



**CITY OF LEESBURG  
FLORIDA**

**INVITATION FOR BID (IFB)**

**IFB TITLE: TURNPIKE WATER RECLAMATION FACILITY  
DEWATERING IMPROVEMENTS**

IFB Number:	<u>180021</u>	Contracting Buyer:	<u>Mike Thornton</u>
Bid Due Date:	<u>December 7, 2017</u>	Pre-Bid Meeting:	<u>November 7, 2017</u>
Bid Due Time:	<u>2:00 P.M.</u>	Issue Date:	<u>October 23, 2017</u>

**Estimate of Project Magnitude: \$800,000 to \$1,100,000**

**Brief Description / Purpose**

**INVITATION FOR BID**

**No. 180021**

**City of Leesburg, Florida**

The City of Leesburg, Florida invites interested, properly licensed and qualified contractors to submit bids for the Turnpike Water Reclamation Facility Dewatering Improvements project as described in the Invitation for Bid package.

Sealed Bids will be received until the appointed time, or as amended, at the office of the Purchasing Manager, 204 N. 5th Street, Leesburg, Florida, 34748. A public opening will be held shortly after that time at the same location.

Interested parties may obtain a copy of the IFB online by visiting [www.leesburgflorida.gov/purchasing](http://www.leesburgflorida.gov/purchasing) and then select 'View Bid Opportunities'. A copy may also be obtained by e-mailing a request to [purch@leesburgflorida.gov](mailto:purch@leesburgflorida.gov).

Publish: Orlando Sentinel | Ocala Star Banner | Vendor Registry

**Bid Package Distribution**

The City of Leesburg utilizes Vendor Registry ([www.vendorregistry.com](http://www.vendorregistry.com)) as the ONLY official on-line bid management system to distribute solicitations, addenda and answers to questions. Solicitation information obtained from other sources may not be current or accurate and should not be relied on for submitting a response to a solicitation.

There is no charge to vendors/contractors to register and participate in the solicitation, nor will any fees be charged to the awarded vendor. Refer to [www.leesburgflorida.gov/purchasing/bids.aspx](http://www.leesburgflorida.gov/purchasing/bids.aspx) for further information.

Vendors are strongly encouraged to register (at no cost) with Vendor Registry to download solicitation documents. Should time not permit you to complete the registration process please contact the Purchasing Division at (352)728-9880 or by email at [purch@leesburgflorida.gov](mailto:purch@leesburgflorida.gov) to obtain a solicitation document(s).

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## SECTION 1 – SPECIAL TERMS & CONDITIONS

### ST-1. **PURPOSE**

The City of Leesburg Turnpike Water Reclamation Facility will be reducing, and ultimately eliminating, the area available for land application of bio-solids. This will require the City to construct a filter belt press to process the bio-solids and dispose of the cake.

The awarded Contractor will be responsible for providing all labor, supervision, equipment and material to construct the dewatering improvements as specified.

### ST-2. **PROJECT LOCATION**

The project is located at the City's Turnpike Water Reclamation Facility at 1600 County Road 470, Okahumpka, Florida 34762.

### ST-3. **PRE-BID CONFERENCE/SITE VISIT**

A “**MANDATORY**” pre-bid meeting/site visit will be held.

<b>Date:</b>	Tuesday, November 7, 2017
<b>Time:</b>	10:00 AM Eastern Standard Time
<b>Location:</b>	Turnpike Water Reclamation Facility 1600 County Road 470 Okahumpka, Florida 34762

This is the only scheduled time contractors and their subcontractors can visit, inspect conditions, and take measurements. Additional visits may be schedule by contacting the designated procurement representative.

Company's not in attendance at the MANDATORY pre-bid meeting shall not be eligible to submit a bid response. It is the responsibility of attending companies to insure they have signed in on the official Sign-In Sheet. Bids received from Company's not represented on the Pre-Bid Meeting Sign-in Sheet shall be deemed non-responsive and not considered for award.

Bidders are advised to bring this solicitation document to the conference, as additional copies may not be available. Also, attendees should have equipment needed for measuring, as this may be their only opportunity.

The vendor is also advised to examine carefully the specifications and to become thoroughly aware regarding any and all conditions and requirements that may in any manner affect the work to be performed under the contract. No additional allowances will be made because of lack of knowledge of these conditions. For any additional information regarding the specifications and requirements of this bid contact the designated procurement representative.

**ST-4. QUESTIONS, INFORMATION or CLARIFICATION**

**ALL** questions regarding this solicitation, including technical specifications or scope of work, shall be submitted in writing to the Designated Procurement Representative. To ensure fair consideration for all parties, the City prohibits communication to or with any department, division, employee, or city representative from the date of issuance of this solicitation until final City action.

- a. Bidders are encouraged to use the question/answer feature of Vendor Registry for the submission of questions and requests for information. Should that not be possible, questions relative to interpretation of specifications, scope of services or the submittal process shall be addressed in writing to the Designated Procurement Representative at **puch@leesburgflorida.gov**.
- b. The deadline for questions is seven (7) business days prior to the solicitation due date. Does not include the day the solicitations are due.
- c. Any interpretation made to Bidders shall be expressed in the form of a written Addendum to the solicitation. Which, if issued, will be made available to all prospective Bidders no later than the three (3) business days immediately before the solicitation due date. Does not include the day the solicitations are due.
- d. Inquiries received after the deadline for questions may not be given any consideration at the discretion of the Purchasing Manager.
- e. It will be the responsibility of the Bidders to contact the Purchasing Division prior to submitting bids to ascertain if any addenda have been issued, to obtain all such addenda, incorporate addenda in their bid response and acknowledge said addenda on the appropriate form.

**ST-5. ELIGIBILITY**

To be eligible to respond to this IFB, bidding firms must demonstrate they, or the principals assigned to the project, have successfully completed projects similar to those specified in the Scope of Services section of the IFB, to at least three municipal entities.

Bidders/Contractors must have a minimum of 3-years experience in performing the same or similar work required on this project. Bidders shall provide a minimum of three (3) reference projects completed within the last 1 year related to similar contracts of similar scope and size. References shall be given on the forms provided.

**ST-6. LICENSES**

The vendor submitting a bid must hold at least one of the following licenses:

- State of Florida Certified General Contractor (CGC), or
- Registered\* General Contractor (RUC)
  
- State of Florida Certified Building Contractor (CBC), or
- Registered\* Building Contractor (RBC)
- \*Lake County Building Services, Lake County Florida is the registering authority for work performed by registered contractors with the City of Leesburg.

The vendor shall obtain and pay for all licenses required for this project and shall comply with all laws, ordinances, regulations and building code requirements applicable to the work contemplated herein. Damages, penalties and/or fines imposed on the City or the vendor for failure to obtain required licenses shall be borne by the vendor.

The contractor and subcontractors must hold the necessary valid license for the type of work to be performed for the full duration of the project. Allowing the license to lapse at any time during the project will be cause for the contract to be terminated for cause. The license must be effective at the time their bid is submitted.

Licenses will be verified through the Florida Department of Professional Regulation website ([myfloridalicense.com](http://myfloridalicense.com)).

**ST-7. DESIGNATED PROCUREMENT REPRESENTATIVE**

Questions concerning any portion of this solicitation shall be directed in writing [fax and e-mail accepted] to the below named individual who shall be the official point of contact for this solicitation. Questions should be submitted no later than seven (7) business days before the bid opening date.

Mike Thornton, CPPO-Purchasing Manager  
City of Leesburg | Purchasing Department  
204 N. 5th Street, Leesburg, FL 34748  
Phone: 352-728-9880 | E-mail: [purch@leesburgflorida.gov](mailto:purch@leesburgflorida.gov)

No answers given in response to questions submitted shall be binding upon this solicitation unless released in writing as an addendum to the solicitation by the Purchasing Division for the City of Leesburg.

**ST-8. RESTRICTED DISCUSSIONS**

From the date of issuance of this solicitation until final City action, vendors should NOT discuss the solicitation or any part thereof with any employee, agent, or any other representative of the City except as expressly authorized by the designated procurement representative. The only communications that shall be considered pertinent to this solicitation are appropriately signed written documents from the vendor to the designated procurement representative and any relevant written document promulgated by the designated procurement representative.

**ST-9. DELIVERY OF SOLICITATION RESPONSE**

To be considered for award, a complete bid response must be received and accepted in the Purchasing Division no later than the due date and time established within the solicitation. Allow sufficient time for transportation and inspection. Each package shall be clearly marked with the applicable solicitation number, title, and company name. Ensure that your bid is securely sealed in an opaque envelope/package to provide confidentiality of the bid prior to the solicitation closing.

<b>Delivery IN PERSON</b>	<b>THIRD PARTY CARRIER i.e., Fed-Ex, UPS</b>
PURCHASING DIVISION CITY OF LEESBURG 204 N. 5TH STREET LEESBURG, FLORIDA	PURCHASING DIVISION CITY OF LEESBURG 204 N. 5TH STREET LEESBURG, FLORIDA 34748

FACSIMILE (FAX) OR ELECTRONIC SUBMISSIONS (E-MAIL) WILL NOT BE ACCEPTED.

**ST-10. COMPLETION REQUIREMENTS FOR INVITATION FOR BID**

**Complete all forms and Item Bid Schedule. One (1) original of all forms and Item Bid Schedule must be** submitted by the vendor in a sealed envelope/package and shall be delivered to the Purchasing Division no later than the official bid opening date and time. Any bid received after this time shall not be considered for award.

The City is not liable or responsible for any costs incurred by any Bidder in responding to this IFB including, without limitation, costs for product and/or service demonstrations if requested.

When you submit your bid, you are making a binding offer to the City and are agreeing to all of the terms and conditions in this Invitation for Bid. Use only the form(s) provided in this document. If you make any change to the content or format of any form, the City may disqualify your bid. All information shall be legible and either written in ink or typewritten. If you make a correction or change on any document, the person signing the bid or proposal must initial the change. The bid shall be manually signed by an official authorized to legally bind the Bidder to its provisions.

Specific Completion Directions - Pricing shall be completed using the provided Schedule of Bid Items in the Forms Section of this solicitation. Reproductions or variations of the Schedule of Bid Items shall not be acceptable.

**ST-11. BID RESPONSE GUARANTEE**

Bid Response Guarantee – A bid bond executed by a surety acceptable to the Owner for not less than five percent (5%) of the amount of the bid shall accompany each Bid Response as guarantee that the bidder will, if awarded the contract, promptly enter into an agreement to do the work and furnish the required Performance and Payment Bond.

Liquidated Damages for Failure to Enter into Contract - The successful bidder, upon failure or refusal to execute and deliver the contract and bonds required within 10 days after receipt of notice of the acceptance of the bid, shall forfeit to the City, as liquidated damages for such failure or refusal, the security deposited with the bid.

**ST-12. RETURN OF BID RESPONSE GUARANTEES**

As soon as the Bid Responses have been evaluated, the City of Leesburg may, at its discretion, return or release the guarantee deposits accompanying such Bid Responses, as in

its judgment, would not likely be considered in making the award. All other Bid Response guarantees will be held until the contract and bond have been executed, after which any sums of money representing security deposits will be returned to the respective Bidders whose Bid Responses they accompanied. Bid Bonds will not be returned unless requested.

**ST-13. GUARANTY OF FAITHFUL PERFORMANCE AND PAYMENT**

Performance and Payment Bonds, written by a Surety firm satisfactory to the City of Leesburg which comply with Section 255.05(1), Florida Statutes, will be required of the successful Bidder to guarantee that he will deliver a complete project under his Contract in strict accordance with the Contract Documents and that he will pay promptly all persons supplying him with labor or materials for the work.

The Performance and Payment Bonds shall each be for an amount not less than the Total Contract Price as agreed to by both parties. The cost of this bond shall be included in the price bid in the Bid Response.

These bonds shall be substantially in the form provided herein and written by a qualified Surety firm and through a reputable and responsible surety bond agency licensed to do business in the State of Florida and Lake County and meet the following requirements:

The Surety must be rated as "A" or better as to strength by Best's Insurance Guide, published by Alfred M. Best Company, Inc., 75 Fulton Street, New York, New York.

Bonding Limit - Any One Risk: The Bonding Limit of the Surety shall not exceed ten (10) percent of the policy holders' surplus (capital and surplus) as listed by the aforementioned Best's Insurance Guide. The completed Bond shall be executed in four (4) counterparts and delivered to the City of Leesburg with the required Power-of-Attorney and executed contract.

**ST-14. POWER OF ATTORNEY**

Attorneys-in-Fact, who sign Bid Bonds and Performance or Payment Bonds, must file with such bonds a certified copy of their power of attorney to sign such bonds.

**ST-15. BID OPENING**

This project is considered a Construction Project. All bids that have been received in a timely manner will be opened in a Public Meeting in accordance with Chapter 255.0518 Florida Statute. The names of the bidders submitting bids will be read aloud and recorded with the bid amounts for each of the base bid items. The bids will be available for inspection in the Purchasing Division during normal business hours.

**ST-16. LOCAL VENDOR PREFERENCE**

(Applicable to projects whose cost is \$25,000 or greater.)

The City of Leesburg applies a Local Vendor Preference (LVP) for the purchase of personal property, general services, and professional services where the total purchase cost is \$25,000 and greater by means of competitive bid, request for proposals, qualifications or other

submittals and competitive negotiation and selection. Except where federal or state law/requirements mandate to the contrary, preference shall be given to Local Vendors in the following manner:

- a. **“Tier I Local Vendor”** shall be defined as the primary Business Office or a Full Time Sales Office of the vendor being located within the City of Leesburg or the vendor receiving one or more Utility Services from the City of Leesburg.
  - i. **Tier I Local Vendor** - Under a Competitive Solicitation, the City may give a preference to a Tier I Local Vendor in the amount of five percent (5%) of the bid price or \$25,000, whichever is less.
- b. **“Tier II Local Vendor”** shall be defined as the primary Business Office or a Full Time Sales Office of the vendor not meeting the definition of a Tier I Local Vendor but nonetheless being located within the 20-Mile Radius as defined in this policy.
  - i. **Tier II Local Vendor** - Under a Competitive Solicitation, the City may give a preference to a Tier II Local Vendor in the amount of two percent (2%) of the bid price or \$10,000, whichever is less.

The Local Vendor preference will be applied only to the items/amount used for purposes of bid evaluation and determining award.

Bidders wanting a copy of the entire policy can receive one by making a request by e-mail to [purch@leesburgflorida.gov](mailto:purch@leesburgflorida.gov) or by calling the purchasing office at (352) 728-9880.

#### ST-17. **METHOD OF AWARD**

To a single vendor in the aggregate. Recommendation of Award shall be to the responsible bidder submitting the lowest responsive bid and holding the necessary licenses, certifications and experience. Determination of low bid amount will be made using the total bid for the Base Bid Items only and will not consider additional contract items. Local Vendor Preference will be considered when applicable in determining the low bid amount.

#### ST-18. **QUANTITIES**

Measurements and quantities which may be given are estimates only, given for informational purposes. Bidders are encouraged to visit the sites to verify measurements and quantities.

