/MR DEP Form 62-620.910(10), Effective November 29, 1994

FACILITY: COUNTY:

Manatee County Master Reuse System (MCMRS) Manatee

DISCHARGE MONITORING REPORT - PART A (Continued)

MONITORING GROUP NUMBER: U-001 MONITORING PERIOD From:

FLA012619 PERMIT NUMBER:

To^T

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Parameter		Quantity or Loading	Units	Quality or	Concentrat	ion	Units	No. Fx	Frequency of Analysis	Sample Type
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PARM Code 00400 A Mon.Site No. EFA-01	Permit Requirement			6.0 (Min.)	T	8.5 (Max.)	SU	1	Continuous	Meter

DAILY SAMPLE RESULTS - PART B

Manatee Count	y Master Reus	e System (MCMRS)
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	Flow (MGD) (Total Flow to R-001)	Flow (MGD) (Southwest WRF)	Flow (MGD) (Southeast WRF)	Flow (MGD) (North WRF)	Flow (MGD) (U-001)	Notes	Notes
Code	50050	50050	50050	50050	50050		
Mon. Site	FLW-01	FLW-02	FLW-03	FLW-04	FL W-05		
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Total							
Mo. Avg.							

Day bille operator				
Evening Shift Operator	Class:	Certificate No:	Name:	
Night Shift Operator	Class:	Certificate No:	Name:	
Lead Operator	Class:	Certificate No:	Name:	

		GR	EAW GUND	FER MON	ITORING WI	ELL REPORT - P/	ART D			
County: Facility Name: Permit Number:	Manatee Manatee Coun FLA474029	ity Master Reuse S	System (MCMR5	()		Monito Well Ty Descrip	ring Well ID: pe: tion:	MWB-01 Background 59th and Cortez Wate:	r Tower (SW-B1)	
Monitoring Period	From:		To			Date Sa	mple Obtained:			
Was the well purged before sampling?	Yes	No				Time St	ample Obtained:			
Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Monitoring Frequency	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered
Water Level Relative to NGVD	82545		Report	FEET	In-situ	Quarterly				
Nitrogen, Nitrate, Total (as N)	00620		Report	MG/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		Report	MG/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		Report	NG/L	Grab	Quarterly				
Chloride (as Cl)	00940		Report	MG/L	Grab	Quarterly				
Cadmium, Total Recoverable	01113		Report	NG/L	Grab	Quarterly				
Chromium, Total Recoverable	01118		Report	NG/L	Grab	Quarterly				
Lead, Total Recoverable	01114		Report	NG/L	Grab	Quarterly				
Coliforn, Fecal	74055		Report	#/100ML	Grab	Quarterly				
pH*	00400		Report	SU	In-situ	Quarterly				
Sulfate, Total	00945		Report	MG/L	Grab	Quarterly				
Turbidity*	00070		Report	NTU	In-situ	Quarterly				
Sodium, Total Recoverable	00923		Report	MG/L	Grab	Quarterly				
Specific Conductance*	00095		Report	UMHO/CM	In-situ	Quarterly				
Temperature (C), Water*	00010		Report	DEG.C	In-situ	Quarterly				
Dissolved Oxygen*	00300		Report	MG/L	In-situ	Quarterly				
* The field parameters shall be sampled pt field parameters to be reported on Part D $_{\rm O}$	er DEP-SOP-001 of GW DMR shal	I/01, FS 2200 Gro	undwater Sampli le recorded.	ing and record	led, (see Figure FS	2200-2 Groundwater Pu	Irging Procedure and	Form FD 9000-24, Gro	undwater Sampling Log	g). The
I certify under penalty of law that this doci information submitted. Based on my inqu and belief, true, accurate, and complete. 1	urment and all att. ury of the person am aware that th	achments were pro or persons who m ere are significant	epared under my nanage the systen	direction or s 1, or those per	upervision in acco sons directly respc information inclu	rdance with a system des msible for gathering the i dime the nossibility of fir	igned to assure that c information, the infor	qualified personnel prop mation submitted is, to for knowing violations	berly gather and evaluate the best of my knowled	e the Ige
NAME/TITLE OF PRINCIPAL EXECUTIVE	OFFICER OR AU	THORIZED AGENT	S	IGNATURE OF	F PRINCIPAL EXEC	JUTIVE OFFICER OR AUT	HORIZED AGENT	TELEPHONE	NO DATE (yy/mm/	(pp
									2	

Samples (IL/F/N) * The field parameters shall be sampled per DEP-SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The field parameters to be reported on Part D of GW DMR shall be the last sample recorded. Intermediate SW WRF on-site ponds (MW-1, SW-2, 102320) Sampling Equipment Used Analysis Method **MWI-01** Detection Limits Time Sample Obtained: Date Sample Obtained: Monitoring Well ID: Well Type: Description: Monitoring Frequency Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Ouarterly Ouarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Sample Type In-situ In-situ In-situ In-situ In-situ In-situ Grab JMHO/CM DEG.C #/100ML MG/L MG/L NG/L NTU MG/L MG/L UG/L UG/L MG/L Units FEET MG/L UG/L SU Manatee County Master Reuse System (MCMRS) Requirement Report Permit To: Sample Measurement °N N PARM Code 00945 00010 01118 01114 74055 00400 00070 00923 26000 00300 FLA474029 70295 82600 00940 01113 82545 00620 Yes Manatee From: Was the well purged before sampling? Water Level Relative to NGVD Chromium, Total Recoverable Nitrogen, Nitrate, Total (as N) Solids, Total Dissolved (TDS) Cadmium, Total Recoverable sodium, Total Recoverable Arsenic. Total Recoverable Parameter Cemperature (C), Water* ead, Total Recoverable pecific Conductance* Dissolved Oxygen* Monitoring Period Chloride (as Cl) Coliform, Fecal Permit Number: Facility Name: Sulfate, Total **Turbidity*** County: ŧH.

COMMENTS AND EXPLANATION (Reference all attachments here):

GROUND WATER MONITORING WELL REPORT - PART D

Samples Filtered (L/F/N) SW WRF on-site ponds (MW-C1, SW-3, 102321) Sampling Equipment Used Analysis Method Compliance MWC-10 Detection Limits Time Sample Obtained: Date Sample Obtained: Monitoring Well ID: Well Type: Description: Monitoring Frequency Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Ouarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Sample Type In-situ Grab Grab In-situ In-situ Grab Grab Grab In-situ In-situ Grab Grab Grab Grab Grab UMHO/CM #/100ML DEG.C Units FEET MG/L MG/L MG/L UG/L UG/L UG/L MG/L MG/L UG/L NTU SU Manatee County South Master Reuse System (MCMRS) Requirement 6.5 to 8.5 Permit Report Report Report Report 500 10 01 250 100 250 160 To: 15 Ś 4 Sample Measurement °N PARM Code FLA474029 82545 70295 00940 01118 01114 74055 00945 00070 00620 87900 01113 00400 00923 26000 00010 00300 Yes Manatee From: Was the well purged before sampling? Water Level Relative to NGVD Nitrogen, Nitrate, Total (as N) Chromium, Total Recoverable Solids, Total Dissolved (TDS) Cadmium, Total Recoverable Parameter Arsenic, Total Recoverable Sodium, Total Recoverable ead, Total Recoverable Cemperature (C), Water* Specific Conductance* Dissolved Oxygen* Monitoring Period Chloride (as CI) Permit Number: Coliform, Fecal Facility Name: Sulfate, Total **Furbidity*** County: *Ho

GROUND WATER MONITORING WELL REPORT - PART D

* The field parameters shall be sampled per DEP-SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The field parameters to be reported on Part D of GW DMR shall be the last sample recorded. Quarterly In-situ MG/L Report

GROUND WATER MONITORING WELL REPORT - PART D

Samples Filtered (L/F/N) * The field parameters shall be sampled per DEP-SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The field parameters to be reported on Part D of GW DMR shall be the last sample recorded. SW WRF on-site ponds (MW-C2, SW-4, 102322) Sampling Equipment Used Analysis Method Compliance MWC-11 Detection Limits Time Sample Obtained: Date Sample Obtained: Monitoring Well ID: Well Type: Description: Monitoring Frequency Quarterly Quarterly Quarterly Ouarterly Quarterly Sample Type In-situ In-situ In-situ In-situ In-situ In-situ Grab JMHO/CM #/100ML DEG.C MG/L MG/L MG/L NTU MG/L MG/L MG/L UG/L UG/L Units FEET UG/L UG/L SU Manatee County Master Reuse System (MCMRS) Requirement 6.5 to 8.5 Report Report Report Report Report Permit 250 500 250 100 160 10 10 15 Ś To: Sample Measurement °Z PARM Code 01114 00945 00095 00010 00300 FLA474029 70295 87900 00940 01118 74055 00400 00070 00923 00620 01113 82545 Yes Manatee From: Was the well purged before sampling? Water Level Relative to NGVD hromium, Total Recoverable Nitrogen, Nitrate, Total (as N) Solids, Total Dissolved (TDS) admium, Total Recoverable sodium, Total Recoverable Arsenic, Total Recoverable Parameter Femperature (C), Water* ead, Total Recoverable specific Conductance* Dissolved Oxygen* Monitoring Period Chloride (as Cl) Coliform, Fecal Permit Number: Facility Name: Sulfate, Total **Curbidity*** County: *He

County: Facility Name: Permit Number:	Manatee Manatee Coun FLA474029	ity Master Reuse ?	System (MCMRS			Moníto Well Ty Descrip	ring Well ID: pe: tion:	MWB-05 Background G.T. Bray Park (repla	cement well for PR-1. 12	189)
Monitoring Period	From:		To:			Date Sa	mple Obtained:	-		
Was the well purged before sampling?	Yes	No				Time Sa	ample Obtained:			
Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Monitoring Frequency	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered
Water Level Relative to NGVD	82545		Report	FEET	In-situ	Quarterly				(and a
Nitrogen, Nitrate, Total (as N)	00620		Report	MG/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		Report	MG/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		Report	NG/L	Grab	Quarterly				
Chloride (as CI)	00940		Report	MG/L	Grab	Quarterly				
Cadmium, Total Recoverable	01113		Report	NG/F	Grab	Quarterly				
Chromium, Total Recoverable	01118		Report	NG/F	Grab	Quarterly				
Lead, Total Recoverable	01114		Report	NG/F	Grab	Quarterly				
Coliform, Fecal	74055		Report	#/100ML	Grab	Quarterly				
pH*	00400		Report	su	In-situ	Quarterly				
Sulfate, Total	00945		Report	MG/L	Grab	Quarterly				
lfurbidity*	00070		Report	NTU	In-situ	Quarterly				
Sodium, Total Recoverable	00923		Report	MG/L	Grab	Quarterly				
Specific Conductance*	00095		Report	UMHO/CM	In-situ	Quarterly				
Temperature (C), Water*	00010		Report	DEG.C	In-situ	Quarterly				
Dissolved Oxygen*	00300		Report	MG/L	In-situ	Quarterly				
* The field parameters shall be sampled per field parameters to be reported on Part D of	r DEP-SOP-001 f GW DMR sha	1/01, FS 2200 Gro	undwater Sampli le recorded.	ng and recorc	led, (see Figure FS	2200-2 Groundwater Pu	Irging Procedure and	Form FD 9000-24, Gro	undwater Sampling Log). The

GROUND WATER MONITORING WELL REPORT - PART D

Samples Filtered (L/F/N) * The field parameters shall be sampled per DEP–SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The field parameters to be reported on Part D of GW DMR shall be the last sample recorded. Sampling Equipment G.T. Bray Park (PR-4A, 13163 MWC-09) Used Analysis Method Intermediate **MWI-02** Detection Limits Time Sample Obtained: Date Sample Obtained: Monitoring Well ID: Well Type: Description: Monitoring Frequency Quarterly Quarterly Quarterly Ouarterly Quarterly Ouarterly Sample Type In-situ In-situ In-situ In-situ In-situ Grab In-situ Grab Grab Grab Grab Grab Grab Grab Grab Grab JMHO/CM DEG.C #/100ML MG/L MG/L MG/L MG/L UG/L UG/L MG/L NTU Units FEET MG/L UG/L UG/L SU Manatee County Master Reuse System (MCMRS) Requirement Report Permit To: Measurement Sample ۷ PARM Code FLA474029 00010 00945 00070 00095 00620 70295 87900 00940 01113 01118 01114 74055 00400 00923 00300 82545 Yes Manatee From: Was the well purged before sampling? Water Level Relative to NGVD Chromium, Total Recoverable Nitrogen, Nitrate, Total (as N) Solids, Total Dissolved (TDS) Cadmium, Total Recoverable Sodium, Total Recoverable Arsenic, Total Recoverable Parameter emperature (C), Water* cad, Total Recoverable pecific Conductance* Dissolved Oxygen* Monitoring Period Chloride (as CI) Coliform, Fecal Permit Number: Facility Name: Sulfate, Total 'urbidity* County:

GROUND WATER MONITORING WELL REPORT - PART D

Monitoring Period From: Was the well purged before sampling?	474029	Master Reuse S	ystem (MCMRS	~		Well T) Descrip	pe: tion:	Compliance G.T. Brav Park (PR-C	(1)	
Was the well purged before sampling?			To:		1	Date Sa	mple Obtained:			
	Yes No	-				Time Se	umple Obtained:	1		
PAI	RM Code	Sample Aeasurement	Permit Requirement	Units	Sample Type	Monitoring Frequency	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered
Water Level Relative to NGVD 8	82545		Report	FEET	In-situ	Quarterly				
Nitrogen, Nitrate, Total (as N) 6	0620		10	MG/L	Grab	Quarterly				
Solids, Total Dissolved (TDS) 7	70295		500	MG/L	Grab	Quarterly				
Arsenic, Total Recoverable 6	00978		10	NG/L	Grab	Quarterly				
Chloride (as CI) 0	00940		250	MG/L	Grab	Quarterly				
Cadmium, Total Recoverable 0	01113		5	NG/L	Grab	Quarterly				
Chromium, Total Recoverable 0	01118		100	NG/L	Grab	Quarterly				
Lead, Total Recoverable 0	01114		15	UG/L	Grab	Quarterly				
Coliform, Fecal 7	74055		4	#/100ML	Grab	Quarterly				
pH* 0	00400		6.5 to 8.5	SU	In-situ	Quarterly				
Sulfate, Total 0	00945		250	MG/L	Grab	Quarterly				
Turbidity* 0	00070		Report	NTU	In-situ	Quarterly				
Sodium, Total Recoverable 0	0923		160	MG/L	Grab	Quarterly				
Specific Conductance* 0	0095		Report	UMHO/CM	In-situ	Quarterly				
Temperature (C), Water* 0	0010		Report	DEG.C	In-situ	Quarterly				
Dissolved Oxygen* 0.	0300		Report	MG/L	In-situ	Quarterly				1

COMMENTS AND EXPLANATION (Reference all attachments here):

PA File No. FLA474029-005-DW1/MR DEP Form 62-620.910(10), Effective November 29, 1994

GROUND WATER MONITORING WELL REPORT - PART D

Filtered (IL/F/N) Samples * The field parameters shall be sampled per DEP–SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The field parameters to be reported on Part D of GW DMR shall be the last sample recorded. Sampling Equipment Used Analysis Method Background SE WRF (BGW-1) **MWB-02** Detection Limits **Fime Sample Obtained:** Date Sample Obtained: Monitoring Well ID: Well Type: Description: Monitoring Frequency Quarterly Quarterly Ouarterly Quarterly Quarterly Quarterly Quarterly Quarterly Ouarterly Ouarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Sample Type In-situ In-situ In-situ In-situ In-situ In-situ Grab MHO/CM #/100ML DEG.C MG/L MG/L NTU MG/L Units MG/L MG/L UQ/L MG/L UG/L UG/L UG/L FEET SU Manatee County Master Reuse System (MCMRS) Permit Requirement Report To: Sample Measurement °Z PARM Code 00010 FLA474029 70295 87900 00940 01113 01118 01114 74055 00400 00945 00070 00923 00095 00300 82545 00620 Yes Manatee From: Was the well purged before sampling? Water Level Relative to NGVD Chromium, Total Recoverable Nitrogen, Nitrate, Total (as N) Solids, Total Dissolved (TDS) admium, Total Recoverable Arsenic, Total Recoverable Sodium. Total Recoverable Parameter emperature (C), Water* ead, Total Recoverable specific Conductance* Dissolved Oxygen* Monitoring Period Chloride (as Cl) Coliform, Fecal Permit Number: Facility Name: Sulfate, Total Furbidity* County: ÷

COMMENTS AND EXPLANATION (Reference all attachments here):

PA File No. FLA474029-005-DW1/MR DEP Form 62-620.910(10), Effective November 29, 1994

GROUND WATER MONITORING WELL REPORT - PART D

Samples Filtered (IL/F/N) The field parameters shall be sampled per DEP-SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The Sampling Equipment Used SE WRF (SE 8, 13143 MWC-05) Analysis Method Intermediate **MWI-05** Detection Limits Time Sample Obtained: Date Sample Obtained: Monitoring Well ID: Description: Well Type: Monitoring Frequency Quarterly Sample Type In-situ In-situ In-situ In-situ In-situ In-situ Grab IMHO/CM DEG.C #/100ML Units MG/L MG/L UG/L MG/L NG/L NG/L MG/L MG/L FEET UG/L MG/L NTU SU Manatee County Master Reuse System (MCMRS) Requirement Permit Report field parameters to be reported on Part D of GW DMR shall be the last sample recorded. To: Sample Measurement ° PARM Code FLA474029 70295 00978 00940 01000 82545 00620 01113 01118 01114 74055 00400 00945 00070 00923 00095 00300 Yes Manatee From; Was the well purged before sampling? Water Level Relative to NGVD Vitrogen, Nitrate, Total (as N) Solids, Total Dissolved (TDS) Chromium, Total Recoverable Cadmium, Total Recoverable Arsenic, Total Recoverable Sodium, Total Recoverable Parameter ead, Total Recoverable Temperature (C), Water* Specific Conductance* Dissolved Oxygen* Monitoring Period Permit Number: Chloride (as Cl) Coliform, Fecal Facility Name: Sulfate, Total **Curbidity*** County: *H

GROUND WATER MONITORING WELL REPORT - PART D

GROUND WATER MONITORING WELL REPORT - PART D

Samples Filtered (IL/F/N) Sampling Equipment Used SE WRF (SE 4, 13147) Analysis Method Compliance **MWC-06** Detection Limits Time Sample Obtained: Date Sample Obtained: Monitoring Well ID: Well Type: Description: Monitoring Frequency Quarterly Sample Type In-situ In-situ In-situ In-situ In-situ In-situ Grab JMHO/CM DEG.C #/100ML MG/L MG/L MG/L NTU MG/L NG/L UG/L Units MG/L MG/L NG/L FEET UG/L SU Manatee County Master Reuse System (MCMRS) Requirement 6.5 to 8.5 Report Report Report Report Permit Report 160 250 100 250 500 15 10 2 5 4 To: Sample Measurement ٥N PARM Code 00010 01118 01114 00400 00945 00070 00923 00095 00300 87900 00040 01113 74055 FLA474029 70295 82545 00620 Yes Manatee From: Was the well purged before sampling? Water Level Relative to NGVD Nitrogen, Nitrate, Total (as N) Chromium, Total Recoverable solids, Total Dissolved (TDS) admium, Total Recoverable Sodium, Total Recoverable Arsenic, Total Recoverable Parameter Temperature (C), Water* ead, Total Recoverable Specific Conductance* Dissolved Oxygen* Monitoring Period Chloride (as Cl) Coliform, Fecal Permit Number: Facility Name: Sulfate, Total urbidity* County:

* The field parameters shall be sampled per DEP–SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The field parameters to be reported on Part D of GW DMR shall be the last sample recorded.