The City reserves the right to alter the quantities of work to be performed at any time when necessary and the Contractor shall perform the work as altered, increased or decreased. Payment for such altered increased or decreased quantity will result in an Equitable Adjustment for changed work. Equitable Adjustments can result in price increases for the Contractor for increased work, or price reductions for the City for reduced work. No allowance will be made for any change in anticipated profits nor shall such changes be considered as waiving or invalidating any conditions or provisions of the Contract and Bond.

#### ST-19. **CONTRACT**

The City intends to execute a Firm-Fixed Price Construction Services Agreement prepared by the City with the awarded company as a result of this solicitation.



**ST-20. TERM OF CONTRACT**

The performance period under this contract shall commence upon the date of the Notice To Proceed and shall remain in effect until such time as the commodities, equipment and/or services acquired in conjunction with this solicitation and resulting contract have been delivered and/or completed, and accepted by the City's authorized representative, and will then remain in effect until completion of the expressed and/or implied warranty periods.

**ST-21. START AND COMPLETION OF WORK**

Work performed under the resulting agreement shall commence upon issuance of a Notice to Proceed and City purchase order. Notice to Proceed shall state the completion date of the ordered work.

All work shall be performed in accordance with good commercial practice. The work schedule and completion dates shall be adhered to by the vendor(s); except in such cases where the completion date will be delayed due to acts of God, strikes, or other causes beyond the control of the vendor. In these cases, the vendor shall notify the City of the delays in advance of the original completion so that a revised delivery schedule can be appropriately considered by the City.

Should the vendor(s) to whom contract(s) is/are awarded fail to complete the work within the number of days stated in its bid, or the "not-to-exceed timeframe cited above, it is hereby agreed and understood that the City reserves the authority to terminate the contract with the vendor and to secure the services of another vendor to complete the work. If the City exercises this authority, the City shall be responsible for reimbursing the vendor for work which was completed and found acceptable to the City in accordance with the contract specifications. The City may, at its option, demand payment from the vendor, through an invoice or credit memo, for any additional costs over and beyond the original contract price which were incurred by the City as a result of having to secure the services of another vendor. If the incumbent vendor fails to honor this invoice or credit memo, the City may terminate the contract for default.

**ST-22. METHOD OF PAYMENT**

- i. All invoices shall contain the purchase order number, date and location of delivery or service, and confirmation of acceptance of the goods or services by the appropriate City representative.
- ii. Failure to submit invoices in the prescribed manner will delay payment.
- iii. The project is considered a construction project and retainage may be withheld according to State of Florida Statute.

**ST-23. PERMITS**

The vendor shall obtain and pay for all permits and inspection fees required for this project and shall comply with all laws, ordinances, regulations and building code requirements applicable to the work contemplated herein. Damages, penalties and/or fines imposed on the City or the vendor for failure to obtain required permits, inspection fees, or inspections shall be borne by the vendor.

The City is aware of the following requirements regarding permits:

Commercial Building Permit: \$0.91 per SF, or  
Minimum Fee: \$180.00

Electrical Permit:  
Minimum Fee: \$124.00

Mechanical Permit:  
Minimum Fee: \$124.00

A 3% State Surcharge is added to each Permit Fee amount.

**ST-24. ACCEPTANCE OF GOODS OR SERVICES**

The goods delivered as a result of an award from this solicitation shall remain the property of the Contractor, and services rendered under the contract will not be deemed complete, until a physical inspection and actual usage of the product(s) and/or service(s) is (are) accepted by the City and shall be in compliance with the terms herein, fully in accord with the specifications and of the highest quality.

Any goods and/or services purchased as a result of this solicitation and/or contract may be tested and/or inspected for compliance with specifications. In the event that any aspect of the goods or services provided is found to be defective or does not conform to the specifications, the City reserves the right to terminate the contract or initiate corrective action on the part of the vendor, to include return of any non-compliant goods to the vendor at the vendor's expense, requiring the vendor to either provide a direct replacement for the item, or a full credit for the returned item. The vendor shall not assess any additional charge(s) for any conforming action taken by the City under this clause. The City will not be responsible to pay for any product or service that does not conform to the contract specifications.

In addition, any defective product or service or any product or service not delivered or performed by the date specified in the purchase order or contract, may be procured by the City on the open market, and any increase in cost may be charged against the awarded Contractor. Any cost incurred by the City in any re-procurement plus any increased product or service cost shall be withheld from any monies owed to the Contractor by the City for any contract or financial obligation.

This project will be inspected by an authorized representative of the City. This inspection shall be performed to determine acceptance of work, appropriate invoicing, and warranty conditions.

**ST-25. ACCIDENT PREVENTION AND BARRICADES**

Precautions shall be exercised at all times for the protection of persons and property. All vendors performing services under this contract shall conform to all relevant OSHA, State, County, and City regulations during the course of such effort. Any fines levied by the above mentioned authorities for failure to comply with these requirements shall be borne solely by the responsible vendor. Barricades shall be provided by the vendor when work is performed in areas traversed by persons, or when deemed necessary by the City's Project Manager.

**ST-26. LABOR, MATERIALS, & EQUIPMENT SHALL BE SUPPLIED BY THE VENDOR**

Unless otherwise stated in this solicitation the vendor shall furnish all labor, material and equipment necessary for satisfactory contract performance. When not specifically identified in the technical specifications, such materials and equipment shall be of a suitable type and grade for the purpose. All material, workmanship, and equipment shall be subject to the inspection and approval of the City's Project Manager.

**ST-27. CLAIMS FOR EXTRA COST**

If the Contractor claims that any instructions by drawings or otherwise involve extra cost under this contract, he shall give the Project Representative written notice thereof within ten (10) days after the receipt of such instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property, the procedure shall then be as provided for changes in the work. No such claim will be valid unless so made.

**ST-28. CONTRACTORS ACCEPTANCE OF CONDITIONS**

The Contractor hereby agrees that he has carefully examined the surface of the site and surrounding areas to fully satisfy himself that such site is a correct and suitable one for this work and he assumes full responsibility therefore. The provisions of this contract shall control any inconsistent provisions contained in the specifications. All Drawings and Specifications have been read and carefully considered by the Contractor, who understands the same, and agrees to their sufficiency for the work to be done. It is expressly agreed that under no circumstances, conditions or situations shall this contract be more strongly construed against the City than against the Contractor and his Surety.

Any ambiguity or uncertainty in the Drawings or specifications shall be interpreted and constructed by the Engineer of Record and his decision shall be final and binding upon all parties.

It is distinctly understood and agreed that the passing, approval and/or acceptance of any part of the work or material by the City, the Engineer of Record, or by any agent or representative as in compliance with the terms of this contract and/or of the Drawings and Specifications covering said work, shall not operate as a waiver by the City of strict compliance with the terms of this Contract, and/or the Drawings and Specifications

covering said work; and the City may require the Contractor and/or his surety to repair, replace, restore and/or make to comply strictly and in all things with this Contract and the Drawings and Specifications any and all of said work and/or materials which within a period of one (1) year from and after the date of the passing, approval, and/or acceptance of such work or material, are found to be defective or to fail in any way to comply with this contract or with the Drawings and Specifications. This provision shall not apply to materials or equipment normally expected to deteriorate or wear out and become subject to normal repair and replacement before the condition is discovered. The Contractor shall not be required to do normal maintenance work under the guarantee provisions. Failure on the part of the Contractor and/or his surety, immediately after notice to either, repair or replace any such defective materials and workmanship shall entitle the City, if it sees fit, to replace or repair the same and recover the reasonable cost of such replacement and/or repair from the Contractor and/or his surety, who shall in any event be jointly and severally liable to the City for all damage. Loss and expenses caused to the City by Reason for the Contractor's breach of this contract and/ or his failure to comply strictly and in all things with this Contract and with the Drawings and Specifications.

**ST-29. FAILURE TO COMPLETE THE WORK ON TIME/LIQUIDATED DAMAGES**

The Contractor shall take into account all contingent work which has to be done by other parties arising from any cause whatsoever, and shall not plead his need of knowledge of said contingent work as an excuse for delay in his work or for non-performance.

If the work is not completed in full by the deadline specified, then for each day thereafter on which the work has not been completed, Contractor shall pay to the Owner liquidated damages in the amount of **Two Hundred Fifty Dollars (\$250.00)** per calendar day, which Owner is hereby authorized to deduct from the final draw before paying any remaining amount to Contractor. The parties agree that it would be impossible or extremely difficult to compute the actual damages suffered by the Owner due to late completion of the work, that it is therefore appropriate to provide for liquidated damages in this Contract, and that the amount of liquidated damages specified is reasonable and bears a substantial relationship to the probable amount of actual damages the Owner would suffer, and therefore does not constitute a penalty or forfeiture. Contractor acknowledges that this provision is material to the Owner and that the Owner would not have entered into this Contract but for this provision and that as a result of the Owner's reliance on this provision, the Contractor shall be stopped to deny or dispute the validity or enforceability of this liquidated damage clause.

Nothing shall be construed as limiting the right of the Owner to declare the Contract forfeited, or to take over the work, or to claim damages for the failure of the Contractor to abide by each and every one of the terms of the Contract Documents. The completion date shall be construed as being the date on which the work is fully accepted by the Owner.

**ST-30. WARRANTY**

Contractors material and workmanship is warranted for a period of One (1) year from acceptance by the City. City shall notify Contractor of any defects in material or workmanship. Contractor shall coordinate with City any warranted repairs.

**ST-31. MATERIAL STORAGE**

On-site storage is available and must be coordinated with the City.

**ST-32. RISK OF LOSS**

The vendor assumes the risk of loss of damage to the City's property during possession of such property by the vendor, and until delivery to, and acceptance of, that property to the City. The vendor shall immediately repair, replace or make good on the loss or damage without cost to the City, whether the loss or damage results from acts or omissions (negligent or not) of the vendor or a third party.

The vendor shall indemnify and hold the City harmless from any and all claims, liability, losses and causes of action which may arise out of the fulfillment of any subsequent contract. The vendor shall pay all claims and losses of any nature whatsoever in connection therewith, and shall defend all suits, in the name of the City when applicable, and shall pay all costs and judgments which may issue thereon.

**ST-33. INSURANCE AND INDEMNITY REQUIREMENTS**

- a) **Scope of Insurance** - The Contractor shall procure and maintain at its own expense, the following minimum insurance coverage, unless otherwise specified in the agreement, contract or lease.
- i. All required insurance shall be provided by insurers acceptable to the City with an A.M. Best rating of at least A: VII.
  - ii. The Contractor shall require, and shall be responsible for assuring that any and all of its subcontractors secure and maintain such insurance that are required by law to be provided on behalf of their employees and others until the completion of that subcontractors work.
  - iii. The required insurance shall be secured and maintained for not less than the limits required by the City, or as required by law, whichever is greater.
  - iv. The required insurance shall not limit the liability of the Contractor. The City does not represent these coverages or amounts to be adequate or sufficient to protect the Contractor's interests or liabilities, but are merely required minimums.
  - v. The provisions of the required insurance are subject to the approval of the City's Risk Manager, and upon request, the Contractor shall make available certified copies of the various policies for inspection.
  - vi. All liability insurance, except professional liability, shall be written on an occurrence basis.
  - vii. The Contractor waives its right of recovery against the City to the extent permitted by its insurance policies.
  - viii. Insurance required of the Contractor, or any other insurance of the Contractor shall be considered primary, and insurance of the City, if any, shall be considered excess as applicable to any claims which arise out of the agreement, contract or lease.
- b) **Indemnification** - The Contractor shall indemnify and hold harmless the City and its officers and employees, from liabilities, damages, attorneys' losses, and costs, including, but not limited to, reasonable fees, to the extent caused by the negligence, recklessness,

- or intentionally wrongful conduct of the Contractor and other persons employed or utilized by the Contractor in the performance of the contract.
- c) **Certificate of Insurance** - The Contractor shall provide evidence of required minimum insurance by providing the City an ACORD or other Certificate of Insurance in forms acceptable to the Risk Manager for the City, before any work under the agreement, contract or lease begins.
- i. Except for workers' compensation and professional liability, the Contractor's insurance policies shall be endorsed to name the City of Leesburg as additional insured to the extent of the agreement, contract or lease.
  - ii. The Certificate(s) of Insurance shall designate the City as certificate holder as follows: City of Leesburg, Attn: Purchasing Manager, P.O. Box 490630, Leesburg, Florida 34749-0630.
  - iii. The Certificate(s) of Insurance shall include a reference to the project and/or purchase order number.
  - iv. The Certificate(s) of Insurance shall indicate that the City shall be notified at least thirty (30) days in advance of cancellation.
  - v. The Certificate(s) of Insurance shall include all deductibles and/or self-insurance retentions for each line of insurance coverage.
  - vi. The Contractor, at the discretion of the Risk Manager for the City, shall provide information regarding the amount of claims payments or reserves chargeable to the aggregate amount of the Contractor's liability coverage(s).
- d) **Comprehensive General Liability** - The Contractor shall purchase and maintain Commercial General Liability coverage on forms no more restrictive than the latest editions of the Commercial General Liability policies of the Insurance Services Office (ISO). The Commercial General Liability policy shall provide minimum limits of \$1,000,000 per occurrence combined single limit that includes coverage for bodily and personal injury and property damage liability for premises, operations, products and completed operations\*, independent contractors, contractual liability covering the agreement, contract or lease, broad form property damage coverage, and property damage resulting from explosion, collapse or underground exposures (x, c, u).
- i. For remodeling and construction projects, the Contractor shall purchase and maintain products and completed operations coverage for a minimum of three (3) years beyond the City's acceptance of the project.
- e) **Business Automobile Liability** - The Contractor shall purchase and maintain Business Automobile Liability coverage on forms no more restrictive than the latest editions of the Business Automobile Liability policies of the Insurance Services Office (ISO). The Business Automobile Liability policy shall provide minimum limits of \$1,000,000 per occurrence combined single limit that includes coverage for claims for bodily injury and property damage arising from the use of motor vehicles, including on-site and off-site operations, and owned, non-owned and hired vehicles, and employee non-ownership use.
- f) **Workers' Compensation** - The Contractor shall purchase and maintain Workers' Compensation insurance for all workers' compensation obligations imposed by state law

and with employers liability limits of at least \$100,000 each accident and \$100,000 each employee with \$500,000 policy limit for disease.

Contractors exempt from maintaining Workers' Compensation insurance must provide a valid certificate of exemption issued by the State of Florida.

**ST-34. ILLEGAL ALIEN LABOR**

Contractor shall comply with all provisions of the Federal Immigration and Control Act of 1986 (8 U.S. Code § 1324 a) and any successor federal laws, as well as all provisions of Section 448.09, Florida Statutes, prohibiting the hiring and continued employment of aliens not authorized to work in the United States. Contractor shall not knowingly employ or contract with an illegal alien to perform work under this contract or enter into a contract with a subcontractor that fails to certify to the contractor that the subcontractor is in compliance with the terms stated within. The General Contractor nor any subcontractor employed by him shall not knowingly employ or contract with an illegal alien to perform work under this contract. Contractor agrees that it shall confirm the employment eligibility of all employees through participation in E-Verify or an employment eligibility program approved by the Social Security Administration and will require same requirement to confirm employment eligibility of all subcontractors. All cost incurred to initiate and sustain the aforementioned programs shall be included in contract price. Failure to meet this requirement may result in contract termination by the City.