GROUND WATER MONITORING WELL REPORT - PART D

Manatee

Facility Name:

County:

MWB-03

Filtered (L/F/N) Samples Sampling Equipment Used Schroeder Manatee Ranch (SM-B1) Analysis Method Background Detection Limits Time Sample Obtained: Date Sample Obtained: Monitoring Well ID: Well Type: Description: Monitoring Frequency Quarterly Sample Type In-situ In-situ In-situ In-situ In-situ Grab Grab Grab In-situ Grab Grab Grab Grab Grab Grab Grab JMHO/CM DEG.C #/100ML Units MG/L MG/L FEET UG/L MG/L MG/L UQ/L UG/L NG/L MG/L NTU MG/L SU Manatee County Master Reuse System (MCMRS) Requirement Report Permit Report To: Sample Measurement Я PARM Code FLA474029 00620 82600 01118 01114 82545 70295 00940 01113 74055 00400 00945 00070 00010 00923 26000 00300 Yes From: Was the well purged before sampling? Water Level Relative to NGVD Nitrogen, Nitrate, Total (as N) Chromium, Total Recoverable Solids, Total Dissolved (TDS) Cadmium, Total Recoverable Parameter Arsenic, Total Recoverable odium, Total Recoverable lead, Total Recoverable emperature (C), Water* pecific Conductance* Dissolved Oxygen* Monitoring Period Permit Number: Chloride (as CI) Coliform, Fecal Sulfate, Total urbidity*

* The field parameters shall be sampled per DEP–SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The field parameters to be reported on Part D of GW DMR shall be the last sample recorded.

Samples (L/F/N) Schroeder Manatee Ranch (SM 16, 13122 MWC-02) * The field parameters shall be sampled per DEP-SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The Sampling Equipment Used Analysis Method Intermediate **MWI-04** Detection Limits Time Sample Obtained: Date Sample Obtained: Monitoring Well ID: Description: Well Type: Monitoring Frequency Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Ouarterly Ouarterly Ouarterly Ouarterly Quarterly Quarterly Quarterly Quarterly Quarterly Sample Type In-situ In-situ In-situ In-situ In-situ In-situ Grab JMHO/CM #/100ML DEG.C MG/L MG/L MG/L Units FEET MG/L MG/L UG/L **NG/L** UG/L UG/L MG/L NTU SU Manatee County Master Reuse System (MCMRS) FLA474029 Requirement Report Report Report Report Report Report field parameters to be reported on Part D of GW DMR shall be the last sample recorded. Report Report Permit Report Report Report Report Report Report Report Report To: Measurement Sample ů PARM Code 00010 00070 00300 00620 01113 01118 01114 74055 00400 00945 00923 26000 70295 87900 00940 82545 Yes Manatee From: Was the well purged before sampling? Water Level Relative to NGVD Chromium, Total Recoverable Nitrogen, Nitrate, Total (as N) solids, Total Dissolved (TDS) Cadmium, Total Recoverable sodium. Total Recoverable Arsenic, Total Recoverable Parameter l'emperature (C), Water* cad. Total Recoverable Specific Conductance* Dissolved Oxygen* Monitoring Period Chloride (as Cl) Permit Number: Coliform, Fecal Facility Name: Sulfate, Total **Furbidity*** County: *He

GROUND WATER MONITORING WELL REPORT - PART D

		GR	OUND WAT	TER MON	ITORING W	ELL REPORT - P/	ART D			
County: Facility Name: Permit Nurnber: Monitoring Period Was the well purged before sampling?	Manatee Manatee Cour FLA474029 From:Yes	nty Master Reuse ?	System (MCMRS Ta:			Monito Well T ₃ Descrip Date Sa Time Sa	ring Well ID: pe: tion: mple Obtained: imple Obtained:	MWC-01 Compliance Schroeder Manatee R	anch (SM-C1)	
Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Monitoring Frequency	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered
Water Level Relative to NGVD	82545		Report	FET	In-situ	Quarterly				(NITT)
Nitrogen, Nitrate, Total (as N)	00620		10	MG/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		500	MG/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		10	NG/T	Grab	Quarterly				
Chloride (as Cl)	00940		250	MG/L	Grab	Quarterly				
Cadmium, Total Recoverable	01113		5	NG/L	Grab	Quarterly				
Chromium, Total Recoverable	01118		100	NG/L	Grab	Quarterly				
Lead, Total Recoverable	01114		15	NG/L	Grab	Quarterly				
Coliform, Fecal	74055		4	#/100ML	Grab	Quarterly				
pH*	00400		6.5 to 8.5	SU	In-situ	Quarterly				
Sulfate, Total	00945		250	MG/L	Grab	Quarterly				
Turbidity*	00010		Report	NTU	In-situ	Quarterly				
Sodium, Total Recoverable	00923		160	MG/L	Grab	Quarterly				
Specific Conductance*	00095		Report	UMHO/CM	In-situ	Quarterly				
Temperature (C), Water*	00010		Report	DEG.C	In-situ	Quarterly				1
Dissolved Oxygen*	00300		Report	MG/L	ln-situ	Quarterly				
* The field parameters shall be sampled pt field parameters to be reported on Part D α	er DEP-SOP-00. of GW DMR shal	1/01, FS 2200 Gro Il be the last samp	undwater Sampli le recorded.	ing and record	led, (see Figure FS	3 2200-2 Groundwater Pu	Irging Procedure and	Form FD 9000-24, Gr	undwater Sampling Log	g). The

GROUND WATER MONITORING WELL REPORT - PART D

Manatee

County:

Compliance **MWC-02**

Monitoring Well ID:

Samples Filtered (IL/F/N) Sampling Equipment Used Schroeder Manatee Ranch (SM-C2) Analysis Method Detection Limits Time Sample Obtained: Date Sample Obtained: Description: Well Type: Monitoring Frequency Quarterly Ouarterly Quarterly Quarterly Quarterly Quarterly Sample Type In-situ In-situ In-situ In-situ In-situ In-situ Grab IMHO/CM #/100ML DEG.C MG/L MG/L Units FEET MG/L MG/L NG/L MG/L UG/L UG/L MG/L NTU UG/L SU Manatee County Master Reuse System (MCMRS) Requirement 6.5 to 8.5 Report Report Report Report Permit Report 160 250 500 250 100 15 10 10 4 5 To: Sample Measurement γN PARM Code 00010 00300 00095 FLA474029 8/600 00940 01113 01118 01114 74055 00400 00945 00070 00923 70295 82545 00620 Yes From: Was the well purged before sampling? Water Level Relative to NGVD Chromium, Total Recoverable Vitrogen, Nitrate, Total (as N) solids, Total Dissolved (TDS) Cadmium, Total Recoverable sodium, Total Recoverable Arsenic, Total Recoverable Parameter emperature (C), Water* cad. Total Recoverable specific Conductance* Dissolved Oxygen* Monitoring Period Chloride (as Cl) Coliform, Fecal Permit Number: Facility Name: Sulfate, Total **furbidity*** <u>*</u>

* The field parameters shall be sampled per DEP–SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The field parameters to be reported on Part D of GW DMR shall be the last sample recorded.

Samples Filtered (L/F/N) * The field parameters shall be sampled per DEP–SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The field parameters to be reported on Part D of GW DMR shall be the last sample recorded. Sampling Equipment Used Background Buffalo Creek Golf Course (P-B1) Analysis Method **MWB-04** Detection Limits Time Sample Obtained: Date Sample Obtained: Monitoring Well ID: Well Type: **GROUND WATER MONITORING WELL REPORT - PART D** Description: Monitoring Frequency Quarterly Sample Type In-situ In-situ In-situ In-situ In-situ In-situ Grab JMHO/CM #/100ML DEG.C Units FEET MG/L MG/L UG/L UQ/L UQ/L MG/L MG/L MG/L UG/L MG/L NTU SU Manatee County Master Reuse System (MCMRS) Requirement Report Report Report Report Permit Report To: Measurement Sample No PARM Code FLA474029 82545 00620 87900 00940 01113 70295 01118 01114 74055 00400 00945 00070 00923 00095 00010 00300 Yes Manatee From: Was the well purged before sampling? Water Level Relative to NGVD Vitrogen, Nitrate, Total (as N) solids, Total Dissolved (TDS) Chromium, Total Recoverable Cadmium, Total Recoverable Parameter Arsenic, Total Recoverable Sodium, Total Recoverable ead, Total Recoverable Femperature (C), Water* Specific Conductance* Monitoring Period Dissolved Oxygen* Permit Number: Chloride (as Cl) Facility Name: Coliform, Fecal Sulfate, Total **Uurbidity*** County: Ť,

GROUND WATER MONITORING WELL REPORT - PART D

Buffalo Creek Golf Course (P-5B, 35477 MWB-P5B)

Intermediate **MWI-06**

Monitoring Well ID: Well Type:

Manatee County Master Reuse System (MCMRS)

Manatee

Facility Name:

County:

Description:

Samples Filtered (L/F/N) Sampling Equipment Used Analysis Method Detection Limits Time Sample Obtained: Date Sample Obtained: Monitoring Frequency Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Ouarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Quarterly Sample Type In-situ In-situ In-situ In-situ In-situ In-situ Grab JMHO/CM #/100ML DEG.C MG/L UG/L MG/L MG/L Units MG/L MG/L NG/L MG/L UG/L UG/L NTU FEET SU Requirement Report Report Report Report Report Report Report Report Report Permit Report Report Report Report Report Report Report To: Sample Measurement ů PARM Code 00010 00400 00095 00300 FLA474029 82545 00620 70295 87900 00940 01113 01114 74055 00945 00070 00923 01118 Yes From: Was the well purged before sampling? Water Level Relative to NGVD Chromium, Total Recoverable Nitrogen, Nitrate, Total (as N) Solids, Total Dissolved (TDS) Cadmium, Total Recoverable Sodium, Total Recoverable Arsenic, Total Recoverable Parameter l'emperature (C), Water* cad, Total Recoverable Specific Conductance* Dissolved Oxygen* Monitoring Period Chloride (as Cl) Coliform, Fecal Permit Number: Sulfate, Total **Furbidity*** *He

* The field parameters shall be sampled per DEP-SOP-001/01, FS 2200 Groundwater Sampling and recorded, (see Figure FS 2200-2 Groundwater Purging Procedure and Form FD 9000-24, Groundwater Sampling Log). The field parameters to be reported on Part D of GW DMR shall be the last sample recorded.

County: Facility Name: Permit Number: Monitoring Period Was the well purged before sampling?	Manatee Manatee Coun FLA474029 From: Yes	ty South Master F	teuse System (M To:	CMRS)		Monito Well Ty Descrip Date Sa Time Sk	ring Well ID: pe: ution: umple Obtained: ample Obtained:	MWC-04 Compliance Buffalo Creek Golf C	ourse (P-C1)	
Parameter	PARM Code	Sample Measurement	Permit Requirement	Units	Sample Type	Monitoring Frequency	Detection Limits	Analysis Method	Sampling Equipment Used	Samples Filtered
Water Level Relative to NGVD	82545		Report	FEET	In-situ	Quarterly				(L/L/N)
Nitrogen, Nitrate, Total (as N)	00620		10	MG/L	Grab	Quarterly				
Solids, Total Dissolved (TDS)	70295		500	MG/L	Grab	Quarterly				
Arsenic, Total Recoverable	00978		10	NG/L	Grab	Quarterly				
Chloride (as Cl)	00940		250	MG/L	Grab	Quarterly				
Cadmium, Total Recoverable	01113		5	UG/L	Grab	Quarterly				
Chromium, Total Recoverable	01118		001	UG/L	Grab	Quarterly				
Lead, Total Recoverable	01114		15	UG/L	Grab	Quarterly				
Coliform, Fecal	74055		4	#/100ML	Grab	Quarterly				1
pH*	00400		6.5 to 8.5	SU	In-situ	Quarterly				
Sulfate, Total	00945		250	MG/L	Grab	Quarterly				
Turbidity*	00070		Report	NTU	In-situ	Quarterly				
Sodium, Total Recoverable	00923		160	MG/L	Grab	Quarterly				
Specific Conductance*	00095		Report	UMHO/CM	In-situ	Quarterly				
Temperature (C), Water*	00010		Report	DEG.C	In-situ	Quarterly				
Dissolved Oxygen*	00300		Report	MG/L	In-situ	Quarterly				

recorded. 1

COMMENTS AND EXPLANATION (Reference all attachments here):

GROUND WATER MONITORING WELL REPORT - PART D

med water data. All domestic wastewater a are different.				calculate an average for that parameter fluent limit, whichever is lower, shall be		number, whether the limits and monitoring d the instructions shown in the permit. The	g group number; however, if the monitoring collected and analyzed. I that the data correspond to the monitoring o the appropriate statistical base code (e.g.	iber of times the measurement was made in	ace above the shaded area. fficial may be reached in the event there are	d, reference all attachments in this area.	
nd of the monitoring period. acility. Facilities may have one or more Part A's for reporting effluent or recla monitoring well data. explanation provided where appropriate. Note: Codes used on Part B for raw da	DESCRIPTION/INSTRUCTIONS	o discharge from/to site. perations were shutdown so no sample could be taken. ther. Please enter an explanation of why monitoring data were not available. ampling equipment failure.	al quantification limits, the following instructions should be used:	s MDL value. These values shall be deemed equal to the MDL when necessary t atory's MDL value, e.g. < 0.001 . A value of one-half the MDL or one-half the e MDL are considered to demonstrate compliance with an effluent limitation.		acility information is preprinted in the header as well as the monitoring groun, etc.). Submit Part A based on the required reporting frequency in the header i	des to be entered for all of the parameters on the DMR for the entire monitori dividually denote those parameters for which there was no discharge. . the month, the quarter, the year, etc.) during which the data on this report we ollected correspond to the limit indicated on the DMR (i.e. interim or final) a non-shaded area above the limit. Be sure the result being entered correspond	mit limit for each parameter in the non-shaded area. If none, enter zero. neasurement is required to be made according to the permit. Enter the actual nu	uous) required by the permit. Enter the actual sample type that was taken in the name and title of the signing official. Include the telephone number where the humane and title or other items which require explanation. If more space is need	by-pass events, or other items which require explanation. If more space is need	
upplicable to every orting ground water of the DMR and a	CODE	NOD OPS OFH SEF	sction limits or prac	ntity. ed as the laboratory followed by the lab . Values less than 1		ader information. /, annually, quarter	here are no data or e should be used to monitoring period (to see that the data or this row in th	hat exceeded the pe umber of times the	b, composite, conti C. Type or print th	dances, any upset o	
Recilities will have a Part B for reporting daily sample results. Part D is used for report When results are not available, the following codes should be used on parts A and D	CODE DESCRIPTION/INSTRUCTIONS	ANCAnalysis not conducted.DRYDry WellFLDFlood disaster.FLDInsufficient flow for sampling.LSLost sample.MNRMonitoring not required this period.	When reporting analytical results that fall below a laboratory's reported method deter	 Results greater than or equal to the PQL shall be reported as the measured quar 2. Results less than the PQL and greater than or equal to the MDL shall be report and when determining compliance with permit limits. Results less than the MDL shall be reported by entering a less than sign ("<") fused for that sample when necessary to calculate an average for that parameter. 	PART A -DISCHARGE MONITORING REPORT (DMR)	Part A of the DMR is comprised of one or more sections, each having its own het requirements are interim or final, and the required submittal frequency (e.g. monthly following should be completed by the permittee or authorized representative:	No Discharge From Site: Check this box if no discharge occurs and, as a result, the group includes other monitoring locations (e.g., influent sampling), the "NOD" code Monitoring Period: Enter the month, day, and year for the first and last day of the 1 Sample Measurement: Before filling in sample measurements in the table, check in group number in the header. Enter the date or calculated results for each parameter	atimular average, monting average, single sample meaningm, every and unus. No. Ex.: Enter the number of sample measurements during the monitoring period the Frequency of Analysis: The shaded areas in this column contain the minimum nutrient entert obtained before the monitoring period the provident of the monitoring period period period period period period period perio	support above the shaded areas in this column contain the type of sample (e.g. grat Sample Type: The shaded areas in this column contain the type of sample (e.g. grat Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C questions concerning this report. Enter the date when the report is signed.	Comment and Explanation of Any Violations: Use this area to explain any exceed	

INSTRUCTIONS FOR COMPLETING THE WASTEWATER DISCHARGE MONITORING REPORT

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160, F.A.C., contains a complete list of all the data qualifier codes that your laboratory may use when reporting analytical results. However, when transferring numerical results onto Part B of the DMR, only the following data Daily Monitoring Results: Transfer all analytical data from your facility's laboratory or a contract laboratory's data sheets for all day(s) that samples were collected. Record the data in the units indicated. Table 1 in Chapter 62-Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed. qualifier codes should be used and an explanation provided where appropriate. CODE | DESCRIPTION/INSTRUCTIONS

CODE	
v	The compound was analyzed for but not detected.
A	Value reported is the mean (average) of two or more determinations.
ſ	Estimated value, value not accurate.
0	Sample held beyond the actual holding time.
Υ	Laboratory analysis was from an unpreserved or improperly preserved sample

Add the results to get the Total and divide by the number of days in the month to get the Monthly Average. Plant Staffing: List the name, certificate number, and class of all state certified operators operating the facility during the monitoring period. Use additional sheets as necessary.

PART D - GROUND WATER MONITORING REPORT

Monitoring Period: Enter the month, day, and year for the first and last day of the monitoring period (i.e. the month, the quarter, the year, etc.) during which the data on this report were collected and analyzed. Date Sample Obtained: Enter the date the sample was taken. Also, check whether or not the well was purged before sampling.

Time Sample Obtained: Enter the time the sample was taken.

Sample Measurement: Record the results of the analysis. If the result was below the minimum detection limit, indicate that.

Detection Limits: Record the detection limits of the analytical methods used.

Analysis Method: Indicate the analytical method used. Record the method number from Chapter 62-160 or Chapter 62-601, F.A.C., or from other sources.

Sampling Equipment Used: Indicate the procedure used to collect the sample (e.g. airlift, bucket/bailer, centrifugal pump, etc.)

Samples Filtered: Indicate whether the sample obtained was filtered by laboratory (L), filtered in field (F), or unfiltered (N)

Signature: This report must be signed in accordance with Rule 62-620.305, F.A.C. Type or print the name and title of the signing official. Include the telephone number where the official may be reached in the event there are questions concerning this report. Enter the date when the report is signed.

Comments and Explanation: Use this space to make any comments on or explanations of results that are unexpected. If more space is needed, reference all attachments in this area.

SPECIAL INSTRUCTIONS FOR LIMITED WET WEATHER DISCHARGES

Flow (Limited Wet Weather Discharge): Enter the measured average flow rate during the period of discharge or divide gallons discharged by duration of discharge (converted into days). Record in million gallons per day (MGD)

The average flow rate can be calculated based on two measurements; one made at the start Flow (Upstream): Enter the average flow rate in the receiving stream upstream from the point of discharge for the period of discharge. and one made at the end of the discharge period. Measurements are to be made at the upstream gauging station described in the permit.

Actual Stream Dilution Ratio: To calculate the Actual Stream Dilution Ratio, divide the average upstream flow rate by the average discharge flow rate. Enter the Actual Stream Dilution Ratio accurate to the nearest 0.1.

No. of Days the SDF > Stream Dilution Ratio: For each day of discharge, compare the minimum Stream Dilution Factor (SDF) from the permit to the calculated Stream Dilution Ratio. On Part B of the DMR, enter an asterisk (*) if the SDF is greater than the Stream Dilution Ratio on any day of discharge. On Part A of the DMR, add up the days with an "*" and record the total number of days the Stream Dilution Factor was greater than the Stream Dilution Ratio.

CBOD;: Enter the average CBOD, of the reclaimed water discharged during the period shown in duration of discharge.

TKN: Enter the average TKN of the reclaimed water discharged during the period shown in duration of discharge.

Actual Rainfall: Enter the actual rainfall for each day on Part B. Enter the actual cumulative rainfall to date for this calendar year and the actual total monthly rainfall on Part A. The cumulative rainfall to date for this calendar year is the total amount of rain, in inches, that has been recorded since January 1 of the current year through the month for which this DMR contains data.

Rainfall During Average Rainfall Year: On Part A, enter the total monthly rainfall during the average rainfall year and the cumulative rainfall for the average rainfall for the average rainfall for the average rainfall bear is the amount of rain, in inches, which fell during the average rainfall year from January through the month for which this DMR contains data.

No. of Days LWWD Activated During Calendar Year: Enter the cumulative number of days that the limited wet weather discharge was activated since January 1 of the current year.

Reason for Discharge: Attach to the DMR a brief explanation of the factors contributing to the need to activate the limited wet weather discharge.

REPORT OF THE GEOTECHNICAL INVESTIGATION

SOUTHEAST WATER RECLAMATION FACILITY 10 MG GST & HSPS PROJECT MANATEE COUNTY, FLORIDA

Geotechnical Engineering & Construction Materials Testing McKim & Creed 3802 Ehrlich Road Suite 306 Tampa, Florida 33624

IGGER

Attention: Mr. Mathew S. Love, P.E.

S

RE: Report of the Geotechnical Investigation Southeast Water Reclamation Facility 10 MG GST & HSPS Project Manatee County, Florida Our File: DES 137207

ENGINEERING

Dear Mr. Love:

Pursuant to your authorization, **DRIGGERS ENGINEERING SERVICES**, **INC.** has completed a geotechnical investigation for the proposed improvements at the Water Treatment Facility. Results of our field and laboratory studies are included in this report together with our geotechnical design and construction recommendations.

It has been our pleasure to be of service to you and we trust, if you have any questions concerning our report, you will not hesitate to contact this office at your convenience.

Respectfully submitted, DRIGGERS ENGINEERING SERVICES, INC.

Wayne S. Driggers, P.E. Senior Geotechnical Engineer FL Registration No. 58013

F. Jaime Driggers, P.E.

SERVICES

INCORPORATED

September 17, 2013

F. Janne Driggers, P.E. President FL Registration No. 16989

WSD-REP\137207 Copies submitted: (4)

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No. 58013

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INTRODUCTION

Improvements to the facility will include the addition of a new 200-foot diameter 10 million gallon storage tank as well as construction of a new pump station. It is also our understanding that the installation of a 30-inch reclaimed water (RCW) line is planned. Included herein are the results of field and laboratory studies completed together with geotechnical recommendations for your consideration.

GEOTECHNICAL INVESTIGATION PROGRAM

Our geotechnical investigation program consisted of a series of Standard Penetration Test borings and Flat Dilatometer Soundings along with laboratory classification and consolidation testing.

STANDARD PENETRATION TEST BORINGS - Plate I of the attachments identifies the respective positioning of a series of Standard Penetration Test (SPT) borings that were performed at the subject site. Specifically, five (5) SPT borings were conducted within the proposed water storage tank to a depth of 75 feet below grade. A profile sheet including these tank area borings is provided in the attachments. Two (2) borings (B-9 and B-10) were conducted along the proposed 30-inch RCW line to a depth of 20 feet. Borings B-3 was performed within the general area of the proposed pump station and electrical building to a requested depth of 20 feet. The proposed boring B-2, however, was not performed because the boring was positioned within the existing pond feature and could not be relocated north of the pond due to the presence of an existing water line, the location of which was not known by the plant representative.

The SPT borings were performed in general accordance with ASTM D-1586. Logs of the test borings are presented in the report attachments reflecting visual together with estimated Unified Soil Classification. Also included on each log are tabulated and graphically plotted Standard Penetration resistance values corresponding to each sample interval. A brief description of the Standard Penetration method of sampling used in our study is included in the report attachments.

FLAT DILATOMETER (DMT) SOUNDINGS - The SPT borings identified a consistent zone of very loose silty to slightly clayey sands within the upper 15 to 20 feet as well at the presence of firm clays below that within the upper 30 to 35 feet. In order to obtain more refined, continuous information relative to the characteristics of this zone and potential compressibility,

Flat Dilatometer Test (DMT) soundings were performed. The DMT soundings were performed in accordance with ASTM D-6635. The results of the DMT Soundings are provided in the attachments.

LABORATORY TESTING - A limited program of laboratory classification testing was performed on representative soil samples. Our laboratory tests included grainsize analyses, Atterberg limits and organic content tests as deemed appropriate. The results of these classification tests are appended.

A one-dimensional consolidation test was also performed on a Shelby tube sample secured at boring B-6 from 20 to 22 feet below grade. The results of the consolidation test are included in the attachments in the form of a graph of void ratio versus the effective vertical pressure.

GENERALIZED SURFACE CONDITIONS

SOIL CONDITIONS - The subsurface soil profile consists of an upper unit of predominantly fine sands with trace silt fines content to depths of about 10 to 12 feet. Standard Penetration resistance data typically revealed a medium dense relative density. A transitional zone of very loose to loose, silty to clayey sands and phosphatic sands was encountered to the surface of a firm to stiff clay to a depth of about 33 feet. Below this average depth, the clays were typically cemented until a zone of firm to stiff clays were again encountered beginning about 43 feet below grade. Below about 53 feet, a variably cemented dolomitic silt and clay was encountered, which is the dolomitic limestone formation. This dolomitic unit continued to the completion depth of the borings with the degree of cementation lessening below about 65 feet.

<u>**GROUNDWATER CONDITIONS</u></u> - Groundwater was recorded during the course of our geotechnical investigation in the depth range of about 2.5 to 4 feet below the existing ground surface within the areas of the planned water storage tank and pump station/electrical building. Based on the existing grades in the area, this equates to an approximate elevation of about EL +31.5\pm feet to EL +32.0\pm feet. You will note that these observations were obtained during a period of moderate to increased rainfall which had cumulative rainfall somewhat higher than average for that time of year. Due to above average rainfall during the first half of the current year, we would expect that the groundwater elevations recorded herein would closely resemble normal wet season groundwater levels. We would anticipate that groundwater would drop about 3 feet during the typical dry months of the year.</u>**

Groundwater was recorded along the RCW pipe alignment (B-9 and B-10) at depths ranging from 5.5 feet to greater than 10 feet below grade. The primary differences in these depths to groundwater are likely attributable to variations in surface topography.

GEOTECHNICAL EVALUATION AND RECOMMENDATIONS

PROPOSED CONSTRUCTION AND LOADING CONDITIONS - The proposed storage tank will have a nominal diameter of 200 feet and will storage approximately 10 million gallons. It is our understanding that an average contact pressure of about 2,700 psf is expected. It is contemplated that the tanks will be prestressed concrete of the Crom-type which will incorporate a concrete diaphragm floor and perimeter continuous footing. We were also informed that a new pump station and wet well will be constructed. The pump station structure will be placed on a mat foundation with a resulting bearing pressure of 450 psf. The bottom of the pump station wet well will be about 13.4 feet below grade with a base of well bearing stress of about 1,000 psf. A new 30-inch reclaimed water (RCW) pipeline is also planned.

Although we have not been provided with details of proposed grades, we would anticipate only minor grade changes to accommodate the proposed finished floor elevation for the tank and pump station structure.

PROPOSED 10 MG STORAGE TANK – The borings conducted have revealed the presence of a zone of loose sands and silty sands about 10 to 15 feet below grade followed by moderately compressible clays within the upper 30 feet below grade. These materials have the potential to produce modest settlement when subjected to the bearing pressures discussed above.

<u>Predicted Settlement</u> - We anticipate that tank settlement will occur as a result of compression of relatively shallow very loose to loose sands below the depth-of-effect of surface compaction as well as through the consolidation or compression of intermediate clay soils primarily within the upper 30 feet. The magnitude of expected settlement is the function of the thickness and lateral extent of the compressible zones. The upper sandy soils are expected to produce settlements of perhaps 1 inch, or less, on the tank interior. These settlements will occur virtually instantaneously with the application of stress. The deeper clay unit is estimated to result in settlement of the tank interior on the order of 2.5 to 3 inches. Adding this to the settlement of the upper loose sandy zones could result in maximum interior settlements in the range of 3.5 to 4 inches. Settlements at the tank perimeter would generally be expected to be about 50% of that of the interior or perhaps

range from 1.75 to 2 inches. From previous experience, we would anticipate that these predicted total and differential settlements are within the range that can be tolerated considering the Crom-type tank construction contemplated on this project.

Even though the above noted movements are considered relatively modest and can probably be tolerated without structural distress, we would certainly suggest giving consideration to influent and effluent piping connections to allow for modest rotation.

Where the above magnitudes of expected settlements are considered intolerable, consideration could be given to deep ground improvement such as Vibro-replacement stone columns. Vibro-replacement stone columns are generally installed on a design-construct basis by proprietary contractors consistent with acceptable total and differential settlement specified by the tank design consultant. Pile foundations could also be considered but would probably not be economical compared to ground improvement.

<u>Subgrade and Fill Preparation</u> - Presuming that the above noted magnitudes of predicted settlement are within an acceptable range, subgrade preparation should consist of stripping the surficial vegetation plus a margin of not less than 5 feet beyond the foundation perimeter. Careful inspection should be planned at that time to ensure removal of any unsuitable underlying materials. The subgrade should then be uniformly compacted utilizing a heavy vibratory roller having a minimum static drum weight of 5 tons. Compaction should consist of no less than ten (10) complete coverages in a criss-cross pattern throughout the entire tank area plus the 5 foot margin. Compaction should continue so as to develop a uniform density of not less than 95% of the Modified Proctor maximum dry density per ASTM D-1557. Compaction tests should be conducted on a frequency of not less than one (1) test for each 2,500 SF and for each 50 foot of foundation perimeter. The foundation perimeter for the tank structure should be densified at the bottom of footing elevation to the above density.

Fill or backfill placed to establish design grade should consist of clean, cohesionless fill comprising the SP to SP-SM Unified Soil Classification or the AASHTO A-3 Classification. Each lift should not exceed 12 inches with each lift uniformly compacted to no less than the 95% Modified Proctor maximum dry density.

Your attention is directed to the possibility that some control and management of groundwater may be required depending upon antecedent rainfall levels at the time of construction. Groundwater levels should be maintained no less than 12 inches below the lowest elevation of compaction. Moisture content should be controlled at the subgrade level and throughout all fill lifts to within $\pm 2\%$ of the optimum moisture as established by the Modified Proctor moisture density relationship of ASTM D-1557.

It is important that a representative of the project geotechnical engineer be present during all earthwork operations to check that effective compaction is being achieved and, identify unsuitable materials that would warrant removal and replacement and to check for compaction in accordance with specification requirements.

<u>Performance Observations</u> - The prediction of total and differential settlement is certainly not an exact science and is based upon both geotechnical analyses and judgment utilizing available geotechnical information. Accordingly, we would strongly recommend establishing elevation points throughout the tank structure to permit observations of settlements during initial tank filling and following completion of filling for as long as practical, but not less than thirty (30) days following complete filling in an effort to detect areas where settlements may be projected to exceed predicted levels so that remedial measures, if needed, can be effected. At the appropriate time, we would be desirous of working with your office and the contractor to select locations for settlement monitoring.

Specific elevation readings should be obtained to an accuracy of at least ± 0.002 feet on a daily basis during filling and at least twice weekly thereafter until settlements have virtually ceased. Some adjustment in observation frequency may be warranted pending the results of early stage observations.

It is very important that these settlement observations be referenced to a relatively fixed benchmark. A good candidate for a fixed benchmark would be the presence of any deep well casing or something that may be firmly embedded or grouted into the underlying limestone formation well away from the tank structure that would be very unlikely to sustain any movement during the observation period. If no such benchmark is available, there would be merit in drilling and installing a casing into the underlying limestone formation to serve as a fixed benchmark for future reference.
<u>WETWELL STRUCTURE</u> - Boring B-2 was intended to be conducted at the planned Pump Station site. However, since the boring and pump station is within an existing pond, the boring was not conducted at this time. Boring B-3, which is about 30 to 40 feet away, is the closest boring to the pump station site. Based on the survey information provided, the bottom of the existing pond is at about EL +26 feet. The pump station finished floor will be at about EL +34.5 feet which will necessitate about 8 feet of fill. However, it is important to note that the current pond is a dug pond and thus the addition of the weight of the fill will result in recompression of the soils below as opposed to new load and resulting settlement.

The bottom of the proposed wet well will be at a depth of about 13.4 feet below the finished floor elevation. Based on the information provided, the total operational weight of the wet well and pump assemblies will result in an imposed soil bearing stress of about 1,000 psf which results in a minor net increase in soil pressure compared to the previously present overburden soils. Based on boring B-3, a light gray and brown slightly silty fine sand is expected which was underlain by a light brown sand to a depth of 18 feet. These materials would be considered suitable for support of the proposed wet well structure. However, it should be recognized that boring B-3 was performed 30 to 40 feet from the pump station. Thus, once access is gained to this area, an additional boring should be conducted.

<u>Subgrade Preparation</u> - Based on the B-3 subsurface conditions, we would not anticipate the need for a gravel bedding material from a geotechnical perspective. The bottom of the excavation should be compacted utilizing hand guided vibratory compaction equipment until a density of at least 95% of the Modified Proctor maximum dry density. However, should a gravel working platform be desired for construction reasons or should the additional boring conducted at a later date reveal soils with moderate to increased plasticity, a geotextile fabric such as Mirafi 140N (or equivalent) should be placed on the excavation bottom and draped up the sides of the excavation to accommodate the placement of a compacted 12-inch thick gravel working platform corresponding to grading no coarser than FDOT No. 57 aggregate. The No. 57 aggregate should be uniformly compacted so as to develop a firm and unyielding subgrade for subsequent mat foundation construction. The geotextile should then be wrapped over the top of the gravel bedding to prevent the migration of sands into the gravel.

Following proper subgrade preparation as recommended herein, we would anticipate settlements of the wet well assembly to be less than 1 inch and largely related to

recompression of materials below the wet well. We would expect this settlement would occur virtually coincident with the replacement of backfill soils and installation of the pump and piping. Further, we would anticipate relatively uniform settlement provided that appropriate plumbness is maintained during backfilling operations and extraction of any sheeting that may be utilized. Although the settlement magnitudes are relatively modest, consideration should be given to the timeliness of influent and effluent piping connections so as to avoid any excessive stresses on the piping. It would also be prudent to maintain observations of elevations of the structure during the backfilling operations to check that settlements are consistent with expected levels and confirm that settlements are virtually complete prior to making final piping connections.

Backfill or Fill Suitability - The project will include compaction of backfill and fill around the wet well cans. Suitable backfill and fill shall be granular materials that are densified to no less than 95% of the Modified Proctor maximum dry density per ASTM D-1557. Backfill and fill soils comprising the SP to SP-SM Unified Soil Classification (AASHTO A-3) would represent suitable materials for use as compacted backfill. The majority of the soils excavated to permit construction of the wet well should be suitable for backfill placement.

The backfill material should be placed and compacted so as to achieve a uniform density of not less than 95% of the Modified Proctor maximum dry density per ASTM D-1557. These soils should be backfilled in thin lifts not exceeding 12 inches with each lift compacted utilizing hand-guided vibratory compaction equipment. Larger self-propelled units should be avoided due to the fact that they may develop excessive lateral earth pressures that could result in damage to the underground structures. Soils to be utilized as backfill excavated below the groundwater table would require appropriate adjustment in moisture content for replacement and compaction. Moisture content should be controlled to within $\pm 2\%$ of optimum moisture as established by the Modified Proctor moisture density relationship to facilitate compaction.

<u>**PUMP STATION STRUCTURE</u></u> - Based on the results of boring B-3, the planned mat foundation for the pump station structure above the wet wells may be supported on compacted fill or backfill. Settlements are estimated to be on the order of 0.5 inch for the foundation based upon the provided average contact pressure of about 450 psf. You will note that the new stresses from the pump station structure will likely also induce minor additional settlement of the pump cans. For the mat supported structure, we would suggest consideration of a maximum peak allowable</u>**

soil bearing pressure of up to 1,500 pounds per square foot and a subgrade modulus of 10 pounds per cubic inch for the mat foundation design.

As mentioned previously, the proposed pump station building will extend into an existing pond/swale that will require filling. Therefore, subgrade preparation should consist of stripping the surficial vegetation, any compressible sediments and potential highly organic soils that may be present in the bottom of the pond/swale. The stripping should extend at least 5 feet beyond the foundation perimeter. Careful inspection should be planned at that time to ensure removal of any unsuitable underlying materials. The subgrade should then be uniformly compacted utilizing a hand-guided vibratory roller to prevent damage to the nearby wet well. Compaction should consist of no less than ten (10) complete coverages in a criss-cross pattern throughout the pump station structure plus the 5 foot margin. Compaction should continue so as to develop a uniform density of not less than 95% of the Modified Proctor maximum dry density per ASTM D-1557.

PLANNED 30-INCH RECLAIMED WATER PIPELINE - The proposed underground piping will be embedded a nominal 3 to 10 feet below grade. In general, our geotechnical investigation indicates that the subgrade soils within the depths contemplated consist predominantly of sandy soils comprising the SP to SP-SM Unified Soil Classification and the AASHTO A-3 classification. These soils should provide suitable subgrade support with routine subgrade preparation in accordance with applicable specifications. Pipe settlement is expected to be limited to less than 1 inch and the settlement should occur quickly following backfill placement.

In general, the soils excavated for pipe embedment would be suitable from a geotechnical perspective for re-use as compacted backfill with proper moisture control and compaction. Commonly, these soils consisted of fine sands and slightly silty sands representing the SP to SP-SM or A-3 designations. Backfill soils should be compacted to at least 95% of the Modified Proctor maximum dry density ASTM D-1557 or to applicable project specifications, whichever is more stringent.

Where soils may be excavated below the pre-construction groundwater table, these soils may occur in an elevated moisture content even with the utilization of construction dewatering. These soils will likely require aeration to reduce the moisture content to facilitate placement and compaction to project specification requirements. We would suggest that the moisture contents be controlled within $\pm 2\%$ of the optimum moisture content as established by the Modified Proctor moisture density relationship of ASTM D-1557.

<u>SOIL STRENGTH PARAMETERS</u> - As mentioned, there will be various below grade structures as well as potential temporary earth retention systems to aid construction. Accordingly, the following geotechnical parameters are considered preliminary for use in the analyses of the various structures.

Soil Consistency	Total Unit Weight (pcf)	Buoyant Unit Weight (pcf)	Angle of Internal Friction, φ	Undrained Shear Strength (psf)	Active Earth Pressure Coefficient (Ka)	At-Rest Earth Pressure Coefficient (Ko)	Passive Earth Pressure Coefficient (Kp)
<u>Very loose</u> fine sands and slightly silty sands	115	55	28	-	0.36	0.53	2.7
Loose fine sands and slightly silty sands	120	60	30	*	0.33	0.5	3.0
Medium dense fine sands and slightly silty sands	120	60	32	-	0.30	0.47	3.33
<u>Firm</u> Clays	110	50		- 1,000	-	-	

Note: Properly compacted sands and non-plastic slightly silty and silty sands would likely possess a medium dense relative density for use in analyses.

Naturally, an appropriate factor of safety should be utilized in the design of earth retaining structures and one must consider potential surcharge loads both during and after construction. The coefficient of sliding friction (Tan δ) for concrete on compacted sands or gravel equal to 0.45 should be utilized in design.

<u>GEOTECHNICAL CONSTRUCTION CONSIDERATIONS</u> - We would expect that most, if not all of the construction will take place in and open sloped excavation. Where open-

excavations are contemplated, the contractor should comply with all the applicable City or County Standards for pipe construction. However, based on the soil types encountered, we would recommend construction side slopes no steeper than 1.5 horizontal to 1 vertical provided that effective dewatering is developed and maintained during the excavation and backfilling operations. Naturally, the contractor must also comply with applicable OSHA trench safety requirements.