**ST-35. FAIR LABOR STANDARDS ACT**

No contractor or subcontractor holding a service contract with the City for any dollar amount shall pay any of its employees working on the contract less than the minimum wage specified in section 6(a)(1) of the Fair Labor Standards Act 29 U.S.C. 206. Failure to meet this requirement may result in contract termination by the City.

[END OF SECTION]

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## **SECTION 2 – SCOPE OF WORK**

### **SW-1. SCOPE OF WORK**

Performance under any subsequent Contract related to this Invitation for Bid 180021 shall consist of furnishing all labor, materials, tools, equipment and incidentals (other than those provided by the City) and performing all Work required as identified by the Project Manual consisting of Technical Specifications and Drawings included in this Invitation for Bid.

[END OF SECTION]

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## SECTION 3 - GENERAL TERMS & CONDITIONS

### GT-1. DEFINITIONS

- 1.1. **Addendum:** A written change to a Solicitation.
- 1.2. **Bid, Offer, or Response:** Shall refer to any bid, offer, or response submitted in regard to this Invitation for Bid that if accepted would bind the Contractor to perform the resultant contract.
- 1.3. **Bidder:** A general reference to any entity responding to this solicitation and must be the party entering into the Agreement with the City; also includes bidder, contractor, company, respondent, vendor, etc.
- 1.4. **Contract:** The Agreement to provide the goods or perform the services set forth in this solicitation.
  - 1.4.1. **Purchase of Goods -** The contract will be comprised of the solicitation document signed by the vendor with any addenda and other attachments specifically incorporated and a City purchase order.
  - 1.4.2. **Performance of Services –** The contract will be comprised of the Agreement between the City and the vendor, the solicitation document, any addenda, and other attachments incorporated into the agreement.
- 1.5. **Contractor:** The vendor to whom award has been made.
- 1.6. **City:** Shall refer to City of Leesburg, Florida.
- 1.7. **In Writing –** Unless otherwise designated 'In Writing' includes submitting documents or questions through the electronic bid system, *Vendor Registry*, currently used by the City.
- 1.8. **Invitation for Bid (IFB):** Shall mean this solicitation document, including any Addenda, used to communicate City requirements to prospective bidders and to solicit bid responses from them.
- 1.9. **Language:** The City has established for purposes of this solicitation that the words "shall", "must", or "will" are equivalent in this solicitation and indicate a mandatory requirement or condition, the material deviation from which shall not be waived by the City. A deviation is material if, in the City's sole discretion, the deficient response is not in substantial accord with this IFB's mandatory requirements. The words "should" or "may" are equivalent in this solicitation and indicate very desirable conditions or requirements, but are permissive in nature. The masculine pronoun shall include the feminine and neuter and the singular shall include the plural.
- 1.10. **Official Purchasing Time:** The Official Purchasing Time shall be that time reflected on the digital clock located in the Purchasing Office and labeled 'Official Purchasing Time'. This clock shall be used for all time deadlines related to City purchasing solicitations.
- 1.11. **Owner:** Shall refer to City of Leesburg, Florida.
- 1.12. **Responsible:** Refers to a vendor that has the capacity and capability to perform the work required under a Solicitation and is otherwise eligible for award.
- 1.13. **Responsive:** Refers to a Bidder that has taken no exception or deviation from the terms, conditions, and specifications set forth in an IFB. Their bid, offer or response conforms to the instructions and format specified in the solicitation document.
- 1.14. **Solicitation:** The written document detailing the solicitation requirements and requesting bids, offers or submittals from Bidders.

### GT-2. INSTRUCTIONS TO BIDDERS

- 2.1. **Addenda –** The Purchasing Division may issue an addendum in response to any inquiry received, prior to the deadline for questions which changes, adds to, or clarifies the terms, provisions, or requirements of the solicitation. The Bidder should not rely on any representation, statement or explanation whether written or verbal, regardless of the source, other than those made in this solicitation document or in any addenda issued. Where there appears to be a conflict between this solicitation and any addenda, the last addendum issued shall prevail.
  - 2.1.1. **Bidders Responsibility -** It is the Bidders responsibility to ensure receipt of all addenda and any accompanying documentation. The Bidder is required to Acknowledge receipt of the addenda issued on the appropriate bid form. Failure to acknowledge each addendum may cause the bid to be deemed non-responsive and not be considered for award.
- 2.2. **Contents of Solicitation and Bidders Responsibilities –** It is the responsibility of the Bidder to become thoroughly familiar with the requirements, terms, and conditions of this solicitation. Pleas of ignorance of these matters by the Bidder will not be accepted as a basis for varying the requirements of the City of the amount to be paid to the vendor.
- 2.3. **Request for Additional Information/Questions -** Any communication or inquiries, except for clarification of process or procedure already contained in the solicitation, are to be made in writing to the attention of the

Procurement Representative identified in Section 1 of the solicitation no later than **SEVEN (7) DAYS** prior to the bid opening date. Oral answers given by anyone shall not be authoritative.

Vendors are encouraged to submit their questions electronically through *Vendor Registry*. If this is not possible questions may be submitted via e-mail at [purch@leesburgflorida.gov](mailto:purch@leesburgflorida.gov). You must reference the solicitation number in the subject line. All requests for information or questions should be clearly marked and must be received no later than the cutoff for questions.

- GT-3. **Award** – Award may be made to the Bidder which offers the best value to the City. The City reserves the right to reject any and all offers, to waive non-material irregularities or technicalities and to re-advertise for all or any part of this solicitation as deemed in its best interest. The City shall be the sole judge of its best interest.
- GT-4. **Assignment** – The Contractor shall not assign or transfer any contract resulting from this solicitation, including any rights title or interest therein, or its power to execute such contract to any person, company or corporation without the prior written consent of the City.
- GT-5. **Basis for Bidding** - The total amount bid shall be based on quantities, unit prices and/or lump sum(s) according to the Schedule of Bid Items form provided. Any quantities shown in the Schedule of Bid Items Form are estimates for the purpose of arriving at a total bid price for comparison of Bid Responses.

A Bidders bid prices shall be firm for ninety (90) calendar days after the solicitation opening date, unless stated differently in the Special Terms and Conditions. In the case of a discrepancy between the unit cost and extended cost the unit cost quoted will take precedence and the Purchasing Division shall make and note the correction on the Final Bid Tabulation.

- GT-6. **Bidder Eligibility** – It is the policy of the City to encourage full and open competition among all available qualified vendors. All vendors regularly engaged in the type of work specified in the solicitation are encouraged to submit bids. Eligibility requirements for contract award are:
- 6.1. Have NO delinquent indebtedness to the City of Leesburg or other federal, state, or municipal agencies;
  - 6.2. Shall be regularly and consistently engaged in providing services the same or similar to those being requested in the solicitation;
  - 6.3. Have adequate financial resources, or the ability to obtain such resources as required during performance of the contract;
  - 6.4. Be able to comply with the required or proposed delivery or performance schedule;
  - 6.5. Have a satisfactory record of performance. Vendors who are or have been deficient in current or recent contract performance (when the number of contracts and the extent of the deficiency of each are considered, in the absence of evidence to the contrary or circumstances properly beyond the control of the contractor) shall be presumed unable to meet this requirement. Past unsatisfactory performance will ordinarily be sufficient to justify a finding of non-responsibility;
  - 6.6. Vendors performing work for the City at the time responses to this solicitation are received may be deemed non-responsible and not considered for award of this solicitation should their current performance be rated as less than satisfactory by the City's designated representative. Previous award of work does not guarantee future award(s). The Vendor must perform satisfactorily and professionally on all City work undertaken;
  - 6.7. Have a satisfactory record of integrity and business ethics;
  - 6.8. Be properly licensed by the appropriate regulatory agency for the work to be performed;
  - 6.9. Not have any previous or current investigations, regardless of disposition or outcome, by the regulatory agency responsible for licensing Contractors; and
  - 6.10. Be otherwise qualified and eligible to receive an award under applicable laws and regulations.
- GT-7. **Cancellation of Solicitation** – The City reserves the right to cancel, in whole or in part, any solicitation when it is in the best interest of the City. Availability of all information related to a cancelled solicitation is subject to Chapter 119, Florida Statutes.
- GT-8. **Changing of Forms** – If the City discovers any bid forms submitted by a bidder in response to this solicitation have been altered the City may, at its discretion, disqualify the Bidder and not consider their bid for award.

- GT-9. **City is Tax Exempt** - The City is generally exempt from Federal Excise Taxes and all State of Florida sales and use taxes. The City will provide a tax exemption certificate upon request. Contractors doing business with the City are not exempt from paying sales tax to their suppliers for materials to fulfill contractual obligations with the City, nor shall any contractor be authorized to use any of the City's Tax Exemptions in securing such materials.
- GT-10. **Collusion Among Firms** - Where two (2) or more related parties, as defined herein, each submit a bid for the same contract, such bids shall be presumed to be collusive. The foregoing presumption may be rebutted by the presentation of evidence as to the extent of ownership, control and management of such related parties in preparation of such submittals. Related parties shall mean an interested party or the principals thereof which have a direct or indirect ownership interest in another interested party for the same contract or in which a parent company or the principals thereof of one interested party have a direct or indirect ownership interest in another interested party for the same contract. Furthermore, any prior understanding, agreement, or connection between two (2) or more corporations, firms, or persons submitting a response for the same materials, supplies, services, or equipment shall also be presumed to be collusive. The relationship of manufacturer or their representative(s) providing pricing to distributors while each party submits a bid for the same materials, supplies, services, or equipment shall be presumed to be collusive. Responses found to be collusive shall be rejected. Respondents which have been found to have engaged in collusion may be considered non-responsible, and may be suspended or debarred, and any contract resulting from collusive actions may be terminated for default.
- GT-11. **Conflict of Interest** - The award hereunder is subject to Chapter 112, Florida Statutes. All respondents must disclose with their response the name of any officer, director, or agent who is also an employee of the City of Leesburg. Further, all respondents must disclose the name of any City of Leesburg employee who owns, directly or indirectly, an interest of five percent (5%) or more of the Bidders firm or any of its branches.
- GT-12. **Conflicts within the Solicitation** – Where there appears to be a conflict between the General Terms and Conditions, Special Terms and Conditions, the Supplemental Terms & Conditions the Statement of Work, the Schedule of Bid Items, or any addendum issued, the order of precedence shall be the last addendum issued, the Schedule of Bid Items, the Statement of Work, the Special Terms & Conditions, the Supplemental Terms & Conditions and then the General Terms & Conditions. In addition, in the case of a conflict between any term or provision contained in contract documents which cannot be resolved by the order of precedence set forth previously, the term or condition that is more stringent and/or specific shall govern and apply.
- GT-13. **Continuation of Work** – Any work that commences prior to and will extend beyond the expiration date of the current contract period shall, unless terminated by mutual written agreement between the City and the vendor, continue until completion without change to the then current prices, terms and conditions.
- GT-14. **Contract Documents** – Following City Commission approval of the execution of a Construction Services Agreement, the Contract Documents shall consist of the following:
- 14.1. The Construction Services Agreement;
  - 14.2. This Solicitation issued by the City;
  - 14.3. Any Addendum to the Solicitation issued by the City;
  - 14.4. Applicable Engineer Drawings, Design and Specifications;
  - 14.5. The Contractors Bid Response;
  - 14.6. The Notice to Proceed issued by the City and acknowledged by the Contractor.
- GT-15. **Contingent Fees Prohibited** - The CONTRACTOR warrants that he or she has not employed or retained any company or person, other than a bona fide employee working solely for the CONTRACTOR, to solicit or secure this Agreement and that he or she has not paid or agreed to pay any person, company, corporation, individual, or firm, other than a bona fide employee working solely for the Bidder any fee, commission, percentage, gift, or other consideration contingent upon or resulting from the award or making of this Agreement. In the event of a breach of this provision, the CITY shall have the right to terminate this Agreement without further liability and at its discretion, deduct from the contract price, or otherwise recover, the full amount of any such fee, commission, percentage, gift or consideration paid in breach of this Agreement.
- GT-16. **Copeland "Anti-Kickback" Act** - The Contractor must comply with the Copeland "Anti-Kickback" Act, 18 USC 874 as supplemented in Department of Labor regulations, 29 CFR Part 3, prohibiting employers from inducing any person employed to give up any part of the compensation to which he or she is otherwise entitled.

GT-17. **Cost of Preparing Bid Response** - All costs incurred by the Bidder for proposal preparation and participation in this competitive procurement will be the sole responsibility of the Bidder. The City of Leesburg shall not reimburse any Bidder for any such costs.

GT-18. **Disputes** - In case of any doubt or differences of opinion as to the items to be furnished hereunder, the decision of the City of Leesburg Purchasing Manager shall be final and binding on both parties.

GT-19. **Execution of Contract** – The Contractor to whom the City intends to award a Contract will be required to execute an Agreement within **ten (10) days** from the date of the Notice of Recommendation for Award, and deliver these executed instruments as instructed to the City of Leesburg Purchasing Division.

GT-20. **Governing Law/Jurisdiction** – The interpretation, effect, and validity of any contract(s) resulting from this solicitation shall be governed by the laws and regulations of the State of Florida. Venue of any court action shall be in Lake County, Florida. In the event that a suit is brought for the enforcement of any term of the contract(s).

GT-21. **Interpretation of Contract Documents** - Each Bidder shall thoroughly examine the Forms Response Form, and all other papers comprising the Contract Documents. He shall also examine and judge for himself all matters relating to the location and the character of the proposed work. If the Bidder should be of the opinion that the meaning of any part of the specifications is doubtful or obscure, or that they contain errors or reflect omissions, he should report such opinion or opinions in writing for an interpretation to the Purchasing Division at 204 N. 5<sup>th</sup> Street Leesburg, Florida 34748 or by electronic mail to: [purch@leesburgflorida.gov](mailto:purch@leesburgflorida.gov). Such notification should be done immediately, but in no case no later than **seven (7) business days** before the due date and time of Bid Responses.

The City shall not be responsible for oral interpretation given by any City representative, the issuance of a written addendum being the only official method whereby such an interpretation will be given. The failure of the Bidder to direct the attention of the Purchasing Representative to errors or discrepancies will not relieve the Bidder, should he be awarded the contract, of responsibility of performing the work to the satisfaction of the City of Leesburg in accordance with the specifications.

GT-22. **Liability** - The Contractor shall hold and save the City of Leesburg, its officers, agents, and employees harmless from liability of any kind in the performance of or fulfilling the requirements of a Contract resulting from this solicitation.

GT-23. **Notice to Proceed** – Following contract award the City shall schedule with Contractor a pre-construction meeting. At that meeting the parties will mutually agree on a projects start date which will be used as the Notice to Proceed date. The City shall provide the Notice to Proceed (NTP) to the Contractor. Contractor shall sign NTP acknowledging receipt and agreeing to the dates. The performance period will be defined in the NTP using the NTP date with the days stated in the Time of Completion paragraph of the Contract Documents.

GT-24. **Price Bid** - The unit prices, lump sum(s) and total price bid for the work shall be stated in figures in the appropriate places on the prescribed form(s), and shall be firm for ninety (90) calendar days after the solicitation opening date, unless stated differently in the Special Terms and Conditions. In the case of a discrepancy between the unit cost and extended cost the unit cost quoted will take precedence.

GT-25. **Protests** – Protests can only be made by Interested Parties. Protests must be submitted in writing to the Purchasing Manager at 204 N. 5<sup>th</sup> Street, Leesburg, FL 32748, no later than three (3) business days after the day the Notice of Recommendation to Award is posted to Vendor Registry, the City's official on-line bid management and vendor notification system. The written protest must specifically state the reason for the protest and exactly what is being protested. Protests received after the deadline will not be considered. The Purchasing Manager will respond to protests no later than seven (7) business days from the day it is received. In case of a protest the determination and decision of the City of Leesburg Purchasing Manager shall be final.

GT-26. **Public Entity Crimes** – Pursuant to Section 287.133(12)(a) of the Florida Statutes, a person or affiliate who has been placed on the convicted vendor list following a conviction for a public entity crime may not submit a Bid Response on a contract to provide any goods or services to a public entity, may not submit a bond on a contract with a public entity

for the construction or repair of a public building or public work, may not submit Bid Responses 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 Section 287.017 for Category Two (\$25,000) for a period of 36 months from the date of being placed on the convicted vendor list."

**GT-27. Public Records Law** – The State of Florida has a very broad public records law. Florida Statute Chapter 119 will apply to all bid responses.

**GT-28. Qualifications of Respondents** - The City of Leesburg reserves the right before awarding the contract, to require the Bidder to submit such evidence of his qualifications and experience as it may deem necessary, and may consider any evidence available to it of the financial, technical and other qualifications and abilities of a respondent.

28.1. The Bidder is assumed to be familiar with all Federal, State or local laws, codes, ordinances, rules and regulations that in any manner affect the work, and to abide thereby if awarded the Contract. Ignorance of legal requirements on the part of the Bidder will in no way relieve him of responsibility.

28.2. Any Bidder may be required to show to the complete satisfaction of the City of Leesburg that he has the necessary personnel, facilities, abilities, and financial resources to perform the work in a satisfactory manner and within the time specified.

28.3. Bidder must possess any and all required licenses to perform and complete the work necessary in this project. The Bidder must be licensed at the time of submitting their bid and the license must be in effect for the entire period of the project.

**GT-29. Quantities** – The City reserves the right to adjust quantities stated in this solicitation. Available funding versus prices bid may affect actual quantities ordered. The City may choose to increase or decrease quantities stated in the documents depending on the circumstance. The City is not obligated to place any order for a given amount subsequent to the award of this Solicitation. The City may use any stated estimated quantities in the award evaluation process. Estimated quantities do not contemplate or include possible additional quantities that may be ordered by other government, quasi-governmental or non-profit entities utilizing this contract. In no event shall the City be liable for payments in excess of the amount due for quantities of goods or services actually ordered.

**GT-30. Registration** – Any vendor receiving an award or purchase from this solicitation is required to register with the City's on-line bid/vendor management system. That on-line system is Vendor Registry ([www.vendorregistry.com](http://www.vendorregistry.com)). There is no cost to register. Following issuance of the Notice of Recommendation for Award (NORA), the recommended vendor will be provided instructions on how to register with Vendor Registry. Registration must be completed prior to any work or purchases be made under the Contract.

**GT-31. Responsibility of Respondent to Inform Himself as to All Conditions Relating To Project** - The respondent, by and through the submission of his bid response, agrees that he shall be held responsible for having theretofore examined the site, the location and/or route of all proposed work and for having satisfied himself as to the character of such location and/or route of surface and underground obstructions, the nature of the ground and water table conditions and all other physical characteristics of the job, in order that he may include in the prices which he proposes, all costs pertaining to the work and thereby provide for the satisfactory completion thereof, including the removal, relocation or replacement of any objects or obstructions which will be encountered in doing the proposed work.

**GT-32. Responsiveness (Bids/Proposals)** – Responses shall conform in all material respects to the solicitation in order to be considered for award. Any response which fails to conform to the solicitation's essential requirements may be rejected.

32.1. An effective bid/proposal will be formatted to the solicitation specifically with particular attention paid to providing the information necessary to meet the evaluation factors in detail. The bid/proposal must demonstrate to the City that the respondent is highly qualified with regard to each requirement in the solicitation.

**GT-33. Right to Accept or Reject Submittals** – Submittals which are incomplete, unbalanced, conditional, obscure or which contain additions not required, or irregularities of any kind, or which do not comply in every respect with the solicitation, and the Contract Documents, may be rejected at the option of the City of Leesburg (also see the solicitation Definitions).

- 33.1. The City of Leesburg does not bind itself to accept the lowest price for the minimum specifications stated herein, but reserves the right to accept any response which in the judgment of the City will best serve the needs and interests of the City of Leesburg.
- 33.2. If, at the time this contract is to be awarded, the lowest Cost Response submitted by a responsible Bidder having acceptable qualifications and abilities to perform the work, does not exceed the amount of funds then estimated by the City as available to fund the work under the contract; the contract may be awarded to that Bidder.
- 33.3. If such lowest Cost exceeds the available funding for the work, the City may reject all Bids or may award the contract to the lowest Cost Bid less such deductible alternates or schedules of work which are listed in the Bid, as produces a net amount which is within the available funds.

**GT-34. Rules, Regulations and Licenses** – The Contractor shall comply with all federal, state, county, and local laws ordinances, rules and regulations applicable to the provision of the services specified in this solicitation. Lack of knowledge by the Bidder will in no way be relief from responsibility.

**GT-35. Signature of Bidder** - The Bidder shall sign the Bidders Certification Form in the space provided for the signature. If the vendor is an individual, the words, "Doing Business As (business name)", or "Sole Owner" shall appear beneath his signature. In the case of partnership, the signature of at least one of the partners shall follow the firm name and the words, "Member of Firm", should be written beneath such signature. If the vendor is a corporation, the title of the office signing the Response in behalf of the corporation shall be stated and evidence of his authority to sign the Response shall be submitted.

**GT-36. State Registration Requirements** – Any corporation submitting a bid in response to this Solicitation shall either be registered or have applied for registration with the Florida Department of State in accordance with the provisions of Chapter 607, Florida Statutes. A copy of the registration/application may be required prior to award of a contract. Any partnership submitting a response to this Solicitation shall have complied with the applicable provisions of Chapter 620, Florida Statutes. For additional information on these requirements, please contact the Florida Secretary of State's Office, Division of Corporations, (800) 755-5111 (<http://www.dos.state.fl.us>).

**GT-37. State Professional Licenses** – The Bidder shall hold all required Professional Licenses as issued by the State of Florida Department of Business and Professional Regulation at the time their bid is submitted and maintain said licenses for the duration of the Contract.

**GT-38. Subcontracting** – Unless otherwise specified in this solicitation or Contract Documents, the Contractor shall not change subcontractors from those listed on their Subcontractor Listing form provided in advance of the Notice to Proceed being issued. Changes to Subcontractors may only be made following Contractor submitting a revised Subcontractor Listing and written approval by the City of the requested change in the subcontractor(s).

**GT-39. Time Allowed** – Contractor will start and complete the work in an expeditious manner which meets the mutually agreed upon schedule and Performance Period as set in the Contract Documents.

**GT-40. Warranty** - All warranties express and implied, shall be made available to the City for goods and services covered by this solicitation. All goods furnished shall be fully guaranteed by the vendor against factory defects and workmanship. At no expense to the City, the vendor shall correct any and all apparent and latent defects that may occur within the manufacturer's standard warranty period. The special conditions of the solicitation may supersede the manufacturer's standard warranty. This paragraph does not apply to Solicitations for professional services covered by Chapter 287.055, Florida Statutes.

**GT-41. Withdrawal of Bids** - Any response to this solicitation may be withdrawn **prior** to the due date and time specified in the solicitation document or as revised by an addenda.

[END OF SECTION]



## SECTION 4 - SUPPLEMENTAL CONDITIONS – CONSTRUCTION

- SC-1. **DEFINITIONS** - The following definitions shall apply. Whenever the following terms (or pronouns in place of them) are used in the Contract Documents, the intent and meaning of such terms shall be interpreted as follows:
- 1.1. **City Project Representative:** There shall be authorized representative(s) of the City assigned to make all necessary inspections of the work performed by the Contractor and for such other purposes as outlined in the Contract Documents.
  - 1.2. **City Technical Representative:** There may be a designated Project Representative assigned by the City to inspect the technical aspects of the project. To insure the project is being constructed as designed.
  - 1.3. **Engineer of Record:** The Engineer of Record designated by the City following Contract Execution.
  - 1.4. **Engineer:** The design professional (engineer, architect, landscape architect or surveyor) designated by the City to serve as the design professional representing the City.
  - 1.5. **Notice to Proceed (NTP):** The official Notice from the City to the Contractor providing the date work may begin and the date the performance period begins. The NTP date will be mutually agreed to at or following the pre-construction meeting. Contractor shall sign the acknowledgement section of the NTP and return to the Purchasing Division. The NTP shall become a part of the Contract Documents.
  - 1.6. **Subcontractor:** Includes only those having a direct contract with the Contractor and it includes one who furnished material worked to a special design according to the plans or specifications of this work, but does not include one who merely furnishes material not so worked.
  - 1.7. **Work:** 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.
  - 1.8. **Manual(s):** Equipment documentation meant for the end user/consumer of the equipment. Contractor shall provide all Manuals to the City upon substantial completion. Retainage may not be released until the City has received all Manuals relevant to the equipment incorporated into the project.
  - 1.9. **Surety:** The corporate body which is bound with and for the contractor which is primarily liable and which guarantees the faithful performance of the bid and/or agreement.
  - 1.10. **Plans, Drawings and/or Sketches:** Graphic representations of the work to be performed or reproductions thereof.
  - 1.11. **Specifications:** Broadly defined, the specifications include all data bound together herein or referenced on the plans, including, but not limited to, General Conditions, Technical Specifications, Special Conditions, Geotechnical Investigation, Supplemental Conditions (if any), other detailed technical specifications, exhibits and all addenda.
  - 1.12. **Defective:** An adjective which when modifying the word 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 Engineer's recommendation of final payment (unless responsibility for the protection thereof has

been assumed by City at Substantial Completion or City has taken beneficial use of completed portions.

- 1.13. **Shop Drawings:** 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.
- 1.14. **Substantial Completion:** The Work (or a specified part thereof) has progressed to the point where, in the opinion of Engineer as evidenced by Engineer's definitive certificate of Substantial Completion, it is sufficiently complete, in accordance with the Contract Documents, so that the Work (or specified part) can be utilized for the purposes for which it is intended; or if there be no such certificate issued, when final payment is due. The terms "substantially complete" and "substantially completed" as applied to any Work refer to Substantial Completion thereof.
- 1.15. **Underground Facilities:** All pipelines, conduits, ducts, cables, wires, manholes, vaults, tanks, tunnels or other such facilities or attachments, and any encasements 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.

SC-2. **INSPECTION OF WORK** - The Project Representative and his representatives shall, at all times, have access to the work whenever it is in preparation or progress and the Contractor shall provide proper facilities for such access and for inspection. The work will be conducted under the general direction of the Project Representative of the City and is subject to inspection by his appointed inspectors to insure compliance with the terms of the contract. No inspector is authorized to change any provisions of the specifications without written authorization of the City, nor shall the presence or absence of an inspector relieve the Contractor from any requirements of the contract.

If the specifications, the Project Representative's instructions, laws, ordinances or any public authority require any work to be specifically tested or approved, the Contractor shall give the City timely notice of its readiness for inspection, and if the inspection is by another authority than the Project Representative, of the date fixed for such inspection. Inspections by the Project Representative will be promptly made, and where practicable at the source of supply. If any work should be covered up without approval or consent of the City, it shall, if required by the Project Representative, be uncovered for examination at the Contractor's expense.

Re-examination of questioned work may be ordered by the Project Representative and, if so ordered, the work shall be uncovered by the Contractor. If such work is found in accordance with the contract documents, the City will pay the cost of re-examination and replacement. If such work is found not in accordance with the contract documents, the Contractor shall pay such cost.

SC-3. **TESTS** - The Project Representative will have the right to require all materials to be submitted to test prior to incorporation in the work. In some instances, it may be expedient to make these tests at the source of supply and for this reason it is requested that the Contractor furnish the source before incorporating material in the work. This does not in any way obligate the Project

Representative to perform tests for acceptance of material and does not relieve the Contractor of his responsibility to furnish satisfactory material. The Contractor shall furnish two copies of manufacturer's certificate of compliance with these specifications covering manufactured items incorporated in the work.

All field tests for compaction of earthwork and of material incorporated in the sub grade and base will be performed by technicians of a materials testing laboratory approved by the City. All tests performed by the laboratory to ascertain that the material, as placed, meets the required specification will be at the expense of the Contractor and should be included in the bid items as such.

- SC-4. **TOOLS, PLANT AND EQUIPMENT** - If any time before the commencement or during the progress of the work, tools, plant or equipment appears to the Project Representative to be insufficient, inefficient or inappropriate to secure the quality of work required, or the proper rate of progress, the Project Representative will notify the City of such conditions. The Engineer will provide written notification to the Contractor of City's quality and/or schedule concerns. The Contractor will respond in writing within 5 business days of receiving the City's notice and will propose remedial actions to address the quality and/or schedule concerns.
- SC-5. **COLLECTION AND DISPOSAL OF WASTE** - The Contractor shall collect waste from construction areas and elsewhere; handle hazardous, dangerous, or unsanitary waste materials separately from other waste by containerizing properly; dispose of material in a lawful manner. The Contractor shall be responsible for the transportation and disposal costs of all waste construction materials.
- SC-6. **BURNING OF DEBRIS** - For any areas where the burning of debris is permitted, the Contractor will be required to request a permit therefore, from the fire authority having jurisdiction in the area in due advance time, and if such permission is granted he shall rigidly abide by all provisions and requirements of such permit. In no case will burning be permitted until the fire authorities have adequately checked the size of the pile to be burned, the weather conditions and any other factors which might affect the proper control of the burning operation.
- SC-7. **MAINTENANCE OF TRAFFIC** - Where construction is located in public right of ways, traveled streets and roads, the Contractor shall exercise extreme care in seeing that sufficient area is provided and kept open for police, fire, ambulance, mail and private vehicular traffic.

The Contractor shall ensure that each person supervising the selection, placement and maintenance of Traffic Control Devices in the FDOT Work Zone shall be certified by attending an FDOT approved MOT training course. A copy of these certifications shall be submitted to the City of Leesburg upon request.

- SC-8. **PROTECTION AGAINST POLLUTION** - The Contractor shall comply with all legal regulations pertaining to pollution as are applicable to the site and he shall take all measures necessary to assure that no pollution, temporary or permanent, occurs to any lakes or other water areas as a result of runoff from the areas within which he is working.

This shall include the installation of temporary construction turbidity screens or hay bales along the edge of existing wetlands prior to the start of construction. These areas shall be as shown on the plans.