We would also anticipate that portions of the below grade construction where deeper excavations are planned or where adjacent utilities may be present may incorporate trench box methodologies or sheeting. Careful consideration must be given to earth pressures, including hydrostatic pressures as well as horizontal stresses from surface loading. Where implemented, techniques should be utilized so as to minimize any vibrations and disturbance of previously placed piping or existing utilities during installation and advancement of the trench box. Also, where existing utilities or structures may occur within close proximity to wet well or pipeline construction, the contractor must exercise due care so as to avoid any deformation or damage to existing facilities. Clearly, techniques that would involve significant vibration such as vibratory sheeting installation and extraction or heavy vibratory compaction equipment should be avoided. where possible. Compaction of backfill in such areas should be performed utilizing relatively light hand-guided vibratory compaction equipment in thin lifts not in excess of 6 inches so as to achieve uniform compaction consistent with the equipment selected for compaction. We would certainly recommend that elevations be established on existing utilities or structures and that elevations be carefully monitored during all excavation and construction activities to detect any movements that might signal a need for a modification in the ways and means of construction. It would also be prudent to monitor vibrations within critical areas.

Appropriate dewatering is a critical aspect of construction of the wet well and piping so as to allow proper preparation of the subgrade and appropriate backfilling and compaction of surrounding soils. Improper implementation of dewatering can result in de-stabilization of the subgrade soils which can cause enhanced total and differential settlement. It is recommended that the dewatering system consist of a properly designed wellpoint system. Due to the stratified nature of the soils and the required depth of dewatering, we would strongly recommend that the contractor retain the services of a qualified dewatering consultant to appropriately design and monitor performance of the dewatering system. As a minimum, the wellpoints should be fully slotted and encased in properly designed filter media for more effective dewatering. The dewatering system should be installed so as to maintain groundwater levels to no less than 1.5 feet below the planned bottom of the excavation bottom.

Due to the relatively wide spacing of borings along the pipeline alignment, careful geotechnical inspection will be critical during the construction stage. Accordingly, it is our recommendation that a representative of the project geotechnical engineer be retained to monitor the pipeline construction activity to detect areas that may warrant special treatment or remediation. Appropriate compaction tests should also be performed as required by project specification requirements.

LIMITATIONS

Our Geotechnical Investigation was conducted for the purpose of investigating generalized subsurface conditions to assist in the design of the planned facilities and to provide general information for use in construction. Our investigation may not have included development of all subsurface soils information that may be needed by the prospective contractor in the development of their construction procedures. The contractor is certainly encouraged to conduct such additional investigations as they may deem necessary to develop his bid proposal.

NEED FOR FURTHER TESTING

As discussed in the report text, a boring at the actual pump station could not be conducted at this time since the pump station is positioned within an existing pond. Conducting a boring at this time would necessitate mobilization of our barge and conducting the boring with our barge mounted drilling equipment. An alternative to conducting the boring at this time would be to conduct the boring once the area of the pond where the pump station is planned is drained to facilitate subgrade and fill preparation.

APPENDIX

PLATE I - BORING LOCATION PLAN

TANK AREA SOIL BORING PROFILES

STANDARD PENETRATION TEST BORING (SPT) LOGS

RESULTS OF DILATOMETER TEST SOUNDINGS

SUMMARY OF LABORATORY TEST RESULTS

GRAINSIZE ANALYSES

RESULTS OF CONSOLIDATION TESTING

METHOD OF TESTING

PLATE I - BORING LOCATION PLAN

TANK AREA SOIL BORING PROFILES

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STANDARD PENETRATION TEST BORING LOGS



Proje	ect No	. <u>C</u>	ES 137	7207	Essility 10	BORING	NO. <u>B-</u>	 	nation A	A	0			
Loca	tion	See	Plate I	eciamation	Facility 10	ivig water st	orage rar	Foren	nection, N	/ianatee r	Coun	ty, F	L	-
Com	pletio	n			a fair a f	Depth To	17.3							-
De	epth_	2	1.5'	Date	8/6/13	Water	2.4'	Time		Date	۱. <u></u>	8/6/	13	_
DEPTH, FT	SYMBOL	SAMPLES	SURF.	SC EL:	DIL DESC	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	F Bl H (Al	STAN PENETRA LOWS/FT SAMPLE AMMER, UTOMAT	IDAR TION ON R-140 30" IC HA	D TES 2" O. D LB. DRO MME 40	T D. P R) 60	80
0		-	Brown	Fine SANI) with roots	(SP) (A-3)		_		· · · · ·				
- 5 -			Brownis Light gr with tra Dark br Brown a (SP-SM Medium	sh-gray Fin rayish-brow ce of roots rown Fine and light b 1) (A-3) b dense da	ne SAND wi vn Fine SAN s (SP) (A-3 SAND (SP) rown slighth	ith roots (SP) ND i)) (A-3) y silty Fine SA	(A-3)	3/5/6		•				
- 10 -			(SP) (A Loose li with trac Very loc with trac Very loc silty Fin	A-3) ight brown ce of roots ose tannis ce of shell ose grayis e SAND (Fine SANE (SP) (A-3 h-brown Fin (SP) (A-3 h-brown pho SM) (A-2-4) e SAND) osphatic, i)		3/2/3 2/2/2 						
- 15 -			Loose g (SP) (A	jrayish-bro 1-3) avish-gree	wn phosph	atic Fine SAN	D	4/5/5						
- 20 -			(CH) (A	A-7-6)				14/10/26				>		
- 25 -														
30 -														
35														
Rem	narks	Boi	ehole (I = Wei	Grouted ght of Hai	nmer			Ca	asing Le	ngth				

DRIGO	ERS ENGINEERING SERV	/ICES	NCORPORATED
Project No Project S Location Completio Depth	DES 137207 BORING NO. B-3 E Water Reclamation Facility 10MG Water Storage Tan See Plate I n Depth To 21.5' Date 8/6/13	k & Interconne Forema	ction, Manatee County, FL nD.S. Date 8/6/13
DEPTH, FT SYMBOL	SOIL DESCRIPTION SURF. EL: +35.4+/-'	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP (AUTOMATIC HAMMER) 10 20 40 60 80
0 5 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	Brown Fine SAND with trace of roots (SP) (A-3) Light grayish-brown Fine SAND (SP) (A-3) Dark brown Fine SAND (SP) (A-3) Tannish-brown Fine SAND (SP) (A-3) Light brown Fine SAND (SP) (A-3) Light brown Fine SAND with trace of roots (SP) (A-3) Medium dense tan Fine SAND (SP) (A-3) Medium dense tan Fine SAND (SP) (A-3) Medium dense tan Fine SAND (SP) (A-3) Firm dark grayish-brown phosphatic, slightly silty Fine SAND (SP-SM) (A-3) Firm dark grayish-green and light brown CLAY (CH) (A-7-6)	2/4/7 5/8/8 2/2/1 5/7/8 2/2/3	
35 Remarks	Borehole Grouted	Cas	ing Length



Project No	BORING NO. <u>B-4</u>	4	
Project S	E Water Reclamation Facility 10MG Water Storage Tar See Plate I	k & Interconnect	tion, Manatee County, FL
Completio Depth	n Depth To 76.5' Date 8/12/13 Water 2.7'	Foreman	D.S. Date 8/8/13
DEPTH, FT SYMBOL	SOIL DESCRIPTION SURF. EL: +34.5+/-'	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP
0	Dark brown Fine SAND with roots (SP) (A-3)		
5	Grayish-brown Fine SAND with some roots (SP) (A-3) Brown Fine SAND with some roots (SP) (A-3) Light brown Fine SAND (SP) (A-3)		
	and trace of rock fragments (SP) (A-3)	-	
	Medium dense light grayish-brown to grayish-brown slightly silty Fine SAND (SP-SM) (A-3)	9/10/10	
- 10 (11)(1) (11)(1) (11)(1) (11)(1)	Medium dense brown slightly silty Fine SAND (SP-SM) (A-3)	10/9/6	
	Very loose grayish-brown silty, slightly clayey Fine SAND with some phosphate (SM) (A-2-4)	1/0/1	
15	Loose gray and light brown clayey Fine SAND with phosphate to stiff gray and light brown sandy CLAY with phosphate (SC) to (CH) (A-2-6) to (A-7-6)	7/5/5	
20	Firm green and light brown CLAY (CH) (A-7-6)	3/4/4	
	Stiff dark gray sandy CLAY (CH) (A-7-6)		
25		4/4/7	
30 -	Stiff grayish-green CLAY (CH) (A-7-6)	5/4/8	
35	Hard grayish-green weakly cemented CLAY (CL) (A-7-6)		
Remarks	Borehole Grouted	Casin	g Length



Loca	pletio	See n	Plate	Data	8/10/10	Depth To	יד כ	Forei	nan	Dete	D.S.		0 / 4		
DEPTH, FT	SYMBOL	SAMPLES	SURF	_ Date _ S	OIL DESC			BLOWS ON SAMPLER PER 6" OR PEN. STR.	P BL H	STAN ENETRA .OWS/FT SAMPLE AMMER, 10 20	IDAI TIO . ON 	8/4 RD N T 1 2" 40 L " DI 40	ES O. B. RO	5 T D. P	80
	1.	A	Hard g (CL) (jrayish-gr A-7-6)	een weakly c	emented CLA	Y	5/17/50*	* 0.3'	Penetratio	on		-		T
40		 	Hard b (CL) (prownish-(A-7-6)	gray variably	cemented CL	AY	7/47/50*	* 0.2'	Penetratio	on_				
45		 Z	Firm g	rayish-gre	een CLAY (C	:H) (A-7-6)		5/3/5	-						
50 -		7	Stiff lig (CH) (ht grayish A-7-6)	n-brown silty	CLAY		29/6/8							
55 -			Hard li (CL) (<i>i</i> (Dolom	ght gray o A-7-6) nitic LIME	lolomitic, cen STONE Forn	nented, silty C nation)	LAY	50*	* 0.5'	Penetratio	on				
60 -		K					÷	50*	-* 0.2'	Penetratio	on—				
65 -			Very st variabl (Dolorr	iff grayish y cemente hitic LIME	n-green dolor ed CLAY (CI STONE Forn	nitic, _) (A-7-6) nation)		6/6/15							
70 Ren	1. Anarks	Bo	rehole	Grouted											Ц

DRIGGERS ENGINEERING S Project No. DES 137207 BORING NO Project SE Water Reclamation Facility 10MG Water Stora Location See Plate I	ERVICES II . <u>B-4</u> ge Tank & Interconnec Foreman	NCORI	POF e Cour D.S.	RATE	=□			
Completion Depth To Depth 76.5' Date 8/12/13 Water	2.7' Time	Da	ite	8/8/13				
DEPTH, FT SOIF DESCRIPTION	BLOWS ON SAMPLER PER	NO STANDARD NO STANDARD STANDARD PENETRATION BLOWS/FT. ON 2 SAMPLER-140 HAMMER, 30" [
Very stiff gravish-green dolomitic	0	10	20	40 60	80			
(Dolomitic LIMESTONE Formation)	13/10/14 _ - -							
	5/8/12							
80 -								
					\mathbb{H}			
85 -								
90 -								
95 -								

Remarks Borehole Grouted

- oasing congui	_	Casing	Length
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DRIGGERS ENGINEERING SERVICES INCORPORATED

Proje Proje	ect No	. <u>[</u> E V	DES 137207 BORING NO. B-	5 ak & Interconner	tion Man	atee Co	untv í	FI		
Loca	tion	Se	e Plate I	Forema	n	D.S	i.			
Com De	pletio pth	n	Depth To 76.4' Date 8/12/13 Water 3.0'	_ Time		Date _	8/12	2/13		
DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION SURF. EL: +35.0+/-'	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D SAMPLER-140 LB. HAMMER, 30" DROP					
0	N Z	Í	Dark brown Fine SAND with trace of roots							
	A States		(SP) (A-3) Dark reddish-brown slightly organic Fine SAND (SP) (A-3)							
			Light brown Fine SAND (SP) (A-3)				++	┼┼┼╂		
- 5 -	111121		Tan slightly silty Fine SAND (SP-SM) (A-3)				++	++++		
- 10 -			Medium dense light grayish-brown to light brownish-gray Fine SAND (SP) (A-3)	3/4/8 10/11/9 10/11/7						
			Very loose grayish-brown silty, clayey Fine SAND with trace of phosphate (SM-SC) (A-2-6)	1/1/2						
15 -			Very loose brownish-gray phosphatic Fine SAND (SP) (A-3)	3/2/2	•					
- 20 -		7	Firm light green and light brown CLAY (CH) (A-7-6)		•					
25 -		7	Stiff grayish-green weakly cemented CLAY (CH) (A-7-6)	4/4/6						
30 -		7	Stiff dark grayish-green sandy CLAY (CH) (A-7-6)	5/4/5						
35			Hard light brownish-gray variably cemented, sandy CLAY (CL) (A-7-6)							
Rem	narks	Bo	rehole Grouted	Casi	ng Lengt	h				



DEPTH, I	SYMBO	SAMPLE	SOIL DESCRIPTION	BLOWS (SAMPLER 6" OR PEN.	BL St	OWS/F SAMPL AMMEI	T. OI ER-1 R, 30	40 " D	C.LB.RO	P	90
	17	1	Hard light brownish-gray variably comented	30/50*	* 0.3' F	Penetra	tion	4			17
			sandy CLAY (CL) (A-7-6)							_	
- 40			Hard light grayish-green cemented CLAY with seams of dark grayish-green sandy CLAY (CL/CH) (A-7-6)	16/16/50*	* 0 2' F	Penetra	tion				
- 45			Firm to stiff grayish-green to light brownish-gray CLAY (CH) (A-7-6)	3/3/4							
- 50				10/5/7							
- 55			Hard light brownish-gray dolomitic, cemented, silty, sandy CLAY (CL) (A-7-6) (Dolomitic LIMESTONE Formation)	50*	-* 0.3' F	Penetra	tion				
- 60 -				50*	⁻ * 0.3' F	Penetra	tion				
- 65 -				6/10/32						/	
70		-	Very stiff dark grayish-green dolomitic CLAY (CH) (A-7-6) (Dolomitic LIMESTONE Formation)	-				/			
Rer	narks	Bo	prehole Grouted								
				Ca	sing Le	ngth					



Loca	tion	See Plat	e I		Danth Tr		Forem	ian	D.8	i		_	_
De	pietio	76.4'	Date	8/12/13	Water	3.0'	_ Time		Date	8/	12/	13	
DEPTH, FT	SYMBOL	SAMPLES	S(F. EL: +35.	OIL DESC 0+/-'	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	PEN BLOV SA HAM 10	STAND/ ETRATIC VS/FT. C MPLER- IMER, 3 20	ARD ON 1 ON 2' 140 0" D 4	ES " O LB. RO	T .D. P 60	8(
	1	Very (CH)	stiff dark gr (A-7-6)	ayish-green	dolomitic CLA	Y	11/13/16				\vdash	+	\parallel
	1	(Dold	omitic LIMES	STONE Form	nation)					+		+	Ħ
	1%	Hard	grayish-gre	en dolomitic	\ /A 7 C)							X	
75 -	//	(Dold	omitic LIMES	STONE Form	-) (A-7-6) nation)					-	Н	+	Ņ
	1.1	7					10/12/50*	* 0.4' Pen	etration_	-	$\left \right $	+	╫
												T	Ħ
_											\square	1	
80 -										+	H	+	॑
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									-	-		-	4
85 -	6									-	\vdash	+	+
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										+	H	+	+
95 -											\square	+	Ħ
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100 -											H	+	\ddagger
													Ħ
										-	Ц	1	Ц
40.0										-	H	+	H
105										_			1



Proje	ct No	BORING NO. B	-6	
Proje	tion	Water Reclamation Facility 10MG Water Storage Ta See Plate I	Ink & Interconnect	D.S.
Com	pletio pth	n Depth To 76.5' Date <u>8/7/13</u> Water 4.0'	Time	Date 8/6/13
DEPTH, FT	SYMBOL	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP (AUTOMATIC HAMMER) 10 20 40 60 80
0		Dark brown slightly silty Fine SAND with finely		
- 5		divided organic material and roots (SP-SM) (A-3) Gray Fine SAND with trace of roots (SP) (A-3) Dark reddish-brown Fine SAND (SP) (A-3) Tannish-brown Fine SAND (SP) (A-3) Light brown Fine SAND with trace of roots (SP) (A-3) Very loose light tan and light brown slightly silty Fine SAND with trace of roots (SP-SM) (A-3)	1/1/3	
- 10 -		Medium dense light tan Fine SAND (SP) (A-3)	E IOIE	
		Very loose grayish-brown silty Fine SAND with trace of phosphate (SM) (A-2-4)	WH/1/1	
- 15 -		Very loose light greenish-brown phosphatic, clayey Fine SAND (SC) (A-2-6)	1/2/1	
- 20 -		Firm dark gray and light brown CLAY (CH) (A-7-6)	1/3/2	
- 25 -		Stiff dark grayish-green to gray CLAY (CH) (A-7-6)	3/4/5	
- 30 -			3/4/6	
25	//	variably cemented CLAY (CL) (A-7-6)		
Ren	narks	Borehole Grouted		
		WR = Weight of Rod WH = Weight of Hammer	Casi	ng Length

Proje Proje	ect No ect <u>SI</u>		Ater Reclamation Facility 10MG Water Storage Tank	& Interconne	ection, Manate	e Coun	ity, F	Ľ	
Loca	tion i pletio	See n	Plate I Depth To	Forema	an	D.S.		_	
De	pth_	7	76.5' Date 8/7/13 Water 4.0'	Time	Da	ite	8/6/	13	_
DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION SURF. EL: +35.5+/-'	BLOWS ON SAMPLER PER 6" OR PEN. STR.	ST. PENETI BLOWS/ SAMP HAMME (AUTOM/ 10	ANDAR RATION FT. ON LER-140 R, 30" ATIC HA 20	D 2" O 0 LB DRC MM 40	5T .D.	0 80
	11		variably cemented CLAY (CL) (A-7-6)	12/32/50*	* 0.4' Penetra	ition		H	+
	1.						-		
40	1.								
40	1.1	A	 trace of brownish-gray silty CLAY at depth 40 0' 	46/50*	* 0.3' Penetra	tion		Ц	
	1.1			-			_	\downarrow	4
	GGEHS EINGINEERING SEI ct No. DES 137207 BORING NO. ct SE Water Reclamation Facility 10MG Water Storage ion See Plate 1 bletion Depth To 4.0' Very Stiff dark brownish-green CLAY CL) (A-7-6) Very stiff dark brownish-green dolomitic, cemented CLAY (CL) (A-7-6) Very stiff dark brownish-green dolomitic, cemented CLAY (CL) (A-7-6)				\times	\mathbb{H}	+		
	1							Ħ	
45	//	7		3/4/11				П	
	1/	H							
	1						X	\square	
	//					+++	+	X	+
50	4	7		WR/50*	* 0.4' Penetra	ation	-	\mathbb{H}	1
	1.	Ē	Hard cream colored dolomitic, cemented CLAY (CL) (A-7-6)					Ħ	
	1/								
	1/								
55	//	H		50*	* 0.5' Penetra	ation		\square	H
	11	FI.		00				+	++
	1.1					-		\mathbb{H}	Ħ
	///							T	T
60	11				r* 0.2! Denote	ation			
00	11	F		50*	0.5 Pelleura		_		
	1						_	+	$\left \right \right $
	11						+	+	+
	1%								
65	///			8/44/48					
	1.1	H						\square	K
	1.1			_		_		X	\square
	11		(CH) (A-7-6) (Dolomitic LIMESTONE Formation)				A	+	$\left + \right $
70	11								