Contractor shall maintain the fuel storage area in accordance with local, state and federal regulations. Refueling vehicles and refueling techniques shall also comply with all applicable regulations. Clean-up of the fuel storage area shall be as required by the regulations and in accordance with these regulations.

SC-9. **TEMPORARY FENCING AND BARRICADES** - The Contractor shall at his cost erect barricades sufficient to prevent injury to persons or damage to property, including the Contractor's personal property and materials. The City shall not be held responsible for the loss, theft, or vandalism of the Contractor's equipment or other personal property, including construction materials and supplies. Fences shall be constructed to prevent entry of unauthorized persons; cover trenches and holes when not in use; erect barriers at sharp changes in plane more than four (4) feet high. Should construction operations temporarily obstruct road passage, the Contractor shall at his cost provide suitable flagmen to control vehicular traffic on the road. Permits to use construction equipment on Florida Department of Transportation Right-of-Way shall be secured by the Contractor prior to actual beginning of work. The Contractor shall, at his cost, remove all temporary protection from the work site upon completion of the work.

SC-10. **WORKMANSHIP, MATERIALS, APPLIANCES, AND EMPLOYEES** - All work will be done in a competent and workmanlike manner. All materials, equipment and supplies furnished by the Contractor for permanent incorporation in the work shall be new and of quality standards specified. Workmanship shall be first class and the finished product equal to the best-accepted standards of the trade for the category of work performed. It is the City's intent to obtain a high quality job that will operate and function with least maintenance costs. The Contractor shall, if requested by City, furnish satisfactory evidence as to the kind and quality of materials.

Unless otherwise stipulated, the Contractor shall provide and pay for all materials, labor, water, tools, equipment, light, power, transportation and other facilities necessary for the execution and completion of the work.

The Contractor shall, at all times, enforce strict discipline and good order among his employees and shall not employ on the work any unfit person or anyone not skilled in the work assigned to him.

Neither party shall employ or hire any employees of the other party without his consent.

SC-11. **GENERAL QUALITY AND STANDARDS** - To facilitate rapid examination, detailed specifications concerning basic requirements for labor, materials, equipment and/or incidentals to be used on the project are included under the various divisions in as brief a form as is consistent with clarity. The primary concern of the detailed specifications is for standards of performance expected for the finished work.

When in the detailed specifications reference is made to a particular code or specification, the latest edition of said code or specification shall apply.

The interests of the City, the Contractor and others concerned with the work require the inclusion of certain general governing requirements and standards, as a precaution against contingency and to provide for the conditions under which the construction and the administration of the work will be carried out.

General requirements for the quality of the work, when not otherwise covered in more specific detail in the specifications, will be governed by acceptable standards of the trade.

These specifications consider the project as a whole and assume it's completion under a general contract. Further, the scope of subcontracts and the quantities of materials and labor supplied to the Contractor by others are assumed to be matters governed by agreement between the Contractor and his Subcontractors and suppliers and not by agreement between the City and any Subcontractor or suppliers.

Various sections of the construction specifications are intended to govern only the quality of work and/or materials incidental to the particular branch of work mentioned in the section title. Sections are not intended as itemizations of the work materials to be furnished or to limit or define the scope of any subcontract or agreement to furnish material and labor.

The furnishing of all items of material, labor, equipment and/or incidentals necessary to the completion of the work as a whole will be expected when such items are called for on the drawings by diagram, note or schedule, are listed in the specifications, or are reasonably inferred by either or a combination of both.

During the construction operations under this contract, the City may elect to contract other work for the project. The Contractor shall coordinate his operations with those of any other such Contractors as well as any work of constructing or adjusting utilities by any other authorities, to the end that the least practical handicap to the work of all such Contractors or authorities will result.

SC-12. **PROJECT COORDINATION** - The Contractor shall coordinate construction operations that are dependent upon each other for proper installation, connection and operation. The Contractor shall make adequate provisions to accommodate items scheduled for later installation.

The Contractor shall inspect both the substrate and conditions under which the work is to be performed. The Contractor shall not proceed until unsatisfactory conditions have been corrected in an acceptable manner.

The Contractor shall inspect materials or equipment immediately upon delivery and again prior to installation. The Contractor shall reject damaged and defective items.

The Contractor shall supervise construction activities to ensure that no part of the construction is subject to deleterious exposure during the construction period. Where applicable, such exposures include, but are not limited to, the following: Unprotected storage, Improper shipping and handling, Theft, Vandalism.

- SC-13. **COORDINATION WITH UTILITY COMPANIES** - Contractor shall coordinate with all utility installations. Contractor shall notify the appropriate utility companies, in writing, adequately in advance of the time frame set aside for such utility installation. The utility companies referred to herein shall include, but not be limited to, Power, Gas, Telephone, and Cable Television. Contractor shall coordinate the installation of “sleeves” for the utility companies as may be required.

Contractor shall supply the City with copies of all correspondence notifying the utility companies of his intended schedule of construction and the expected date for their respective utility installations. Written notices shall be sent to the utility companies at sixty (60) days, thirty (30) days and two (2) weeks prior to the time at which the utility installation should begin.

- SC-14. **SUPERVISION** - Contractor shall supervise and direct the Work competently and efficiently, devoting such attention thereto and applying such skills and expertise as may be necessary to perform the Work in accordance with the Contract Documents. Contractor shall be solely responsible for the means, methods, techniques, sequences and procedures of construction. Contractor shall be responsible to see that the finished Work complies accurately with the Contract Documents.

If the Contractor, in the course of the work, finds any discrepancy between the drawings and the physical conditions of the locality, or any errors or omissions in the drawing or in layout as given by points and instructions, it shall be his duty to immediately inform the Project Representative, in writing, and the Project Representative will promptly verify the same. Any work done after such discovery, until authorized, will be done at the Contractors’ risk.

- SC-15. **CONSTRUCTION SUPERINTENDENT** - Contractor shall employ a Construction Superintendent who shall be present on-site or available throughout the duration of the project and shall remain associated with the project until completion unless otherwise requested to be replaced by the City. The superintendent shall be experienced in the work required and perform all coordination activities generally conducted by project superintendents including, but not limited to, subcontractor coordination, utility installations, inspections, testing, material deliveries, etc. The superintendent shall be present at the pre-construction meeting and shall remain on the project until completion. The owner reserves the right to request a resume of experience for the superintendent including, but not limited to, requesting references from recent projects. Substitution of superintendents after the start of the work shall be approved by the owner in advance. All communications given to the superintendent shall be as binding as if given to Contractor.

- SC-16. **WAGE RATES/EQUAL EMPLOYMENT OPPORTUNITY** - Wage rates for laborers, mechanics and apprentices shall not be less than those established by the Florida Department of Labor and Employment Security and/or the United States Department of Labor for this work, as may be attached hereto. The Contractor must insure Equal Employment Opportunity as part of the awarded contract and also subcontracts awarded by the contractor.

- SC-17. **SUBCONTRACTS** - The Contractor shall, as soon as practicable after signing the contract, notify the Project Representative in writing of any changes in the names of subcontractors proposed for the work as listed on the bid form. The Contractor shall not employ subcontractors, unless they are approved by the Project Representative.

The Contractor agrees that he is as fully responsible to the City for the acts and omissions of his subcontractors and of persons, either directly or indirectly, employed by them, as he is for the acts and omissions of persons directly employed by him.

Nothing contained in the contract documents shall create any contractual relation between any subcontractors and the City.

- SC-18. **PRE-CONSTRUCTION MEETING** - The City shall schedule a meeting after the Notice of Award. The Project Representative, Engineer, and Contractor shall attend this mandatory meeting. The following items shall be completed:
- 18.1. Submission of list of Subcontractors, Schedule of Values and Progress Schedule.
  - 18.2. Designation of Personnel representing the parties in Contract, and the Engineer.
  - 18.3. Use of premises by City and the Contractor.
  - 18.4. Survey layout and scheduling.
  - 18.5. Security and housekeeping procedures.
  - 18.6. Requirements for start-up of equipment.
  - 18.7. Inspection and acceptance of equipment put into service during construction period.

At least ten (10) days before submission of the first Application for Payment a conference attended by Contractor, Engineer and others as appropriate will be held to finalize the schedules submitted by Contractor. The finalized progress schedule will be acceptable to Engineer as providing an orderly progression of the Work to completion within the Contract Time, but such acceptance will neither impose on Engineer responsibility for the progress or scheduling of the Work nor relieve Contractor from full responsibility thereto. The finalized schedule of Shop Drawing submissions will be acceptable to Engineer as providing a workable arrangement for processing the submissions. The finalized schedule of values will be acceptable to Engineer as to form and substance.

- SC-19. **ORDER OF COMPLETION** - The Contractor shall submit at such times as may be requested by the Project Representative, schedules which shall show the order in which the Contractor proposes to carry on the work with dates on which the Contractor will start the several parts of the work and estimated dates of completion of the several parts. The City retains the right to dictate to the Contractor the order of completion of the work.
- SC-20. **MATERIALS AND EQUIPMENT SCHEDULES** - As soon as practicable and within ten (10) days after the date of award of contract and before any material or equipment is purchased, the Contractor will submit to the City for approval a complete list, in triplicate, of materials to be incorporated in the work and samples of each listed material. The list shall include catalog numbers, cuts, diagrams; drawings and such other descriptive data as may be required. No consideration will be given to partial lists submitted from time to time. Approval of materials will be based on manufacturers' published ratings. Any materials listed that are not in accordance with the specification requirements may be rejected.

When one or more manufacturer's items are specified, it shall be understood that the item(s) so specified are hereby approved as to suitability and no substitutions will be permitted unless followed by such qualifying phrases as equal "approval equal" or "as approved" in which case the approval of the City for items not specified shall be obtained before they may be used.

- SC-21. **CONTRACTOR'S REQUESTS FOR INTERPRETATION (RFIs)** – Should Contractor be unable to determine from the Contract Documents the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of Work is described differently at more than one place in the Contract Documents; the Contractor shall request that the Architect/Engineer (AE), or City Representative, make an interpretation of the requirements of the Contract Documents to resolve such matters. Contractor shall comply with procedures specified herein to make Requests for Interpretation (RFIs).
- 21.1. Submission of RFIs: RFIs shall be prepared and submitted on a form provided by the City.
- 21.1.1. Forms shall be completely filled in, and if prepared by hand, shall be fully legible after copying by xerographic process.
- 21.1.2. Each RFI shall be given a discrete, consecutive number.
- 21.1.3. Each page of the RFI and each attachments to the RFI shall bear the City's project name, project number, date, RFI number and a descriptive title.
- 21.1.4. Contractor shall sign all RFIs attesting to good faith effort to determine from the Contract Documents the information requested for interpretation. Frivolous RFIs shall be subject to reimbursement from Contractor to City for fees charged by A/E, A/E consultants and other design professionals engaged by the City.
- 21.2. Subcontractor-Initiated and Supplier-Initiated RFIs: RFIs from subcontractors and material suppliers shall be submitted through, be reviewed by and be attached to an RFI prepared, signed and submitted by Contractor. RFIs submitted directly by subcontractors or material suppliers will be returned unanswered to the Contractor.
- 21.2.1. Contractor shall review all subcontractor- and supplier-initiated RFIs and take actions to resolve issues of coordination, sequencing and layout of the Work.
- 21.2.2. RFIs submitted to request clarification of issues related to means, methods, techniques and sequences of construction or for establishing trade jurisdictions and scopes of subcontracts will be returned without interpretation. Such issues are solely the Contractor's responsibility.
- 21.2.3. Contractor shall be responsible for delays resulting from the necessity to resubmit an RFI due to insufficient or incorrect information presented in the RFI.
- 21.3. Requested Information: Contractor shall carefully study the Contract Documents to ensure that information sufficient for interpretation of requirements of the Contract Documents is not included. RFIs that request interpretation of requirements clearly indicated in the Contract Documents will be returned without interpretation.
- 21.3.1. In all cases in which RFIs are issued to request clarification of issues related to means, methods, techniques and sequences of construction, for example, pipe and duct routing, clearances, specific locations of Work shown diagrammatically, apparent interferences and similar items, the Contractor shall furnish all information required for the A/E or City's Representative to analyze and/or understand the circumstances causing the RFI and prepare a clarification or direction as to how the Contractor shall proceed.
- 21.3.2. If information included with this type RFI by the Contractor is insufficient, the RFI will be returned unanswered.
- 21.4. Unacceptable Uses for RFIs: RFIs shall not be used to request the following::
- 21.4.1. Approval of submittals
- 21.4.2. Approval of substitutions



- 21.4.3. Changes that entail change in Contract Time and Contract Sum
- 21.4.4. Different methods of performing Work than those indicated in the Contract Drawings and Specifications
- 21.5. Disputed Requirements: In the event the Contractor believes that a clarification by the City's A/E, or Representative, results in additional cost or time, Contractor shall comply with the method for requesting a Change Order.
- 21.6. RFI Log: Contractor shall prepare and maintain a log of RFIs, and at any time requested by the City's Representative, the Contractor shall furnish copies of the log showing all outstanding RFIs.
- 21.7. Review Time: Architect/Engineer or City Representative (City) shall return RFIs to Contractor and within five (5) calendar days of receipt. RFIs received after 12:00 noon shall be considered received on the next regular working day for the purpose of establishing the start of the five-calendar day response period.

SC-22. **SUBMITTAL REQUIREMENTS OF CONTRACTOR** - After checking and verifying all field measurements and after complying with applicable procedures specified in the General Requirements, Contractor shall submit to Engineer for review in accordance with the accepted schedule of Shop Drawing submissions, or for other appropriate action if so indicated in the Special Conditions, five copies (unless otherwise specified in the General Requirements) of all Shop Drawings, which will bear a stamp or specific written indication that Contractor has satisfied Contractor's responsibilities under the Contract Documents with respect to the review of the submission. All submissions will be identified as Engineer may require. The data shown on the Shop Drawings will be complete with respect to quantities, dimensions, specified performance and design criteria, materials and similar data to enable Engineer to review the information as required.

Contractor shall also submit to Engineer for review with such promptness as to cause no delay in Work, all samples required by the Contract Documents. All samples will have been checked by and accompanied by a specific written indication that Contractor has satisfied Contractor's responsibilities under the Contract Documents with respect to the review of the submission and will be identified clearly as to material, Supplier, pertinent data such as catalog numbers and the use for which intended.

Before submission of each Shop Drawing or sample Contractor shall have determined and verified all quantities, dimensions, specified performance criteria, installation requirements, materials, catalog numbers and similar data with respect thereto and reviewed or coordinated each Shop Drawing or sample with other Shop Drawings and samples and with the requirements of the Work and the Contract Documents.

At the time of each submission, Contractor shall give Engineer specific written notice of each variation that the Shop Drawings or samples may have from the requirements of the Contract Documents, and in addition, shall cause a specific notation to be made on each Shop Drawing submitted to Engineer for review of each such variation.

Engineer will review with reasonable promptness Shop Drawings and samples, but Engineer's review will be only for conformance with the design concept of the Project and for compliance with the information given in the Contract Documents and shall not extend to means, methods,

techniques, sequences or procedures of construction (except where a specific means, method, technique, sequence or procedure of construction is indicated in or required by the Contract Documents) or to safety precautions or programs incident thereto. The review of a separate item as such will not indicate review of the assembly in which the item functions. Contractor shall make corrections required by Engineer, and shall return the required number of corrected copies of Shop Drawings and submit as required new samples for review. Contractor shall direct specific attention in writing to revisions other than the corrections called for by Engineer on previous submittals.

Engineer's review of Shop Drawings or samples shall not relieve Contractor from responsibility for any variation from the requirements of the Contract Documents unless Contractor has in writing called Engineer's attention to each such variation at the time of submission as required by this Article and Engineer has given written review each such variation by a specific written notation thereof incorporated in or accompanying the Shop Drawing or sample review; nor will any review by Engineer relieve Contractor from responsibility for errors or omissions in the Shop Drawings or from responsibility for having complied with the provisions herein.

Where a Shop Drawing or sample is required by the Specifications, any related Work performed prior to Engineer's review of the pertinent submission will be the sole expense and responsibility of Contractor.

SC-23. **CHANGES IN THE WORK** - Any Change in the Work will be documented in writing and approved by the City in writing. Changes that increase the cost of the work may need to be approved by City Commission depending on the dollar value of the increase change order. No work may be performed prior to the change being approved by City.

The Contract Price constitutes the total compensation payable to the Contractor for performing the work. All duties, responsibilities and obligations assigned to or undertaken by the Contractor shall be at his expense without change in the Contract Price.

The Contract Price may only be changed by a Change Order. Any claim for an increase in the Contract Price, shall be delivered in writing to the City and the Engineer within fifteen days of the occurrence of the event giving rise to the claim. Notice of the amount of the claim with supporting data shall be delivered within forty-five days of such occurrence unless the Engineer allows an additional period of time to ascertain accurate cost data. All claims for adjustments in the Contract Price shall be determined by the Engineer if the City and Contractor cannot otherwise agree on the amount involved. The Engineer(s) decision shall be final and binding. Any change in the Contract Price resulting from any such claim shall be incorporated in a Change Order.

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:

- i. where the work involved is covered by unit prices contained in the Contract Documents, by application of unit prices to the quantities of the items involved, or
- ii. by mutual acceptance of a lump sum, or
- iii. on the basis of the cost of the work plus a Contractor's fee for overhead and profit.

- SC-24. **DETAIL DRAWINGS AND INSTRUCTIONS** - The City will furnish, with reasonable promptness, additional instructions by means of drawings or otherwise, necessary for the proper execution of the work. All such drawings and instructions will be consistent with the contract documents, true developments thereof and reasonably inferable therefrom.
- SC-25. **OWNERSHIP OF DRAWINGS** - All drawings, specifications and copies thereof furnished by the City are the property of the City. They are not to be used on other work and, with the exception of the signed contract set, are to be returned to the City, at the request of the City upon the completion of the work.
- SC-26. **SURVEYS, PERMITS AND REGULATIONS** - The City will furnish horizontal and vertical control necessary to layout the work in an orderly and workmanlike manner.

Horizontal Control furnished by the City shall consist of adequately marked property corners or offset corners, with dimensions as shown on the drawings. Vertical Control will consist of benchmarks established within the immediate area of the work.

It shall be the responsibility of the Contractor to furnish all construction layout of the work, including, but not limited to, layout and elevations for the construction and final grade of the site.

The Contractor shall maintain and preserve all stakes and marks established by the City and should such stakes or marks be carelessly or willfully destroyed or damaged by the Contractor, said stakes or marks shall be replaced by the City at the expense of the Contractor.

The Contractor will set the horizontal and vertical control only at the beginning of the job as specified above. Interim staking during the job and all staking and layout work not furnished by the City as specified above shall be the responsibility of the Contractor.

The City will furnish all personnel and equipment and materials to make such surveys as are necessary to determine the quantities of work performed.

The City will furnish environmental permits unless otherwise specified. The Contractor shall obtain any and all required permits from all appropriate government agencies.

Work permits and licenses necessary for the prosecution of the work shall be secured and paid for by the Contractor. Easements for permanent structures or permanent changes in existing facilities will be secured and paid for by the City unless otherwise specified. The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the work as drawn and specified. If the Contractor observes that the drawings and specifications are at variance therewith, he shall promptly notify the City in writing and any necessary changes shall be adjusted as provided in the contract for changes in the work. If the Contractor performs work knowing it to be contrary to such laws, ordinances, rules and regulations and without such notice to the City, he shall bear all cost arising there from.

- SC-27. **ROYALTIES AND PATENTS** - There may be a design, device, material or process included in these plans and specifications which may be covered by letters, patent or copyright. Prior to use of any design, device, material or process, or its incorporation into the construction, the

Contractor shall secure indemnity from his subcontractors or material suppliers that will protect and save harmless the City from all loss on account thereof.

The Contractor shall pay all royalties and license fees. He shall defend all suits or claims for infringement of any patent rights and shall save the City harmless from loss on account thereof, except that the City shall be responsible for all such loss when a particular process or the product of a particular manufacturer or manufacturers is specified, but if the Contractor has information that the process or article specified is an infringement of a patent, he shall be responsible for such loss unless he promptly gives such information to the City.

SC-28. **PROTECTION OF WORK AND PROPERTY** - The Contractor shall continuously maintain adequate protection of all his work from damage and shall protect the City's property from injury or loss arising in connection with this contract. The Contractor shall at all times protect all public and privately owned property, structures, utilities, and work of any kind against damage or interruption of service which may result from the operations of the Contractor. Damage or interruption to service resulting from failure to do so shall be repaired or restored by or at the expense of the Contractor except such as may be directly due to errors in the contract documents or caused by the agents or employees of the City.

SC-29. **DEDUCTIONS FOR UNCORRECTED WORK** - If the Project Representative deems it inexpedient to correct work injured or done, not in accordance with the contract, an equitable deduction from the contract price will be made therefore.

SC-30. **DELAYS AND EXTENSION OF TIME** - If the Contractor be delayed at any time, in the progress of the work by an act of neglect of the City or of his employees, or by any other contractor employed by the City or by Changes ordered in the work or by strikes, lockouts, fire, unusual delay in transportation, unavoidable casualties or any causes beyond the Contractor's control, or by delay authorized by the Project Representative, or by any cause which the Project Representative may decide to justify the delay, then the time of completion will be extended for any such reasonable time as the Project Representative may decide.

No such extension will be made for delay occurring more than seven (7) days before claim therefore is made in writing to the City. In the case of a continuing cause or delay, only one claim is necessary.

If no schedule or agreement stating the dates upon which drawings shall be furnished is made, then no claim for delay will be allowed on account of failure to furnish drawings until two weeks after demand for such drawings and not then unless such claims be reasonable.

SC-31. **CORRECTION OF WORK BEFORE FINAL PAYMENTS** - The Contractor shall promptly remove from the premises all materials condemned by the Project Representative as failing to conform to the contract, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute his own work in accordance with the contract and without expense to the City and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

If the Contractor does not correct such condemned work and material within a reasonable time fixed by written notice, the City may correct it at the expense of the Contractor. If the

Contractor does not pay the expense of such correction within three (3) days thereafter, the City may, upon three (3) days written notice, deduct all the cost and expenses that should have been borne by the Contractor.

SC-32. **THE CITY'S RIGHT TO DO WORK** - If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this contract, the City after three (3) days written notice to the Contractor, may, without prejudice to any other remedy he may have, make good such deficiencies at the Contractor's expense.

SC-33. **SUSPENSION OF WORK** - The City may at any time suspend the work or any part thereof by giving five (5) days notice to the Contractor in writing. The work shall be resumed by the Contractor within ten (10) days after the date fixed in a written notice to resume work from the City to the Contractor. The City will reimburse the Contractor for expense incurred by the Contractor in connection with the work under this contract as a result of such suspension unless the suspension was recommended to the City by the Project Representative to enforce the contract or for any violation of the contract.

SC-34. **THE CITY'S RIGHT TO TERMINATE FOR CAUSE OR CONVENIENCE** - Any Agreement executed as a result of his solicitation may be terminated in whole or in part in writing by either party in the event of substantial failure by the other party to fulfill its obligations under the Agreement through no fault of the terminating party, provided that no termination may be effected unless the other party is given:

- i. not less than ten (10) calendar days written notice (delivered by certified mail, return receipt requested) of intent to terminate; and
- ii. an opportunity for consultation with the terminating party prior to termination.

The Agreement may be terminated in whole or in part in writing by the City for its convenience, provided the other party is afforded the same notice and consultation opportunity specified.

If termination for default is effected by the City, an equitable adjustment in the price for this contract shall be made, but no amount shall be allowed for anticipated profit on unperformed services or other work, and any payment due to the Contractor at the time of termination may be adjusted to cover any additional costs to the City because of the contractor's default.

If termination for convenience is effected by the City, the equitable adjustment shall include a reasonable profit for services or other work performed for which profit has not already been included in an invoice.

For any termination, the equitable adjustment shall provide for payment to the contractor for services rendered and expenses incurred prior to receipt of the notice of intent to terminate, in addition to termination settlement costs reasonably incurred by the contractor relating to commitments (e.g., suppliers, subcontractors) which had become firm prior to receipt of the notice of intent to terminate.

Upon receipt of a termination action under the paragraphs above, the Contractor shall (1) promptly discontinue all affected work (unless the notice directs otherwise) and (2) deliver or otherwise make available to the City all data, drawings, reports specifications, summaries and

other such information, as may have been accumulated by the Contractor in performing this contract, whether completed or in process.

Upon termination, the City may take over the work and may award another party a contract to complete the work described in the Agreement.

If, after termination for failure of the Contractor to fulfill contractual obligations, it is determined that the Contractor had not failed to fulfill contractual obligations, the termination shall be deemed to have been for the convenience of the City. In such event, adjustment of the contract price shall be made as provided above.

SC-35. **CITY'S RIGHT TO TERMINATE FOR DEFAULT** - If, through any cause, the Contract shall fail to fulfill in a timely and proper manner its obligations under this Agreement, other than for the instances listed below due to "Force Majeure," the City shall thereupon have the right to terminate this Agreement by providing a written notice (show cause notice) to the Contractor requiring a written response due within five (5) calendar days from receipt of the written notice as to why the Agreement should not be terminated for default. The City's show cause notice shall include an Agreement termination date at least seven (7) calendar days subsequent to the due date for the Contractor's response. Should the Contractor fail to respond to such show cause notice, or if the City determines that the reasons provided by the Contractor for failure of the Contractor to fulfill its contractual obligations do not justify continuation of the contractual relationship, the Agreement shall be considered to have been terminated for default on the date indicated in the show cause notice. Should the City determine that the Contractor provided adequate justification that a termination for default is not appropriate under the circumstances; the City shall have a unilateral option to either continue the Agreement according to the original contract provisions or to terminate the contract for convenience. In the event that the City terminates the contract for default, all finished or unfinished deliverable items under this contract prepared by the Contractor shall, at the option of the City, become City property, and the Contractor shall be entitled to receive just and equitable compensation for any satisfactory work completed on such materials. Notwithstanding this compensation, the Contractor shall not be relieved of liability to the City for damages sustained by the City by virtue of any breach of this Agreement, and the City may withhold any payment due the Contractor for the purpose of set-off until such time as the exact amount of damages due the City from such breach can be determined.

In case of default by the Contractor, the City may procure the services from other sources and hold the Contractor responsible for any excess cost occasioned thereby. The City reserves the right to require a performance bond or other acceptable alternative performance guarantees from the successor Contractor without expense to the City.

In addition, in the event of default by the Contractor under this Agreement, the City may immediately cease doing business with the Contractor, immediately terminate for cause all existing Agreements the City has with the Contractor, and debar the Contractor from doing future business with the City.

Upon the Contractor filing a petition for bankruptcy or the entering of a judgment of bankruptcy by or against the Contractor, the City may immediately terminate, for cause, this

Agreement and all other existing agreements the Contractor has with the City, and debar the Contractor from doing future business with the City.

The City may terminate this Agreement for cause without penalty or further obligation at any time following Agreement execution, if any person significantly involved in initiating, negotiating, securing, drafting, or creating the Agreement on behalf of the City is at any time while the Agreement or any extension thereof is in effect, an employee or agent of any other party to the Agreement in any capacity or consultant to any other party of the Agreement with respect to the subject matter of the Agreement. Additionally, the City may recoup any fee or commission paid or due to any person significantly involved in initiating, negotiating, securing, drafting or creating the Agreement on behalf of the City from any other party to the Agreement.

SC-36. **REMOVAL OF EQUIPMENT** - In the case of annulment of this contract before completion, from any cause whatever, the Contractor, if notified to do so by the City, shall promptly remove any part or all of his equipment and supplies from the property of the City, failing which, the City will have the right to remove such equipment and supplies at the expense of the Contractor.

SC-37. **USE OF COMPLETED PORTIONS** - Use by City of any finished part of the Work, which has specifically been identified in the Contract Documents, or which City, Engineer and Contractor agree constitutes a separately functioning and useable part of the Work that can be used by City without significant interference with Contractor's performance of the remainder of the Work, may be accomplished prior to Substantial Completion of all the Work subject to the following:

City at any time may request Contractor in writing to permit City to use any such part of the Work which City believes to be ready for its intended use and substantially complete. If Contractor agrees, Contractor will certify to City and Engineer that said part of the Work is substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work. Contractor at any time may notify City and Engineer in writing that Contractor considers any such part of the Work ready for its intended use and substantially complete and request Engineer to issue a certificate of Substantial Completion for that part of the Work. Within a reasonable time after either such request, City, Contractor and Engineer shall make an inspection of that part of the Work to determine its status of completion. If Engineer does not consider that part of the Work to be substantially complete, Engineer will notify City and Contractor in writing giving the reasons therefore. If Engineer considers that part of the Work to be substantially complete, the provisions of Substantial Completion will apply with respect to certification of that part of the Work and the division of responsibility in respect thereof and access thereto.

City may at any time request Contractor in writing to permit City to take over operation of any such part of the Work although it is not substantially complete. A copy of such request will be sent to Engineer and within a reasonable time thereafter City, Contractor and Engineer shall make an inspection of that part of the Work to determine its status of completion and will prepare a list of the items remaining to be completed or corrected thereon before final payment. If Contractor does not object in writing to City and Engineer that such part of the Work is not ready for separate operation by City, Engineer will finalize the list of items to be completed or corrected and will deliver such list to City and Contractor together, with a written

recommendation as to the division of responsibilities pending final payment between City and Contractor with respect to security, operation, safety, maintenance, utilities, insurance, warranties and guarantees for that part of the Work, which will become binding upon City and Contractor at the time when City takes over such operation (unless they shall have otherwise agreed in writing and so informed Engineer). During such operation and prior to Substantial Completion of such part of the Work, City shall allow Contractor reasonable access to complete or correct items on said list and to complete other related Work.

If City finds it necessary to occupy or use a portion or portions of the Work prior to Substantial Completion of all the Work, such use or occupancy may be accomplished in accordance with this Article; provided that no such use or occupancy shall commence before the insurers providing the property insurance have acknowledged notice thereof and in writing effected the changes in coverage necessitated thereby. The insurers providing the property insurance shall consent by endorsement on the policy or policies, but the property insurance shall not be cancelled or lapse on account of any such partial use or occupancy.