DRIGGERS ENGINEERING SERVICES INCORPORATED

Project SE visiter Acclamation Facility UNIX Visiter Storage Lank & Interconnection, Manates County, FL DS. Completion 76.5 Date 9/7/13 Water 4.0" Time Date 9/6/13 L To get a strange tank & Interconnection, Manates County, FL Strange tank Str	Proje	ect No	b. [DES 137	7207	E 111 40	BORING	NO. <u>B-</u>	6						
Completion Total Date 8/7/13 Depth To Time Date 8/6/13 L Time Date 8/6/13 STANDARD PENETRATION TEST SOIL DESCRIPTION Sold State Sold DESCRIPTION Sold State StanDaRD SURF. EL: +35.5+/- Sold DESCRIPTION Sold State StanDaRD PENETRATION TEST SURF. EL: +35.5+/- Sold DESCRIPTION Sold State State HAMMER, 30° DROP Very stiff dark brownish-green dolomitic CLAY 8/9/13 Image: Sold State 10 20 40 60 80 80 Dolomitic LIMESTONE Formation) S77/9 S77/9 Image: Sold State Im	Proje	tion	E V	Plate I	eclamation	h Facility 10	MG Water St	orage Ta	nk & Interconnec	tion, Ma	anatee Co	unty,	FL		
Depth 76.5' Date 8/7/13 Water 4.0' Time Date 8/6/13 L 10 20 4.0' 100 20 4.0' 100 20 4.0' 100 20 4.0' 100 20 4.0' 100 20 4.0' 100 20 4.0' 100 20 4.0' 100 20 4.0' 100 20 4.0' 6.0' 20 4.0' 100 20 4.0' 6.0' 100 20 4.0' 6.0' 100 100 20 4.0' 6.0' 100 100 20 4.0' 6.0' 100	Com	pletio	n	i late i			Depth To		Foremai	·	D.0		-		
L JO JO JO JO JO JOO	De	pth		76.5'	Date	8/7/13	Water	4.0'	_ Time		_ Date _	8/6	6/13	-	
Very stiff dark brownish-green dolomitic CLAY (CH) (A6) (Dolomitic LIMESTONE Formation) 8/9/13 IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII	DEPTH, FT	SYMBOL	SAMPLES	SURF.	SC EL: +35.6	DIL DESC	RIPTION		NO 22 22 NO 22 23 NO 22 24 NO 22 24 NO 22 24 NO 22 25 NO 22 25 NO 22 25 NO 22 25 NO 27 BLOWS/FT. ON 2" SAMPLER-140 LI HAMMER, 30" DR (AUTOMATIC HAMM 0 20 40						
(Dolomitic LIMESTONE Formation) 75 80 80 80 90 90 90 100		1	1	Very sti	iff dark bro	wnish-gree	n dolomitic Cl	AY	8/9/13						
80 80 85 90 91 92 93 95 100 100 105	- 75 -			(CH) (/ (Dolom	4-7-6) itic LIMES	TONE Forn	nation)		5/7/9						
80															
85 90 91 92 93 95	80 -														
90 90 90 90 100 100 Remarks Borehole Grouted	- 85 -	÷							-						
90 - 95 - 95 - 100 - 100 - 105															
95 - 95 - 100 - 105 Remarks Borehole Grouted	90 -														
100	95 -								-						
100 -									-						
105 Image: Second	100 -														
105 Remarks Borehole Grouted															
Remarks Borehole Grouted	105														
WR = Weight of Rod WH = Weight of Hammer Casing Length	Rem	narks	Bo	rehole (R = Wei	Grouted ight of Ro	d WH =	Weight of Ha	mmer	Casi	ng Len	gth				



Proje	ect No	. [DES 137207		BORING	NO. B-7	7				
Proje	ect S	EV	Vater Reclama	tion Facility	10MG Water S	torage Tan	k & Interconned	ction, Mana	tee Cou	inty, F	L
Loca	tion	See	e Plate I				Forema	n	D.S.		
Com De	pletio pth_	n 7	76.5' Date	8/7/13	Depth To Water	3.7'	Time		Date	8/7/	13
DEPTH, FT	SYMBOL	SAMPLES	SURF. EL: +:	SOIL DES 35.0+/-'	CRIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	PENE BLOW SAN HAMN (AUTO 10	RD N TES N 2" O. 40 LB. " DRO IAMME 40	T D. P :R) 60 80	
0	1		Light brown a	nd dark brow	n Fine SAND						TIT
- 5			with some roc Grayish-brown (SP) (A-3) Dark brown F Tannish-brow	n Fine SAND ine SAND (S ine SAND (S in Fine SAND	 with trace of ro P) (A-3) (SP) (A-3) 	ots					
			Medium dense silty Fine SAN Medium dense	e light grayist D (SM) (A-2 e light browni	n-brown 2-4) sh-gray	A-3)	4/5/6	•			
- 10 -			slightly silty Fi Medium dense light brown Fir	ne SAND (S e to very loos ne SAND (SF	P-SM) (A-3) e ?) (A-3)		6/7/13				
15 -			Very loose bro slightly silty Fi	wnish-gray p ne SAND (Si	hosphatic, P-SM) (A-3)		2/1/3				
20 -			Firm green an	d light brown	CLAY (CH) (/	4-7-6)	3/3/4				
25 -			Stiff to very sti to grayish-brow	ff dark grayis wn CLAY (Cl	h-green H) (A-7-6)		5/5/6				
30 -							8/6/9		• •		
35 Ren	narks	Bo	rehole Groute	d			Casi	ing Length			
		-							-		

Proj Proj	ect No ect S	D. L E V Se	DES 137207 BORING NO. B-7 Vater Reclamation Facility 10MG Water Storage Tank	& Interconne	ection, Manatee County, FL
Com	pletio epth	n	Depth To 76.5' Date <u>8/7/13</u> Water 3.7'	Time	Date 8/7/13
DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION SURF. EL: +35.0+/-'	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP (AUTOMATIC HAMMER) 10 20 40 60 80
	V	1	Stiff to very stiff dark grayish-green to gravish-brown CLAY (CH) (A-7-6)	4/4/6	
			Very stiff light grayish-brown dolomitic CLAY	-	
- 40				18/12/17	
- 45			Stiff dark grayish-green CLAY (CH) (A-7-6)	-	
				7/4/8	
50		7	Very stiff brownish-gray dolomitic CLAY (CL) (A-7-6)	6/12/12	
55			Hard cream colored to gray dolomitic, cemented CLAY (CL) (A-7-6) (Dolomitic LIMESTONE Formation)	50*	* 0.4' Penetration
60 -		-		50*	-* 0.1' Penetration
65 -				10/10/15	
70 Ren	narks	Bo	prehole Grouted		
		_		Ca	sing Length

				_								
DR	IGG	βE	RS ENGINEERING	SERV	/ICES	INCO	DRPC	DR.	A	ΓE	Ξ	
Proje Proje Loca	ect No ect <u>Si</u> tion	E V	DES 137207 BORING N Vater Reclamation Facility 10MG Water Sto e Plate I	IO. <u>B-7</u> prage Tanl	k & Interconne Forema	ection, N	lanatee C	ounty S	y, FL		~	
Com De	pletio pth	n	76.5′ Date <u>8/7/13</u> Depth To Water	3.7'	Time		_ Date	8	3/7/1	3		-
DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION SURF. EL: +35.0+/-'		BLOWS ON SAMPLER PER 6" OR PEN. STR.	P BL H/ (AL	STANE ENETRAT OWS/FT. SAMPLER AMMER, S JTOMATIC 0 20	ARD ION 1 ON 2' -140 30" D HAN	FEST " O.E LB. ROF AME! 40). R)	80	
		F	Hard cream colored to gray dolomitic,		50*	* 0.5' P	enetration		ĪT	Ī	Ĩ	Ţ
	11		(Dolomitic LIMESTONE Formation)								1	1
	1.4		Hard dark gravish-green dolomitic		-				+	\downarrow	4	+
	1.		weakly cemented CLAY (CL) (A-7-6)					+	+	X	H	+
- 75 -	/	7	(Dolomitic LIMESTONE Formation)		17/21/26			+		+	H	t
	1.7								T	T	ſŤ	t
											Ι	
											Ц	
- 80 -	t 1								++	\square	\parallel	ļ
									++	+	+	+
								-	+	+	+	ł
								-	++	H	+	t
- 85 -								-	\square	T	T	t
										T	T	Ť
						1.						
								_	\square			
						-		-	++	-	-	+
- 90 -									++	+	+	╀
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									\square	T	T	t
- 95 -												
	= 1							-		\square	-	ļ
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- 100 -								-	++	Ħ	+	t
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105												
Rem	arks	BO	renoie Grouted		Cae	inglas	ath			_		-
		-			VdS	my LGI	Jui			_	_	

DRIGGERS	EN	GINEE	RING	SER	VICES	INC	ORPO	RATED
Project No. DES 13 Project SE Water R	7207 eclamatio	n Facility 10	BORING MG Water S	NO. B.	-8	nnection	Manatee Co	unty El
Location See Plate	I				For	eman	D.S	b.
Completion Depth 76.5'	Date	8/8/13	Depth To Water	2.6'	_ Time		Date	8/8/13

DEPTH, FT	SYMBOL SAMPI FS	SOIL DESCRIPTION	BLOWS ON SAMPLER PER	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP					
0 1) SURF. EL: +34.7+/-'	0,0	10 20	40 60 80				
0		Dark brown Fine SAND with roots (SP) (A-3)							
1 1		Grayish-brown Fine SAND (SP) (A-3)							
		Dark reddish-brown Fine SAND (SP) (A-3)							
1		Light brown Fine SAND (SP) (A-3)	-						
5									
		Medium dense tan and light brown to light brown Fine SAND (SP) (A-3)	4/5/6	•					
10			7/8/9						
		Verv loose brownish-gray phosphatic.	6/6/7						
		silty Fine SAND (SM) (A-2-4)	1/1/2						
15		clayey Fine SAND with phosphate (SC) (A-2-6)	5/5/8						
20		Stiff grayish-green CLAY (CH) (A-7-6)							
	1		5/5/8						
25		Stiff dark grayish-green CLAY (CH) (A-7-6)							
			5/5/6						
30 -		- weakly cemented at depth 30.0'	6/6/8						
		Hard light brownish-gray dolomitic, variably cemented CLAY (CL) (A-7-6)							

DR	IGG		RS ENGINEERING SERV	ICES	INC	ORF	POF	7,4	47	ГЕ	ĒC
Proje Proje Loca	ect No ect <u>SE</u> tion <u>S</u>	. I V Se	DES 137207 BORING NO. B-8 Vater Reclamation Facility 10MG Water Storage Tank Plate I	& Interconne Forem	ection, N an	lanatee	Cou D.S.	nty	, FL		_
De	pietio		<u>'6.5'</u> Date <u>8/8/13</u> Water <u>2.6'</u>	Time		Dat	e	8/	8/1	3	_
DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER " OR PEN. STR.	PE BLC S HA	STAI ENETRA OWS/F1 SAMPLE	NDA ATIO F. OI ER-1 , 30	RD N T N 2' 40 " D	' O. LB. RO	T D. P	
-	1.7.	ŕ	Hard light brownish-gray dolomitic	0	1	0 2	0	4	0	60 I	80
		-	Hard dark grayish-green CLAY (CL) (A-7-6)	14/22/40							X
- 40 -				50*	* 0.5' P	enetrati	on				
- 45 -			Firm grayish-green CLAY (CH) (A-7-6)	3/4/3		\angle	2				
			Hard light brownish-gray dolomitic, cemented,	_							
- 50 -		-	(Dolomitic LIMESTONE Formation)	50*	-* 0.1' P	enetrati	on—				
- 55 -				16/50*	* 0.3' P	enetrati	on				
- 60 -				50*	'* 0.4' P	enetrati	on				
- 65 -			Stiff to very stiff grayish-green o brownish-green dolomitic CLAY (CH) (A-7-6) Dolomitic LIMESTONE Formation)					/			
				4/5/7							
70	1			· · · · · · ·						11	
Rem	arks [30	enole Grouted	Cas	sing Ler	ngth			_	_	_

DRIGGERS	ENGINEERING	SERVICES	INCORPORATED

Proje	ect No). <u>[</u>	DES 1372	207		BORING	NO. <u>B-8</u>			0 0 0			
Proje	ect S	EV	Vater Rec	lamation	Facility 10	MG Water St	orage Tank	& Interconnec	tion, Mar	natee Cou	inty, F	÷L	
Com	pletic	n			and the second	Depth To		Foremai	n	D.5.	<u>.</u>		-
De	pth		76.5'	Date	8/8/13	Water	2.6'	Time		Date	8/8/	13	
DEPTH, FT	SYMBOL	SAMPLES	SURF. E	SC :L: +34.7	DIL DESC	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TI BLOWS/FT. ON 2" SAMPLER-140 L HAMMER, 30" DF				80
		1	Stiff to ve	ery stiff g	rayish-gree	n	Alter -	7/7/11		2	\square	ΠŤ	ĨĨ
- 75 -			to browni (Dolomiti	ish-greer c LIMES	n dolomitic (TONE Forn	CLAY (CH) (/ nation)	4-7-6)	11/9/12					
- 80 -													
85 -						-							
90 -						1							
95 -													
100 -													
105													
Ren	narks	Bo	rehole Gr	outed									
		_	_					Casi	ng Lengt	th			

		at the second	and the second second
DRIGGERS	ENGINEERING	SERVICES	INCORPORATED

Loca	tion	See Plate I	Foreman		D.S.			
Com	pletio epth	Depth To 21.5' Date <u>8/5/13</u> Water **	Time	D	ate	8/5/	13	
DEPTH, FT	SYMBOL	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	S PENET BLOWS SAME HAMME (AUTOM	RD N TES 2" O. 10 LB. 10 DRO AMME	ST).D. 3. DP ER) 60 80		
0		Brown Fine SAND with some roots (SP) (A-3)		10	20	40	60 80	
	1111	Tannish-brown Fine SAND (SP) (A-3)						
	707	Brown Fine SAND (SP) (A-3)						
-	2002	Light grayish-brown Fine SAND (SP) (A-3)						
5		Dark reddish-brown Fine SAND (SP) (A-3)						
		Medium dense tan to light tan Fine SAND	3/5/7		1			
		(SP) (A-3)						
			5/8/12					
10								
			5/6/8					
-			6/8/11					
	//	Soft to firm groop and light brown	_					
15 -	1	to light brown CLAY (CH) (A-7-6)		1			+++	
	$\langle \Lambda$		1/1/2				+++	
				$\left\{ - \right\}$	-		+++	
				-				
	//			\rightarrow	_		+++	
20 -	//				_		+++	
	1		2/3/5	•		_		
			-					
							+++	
1								
25 -							+++-	
20								
30 -								
35	-							
Dan	arko	Derehala Oraulad						

DRIGGERS ENGINEERING SERVICES INCORPORATED

Proje	ect No	. [DES 137207	_	BORING	NO. <u>B-1</u>	0					
Proje	ect <u>S</u>	E V See	Vater Reclamat	ion Facility 10	MG Water St	orage Tan	k & Interconne	ction, Mana	atee Co	unty, I	FL	
Com	pletio	n	of late i		Depth To		Porema	n	D.5		-	-
De	epth_		21.5' Date	8/5/13	Water	5.5'	Time		Date _	8/5	/13	
ОЕРТН, FT	SYMBOL	SAMPLES	SURF. EL:	SOIL DESC	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	PENI BLOW SAM HAMM (AUTO 10	STANDA ETRATIC /S/FT. OI MPLER-1 MER, 30 MATIC H 20	RD N TE: N 2" C 40 LE " DRC IAMM 40	ST).D. DP ER) 60	80
0	r Q		Brown Fine SA	ND with trace	of roots						T	TT
	D N	1	and trace of Li	nestone Grav	rel (SP) (A-3)		_					
	1		Dark grayish-b	Fine SAND	ND (SP) (A-3	3)	-				\square	444
	500		(SP) (A-3)	FILE SAND W	nun some rook	5					++	
- 5 -			Dark reddish-b	rown Fine SA	ND (SP) (A-3	3)				++	++	
			Very loose to lo	ose light tan) (A-3) to tan Fine SA	ND	21212	•			tt	
		H	(SP) (A-3)	girt tall								
							1/2/2					
- 10 -										$\left \right $	++	
		4					3/5/5		-		++	
		/	Medium dense	light grayish-l	brown Fine SA	ND	A/5/8					
		4	(SP) (A-3)					Ĭ				
- 15 -	Jai, jai, e. 1. e. j. e. j.		Medium dense slightly silty Fin	brownish-gra	y phosphatic,							
	n na tr		Sugnuy Suty I III	CONID (OF-	·SIVI) (A-3)		3/5/7					
	Jal. jal. j 14 [a]. a]. 4						-				++	
		-	Soft green and	light brown C	LAY (CH) (A	-7-6)	-	- /				
20 -	$\langle \rangle$							/				
20		1					1/2/2					
		T		2.0			-					
											++	
											+	
25 -											H	
30 -												
											+	
											H	
35												
Rem	narks	Bo	rehole Grouted									
							Casi	ng Lengtl	n			

RESULTS OF DILATOMETER SOUNDINGS

32-* 10-10-*

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Drigg JOB F LOCAT	ers Eng. ILE: SEV ION: 6'	WRF WSW of B	-6	INIERP	RETATIC	DN (BAS	ED ON 1	'HE 198	8 DILA	TOMETE	R MANUA	L)	SND Pag FIL	G. NO. e la E NO. :	DMT-1 137207		
ANAL.	BY : Jef	f Drigge	rs										SND	G. DATE	8/27/	13	
ANALY SURF.1 WATER SP.GR. MAX SU UNIT (SIS PARA ELEV. = DEPTH = .WATER = J ID = CONVERSI	METERS: 0.0 F 4.0 F 1.000 0.6 ONS:	LO R T LO T HI CAL SU O 1 BA	ANGE GAGE 0 GAGE 0 GAGE 0 PTION R = 1.	= 9.4 = 0.0 = 0.0 = 0.0 = 0.0	0 TSF 0 TSF 0 TSF 0 TSF 0 /CM2 =	ROD DI FR.RED LIN.RC DELTA/ MIN PH 100 KP	AM. DIA. D WT. PHI I ID A = 1.	= 1.7 $= 0.0$ $= 4.3$ $= 0.3$ $= 1.3$ $044 TS$	5 IN 0 IN 2 LBF/: 5 2 F = 14	BL.TH BL.WI FTDELTA DELTA OCR O .51 PSI	ICK. DTH -A -B PTION 1 1	= 0.5 = 3.7 = 0.1 = 0.3 = 0.3	9 IN 8 IN 8 TSF 7 TSF 0 2808 FT	SU F PHI F OCR F M FA KO FA	ACTOR = ACTOR = ACTOR = CTOR = CTOR =	1 1 1 1
Z (FT) *****	ELEV (FT) *****	THRUST (LBF) ******	A (TSF) *****	B (TSF) *****	C (TSF) *****	DA (TSF) ****	DB (TSF) *****	ZMRNG (TSF) *****	ZMLO (TSF) *****	ZMHI (TSF) *****	ZMCAL (TSF) *****	P0 (TSF) ****	P1 (TSF) *****	P2 (TSF) *****	U0 (TSF) *****	GAMMA (PCF) *****	SVP (TSF)
13.0	-12.0 -13.0 -14.0	0	1.10	5.53 4.23 9.81		0.18 0.18 0.18	0.37 0.37 0.37	9.40 9.40 9.40	0.00	0.00	0.00 0.00 0.00	2.67 1.15 1.19	5.17 3.86 9.45		0.250	106.1	0.45
16.0	-15.0	0	3.86 2.87	11.90 7.20		0.18	0.37	9.40 9.40	0.00	0.00	0.00	3.66	11.54 6.84		0.343	118.6	0.49