SC-38. **PROMPT PAYMENT** - It is the policy of the City that payment for all purchases by the City shall be made in a timely manner and that interest payments will be made on late payments in accordance with Part VII, Chapter 218, Florida Statutes, known as the Florida Prompt Payment Act.

SC-39. **APPLICATION FOR PAYMENT** - The Contractor shall submit to the City, at least 20 days before the date established for each progress payment (but not more often than once a month), an Application for Payment filled out and signed by Contractor covering the work completed as of the date of the Application. Upon review and approval by the City and Engineer (if applicable).

The retained percentage (retainage) amount with respect to the progress payments shall initially be 10% unless stated otherwise in the Construction Services Agreement. Retainage amounts and retainage process shall be governed by Florida Statute 255.078 – Public Construction Retainage.

Contractor shall, before any draw is issued, provide a sworn statement to City attesting that all services, materials and labor, furnished to the project to the date of the draw request have been paid for in full, or listing the amounts due for such services, materials and labor, and if any amounts are listed as being due, the City shall have the right to pay those amounts directly to the persons to whom they are due, with the balance of the draw amount to be paid to Contractor, and if the draw is insufficient to pay the amounts then due for services, materials and labor, the City shall pay those to whom such amounts are due on a pro rata basis until the draw is exhausted, and any remaining amounts due others shall be paid first out the next draw due.

The City shall not be required to issue progress payments pursuant to the draw schedule until the City has verified, by on-site inspection, that construction has in fact progressed to the stage at which a draw is required and that the work done and materials furnished are in compliance with the Contract Documents, and all applicable technical codes. The final draw due upon “completion” shall not be payable until the City, its Project Representative or Engineer of Record has determined the work has been completed in accordance with the Contract Documents and a Certificate of Completion has been issued by the City.



- SC-40. **PAYMENTS WITHHELD** - The City may withhold or, on account of subsequently discovered evidence, recover the whole or part of any payment to such an extent as may be necessary to protect the City from loss on account of—
- i. Defective work not remedied.
  - ii. Claims filed or reasonable evidence indicating probable filing of claims.
  - iii. Failure of the Contractor to make payments properly to subcontractors or for materials or labor.
  - iv. The Project Representative's opinion that the contract cannot be completed for the balance then unpaid.
  - v. Damage to another contractor.
  - vi. Failure to maintain adequate progress.
  - vii. Damage to the building resulting from the negligence of the Contractor.

When the above grounds are removed, payment will be made for amounts withheld because of them.

- SC-41. **FINAL PAYMENT APPLICATION** - Administrative actions and submittals that must precede or coincide with submittal of the final payment Application for Payment include the following:
- i. Completion of Project closeout requirements.
  - ii. Completion of items specified for completion after Substantial Completion.
  - iii. Assurance that unsettled claims will be settled.
  - iv. Transmittal of required project construction records to City.
  - v. Final Clean Up as outlined in these General Conditions

Upon written notice from Contractor that the entire Work or an agreed portion thereof is complete, Engineer will make a final inspection with City and Contractor and will notify Contractor in writing 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 remedy such deficiencies.

After Contractor has completed all such corrections to the satisfaction of Engineer and delivered all maintenance and operating instructions, schedules, guarantees, bonds, certificates of inspection, marked-up record documents and other documents--all as required by the Contract Documents, and after Engineer has indicated that the Work is acceptable (subject to the provisions under Waiver of Claims), Contractor may make application for final payment following the procedure for progress payments. The final Application for Payment shall be accompanied by all documentation called for in the Contract Documents, together with complete and legally effective releases or waivers (satisfactory to City) of all Liens arising out of or filed in connection with the Work. In lieu thereof and as approved by City, Contractor may furnish receipts or releases in full; an affidavit of Contractor that the releases and receipts include all labor, services, material and equipment for which a Lien could be filed, and that all payrolls, material and equipment bills, and other indebtedness connected with the Work for which City or City's property might in any way be responsible, have been paid or otherwise satisfied; and consent of the surety, if any, to final payment. If any Subcontractor or Supplier fails to furnish a release or receipt in full, Contractor may furnish a Bond or other collateral satisfactory to City to indemnify City against any Lien.

If, on the basis of Engineer's observation of the Work during construction and final inspection, and Engineer's review of the final Application for Payment and accompanying documentation--all as required by the Contract Documents, Engineer is satisfied that the Work has been completed and Contractor's other obligations under the Contract Documents have been fulfilled, Engineer will, within ten days after receipt of the final Application for Payment, indicate in writing Engineer's recommendation of payment and present the Application to City for payment. Thereupon Engineer will give written notice to City and Contractor that the Work is acceptable subject to the provisions found under "Waiver of Claims". Otherwise, Engineer will return the Application to Contractor, indicating in writing the reasons for refusing to recommend final payment, in which case Contractor shall make the necessary corrections and resubmit the Application. Thirty days after presentation to City of the Application and accompanying documentation, in appropriate form and substance, and with Engineer's recommendation and notice of acceptability, the amount recommended by Engineer will become due and will be paid by City to Contractor.

If, through no fault of Contractor, final completion of the Work is significantly delayed and if Engineer so confirms, City shall, upon receipt of Contractor's final Application for Payment and recommendation of Engineer, and without terminating the Agreement, make payment of the balance due for that portion of the Work fully completed and accepted. If the remaining balance to be held by City for Work not fully completed or corrected is less than the retainage stipulated in the Agreement, and if Bonds have been furnished as required, the written consent of the surety to the payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by Contractor to Engineer with the Application for such payment. Such payment shall be made under the terms and conditions governing final payment, except that it shall not constitute a waiver of claims.

- SC-42. **CONTRACTOR'S CONTINUING OBLIGATION** - Contractor's obligation to perform and complete the Work in accordance with the Contract Documents shall be absolute. Neither recommendation of any progress or final payment by Engineer, nor the issuance of a certificate of Substantial Completion, nor any payment by City to Contractor under the Contract Documents, nor any use or occupancy of the Work or any part thereof by City, nor any act of acceptance by City nor any failure to do so, nor any review and approval of a Shop Drawing or sample submission, nor the issuance of a notice of acceptability by Engineer, nor any correction of *defective* Work by City will constitute an acceptance of Work not in accordance with the Contract Documents or a release of Contractor's obligation to perform the Work in accordance with the Contract Documents (except as provided under Waiver of Claims)
- SC-43. **DAMAGES** - Any claim for damage arising under a resulting Agreement shall be made in writing to the party liable within ten (10) days after the first observance of such damage and not later than the time of final payment, except as expressly stipulated otherwise in the case of faulty work or materials.
- SC-44. **EQUIPMENT STARTUP** - Equipment startup shall be in accordance of the manufacturer's recommendations, and as required to demonstrate performance to the Engineer and City in accordance with the specifications. The Contractor shall provide 30-days notice to the Engineer and City of the date on which all equipment and systems will be ready for startup. The startup date shall be arranged as required by the City's operational schedule with consideration of the schedule needs of the Engineer and Contractor.

SC-45. **COMPLETION OF WORK** - The Contractor shall be considered "substantially complete" when the equipment and systems have been used without failure for seven (7) continuous days, and in the opinion of the City, its Project Representative or Engineer of Record, all work has been completed in general accordance with the plans and specifications and all test reports, inspections, etc. have been completed and delivered to the Engineer. Substantial completion shall also mean that degree of completion which allows the City to occupy and use the facilities. When the Engineer deems the work to be "substantially complete" he shall indicate this to the City in writing with copies to the Contractor. The date of contract completion shall be the same date at which the Contractor is considered substantially complete by the Engineer.

SC-46. **ACCEPTANCE OF FINISHED WORK** - The City shall make final acceptance inspection of the Project covered by this Contract when the Project is completed and finished in all respects in accordance with the Contract Documents. Contractor shall furnish to the Engineer or City Representative a complete set of As-Built drawings. These drawings shall be prepared by a licensed Surveyor in the State of Florida and shall be submitted to the Engineer within five (5) days following the completion of the work.

SC-47. **FINAL CLEAN UP** - The Contractor shall complete all cleaning operations before requesting final inspection.

The Contractor shall, as directed by the Project Representative, remove from the City's property and from all public and private property, at his own expense, all temporary structures, rubbish, and waste materials resulting from his operation.

The Contractor shall remove temporary protection and facilities installed for protection of the work during construction.

The Contractor shall comply with all regulations of authorities having jurisdiction and safety standards for cleaning. The Contractor shall not burn waste materials. The Contractor will not discharge volatile, harmful or dangerous materials into drainage systems. The Contractor will remove all waste materials from the site and dispose of in a lawful manner. Materials of value remaining after completion of associated work will become the owner's property. The Contractor will arrange for the disposition of these materials as directed by the City.

The Contractor shall rake the grounds that are neither paved nor planted to a smooth, even-textured surface.

SC-48. **TREES** - It shall be the responsibility of the Contractor to protect all trees within the limits of the work and as designated by the Project Representative.

SC-49. **GUARANTY** - Contractor warrants and guarantees to City that all Work will be in accordance with the Contract Documents and will not be *defective*. Prompt notice of all defects shall be given to Contractor. All *defective* Work, whether or not in place, may be rejected, corrected or accepted as provided in the paragraph in this section labeled 'Inspections, Correction, Removal Of Defective Work'.

All equipment, materials and installation and workmanship furnished by the Contractor under the terms of the Contract, shall be guaranteed by the Contractor against defective workmanship, mechanical and physical defects, leakage, breakage and other damages and failure, under normal

operation for a period of two (2) years or as otherwise specified in the Technical Specifications and after the date of acceptance thereof by the City, and each item of equipment or materials and installation proving to be defective within the specified period of guaranty shall be replaced, without cost to the City, by the Contractor or by the Surety. The period of guaranty of such replacement shall be from and after the date of final acceptance of the Project by the City, provided however, that where any item or equipment or material comes with a manufacturer's warranty of two (2) years or longer, that warranty shall take precedence over the warranty of Contractor hereunder.

- SC-50. **INDEMNITY** - The Contractor agrees to make payment of all proper charges for labor required in the aforementioned work and defend, indemnify, and save harmless the City and Engineer or any of their officers, agents, or servants and each and every one of them against and from all claims, suits, and costs of every kind and description, including attorney's fees, and from all damages to which the City and Engineer or any of their officers, agents, or servants may be put by reason of injury to the persons or property of others resulting from the performance of Contractor's duties under the Contract, or through the negligence of the Contractor in the performance of its duties under this Contract, or through any act or omission on the part of the Contractor, his agents, employees, or servants or subcontractors.

Provided, however, if this Contract is deemed, by a court of competent jurisdiction, to be a construction contract for the purposes of Section 725.06, Florida Statutes, any obligation of the Contractor to defend, indemnify or hold harmless an City and Engineer shall be limited to an obligation to indemnify and hold harmless the City and Engineer, and its officers and employees, from liabilities, damages, losses, and costs, including, but not limited to, reasonable attorneys' fees, to the extent caused by the negligence, recklessness, or intentionally wrongful conduct of the Contractor and persons employed or utilized by the Contractor in the performance of this Contract.

- SC-51. **ASSIGNMENT** - Neither party to the contract shall assign the contract or sublet it as a whole without the written consent of the other, nor shall the Contractor assign any moneys due, or to become due to him hereunder, without the previous written consent of the Project Representative.

- SC-52. **RIGHTS OF VARIOUS INTERESTS** - Wherever work being done by the City's forces, or by the other contractors, is contiguous to work covered by this contract, the respective rights of the various interests involved will be established by the Project Representative, to secure the completion of the various portions of the work in general harmony.

- SC-53. **SEPARATE CONTRACTS** - The City 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 the execution of their work, and shall properly conduct and coordinate his work with theirs.

If any part of the Contractor's work depends, for proper execution or results upon the work of any other contractor, the Contractor shall inspect and promptly report to the Project Representative any defects in such work that render it unsuitable for such proper execution and results. His failure to so inspect and report shall constitute an acceptance of the other

contractor's work as fit and proper for the reception of his work, except as to defects which may develop in the other contractor's work after the execution of the work.

To insure the proper execution of his subsequent work, the Contractor shall measure work already in place and shall at once report to the Project Representative any discrepancy between the executed work and the drawings.

- SC-54. **LANDS FOR WORK** - The City will provide the lands upon which the work under this contract is to be done, except that the Contractor shall provide land required for the erection of temporary construction facilities and storage of his material, together with right of access to same.
- SC-55. **ACCESS TO RECORDS** - The City, the Florida Department of State, or any of their duly authorized representatives shall have access to any books, documents, papers or any other records prepared by the Contractor that are directly pertinent to the work produced under this Agreement for making audit, examination, excerpts and transcription. Such records will be maintained for five (5) years after the completion of the work and until claims or audit findings have been resolved which were initiated prior to the expiration of the five (5) year period.
- SC-56. **EXECUTION, CORRELATION AND INTENT OF DOCUMENTS** - The Agreement shall be signed in quadruplicate by the City and the Contractor. The Contract Documents comprise the entire agreement between City 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 law of the place of the Project.

It is the intent of the Contract Documents to describe a functionally complete Project (or part thereof) to be constructed in accordance with the Contract Documents. Any Work, materials or equipment that may reasonably be inferred from the Contract Documents as being required to produce the intended result will be supplied whether or not specifically called for. When words which have a well-known technical or trade meaning are used to describe Work, materials or equipment, such words shall be interpreted in accordance with that meaning. Reference to standard specifications, manuals or codes of any technical society, organization or association, or to the Laws or Regulations of any governmental authority, whether such reference be specific or by implication, shall mean the latest standard specification, manual, code or Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no 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 City, Contractor or Engineer, or any of their consultants, agents or employees from those set forth in the Contract Documents, nor shall it be effective to assign to Engineer, or any of Engineer's consultants, agents or employees, any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of these Supplemental Conditions. Clarifications and interpretations of the Contract Documents shall be issued by Engineer.

If, during the performance of the Work, Contractor finds a conflict, error or discrepancy in the Contract Documents, Contractor shall so report to Engineer in writing at once and before

proceeding with the Work affected thereby shall obtain a written interpretation or clarification from Engineer; however, Contractor shall not be liable to City or Engineer for failure to report any conflict, error or discrepancy in the Contract Documents unless Contractor had actual knowledge thereof or should reasonably have known thereof.

- SC-57. **CONTRACTOR'S UNDERSTANDING** - Contractor has visited the site, has called for utility locates and has familiarized itself with the local conditions under which the work is to be performed, both underground and above ground and both on and off premises and has correlated these observations with the requirements of the proposed contract documents; all as considered necessary or pertinent to the work, and any failure to thus make all such prior investigations and studies shall in no way act as a waiver of any of the terms of the contract. No verbal agreement or conversation with any officer, agent or employee of the City, either before or after the execution of this contract, shall affect or modify any of the terms or obligations herein contained
- SC-58. **FAMILIARITY WITH LAWS** - The Contractor is required to be familiar with all Federal, State and Local laws, ordinances, rules and regulations that in any manner affect the work. Ignorance on the part of the Contractor will in no way relieve him from responsibility.
- SC-59. **SALES TAX** - The Contractor is required to pay Florida sales and use taxes on all materials purchased for this project unless otherwise specified in the document. All Florida sales and use taxes will be included in the submitted bid price(s).
- SC-60. **CLARIFICATIONS AND INTERPRETATIONS OF CONTRACT DOCUMENTS** - It is the duty of the Contractor to notify the Engineer, in writing, in the event of any doubt or question as to the true meaning of any provision in the Contract Documents. The Engineer's decision thereon shall be final. Annotated dimensions on drawings shall govern and work not dimensioned shall be as clarified by the Engineer. Work not particularly shown or specified shall be the same as similar parts that are shown or specified. Materials or work described in words which have a well-known technical or trade meaning shall be deemed to refer to such recognized standard.