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DILAT Drigg JOB F LOCAT	OMETER 1 ers Eng ILE: SEV ION: 6'	DATA LI WRF WSW of	STING B-6	& INTE	RPRETAT	ION (BAS	SED ON "	THE 1980	B DILAT	OMETER M	ANUAL)	SI Pa F1	NDG. NO. age 2 ILE NO.	: DMT-1	L
ANAL.	BY : Jei	f Drig	gers									SN AN	NDG. DAT NAL. DAT	TE: 8/27/ TE: 9/4/3	/13 13
ANALYS SURF.I WATER SP.GR	SIS PARA ELEV. = DEPTH = .WATER =	METERS = 0.0 = 4.0 = 1.000	: LO FT LO FT HI C	RANGE GAGE GAGE AL GAG	= 9. 0 = 0. 0 = 0. E 0 = 0	40 TSF 00 TSF 00 TSF 00 TSF	ROD DI FR.REI LIN.RC	IAM. = D.DIA. = DD WT. =	= 1.75 = 0.00 = 4.2	IN BI IN BI LBF/FTDI	L.THICK. L.WIDTH ELTA-A	- = 0. = 3. = 0.	59 IN 78 IN 18 TSF	SU FI PHI FI OCR H	ACTOR = 1 ACTOR = 1 FACTOR = 1
MAX SU UNIT (J ID = CONVERSI	= 0.6 ONS:	SU 1	OPTIO BAR =	N = 1.019 KG	0 F/CM2 =	DELTA MIN PH 100 KH	A / PHI HI ID = PA = 1.0	= 0.9 = 1.2 044 TSF	5 I O(= 14.51	DELTA - CR OPTIC PSI	B = 0. DN = 1 M = 3	37 TSF 0 .2808 F	M FAC KO FAC T	CTOR = 1 CTOR = 1
Z (FT) *****	ELEV (FT)	KD	ID	UD	ED (TSF)	K0	SU (TSF)	QD (TSF)	PHI (DEG)	SIGFF (TSF)	PHIO (DEG)	PC (TSF)	OCR	M (TSF)	SOIL TYPE
12.0	-12.0	5.36	1.03		97	1 22	*****	*****	*****	*****	*****	****	****	*****	*********
13.0	-13.0	1.83	3.15		94	1.22						2.10	4.7	163	SILT
14.0	-14.0	1.78	9.37		286									96	SILTY SAND
15.0	-15.0	6.36	2.37		274									286	SAND
16.0	-16.0	4.53	1.60		138									570	SILTY SAND
17.0	-17.0	7.81	1.03		159	1.57						4.78	8.4	358	SANDY SILT SILT

JOB F LOCAT	ILE: SEW	RF North of	B-5										FIL	e la E NO. :	137207		
SNDG. ANAL.	BY : Dri BY : Jef	ggers f Drigge	rs										SNDO	G. DATE: L. DATE:	8/27/ 9/4/1	13 3	
ANALY: SURF.1 WATER SP.GR MAX SU UNIT (SIS PARA ELEV. = DEPTH = WATER = JID = CONVERSI	METERS: 0.0 F 3.0 F 1.000 0.6 ONS:	LO R T LO T HI CAL SU O 1 BA	ANGE GAGE 0 GAGE 0 GAGE 0 PTION R = 1.0	= 9.8 = 0.0 = 0.0 = 0.0 = 019 KGF	1 TSF 0 TSF 0 TSF 0 TSF 0 /CM2 =	ROD DI FR.RED LIN.RO DELTA/ MIN PH 100 KP	AM. D.DIA. D WT. PHI I ID A = 1.	= 0.6 = 0.0 = 2.1 = 0.1 = 1.2 044 TSI	9 IN 0 IN 8 LBF/ 5 2 F = 14	BL.TH BL.WI FTDELTA DELTA OCR O .51 PSI	ICK. DTH -A -B PTION 1 N	= 0.0 = 0.1 = 0.1 = 0.4 = 0.4 = 0.4	2 IN 5 IN 8 TSF 1 TSF 0 2808 FT	SU F. PHI F. OCR F. M FA KO FA	ACTOR = ACTOR = CTOR = CTOR =	1 1 1 1
Z (FT) *****	ELEV (FT) *****	THRUST (LBF) ******	A (TSF) *****	B (TSF) ****	C (TSF) ****	DA (TSF) ****	DB (TSF) ****	ZMRNG (TSF) *****	ZMLO (TSF)	ZMHI (TSF)	ZMCAL (TSF)	P0 (TSF)	P1 (TSF)	P2 (TSF)	U0 (TSF)	GAMMA (PCF)	SVP (TSF)
12.0 13.0 14.0	-12.0 -13.0 -14.0	0	4.44 3.29	15.45 8.25 17 75		0.17	0.39	9.40	0.00	0.00	0.00	4.08	15.06		0.282 0.312	118.6 112.3	0.42
15.0	-15.0 -16.0	0	2.04	6.26 12.11		0.17	0.39	9.40 9.40 9.40	0.00	0.00	0.00	5.61 2.01 4.13	17.36 5.88 11.72		0.345 0.375 0.407	124.8 112.3 118.6	0.48
17.0	-17.0	0	6.37	15.45		0.17	0.39	9.40	0.00	0.00	0.00	6.11	15.06		0.437	121.7	0.56

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DILAT Drigg JOB F	OMETER 1 ers Eng ILE: SEU	DATA LI WRF	STING	& INTE	RPRETAT	ION (BAS	ED ON 1	THE 1988	8 DILAT	OMETER M	ANUAL)	SI Pa	NDG. NO. age 2	: DMT-2	2	
LOCAT	ION: 5'	North	of B-5									F.	LLE NO.	:137207		
SNDG .	BY : Dr:	agers	01 0 0									-		-		
ANAL .	BY : Jet	f Drig	gers									SI	NDG. DAT	E: 8/27/	13	
												A	VAL. DAI	E: 9/4/1	.3	
ANALY.	SIS PARA	METERS	: LO	RANGE	= 9	.81 TSF	ROD DI	AM. =	= 0.69	IN B	L. THICK.	= 0	02 TN	CI1 E7	CTOR	-
SURF.1	ELEV. =	= 0.0	FT LO	GAGE	0 = 0	.00 TSF	FR.REI	D.DIA. =	= 0.00	IN B	L.WIDTH	= 0	15 TN	DUT D	CTOR =	1
NATER	DEPTH =	3.0	FT HI	GAGE	0 = 0	.00 TSF	LIN.RC	DD WT. =	= 2.8	LBF/FTD	ELTA-A	- 0	18 797	OCD F	ACTOR =	1
SP.GR	.WATER =	1.000	C	AL GAG	3 0 =	0.00 TSF	;						.10 101	OCK I	ACTOR	= 1
							TOTAL CON	/ DITT			NET TRA		41 mon			
							DELTA	A / PHI	= 0.5		JELIA -	B = 0	41 158	MEAC		
AX S	UID =	0.6	SU	OPTIO	V =	0	MIN PH	I ID =	= 0.9	0	CR OPTIO	B = 0. N =	41 TSF	KO FAC	TOR =	1
MAX SU	U ID = CONVERSI	0.6 ONS:	SU 1 1	OPTION BAR = 1	N = 1.019 KG	0 GF/CM2 =	MIN PH	$\begin{array}{l} \text{II ID} = \\ \text{PA} = 1.0 \end{array}$	= 0.9 = 1.2 044 TSF	00 = 14.51	CR OPTIO	B = 0. N = 1 M = 3	0 0 3.2808 F	M FAC KO FAC T	TOR = : TOR =	1
MAX SI JNIT (U ID = CONVERSI	0.6 ONS:	SU 1 1	OPTIO BAR = 1	N = 1.019 KG	0 GF/CM2 =	MIN PH 100 KF	A / PHI HI ID = PA = 1.0	= 0.9 = 1.2 044 TSF	00 = 14.51	CR OPTIO PSI	B = 0. N = 1 M = 3	0 0 3.2808 F	M FAC KO FAC T	TOR = : TOR =	1
MAX SU JNIT (U ID = CONVERSI	0.6 ONS:	SU 1 1	OPTIO BAR = 1	V = 1.019 ко	0 GF/CM2 =	MIN PH 100 KF	A / PHI HI ID = PA = 1.(= 0.1 = 1.2 044 TSF	00 = 14.51	CR OPTIO PSI	B = 0. N = 1 M = 3	0 0 3.2808 F	M FAC KO FAC T	TOR = T TOR =	1
AX SI MIT (Z	U ID = CONVERSI ELEV	0.6 ONS: KD	SU 1 1 ID	OPTIO BAR = 1 UD	V = 1.019 KG ED	0 GF/CM2 = K0	DELTA MIN PH 100 KF SU	QD	= 0.9 = 1.2 044 TSF PHI	00 = 14.51 SIGFF	PHIO	B = 0. N = 1 M = 3 PC	0 0 0.2808 F OCR	M FAC KO FAC T M	TOR = TOR = TOR = SOIL	1 TYPE
IAX SI INIT (Z FT)	U ID = CONVERSI ELEV (FT)	0.6 ONS: KD	SU 1 1 ID	OPTIO BAR = 1 UD	V = 1.019 K(ED (TSF)	0 GF/CM2 = K0	SU SU	QD (TSF)	= 0.9 = 1.2 044 TSF PHI (DEG)	00 = 14.51 SIGFF (TSF)	PHIO (DEG)	B = 0. N = 1 M = 3 PC (TSF)	0 0 3.2808 F OCR	M FAC KO FAC T M (TSF)	TOR = : TOR = SOIL	1 TYPE
IAX SI INIT (Z FT)	U ID = CONVERSI ELEV (FT) ******	0.6 ONS: KD	SU 1 1 ID	OPTIO BAR = : UD *****	N = L.019 K(ED (TSF) ******	0 GF/CM2 = K0 *****	SU (TSF)	QD (TSF)	= 0.9 = 1.2 044 TSF PHI (DEG) *****	00 = 14.51 SIGFF (TSF) ******	PHIO (DEG)	B = 0. N = 1 M = 3 PC (TSF) ****	0 3.2808 F OCR	M FAC K0 FAC T (TSF) ******	TOR = TOR = SOIL	1 TYPE
4AX SI NIT ((FT) 12.0	U ID = CONVERSI ELEV (FT) ***** -12.0	0.6 ONS: KD	SU 1 1 ID ***** 2.89	OPTIO BAR = 1 UD *****	N = L.019 KO ED (TSF) ***** 381	0 GF/CM2 = K0 ****	DELTA MIN PH 100 KF SU (TSF) *****	QD (TSF)	= 0.9 = 1.2 044 TSF PHI (DEG) *****	00 = 14.51 SIGFF (TSF) ******	PHIO (DEG)	B = 0. N = 1 M = 3 PC (TSF) *****	0 8.2808 F OCR	M FAC K0 FAC T (TSF) ***** 914	SOIL	1 TYPE SAND
4AX SI NIT ((FT) 12.0 13.0	U ID = CONVERSI ELEV (FT) ***** -12.0 -13.0	E 0.6 ONS: KD ***** 8.88 6.44	SU 1 1 ID ***** 2.89 1.58	OPTIO BAR = 1 UD *****	N = L.019 K(ED (TSF) ***** 381 161	0 GF/CM2 = K0 ****	DELTA MIN PH 100 KF SU (TSF) *****	QD (TSF)	= 0.3 = 1.2 044 TSF PHI (DEG) *****	00 = 14.51 SIGFF (TSF) *****	PHIO (DEG)	B = 0. N = 1 M = 3 PC (TSF) *****	0 3.2808 F OCR *****	M FAC KO FAC T (TSF) ****** 914 333	SOIL SOIL SILTY SANDY	1 TYPE SAND SILT
Z (FT) 12.0 13.0	U ID = CONVERSI ELEV (FT) ****** -12.0 -13.0 -14.0	KD KD 8.88 6.44 10.91	SU 1 1 ID ***** 2.89 1.58 2.23	OPTIO BAR = 1 UD *****	V = 1.019 K0 ED (TSF) ***** 381 161 408	0 GF/CM2 = K0 *****	DELTA MIN PH 100 KF SU (TSF)	QD (TSF)	= 0.9 = 1.2 044 TSF PHI (DEG) *****	00 = 14.51 SIGFF (TSF)	PHIO (DEG)	B = 0. N = 1 M = 3 PC (TSF) ****	0 0.2808 F OCR *****	M FAC K0 FAC T (TSF) ****** 914 333 1053	SOIL SOIL SILTY SANDY SILTY	1 TYPE SAND SILT SAND
AAX SUNIT (Z (FT) 12.0 13.0 14.0	U ID = CONVERSI ELEV (FT) ***** -12.0 -13.0 -14.0 -15.0	KD KD 8.88 6.44 10.91 3.22	SU 1 1 ID ***** 2.89 1.58 2.23 2.35	OPTIO BAR = 1 UD *****	N = 1.019 K0 ED (TSF) ****** 381 161 408 134	0 GF/CM2 = K0 *****	DELTA MIN PH 100 KF SU (TSF)	QD (TSF) *****	= 0.3 = 1.2 044 TSF PHI (DEG) *****	Or = 14.51 SIGFF (TSF)	PHIO (DEG)	B = 0. N = 1 M = 3 PC (TSF) *****	0 3.2808 F OCR *****	M FAC K0 FAC T (TSF) ****** 914 333 1053 196	SOIL SOIL SILTY SANDY SILTY SILTY	I TYPE SAND SILT SAND SAND
Z (FT) 12.0 13.0 14.0 15.0 16.0	U ID = CONVERSI (FT) ***** -12.0 -13.0 -14.0 -15.0 -16.0	KD ***** 8.88 6.44 10.91 3.22 6.94	SU 1 1 ID ***** 2.89 1.58 2.23 2.35 2.03	OPTIO BAR = : UD *****	N = ED (TSF) ***** 381 161 408 134 263	0 GF/CM2 = K0 *****	DELTA MIN PH 100 KF SU (TSF) *****	QD (TSF)	= 0.9 = 1.2 044 TSF PHI (DEG) *****	Or = 14.51 SIGFF (TSF) ******	PHIO (DEG)	B = 0. N = 1 M = 3 PC (TSF) *****	0 0.2808 F OCR *****	M FAC KO FAC T (TSF) ****** 914 333 1053 196 569	SOIL SOIL SILTY SANDY SILTY SILTY SILTY	1 TYPE SAND SILT SAND SAND SAND
Z (FT) 12.0 13.0 14.0 15.0 16.0 17.0	U ID = CONVERSI ELEV (FT) ****** -12.0 -13.0 -14.0 -15.0 -16.0 -17.0	KD KD ***** 8.88 6.44 10.91 3.22 6.94 10.02	SU 1 1 ID ***** 2.89 1.58 2.23 2.35 2.03 1.58	OPTIO BAR = : UD *****	N = ED (TSF) ****** 381 161 408 134 263 311	0 GF/CM2 = K0 *****	DELTA MIN PH 100 KF SU (TSF) *****	QD (TSF)	= 0.9 = 1.2 044 TSF PHI (DEG) *****	S 00 0 = 14.51 SIGFF (TSF) ******	PHIO (DEG)	B = 0. N = 1 M = 3 PC (TSF) *****	41 TSF 0 3.2808 F OCR *****	M FAC K0 FAC T (TSF) ***** 914 333 1053 196 569 778	TOR = TOR = SOIL SILTY SANDY SILTY SILTY SILTY SANDY	1 TYPE SAND SILT SAND SAND SAND SAND

DILATO	OMETER I	DATA LIST	TING &	INTERP	RETATIO	ON (BAS	ED ON T	THE 198	8 DILA	TOMETE	R MANUA	L)	SND	G. NO.	: DMT-3		
JOB F	ers Eng.	DE											Pag	e la			
LOCAT	IDE: SEV	SW of B-	7										FIL	E NO. :	137207		
SNDG.I	BY : Dri	agers											2005		1.5.2		
ANAL. H	BY : Jef	f Drigge	rs										SND	G. DATE	: 8/27/	13	
													ANA	L. DATE:	: 9/4/1	3	
ANALYS	SIS PARA	METERS:	LO R	ANGE	= 9.4	0 TSF	ROD DI	AM.	= 1.7	5 IN	BL. TH	TCK	- 0.5	9 TN	CII F	ACTOR	4
SURF. H	ELEV. =	0.0 F	T LO	GAGE 0	= 0.0	0 TSF	FR.RED	DIA.	= 0.0	0 IN	BL.WI	DTH	= 3.7	8 TN	PHT F	ACTOR =	1
WATER	DEPTH =	3.7 F	T HI	GAGE 0	= 0.0	0 TSF	LIN.RC	D WT.	= 4.	2 LBF/1	FTDELTA	-A	= 0.1	7 TSF	OCR F	ACTOR -	1
SP.GR.	WATER =	1.000	CAL	GAGE 0	= 0.0	0 TSF	DELTA/	PHI	= 0.	5	DELTA	-B	= 0.3	9 TSF	M FA	CTOR =	1
MAX SU		0.6	SU O	PTION	=	0	MIN PH	II ID	= 1.	2	OCR C	PTION	- 1	0	KO FA	CTOR =	ī
UNII C	ONVERSI	UNS:	1 BA	R = 1.	019 KGF	'/CM2 =	100 KP	A = 1.	044 TS	F = 14	.51 PSI	1 1	M = 3.:	2808 FT			
Z	ELEV	THRUST	A	в	с	Da	DB	ZMENIC	ZMIO	TMILT	THOAT	-		-	100	Les trans	
(FT)	(FT)	(LBF)	(TSF)	(TSF)	(TSF)	(TSF)	(TSF)	(TCF)	(TCF)	(TCE)	(TCE)	PO (TOR)	PI	P2	00	GAMMA	SVP
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	***** [TDL]	*****	1101/	(151)	(ISF)	(TSF)	(PCF)	(TSF)
12.0	-12.0	0	1.62	4.38		0.17	0.39	9.40	0.00	0.00	0 00	1 67	4 00		0 750	100 1	******
13.0	-13.0	0	1.41	6.73		0.17	0.39	9.40	0.00	0.00	0.00	1 34	6 35		0.259	110 .1	0.444
14.0	-14.0	0	1.98	7.93		0.17	0.39	9.40	0.00	0.00	0.00	1.88	7 55		0.200	112.3	0.467
15.0	-15.0	0	5.12	15.45		0.17	0.39	9.40	0.00	0.00	0.00	4.79	15.06		0 353	124 9	0.492
16.0	-16.0	0	1.67	4.65		0.17	0.39	9.40	0.00	0.00	0.00	1.71	4.26		0.384	112 3	0.540
20.0	-20.0	0	8.56	13.78		0.17	0.39	9.40	0.00	0.00	0.00	8.50	13.39		0.509	121 7	0.559
21.0	-21.0	0	12.74	22.97		0.17	0.39	9.40	0.00	0.00	0.00	12.42	22.58		0.540	131.0	0.699
22.0	-22.0	0	14.62	23.59		0.17	0.39	9.40	0.00	0.00	0.00	14.37	23.21		0.572	131.0	0 725
23.0	-23.0	0	18.58	27.56		0.17	0.39	9.40	0.00	0.00	0.00	18.33	27.18		0.602	127.9	0.757
24.0	-24.0	0	19.00	28.19		0.17	0.39	9.40	0.00	0.00	0.00	18.74	27.80		0.633	127.9	0.789
25.0	-25.0	0	16.50	25.06		0.17	0.39	9.40	0.00	0.00	0.00	16.27	24.67		0.665	127.9	0.823
DILATOME Driggers JOB FILE	TER DATA L Eng. SEWRF	ISTING	& INTE	RPRETA'	TION (BAS)	ED ON 1	THE 19	88 DI	LATO	METER M	ANUAL)	S P F	NDG. NO. age 2 TLE NO	: DMT-3	3		
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LOCATION	5' SW of	B-7															
SNDG.BY	Driggers											S	NDG. DAT	E: 8/27)	/13		
ANAL.BY	Jeff Drig	ggers										A	NAL. DAT.	E: 9/4/3	13		
ANALYSIS	PARAMETER	S: LO	RANGE	- 3	9.40 TSF	ROD DI	LAM.	= 1	75	TN B	L THICK	- 0	50 TM	CI1 P7	CTOD 1		
SURF.ELE	. = 0.4	O FT LO	GAGE	0 = 0	0.00 TSF	FR.REI	D.DIA.	= 0	.00	TN B	I. WIDTH	- 3	79 TN	DUT P	ACTOR = 1		
WATER DEL	TH = 3.	7 FT H.	I GAGE	0 = 0	0.00 TSF	LTN RC	ידיש מו	-	4 2	LBF/FTD	FLTA-A	- 0	17 TOP	PHI PA	ACTOR = 1		
SP.GR.WAT	ER = 1.000	0 (CAL GAG	E 0 =	0.00 TSF			-		5517115	abin n	- 0	.17 151	OCR I	ACTOR =	T	
						DELTA	A / PH	= I	0.5		DELTA -	B = 0	.39 TSF	M FAC	TOR = 1		
MAX SU II	= 0,6	5 SI	J OPTIO	= V	0	MIN PH	II ID	=	1.2	0	CR OPTIO	N =	0	KO FAC	TOR = 1		
UNIT CON	ERSIONS:	1	BAR = 1	1.019 1	KGF/CM2 =	100 KH	PA = 1	.044	TSF	= 14.51	PSI	1 M =	3.2808 F	т			
Z EI	EV KD	ID	UD	ED	ко	SU	OD	P	нт	STOFF	DHTO	DC	OCR	M	-		
(FT) (I	T)			(TSF)		(TSF)	(TSF	1 (1)	EG)	(TCF)	(DEC)	ITCE)	OCR	(DOD)	SOLL T	AbE	
**** ***	*** *****	* ****	*****	*****	* *****	*****	****	* **	***	******	*****	11011	*****	(ISF)			
12.0 -1	2.0 3.19	1.64		80)										******	****	
13.0 -1	3.0 2.25	5 4.78		174										114	SANDY S	ILT	

13.0	-13.0	2.25	4.78	174						209	SAND
14.0	-14.0	3.17	3.64	196						205	CAND
15.0	-15.0	8.54	2.31	356						295	SAND
16.0	-16.0	2.43	1 91	89						839	SILTY SAND
20.0	-20 0	12 14	0 61	120	0.07			a a caso		103	SILTY SAND
20.0	-20.0	12.14	0.01	170	2.07			10.96	16.7	456	CLAYEY SILT
21.0	-21.0	17.24	0.86	353	2.55			19.85	28.8	1063	CLAYEY STLT
22.0	-22.0	19.04	0.64	307	2.70			24 36	33.6	954	CLAVEY CTIT
23.0	-23.0	23.41	0.50	307	3.04	3.60		25 14	AC 4	1015	CHAILI SILI
24.0	-24.0	22 93	0 50	314	2 00	2 66		33.14	40.4	1015	SILTY CLAY
25 0	-25.0	10 05	0.50	0.014	5.00	3.00		35.48	44.9	1034	SILTY CLAY
23.0	-25.0	10.95	0.54	291	2.69	3.01		27.48	33.4	906	SILTY CLAY

SUMMARY OF LABORATORY TEST RESULTS

BORING NO.	DEPTH (ft)	DESCRIPTION		% M	PA	°5	ATTA	MITS	2.4	P. U.	CO	4. G.S	ORG.	Hq	Ъ	\$0 4	RES.
					(mail)		TL	PL P	en) I.		_		8		(uudd)	(mdd)	(ohm-cm)
B-3	2.5-3.0	Dark brown Fine SAND with trace of finely di organic material and seams of light brown Fine	ivided e SAND							-		_	1.6				
B-4	15.0-16.5	Gray and light brown clayey Fine SAND with 1 to gray and light brown sandy CLAY with pho:	phosphate ssphate	39.7			58	18 4	•	-	-	** 53.4					
B-5	1.5-3.0	Dark reddish-brown slightly organic Fine SAN	Ê										4.9				
B-5	30.0-31.5	Dark gravish-green sandy CLAY		58.7			77	32 4	8			**					
B-6	12.0-13.5	Grayish-brown silty Fine SAND with trace of p	phosphate								-	*					
B-6	20.0-21.5	Dark gray and light brown CLAY		93.1			111	50 6	-			** 91.2					
B-7	6.0-7.5	Light grayish-brown silty Fine SAND										*					
B-8	45.0-46.5	Gravish-green CLAY		104.5			144	58 8		_		**					
									-	-	-	-					
			T					-	-	+	-	-					
							1	-	+	-	-	-					
			1			T	-	-	_	_	_	+					
						1	-	+	_	-	_	-					
							_	_	_	_							
N %	= Wate	r Content Con	-	11	S	nsolidation	I Test							-			
(d (pcf)	= Dry L	Density G.S.	. (+1)	1	Gn	ainsize Ana	alysis (F	lydromet	ter)								
I.	= Speci	fic Gravity OR0	(%) (nnm)	H (LO F	ganic Cont	ent			σ	LIENT:		McKim &	Creed			
	- Dlocti		(mmdd)	1	of L	al Cultate	>			Id	UAL OC	÷.	0t	- Q /I		101 - 111 - 2	
,	= Plastiv	city Index RES	s. (ohm-cm)	1	Lal	Resistivit	N					•	Tank & In	erconnect	Manatee	County F	vio water storage orida
. P. (tsf)	= Pocke	it Penetrometer *		I	Sec	Test Curv	ves			F	1.E.		DES 1372	77			1
J.C.	= Uncol	affned Compression ***		ı	Per	cent Passi	ng No. 2	00 Sieve	12		i						
							,										

SUMMARY OF LABORATORY TEST RESULTS

GRAINSIZE ANALYSES

Driggers Engineering Services Incorporated

DRIGGERS ENGINEERING SERVICES, INC.



DRIGGERS ENGINEERING SERVICES, INC.



RESULTS OF CONSOLIDATION TESTING

Driggers Engineering Services Incorporated



METHOD OF TESTING

STANDARD PENETRATION TEST AND SOIL CLASSIFICATION

STANDARD PENETRATION TEST (ASTM D-1586)

In the Standard Penetration Test borings, a rotary drilling rig is used to advance the borehole to the desired test depth. A viscous drilling fluid is circulated through the drill rods and bit to stabilize the borehole and to assist in removal of soil and rock cuttings up and out of the borehole.

Upon reaching the desired test depth, the 2 inch O.D. split-barrel sampler or "split-spoon", as it is sometimes called, is attached to an N-size drill rod and lowered to the bottom of the borehole. A 140 pound hammer, attached to the drill string at the ground surface, is then used to drive the sampler into the formation. The hammer is successively raised and dropped for a distance of 30 inches using a rope and "cathead" assembly. The number of blows is recorded for each 6 inch interval of penetration or until virtual refusal is achieved. In the above manner, the samples are ideally advanced a total of 18 inches. The sum of the blows required to effect the final 12 inches of penetration is called the blowcount, penetration resistance or "N" value of the particular material at the sample depth.

After penetration, the rods and sampler are retracted to the ground surface where the core sample is removed, sealed in a glass jar and transported to the laboratory for verification of field classification and storage.

SOIL SYMBOLS AND CLASSIFICATION

Soil and rock samples secured in the field sampling operation were visually classified as to texture, color and consistency. The Unified Soil Classification was assigned to each soil stratum per ASTM D-2487. Soil classifications are presented descriptively and symbolically for ease of interpretation. The stratum identification lines represent the approximate boundary between soil types. In many cases, this transition may be gradual.

Consistency of the soil as to relative density or undrained shear strength, unless otherwise noted, is based upon Standard Penetration resistance values of "N" values and industry-accepted standards. "N" values, or blowcounts, are presented in both tabular and graphical form on each respective boring log at each sample interval. The graphical plot of blowcount versus depth is for illustration purposes only and does not warrant continuity in soil consistency or linear variation between sample intervals.

The borings represent subsurface conditions at respective boring locations and sample intervals only. V ariations in subsurface conditions may occur between boring locations. Groundwater depths shown represent water depths at the dates and time shown only. The absence of water table information does not necessarily imply that groun dwater was not encountered.

Rev. 9/2011

STANDARD PENETRATION TEST BORING LOGS

Proje	ect No	. [DES 137207		BORING	NO. <u>B-1</u>			T. 6			
Loca	tion	= M	Ater Reclamation	n Facility 10	MG Water Si	orage Tan	k & Interconne Forem	ection, Ma	anatee Co	ounty	, FL	
Com	pletio	n		and the	Depth To		i orem	an	D.	<u>.</u>		
De	pth_	2	21.5' Date	8/6/13	Water	2.4'	Time		_ Date _	8/	6/1	3
DEPTH, FT	SYMBOL	SAMPLES	SURF. EL:	DIL DESC	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	PE BL(S HA (AU 10	STAND ENETRATI OWS/FT. (SAMPLER MMER, 3 TOMATIC) 20	ARD ON 2" 140 L 0" DF HAM	EST O.D .B. ROP MEF).). () () () () () () () () () () () () ()
0			Brown Fine SAN	D with roots	(SP) (A-3)							
- 5 -			Brownish-gray Fi Light grayish-bro with trace of root	ne SAND wi wn Fine SAN s (SP) (A-3 SAND (SP)	th roots (SP) ND))) (A-3)	(A-3)	-					
	2 2		Brown and light b (SP-SM) (A-3) Medium dense da (SP) (A-3)	ark brown ar	y silty Fine SA nd brown Fine	ND SAND	3/5/6		•			
- 10 -	57 177 177		with trace of roots Very loose tannis with trace of shell	h-brown Fin) e SAND		2/2/2					
- 15 -		/ /	silty Fine SAND Loose grayish-bro (SP) (A-3)	(SM) (A-2-4	atic Fine SAN	D	4/5/5					
- 20 -			Hard grayish-gree (CH) (A-7-6)	en CLAY wit	h light brown	veins	14/10/26					
25 -												
30 -												
35 Rem	narks	Boi	rehole Grouted									
	_	vVF	I = Weight of Ha	mmer			Cas	ing Leng	gth			



Proje	ect No	. [DES 13	7207		BORING	NO. <u>B-3</u>	1		210.00		
Proje	tion		Ater R	eclamatio	n Facility 10	MG Water St	orage Tan	k & Interconne	ction, Manatee	County,	FL	
Com	pletio	n	Tiale			Depth To		Foreina	un	0.8.		
De	pth_	2	21.5'	Date	8/6/13	Water	3.8'	Time	Date	8/	6/13	
DEPTH, FT	SYMBOL	SAMPLES	SURF.	SC EL:	DIL DESC	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	STAI PENETRA BLOWS/F1 SAMPLE HAMMER, (AUTOMAT 10 2	NDARD ATION TE T. ON 2" ER-140 L 30" DR IC HAMI 0 40	EST O.D. B. KOP WER) D 6() 0 80
0	S.,		Brown	Fine SAN	D with trace	of roots (SP)	(A-3)					
- 5 -			Light g Dark b divided of light Tannis Light b (SP) (/ Medium	rayish-bro rown Fine brown Fin h-brown F rown Fine A-3) n dense ta ose light g silty Fine s	wn Fine SAI SAND with haterial and <u>e SAND (S</u> ine SAND (SAND with n Fine SAN rayish-brow SAND (SP- tht brown Fi	ND (SP) (A-3 trace of finely seams P) (A-3) SP) (A-3) trace of roots D (SP) (A-3) D (SP) (A-3) ne SAND (SF	3) 	2/4/7 5/8/8 5/5/8 2/2/1 5/7/8				
20 -			Firm da (CH) (/	ark grayish A-7-6)	-green and	light brown Cl	LAY	2/2/3				
Ren	narks	Bo	rehole (Grouted								
								Casi	ing Length			_

Proje Proje	ect No	. <u>[</u> E V	DES 1: Vater F	37207 Reclamatio	n Facility 10	BORING	NO. B-	4 nk & Interconne	ction. Man	natee Co	untv. I	FL	
Loca	tion	See	e Plate				erege re	Forema	n	D.S			-
Com De	pletio pth	n	76.5'	_ Date _	8/12/13	Depth To Water	2.7'	Time		Date _	8/8	/13	
DEPTH, FT	SYMBOL	SAMPLES	SURF	S(5. EL:	DIL DESC	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	PENI BLOW SAI HAM	STANDA ETRATIO VS/FT. O MPLER- MER, 30 20	ARD ON TE ON 2" (140 LI 0" DR 40	ST O.D. B. OP	:0
0	19212	Í	Dark	brown Fine	SAND with	roots (SP) (A	A-3)				TT	TTT	ň
- 5 -			Grayis (SP) Browr Light I Tan F and tr Mediu to gra (SP-S Very k Fine S Loose with p sandy (SC) t	sh-brown F (A-3) n Fine SAN brown Fine ine SAND v ace of rock im dense lig yish-brown M) (A-3) im dense bi M) (A-3) im dense bi (A-3) im dense bi (A-3) im dense bi (A-3) im dens	ine SAND with some SAND (SP) with trace of fragments and grayish-b slightly silty rown slightly some phospl ght brown cl o stiff gray ar phosphate 2-6) to (A-7-1	ith some roots roots (SP) () (A-3) roots (SP) (A-3) orown Fine SAND silty Fine SAND silty Fine SAND (A ayey Fine SA nd light brown 6)	A-3) ND ey -2-4) ND	4/6/8 9/10/10 10/9/6 1/0/1					
20 -								3/4/4					
25 -			SUIT D	ark gray sa	NOY GLAY (uп) (А-7-б)		4/4/7					
30 -			Stiff gr	rayish-gree	n CLAY (CF	ł) (A-7-6)		5/4/8					
35			Hard g (CL) ((rayish-gree A-7-6)	en weakly ce	emented CLA	Y						
Ren	narks	Bo	rehole	Grouted				Casi	ng Lengt	h			-

ocation S	See Plate I	Forem	an	D.S.		
ompletion Depth	Depth To 76.5' Date <u>8/12/13</u> Water <u>2.7'</u>	Time		Date	8/8/	13
DEPTH, FT SYMBOL	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	PENE BLOW SAW HAMM	STANDA TRATIO S/FT. ON IPLER-1 NER, 30 20	RD N TE: N 2" C 40 LE " DR(40	ST).D. }.)P
	Hard grayish-green weakly cemented CLAY (CL) (A-7-6)	5/17/50*	* 0.3' Pene	tration_	Ĥ	Ĥ
	Hard brownish-gray variably cemented CLAY (CL) (A-7-6)	7/47/50*	* 0.2' Pene	stration		
15	Firm grayish-green CLAY (CH) (A-7-6)	5/3/5				
i0 -	Stiff light grayish-brown silty CLAY (CH) (A-7-6)	29/6/8				
5	Hard light gray dolomitic, cemented, silty CLAY (CL) (A-7-6) (Dolomitic LIMESTONE Formation)	50*	* 0.5' Pene	tration		
0		50*	-* 0.2' Pene	tration-		
5	Very stiff grayish-green dolomitic, variably cemented CLAY (CL) (A-7-6) (Dolomitic LIMESTONE Formation)	6/6/15				
0 1.1		-				

Project No	. DES 13	7207		BORING	NO. <u>B-4</u>						
Project SI	E Water R	eclamation	n Facility 10	MG Water St	orage Tan	k & Interconnec	tion, Mana	atee Cou	nty, F	L	
Completio	n			Depth To				0.0.	1.5		-
Depth	76.5'	Date	8/12/13	Water	2.7'	Time		Date	8/8/	13	_
DEPTH, FT SYMBOL	SAMPLES	S(DIL DESC	RIPTION	Ŧ	BLOWS ON SAMPLER PER 6" OR PEN. STR.	S PENE BLOW SAN HAMM 10	STANDA TRATIO S/FT. ON IPLER-1 MER, 30 20	RD N TE: N 2" (40 LE " DR(40	ST).D.).).).)P 60	80
(/)	Very s	tiff grayish-	green dolor	nitic,		13/10/14					
- 75	L variab (Dolon	ly cemente nitic LIMES	d CLAY (CI	_) (A-7-6) nation)		5/8/12					
						-					
- 80 -						-					
- 85 -											
						-					
- 90 -						-					
- 95 -											
100 -											
105						-					
Remarks	Borehole	Grouted				Casi	ng Lenati	1			-
							994				_

Proje	ct No	. [BORING NO. B-	5				
Proje	tion		Ater Reclamation Facility 10MG Water Storage Tar	nk & Interconnec	tion, Mana	D S	unty, F	·L
Com	oletio	n	Depth To			0.0		12.1
De	pth _	7	<u>'6.4'</u> Date <u>8/12/13</u> Water <u>3.0'</u>	_ Time		Date _	8/12	2/13
DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	S PENE BLOW SAM HAMM 10	STANDA TRATIC S/FT. O IPLER- MER, 30 20	ARD DN TE N 2" (140 LE D" DR 40	ST D.D. 3. OP 60 80
0	N.,	T	Dark brown Fine SAND with trace of roots					
- 5 -			(SP) (A-3) Dark reddish-brown slightly organic Fine SAND (SP) (A-3) Light brown Fine SAND (SP) (A-3) Tan slightly silty Fine SAND (SP-SM) (A-3)					
- 10 -			Medium dense light grayish-brown to light brownish-gray Fine SAND (SP) (A-3)	3/4/8	•			
			Very loose grayish-brown silty, clayey Fine SAND with trace of phosphate (SM-SC) (A-2-6)	10/11/7				
- 15 -			Very loose brownish-gray phosphatic Fine SAND (SP) (A-3)	3/2/2				
- 20 -		7	(CH) (A-7-6)	3/2/4				
- 25 -			Stiff grayish-green weakly cemented CLAY (CH) (A-7-6)	4/4/6				
- 30 -		7	Stiff dark grayish-green sandy CLAY (CH) (A-7-6)	5/4/5				
35			Hard light brownish-gray variably cemented, sandy CLAY (CL) (A-7-6)			_	X	
Ren	narks	Bo	rehole Grouted	Casi	ng Lengt	h		

Project No.	DES 137207 BORING NO. B-	5	
Project <u>SE</u> Location S	Water Reclamation Facility 10MG Water Storage Tar See Plate I	nk & Interconne Forema	an D.S.
Completion Depth	Depth To 76.4' Date 8/12/13 Water 3.0'	_ Time	Date 8/12/13
DEPTH, FT SYMBOL	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 5" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP
6/0	Hard light brownish-gray variably cemented,	30/50*	* 0.3' Penetration
40	sandy CLAY (CL) (A-7-6) Hard light grayish-green cemented CLAY with seams of dark grayish-green sandy CLAY (CL/CH) (A-7-6)	16/16/50*	* 0.2' Penetration
	Firm to stiff grayish-green	_	
45	to light brownish-gray CLAY (CH) (A-7-6)	3/3/4	
50		10/5/7	
55	Hard light brownish-gray dolomitic, cemented, silty, sandy CLAY (CL) (A-7-6) (Dolomitic LIMESTONE Formation)	50*	* 0.3' Penetration
60		50*	* 0.3' Penetration
65		6/10/32	
	Very stiff dark grayish-green dolomitic CLAY		
70 Remarks	Borehole Grouted		
		Cas	ing Length

Project No. DES 137207 BORING NO. B-5	6		
Project SE Water Reclamation Facility 10MG Water Storage Tan	k & Interconne	ection, Manatee County, F	<u>-L</u>
Completion Depth To Depth 76.4' Date 8/12/13 Water 3.0'	Time	Date8/12	2/13
DEPTH, FT SOIF DESCRIPTION SAMPLES SIRE'S SOIF ET:	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TE BLOWS/FT. ON 2" (SAMPLER-140 LE HAMMER, 30" DR 10 20 40	ST D.D. 3. OP 60.80
Very stiff dark grayish-green dolomitic CLAY (CH) (A-7-6) (Dolomitic LIMESTONE Formation)	11/13/16		
 Hard grayish-green dolomitic, variably cemented CLAY (CL) (A-7-6) (Dolomitic LIMESTONE Formation) 	10/12/50*	* 0.4' Penetration	
	_		
- 80 -			
90 -			
95 -			
105			
Remarks Borehole Grouted	Cas	ing Length	

Proje	ect No	. [DES 137207		BORING	NO. <u>B-</u>	3					
Proje	ect Sl	EV	Vater Reclamatio	on Facility 10	MG Water St	orage Tan	k & Interconne	ction, M	anatee Co	unty,	FL	
Com	nletio	n	e Plate I		Denth To		Forema	in	D.8			
De	pitth_		76.5' Date _	8/7/13	Water	4.0'	Time		_ Date _	8/	6/13	
DEPTH, FT	SYMBOL	SAMPLES	S SURF. EL:	OIL DESC	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	PI BL S HA (AU 11	STANDA ENETRATIO OWS/FT. O SAMPLER- MMER, 30 TOMATIC 1 0 20	NRD DN TE N 2" 140 L D" DR HAMI 4(EST O.D. B. KOP WER) 0 80
0	1931		Dark brown slig!	ntly silty Fine	SAND with fir	nely						
- 5 -			divided organic (SP-SM) (A-3) (Gray Fine SANE Dark reddish-bro Tannish-brown Fine (SP) (A-3) Very loose light slightly silty Fine (SP-SM) (A-3) Medium dense light	with trace o own Fine SAI Fine SAND (SAND with SAND with t SAND with t	roots f roots (SP) ND (SP) (A-3 SP) (A-3) trace of roots brown race of roots SAND (SP)	(A-3) 3) (A-3)	1/1/3 4/6/9 5/6/5	•				
- 15 -			Very loose grayis with trace of pho Very loose light g clayey Fine SAN	sh-brown silty sphate (SM) greenish-brov D (SC) (A-2	y Fine SAND) (A-2-4) wn phosphatic 2-6)	5,	WH/1/1					
- 20 -		7	Firm dark gray a (CH) (A-7-6)	nd light brow	n CLAY		1/3/2					
25 -			Stiff dark grayish (CH) (A-7-6)	-green to gra	ay CLAY		3/4/5					
30 -			Hard light gray do	blomitic,			3/4/6					
35	1.)	1	variably cemente	d CLAY (CL) (A-7-6)		1				X	JTT
Ren	arks	Boi	rehole Grouted R = Weight of Ro	d WH = V	Weight of Ha	mmer	Casi	ing Len	gth			



Project No. DE	S 137207		BORING	NO. <u>B-6</u>							
Project SE Wa	ter Reclamation	Facility 10	MG Water St	orage Tanl	k & Interconne Earrow	ection, M	lanatee (County	/, Fl	<u> </u>	
Completion		1. 1. 1	Depth To		Forema	an	L	.5.		_	-
Depth 76	.5' Date	8/7/13	Water	4.0'	Time		Date	8	1/6/1	3	
DEPTH, FT SYMBOL SAMPLES	SC URF. EL:	DIL DESC	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	P BL H/ (AL	STAN ENETRA OWS/FT. SAMPLEI AMMER, JTOMATI 0 20	DARD FION 1 ON 2' R-140 30" D C HAN	"EST " O.I LB. ROI ME	Г D. Р (R) 60	80
Н	ard light gray do	lomitic,			12/32/50*	* 0.4' P	enetratio	n		П	T
40	ariably cemented	1 CLAY (CI	-) (A-7-6) Clay		46/50*	* 0 2' P	enetratio				
	at depth 40.0'	. <u>3</u> ,,			40/50	0.3 P	enetratio	<u>.</u>	+	╢	X
	ery stiff grayish-	green CLAY	′ (CH) (A-7-6	3)					2		
45					3/4/11				Ħ		
- 50 - Ha	ard cream colore CL) (A-7-6)	ed dolomitic	;, cemented C	LAY	– WR/50*	* 0.4' P	enetration	1			
55					50*	⁻ * 0.5' P	enetration	1			
60					50*	-* 0.3' P	enetration	n			
65					8/44/48						
70 Ve	ery stiff dark brov H) (A-7-6) (Dol	vnish-green omitic LIME	n dolomitic CL ESTONE Forr	AY nation)							
Remarks Bore	hole Grouted = Weight of Roo	WH = 1	Weight of Ha	mmer	Cas	ing Len	gth				_



Proje	ect No	DE	S 137207		BORING	NO. <u>B-6</u>						
Loca	tion	E vva See F	Plate I	acility 10	MG Water St	orage I an	k & Interconnect Foreman	tion, Mana	atee Cou D.S.	nty, F	L	
Com De	pletic pth	n 76	.5' Date	8/7/13	Depth To Water	4.0'	Time		Date	8/6/	13	
DEPTH, FT	SYMBOL	SAMPLES	SOIL	. DESC	RIPTION		BLOWS ON SAMPLER PER 5" OR PEN. STR.	PENE BLOW SAM HAMM (AUTO	STANDAR ETRATIOI /S/FT. ON MPLER-14 MER, 30' MATIC H	RD 1 TES 2" 0. 40 LB. 1 DRO AMME	T D. P :R)	
	17	V V	erv stiff dark brown	ish-aree	n dolomitic CL	AY	0/0/40	10	20	40	60	80
		(C	CH) (A-7-6) Dolomitic LIMESTC	NE Forn	nation)		8/9/13					
- 75 -							5/7/9		•			
80 -											+	
85 -											+	
90 -							E					
95 -												
100 -												
105 _	arko	Borol	hole Grouted									Щ
Reit	arks	WR =	= Weight of Rod	WH =	Weight of Ha	nmer	Casin	g Length	1			
		_						0.000 M 100 M 1				-

Proj	ect No	. [= v	DES 137207 BORING NO. B-	7 pk & Interconnecti	ion Man	atee Co	untv E	1
Loca	tion	Se	e Plate I	Foreman	on, mana	D.S		L
Com De	pletio epth	n	76.5' Date 8/7/13 Depth To 76.5' Date 3.7'	Time		Date _	8/7/	13
DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	PENI BLOW SAN HAMM (AUTO	STANDA ETRATIC IS/FT. O MPLER-1 MER, 30 MATIC H	ARD ON TES N 2" O I40 LB. O" DRO HAMME	T .D. P ER)
0		ſ	Light brown and dark brown Fine SAND		10	20	40	
- 5			with some roots (SP) (A-3) Grayish-brown Fine SAND with trace of roots (SP) (A-3) Dark brown Fine SAND (SP) (A-3) Tannish-brown Fine SAND (SP) (A-3) Tan Fine SAND with trace of roots (SP) (A-3) Medium dense light grayish-brown silty Fine SAND (SM) (A-2-4) Medium dense light brownish-gray slightly silty Fine SAND (SP-SM) (A-3) Medium dense to very loose light brown Fine SAND (SP) (A-3) Very loose brownish-gray phosphatic, elightly silty Fine SAND (SP-SM) (A-3)	4/5/6				
20			Firm green and light brown CLAY (CH) (A-7-6)	2/1/3				
25 - 30 -			Stiff to very stiff dark grayish-green to grayish-brown CLAY (CH) (A-7-6)	5/5/6				
Ren	narks	Bo	rehole Grouted	<u></u>	1/			
				Casing	g Length			
		-						

ocati	ion i	See Plate I	Forema	n D.:	5.
Dep	oth	n Depth To Date8/7/13 Water3.7'	Time	Date	8/7/13
DEPTH, FT	SYMBOL	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STAND PENETRATI BLOWS/FT. (SAMPLER HAMMER, 3 (AUTOMATIC	ARD ON TEST ON 2" O.D. -140 LB. 30" DROP HAMMER)
	1	Stiff to very stiff dark grayish-green to grayish-brown CLAY (CH) (A-7-6)	4/4/6		
40		Very stiff light grayish-brown dolomitic CLAY (CL) (A-7-6)	18/12/17		
45		Stiff dark grayish-green CLAY (CH) (A-7-6)	7/4/8		
50		Very stiff brownish-gray dolomitic CLAY (CL) (A-7-6)	6/12/12		
5		Hard cream colored to gray dolomitic, cemented CLAY (CL) (A-7-6) (Dolomitic LIMESTONE Formation)	50*	* 0.4' Penetration	
0		-	50* -	* 0.1' Penetration	
5			10/10/15		



Proje	ect No	. [DES 137207 BORING NO. B-	7	
Proje	tion	EV	Vater Reclamation Facility 10MG Water Storage Tar	nk & Interconne	ection, Manatee County, FL
Com	pletio pth	n	Depth To 76.5' Date <u>8/7/13</u> Water 3.7'	Time	Date 8/7/13
DEPTH, FT	SYMBOL	SAMPLES	SOIL DESCRIPTION	BLOWS ON SAMPLER PER 6" OR PEN. STR.	STANDARD PENETRATION TEST BLOWS/FT. ON 2" O.D. SAMPLER-140 LB. HAMMER, 30" DROP (AUTOMATIC HAMMER) 10 20 40 60 80
	1	F	Hard cream colored to gray dolomitic, cemented CLAY (CL) (A-7-6)	50*	* 0.5' Penetration
	1%		(Dolomitic LIMESTONE Formation)	1	
- 75 -			Hard dark grayish-green dolomitic, weakly cemented CLAY (CL) (A-7-6) (Dolomitic LIMESTONE Formation)	17/21/26	
- 80 -					
- 85 -					
- 90 -					
95 -					
- 100 -					
405					
Ren	narks	Bo	orehole Grouted		
		_		Cas	ing Length

Proje	ect No	. [DES 137207	E 111 40	BORING I	NO. <u>B-8</u>					-,	
Loca	tion	= V	vater Reclamatio	n Facility 10	MG water St	orage I an	K & Interconnec Foremar	tion, Mana	D.S	inty, i	-L	-
Com	pletio pth	n	76.5' Date	8/8/13	Depth To Water	2.6'	Time		Date _	8/8/	/13	
DEPTH, FT	SYMBOL	SAMPLES	SUPE EL.	DIL DESC	RIPTION		BLOWS ON SAMPLER PER 5" OR PEN. STR.	PENE BLOW SAN HAMM	STANDA TRATIC S/FT. O IPLER-1 MER, 30	RD DN TE N 2" (140 LI D" DR	ST D.D. 3. OP	
0	1000	K	Dark brown Fine	SAND with	roots (SP) (A	-3)	-	10		40	60 80	T
	2002		Gravish-brown F	ine SAND (SP) (A-3)		=				+++	+
-			Dark reddish-bro	wn Fine SA	ND (SP) (A-3	3)						+
			Light brown Fine	SAND (SP	(A-3)		-					+
- 5 -			Light brown rine	0/110 (0)	, (,, ,,							
		4	Medium dense ta to light brown Fin	n and light e SAND (S	brown P) (A-3)		4/5/6	•				_
40		4					7/8/9					
10		4					6/6/7					
			Very loose brown silty Fine SAND	ish-gray ph (SM) (A-2-4	osphatic, 4)		1/1/2					
- 15 -			Medium dense lig clayey Fine SANI	ght grayish-l D with phos	brown phate (SC) (A	\-2-6)	5/5/8					
20		-	Stiff grayish-gree	n CLAY (C	H) (A-7-6)		1					
20							5/5/8					
		-	Stiff dark grayish-	-green CLA`	Y (CH) (A-7-6	6)						
- 25 -							5/5/6					
- 30 -]	/	- weakly cemente	d at depth 3	30.0'		6/6/8 _					
35		-	Hard light brownis variably cemented	sh-gray dolo d CLAY (CI	omitic, L) (A-7-6)							
Ren	narks	Bo	rehole Grouted									
		_					Casi	ng Lengti	n			-

Proje	ect No	р. <u>Г</u> Е М)ES 13 /ater F	37207 Reclamation	n Facility 1(BORING	NO. B-	8 ak & Interconne	ection A	lanatee	Cou	ntv	FL		
Loca	tion	See	Plate	1			ierage rai	Forem	an		D.S.				-
Com De	pletio	7	6.5'	_ Date	8/8/13	Depth To Water	2.6'	Time		Dat	e	8/8	3/13	3	
DEPTH, FT	SYMBOL	SAMPLES	SURF	S(DIL DESC	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	PI BL S H/	STA ENETR/ OWS/F SAMPLI	NDAI ATIO T. ON ER-1 2, 30	RD N TI I 2" 40 L " DF	EST 0.1 .B. 20F	۲ ٥.	20
	1.	Y	Hard I	ight browni	sh-gray dolo	omitic,		14/22/40				40	N		TT
		H	variab	ly cemente	d CLAY (C	L) (A-7-6)		14/22/40			- 3			V	T
_	14	1 -	Hard	lork groviel	aroon CL		6)	_				-+	-	\square	\downarrow
	1	1	naiu (an grayisi	I-green CL/	AT (UL) (A-7	-0)					-	+	H	H
- 40 -	//	k						50*	⁻ * 0.5' P	enetrati	on		+	H,	P
	1	11											X	1	П
	4	1–	Firm a	ravish-gree	n CLAY (C	H) (A-7-6)		-				4	+	\vdash	₩
4.0	1	1		, ayion groc		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,		1.7		/	F		-	H	Ħ
45 -		1						3/4/3							Π
1	//	f										-	-	\vdash	4
	KK		Hard li	ight brownis	sh-gray dolo	mitic, cemen	ted.	-	2			4	+	\vdash	+
- 50 -		-	silty Cl (Dolon	ĽAY (CL) nitic LIMES	(A-7-6) TONE Forn	nation)		50*	-* 0.1' P	enetrati	on-				
55 -								16/50*	* 0.3' P	enetrati	on				
60 -								50*	"* 0.4' P	enetrati	on				2
65 -		7	Stiff to to brow Dolom	very stiff g vnish-greer hitic LIMES	rayish-gree dolomitic (TONE Forn	n CLAY (CH) (nation)	A-7-6)	4/5/7							
70	11							-							Щ
Ren	narks	Bo	ehole	Grouted				Cas	ingler	nath		_		_	-
	_	-						000		· J · · · · _				_	-



Proje	ct No	. [DES 13	37207		BORING	NO. <u>B-8</u>	1					
Proje	ct S	E V	Vater F	Reclamatio	on Facility 10	MG Water St	orage Tan	k & Interconnec	tion, Man	atee Cor	unty, I	FL	
Com	pletio pth	n	76.5'	_ Date _	8/8/13	Depth To Water	2.6'	Time	·	Date _	8/8	/13	
DEPTH, FT	SYMBOL	SAMPLES		S	OIL DESC	CRIPTION		BLOWS ON SAMPLER PER " OR PEN. STR.	PENE BLOW SAM HAMI	STANDA TRATIC S/FT. O MPLER- MER, 30	ARD ON TE N 2" 140 LI 0" DR	ST O.D B. OP	
		4	SURF	EL:	arouich aroa			0 *	10	20	40	60	80
- 75 -			to brov (Dolor	wery stim wnish-gre nitic LIME	grayisn-gree en dolomitic STONE Fori	en CLAY (CH) (/ mation)	A-7-6)	7/7/11 -					
								11/9/12					
- 80 -													
- 85 -													
- 90 -													
95 -													
100 -													
105													
Rem	arks	Bo	rehole	Grouted				Casi	ng Lengti	h			_
	_											_	-

Proje	Project No. <u>DES 137207</u> BORING NO. <u>B-9</u>											
Proje	tion		Ater Reclamatio	n Facility 10	MG Water St	orage Tan	k & Interconne	ction, M	anatee Co	ounty, I	FL	
Com	pletio	n			Depth To		Foreilla		D.(5.	-	
De	pth	2	21.5' Date	8/5/13	Water	**	Time	_	Date	8/5	/13	
DEPTH, FT	SYMBOL	SAMPLES	SURF. EL:	DIL DESC	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	PE BLC S HA (AU 10	STAND ENETRATI OWS/FT. (C SAMPLER- MMER, 3 TOMATIC 0 20	ARD ON TE: ON 2" C 140 LE 0" DRC HAMM 40	ST).D.). DP ER) 60	80
0			Brown Fine SAN	D with some	e roots (SP) (A-3)						
	14114		Tannish-brown F	ine SAND ((SP) (A-3)							
			Brown Fine SAN	D (SP) (A-:	3)							
- 5 -			Light grayish-bro	wn Fine SAN	ND (SP) (A-3)						
5			Dark reddish-bro	wn Fine SAI	ND (SP) (A-3	5)						
			(SP) (A-3)	in to light tar	n Fine SAND		3/5/7		•		+	
_							5/8/12					
- 10 -							5/6/8				Ħ	
							6/8/11	-				
46			Soft to firm greer	and light br	own		-					
15		4	to light brown CL	AY (CH) (A	A-7-6)		1/1/2	•			\square	
								$\left \right $				
- 20 -							2/3/5				\square	
											Ħ	
											Ħ	
25 -											+	
											\square	
											+	
30 -											H	
												H
35											+	
Ren	narks	Bo	rehole Grouted		s							
		**	vvater Table not	encountere	d within depth	of 10.0'	Casi	ing Len	gth		_	-

Proje	Project No. <u>DES 137207</u> BORING NO. <u>B-10</u>											
Proje	tion	= V	ater Reclamatio	n Facility 10	MG Water St	orage I ani	C& Interconne Forema	ction, Mar n	natee Co	unty, I	-L	-
Com	pletio	n		A. A. A. A.	Depth To		1 0101114					
De	pth_	2	21.5' Date _	8/5/13	Water	5.5'	Time		Date _	8/5	/13	
DEPTH, FT	SYMBOL	SAMPLES	SURF. EL:	OIL DESC	RIPTION		BLOWS ON SAMPLER PER 6" OR PEN. STR.	PEN BLOV SA HAM (AUT) 10	STANDA IETRATIC WS/FT. O MPLER-1 MER, 30 OMATIC I 20	RD N TES N 2" C 40 LE " DRC 1AMM 40	ST).D. I. DP ER) 60	80
0	1.0		Brown Fine SAN	D with trace	of roots						II	
	b N		and trace of Lim	estone Grav	el (SP) (A-3)							
-			Dark grayish-bro	wn Fine SA	ND (SP) (A-3	5)						111
	<u></u>		Grayish-brown F	ine SAND w	ith some roots	3					++	+++
- 5 -			Dark reddish-bro	wn Fine SAI	ND (SP) (A-3	3)				+	++	+++
			Light brown Fine	SAND (SP) (A-3)	10					+	
			Very loose to loo (SP) (A-3)	se light tan t	o tan Fine SA	ND	2/2/2			++	+	
			(1/2/2				$\uparrow \uparrow$	
- 10 -		H					11 641 64					
10							3/5/5					1111
		5	Madium dance li	aht availab h	Fire OA	ND	-				++	
			(SP) (A-3)	gnt grayisn-t	prown Fine SA	ND	4/5/8				+	
	al- 181 - 8-1 - 8 Jelt Jerl - 6-1		Medium dense b	rownish-aray	phosphatic.						+	
- 15 -	1 PJ P.1. PI J I P.1.		slightly silty Fine	SAND (SP-	SM) (A-3)		2/5/7				Ħ	
		-					5/5/7	1			\square	
()	al (a.) (a.) (a.)				in consta			1				
			Soft green and lig	ght brown Cl	LAY (CH) (A-	-7-6)		_/_			\square	111
- 20 -											++	
	//						1/2/2	•		++	+	
											+	++++
										++	+	
0.5								1			T	
- 25 -							1 [
							1 1					
										++	\square	
	1.1									+	++	
- 30 -							1			++	++	++++
											+	+++
											\dagger	
											T	
35												
Ren	narks	Bo	rehole Grouted									
		_					Casi	ing Lengt	:h	-	_	_



DATE: 8/15/13	PROJECT NO.	DES 137207	SHEET NO.	PLATE I
	SHEET TITLE	BORING LOCATION PLAN	PROJECT NAME	SOUTHEAST WATER RECLAMATION FACILITY 10MG WATER STORAGE TANK & INTERCONNECT MANATEE COUNTY, FLORIDA
RING LOCATION	CAD / ENGINEER	R.D.B. / N.T.K.	PREPARED BY	DRIGGERS ENGINEERING SERVICES, INCORPORATED