Engineer will issue with reasonable promptness such written clarifications or interpretations of the requirements of the Contract Documents (in the form of Drawings or otherwise) as Engineer may determine necessary, which shall be consistent with or reasonably inferable from the overall intent of the Contract Documents. If Contractor believes that a written clarification or interpretation justifies an increase in the Contract Price or an extension of the Contract Time then Contractor shall notify City in accordance with the Agreement.

Engineer will be the initial interpreter of the requirements of the Contract Documents and judge of the acceptability of the Work there under. Claims, disputes and other matters relating to the acceptability of the Work or the interpretation of the requirements of the Contract Documents pertaining to the performance and furnishing of the Work and claims in respect of changes in the Contract Price or Contract Time will be referred initially to Engineer in writing with a request for a formal decision in accordance with this paragraph, which Engineer will render writing within a reasonable time. Written notice of each such claim, dispute and other matters will be delivered by the claimant to Engineer and the other party to the Agreement promptly (but in no event later than thirty days) after the occurrence of the event giving rise thereto, and

written supporting data will be submitted to Engineer and the other party within sixty days after such occurrence unless Engineer allows an additional period of time to ascertain more accurate data in support of the claim.

When functioning as interpreter and judge under this Article, Engineer will not show partiality to City or Contractor and will not be liable in connection with any interpretation or decision rendered in good faith in such capacity. The rendering of a decision by Engineer pursuant this Article with respect to any such claim, dispute or other matter (except any which have been waived by the making or acceptance of final payment as permitted by the Agreement.) will be a condition precedent to any exercise by City or Contractor of such rights or remedies as either may otherwise have under the Contract Documents or by Laws or Regulations in respect of any such claim, dispute or other matter.

SC-61. **LIMITATIONS ON ENGINEER'S RESPONSIBILITIES** - Neither Engineer's authority to act nor any decision made by Engineer in good faith either to exercise or not exercise such authority shall give rise to any duty or responsibility of Engineer to Contractor, any Subcontractor, any Supplier, or any other person or organization performing any of the Work, or to any surety for any of them.

Whenever in the Contract Documents the terms "as ordered", "as directed", "as required", "as allowed", "as approved" or terms of like effect or import are used, or the adjectives "reasonable", "suitable", "acceptable", "proper" or "satisfactory" or adjectives of like effect or import are used to describe a requirement, direction, review or judgment of Engineer as to the Work, it is intended that such requirement, direction, review or judgment will be solely to evaluate the Work for compliance with the Contract Documents (unless there is a specific statement indicating other-wise). The use of any such term or adjective shall not be effective to assign to Engineer any duty or authority to supervise or direct the furnishing or performance of the Work or any duty or authority to undertake responsibility contrary to the provisions of this Article.

Engineer will not be responsible for Contractor's means, methods, techniques, sequences or procedures of construction, or the safety precautions and programs incident thereto, and Engineer will not be responsible for Contractor's failure to perform or furnish the Work in accordance with the Contract Documents.

Engineer will not be responsible for the acts or omissions of Contractor or of any Subcontractor, any Supplier, or of any other person or organization performing or furnishing any of the Work.

SC-62. **SAFETY AND PRECAUTION** - 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:

- i. all employees on the Work and other persons and organizations who may be affected thereby;
- ii. all the Work and materials and equipment to be incorporated therein, whether in storage on or off the site; and

- iii. 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.

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 notify owners of adjacent property and of Underground Facilities and utility owners when prosecution of the Work may affect them, and shall cooperate with them in the protection, removal, relocation and replacement of their property. All damage, injury or loss to any property referred to in paragraph caused, directly or in this Article directly, in whole or in part, by Contractor, any Subcontractor, Supplier or any other person or organization directly or indirectly employed by any of them to perform or furnish any of the Work or anyone for whose acts any of them may be liable, shall be remedied by Contractor (except damage or loss attributable to the fault of Drawings or Specifications or to the acts or omissions of City or Engineer or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of Contractor). Contractor's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and Engineer has issued a notice to City and Contractor that the Work is acceptable (except as otherwise expressly provided in connection with Substantial Completion).

Contractor shall designate a responsible representative at the site whose duty shall be the prevention of accidents. This person shall be Contractor's superintendent unless otherwise designated in writing by Contractor to City.

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 City, is obligated to act to prevent threatened damage, injury or loss. Contractor shall give Engineer prompt written notice that any significant changes in the Work or variations from the Contract Documents have been caused thereby. If Engineer 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 variations.

- SC-63. **RECORD DOCUMENTS** - Contractor shall maintain in a safe place at the site one record copy of all Drawings, Specifications, Addenda, Written Amendments, reviewed Shop Drawings, Change Orders, Work Directive Changes, Field Orders and written interpretations and clarifications in good order and annotated to show all changes made during construction. These record documents together with all reviewed samples and a counterpart of all reviewed Shop Drawings will be available to Engineer for reference. Upon completion of the Work, these record documents or as-builts, samples and Shop Drawings will be delivered to Engineer for City. Upon delivery of such documents to Engineer, the Contractor shall provide a written certification, signed and dated, that all documents accurately and completely reflect all deviations from or changes in the original Contract Documents made during construction of the project.



Record documents shall be up-to-date and available for review by the resident project representative prior to each application for progress payment. Payment will not be made for construction of items not shown on the record documents.

These requirements also supplement those of Item 68. Not less than two percent (2%) of the contract price shall be retained until correct record drawings, specifications, addenda, modifications and shop drawings are delivered to and reviewed by the Engineer.

SC-64. **PHYSICAL CONDITIONS-UNDERGROUND FACILITIES** - *Shown or Indicated:* The information and data shown or indicated in the Contract Documents with respect to existing Underground Facilities at or contiguous to the site are based on information and data furnished to City or Engineer by the owners of such Underground Facilities or by others. Unless it is otherwise expressly provided in the Supplementary Conditions:

- i. City and Engineer shall not be responsible for the accuracy or completeness of any such information or data; and
- ii. Contractor shall have full responsibility for reviewing and checking all such information and data, for locating all Underground Facilities shown or indicated in the Contract Documents, for coordination of the Work with the owners of such Underground Facilities during construction, for the safety and protection thereof and repairing any damage thereto resulting from the Work, the cost of all of which will be considered as having been included in the Contract Price.

The word facility as used in this subsection titled "Utilities" includes any pipe conveying gases or liquids and appurtenances attached thereto; cables, conduits, wires, ducts and appurtenances; poles and appurtenances; any of which may be buried below grade or installed at or above grade level. A facility excludes irrigation pipes, service connections and traffic signal wiring. A service connection is a pipe (excluding irrigation pipes), cable, wire, duct or conduit that is intended to connect a facility with a user. The word Utility as used in this subsection titled "Utilities" refers to the entity having legal owner-ship of the facility, service connection, irrigation pipe, or traffic signal wiring.

The Engineer has endeavored to determine the existence of underground facilities at the site of the work from the records of the utilities with known facilities in the vicinity of the work. The position of these facilities as derived from such records is shown on the plans. Service connections, irrigation pipes, and traffic signal wiring may not be shown on the plans. The Contractor shall make his own investigations, including exploratory excavations and contact with Utilities, to determine the exact locations and type of existing facilities, service connections, irrigation pipes, and traffic signal wiring prior to commencing work in the area and shall be responsible for any damage thereto.

Damage, injury, or loss resulting in whole or in part from the Contractor's failure to locate and preserve a facility, service connection, irrigation pipe, or traffic signal wiring shall under no circumstances be deemed attributable to the fault of the Drawings or Specifications or to the acts or omissions of the City or Engineer or anyone employed by either of them or anyone for whose acts either of them may be liable.

With respect to underground facilities, no claim for a change in the contract price may be allowed unless the Contractor discovers an underground facility which is not indicated or

referred to in the Contract Documents or which is in a position differing materially and significantly from that indicated or referred to in the Contract Documents. If such discovery is made, the Contractor shall promptly notify in writing the City, Engineer and the Utility. The City may make changes in the alignment and grade of the work.

At no additional cost to the City, the Contractor shall replace, remove, relocate, protect, or temporarily maintain a facility which is not in a position differing materially and significantly from that indicated or referred to in the Contract Documents. At no additional cost to the City, the Contractor shall adjust the top elevation of all valve boxes and manholes to match the finish grade or pavement surface and shall replace, remove, relocate, protect, or temporarily maintain all service connections, irrigation pipes, and traffic signal wiring. The work on the facility, service connection, irrigation pipe or traffic signal wiring shall be done in a manner satisfactory to the Utility, it being understood that the Utility has the option of doing such work with his own forces, or permitting the work to be done by the Contractor.

SC-65. **PHYSICAL CONDITIONS**

65.1. Exploration and Reports: Reference is made in the Special Conditions to those reports of exploration and tests of subsurface conditions at the site that have been utilized by Engineer in preparation of the Contract Documents. Such reports are not guaranteed as to accuracy or completeness and are not part of the Contract Documents.

65.2. Unforeseen Conditions: Contractor shall promptly notify City and Engineer in writing of any subsurface or latent physical conditions at the site or in an existing structure differing materially from those indicated or referred to in the Contract Documents. Engineer will promptly review those conditions and advise City in writing if further investigation or tests are necessary.

Promptly thereafter, City shall obtain the necessary additional investigations and tests and furnish copies to Engineer and Contractor. If Engineer finds that the results of such investigations or tests indicate that there are subsurface or latent physical conditions which differ materially from those intended in the Contract Documents, and which could not reasonably have been anticipated by Contractor, a Change Order shall be issued incorporating the necessary revisions.

SC-66. **REVIEW OF APPLICATION FOR PROGRESS PAYMENT** - Engineer will, within ten days after receipt of each Application for Payment, to either indicate in writing a recommendation of payment and present the Application to City, or return the Application to Contractor indicating in writing Engineer's reasons for refusing to recommend payment. In the latter case, Contractor may make the necessary corrections and resubmit the Application. Ten (10) days after presentation of the Application for Payment with Engineer's recommendation, the amount recommended will become due and when due will be paid by City to Contractor.

Engineer's recommendation of any payment requested in an Application for Payment will constitute a representation by Engineer to City, based on Engineer's on-site observations of the Work in progress as an experienced and qualified design professional and on Engineer's review of the Application for Payment and the accompanying data and schedules that the Work has progressed to the point indicated; that, to the best of Engineer's knowledge, information and

belief, the quality of the Work is in accordance with the Contract Documents (subject to an evaluation of the Work as a functioning whole prior to or upon Substantial Completion, to the results of any subsequent tests called for in the Contract Documents, to a final determination of quantities and classifications for Unit Price Work, and to any other qualifications stated in the recommendation); and that Contractor is entitled to payment of the amount recommended. However, by recommending any such payment Engineer will not thereby be deemed to have represented that exhaustive or continuous on-site inspections have been made to check the quality or the quantity of the Work beyond the responsibilities specifically assigned to Engineer in the Contract Documents or that there may not be other matters or issues between the parties that might entitle Contractor to be paid additionally by City or City to withhold payment to Contractor.

Engineer's recommendation of final payment will constitute an additional representation by Engineer to City that the conditions precedent to Contractor's being entitled to final payment have been fulfilled.

Engineer may refuse to recommend the whole or any part of any payment if, in Engineer's opinion, it would be incorrect to make such representations to City. Engineer may also refuse to recommend any such payment, or, because of subsequently discovered evidence or the results of subsequent inspections or test, nullify any such payment previously recommended; to such extent as may be necessary in Engineer's opinion to protect City from loss.

City may refuse to make payment of the full amount recommended by Engineer because claims have been made against City on account of Contractor's performance or furnishing of the Work or Liens have been filed in connection with the Work or there are other items entitling City to a set-off against the amount recommended, but City must give Contractor immediate written notice (with a copy to Engineer) stating the reasons for such action.

SC-67. **SUBSTANTIAL COMPLETION** - When Contractor considers the entire Work ready for its intended use, Contractor shall notify City and Engineer in writing that the entire Work is substantially complete (except for items specifically listed by Contractor as incomplete) and request that Engineer issue a certificate of Substantial Completion. Within a reasonable time thereafter, City, Contractor and Engineer shall make an inspection of the Work to determine the status of completion. If Engineer does not consider the Work substantially complete, Engineer will notify Contractor in writing giving the reasons therefore. If Engineer considers the Work substantially complete, Engineer will prepare and deliver to City a tentative certificate of Substantial Completion which shall fix the date of Substantial Completion. There shall be attached to the certificate a tentative list of items to be completed or corrected before final payment. City shall have seven days after receipt of the tentative certificate during which to make written objection to Engineer as to any provisions of the certificate or attached list. If, after considering such objections, Engineer concludes that the Work is not substantially complete, Engineer will within fourteen days after submission of the tentative certificate to City notify Contractor in writing, stating the reasons therefore. If, after consideration of City's objections, Engineer considers the Work substantially complete, Engineer will within said fourteen days execute and deliver to City and Contractor a definitive certificate of Substantial Completion (with a revised tentative list of items to be completed or corrected) reflecting such changes from the tentative certificate as Engineer believes justified after consideration of any objections from City. At the time of delivery of the tentative certificate of Substantial

Completion, Engineer will deliver to City and Contractor a written recommendation as to division of responsibilities pending final payment between City and Contractor with respect to security, operation, safety, maintenance, heat, utilities, insurance and warranties. Unless City and Contractor agree otherwise in writing and so inform Engineer prior to Engineer's issuing the definitive certificate of Substantial Completion, Engineer's aforesaid recommendations will be binding on City and Contractor until final payment.

City shall have the right to exclude Contractor from the Work after the date of Substantial Completion, but City shall allow Contractor reasonable access to complete or correct items on the tentative list.

SC-68. **INSPECTIONS, CORRECTION, REMOVAL OF DEFECTIVE WORK** - Engineer and Engineer's representatives, other representatives of City, testing agencies and governmental agencies with jurisdictional interests will have access to the Work at reasonable times for their observation, inspecting and testing. Contractor shall provide proper and safe conditions for such access.

Contractor shall give Engineer timely notice of readiness of the Work for all required inspections or tests.

If Laws or Regulations of any public body having jurisdiction require any Work (or part thereof) to specifically be inspected, tested or approved, Contractor shall assume full responsibility therefore, pay all costs in connection therewith and furnish Engineer the required certificates of inspection, testing or approval. Contractor shall also be responsible for and shall pay all costs in connection with any inspection or testing required in connection with City's or Engineer's acceptance of a Supplier of materials or equipment proposed to be incorporated in the Work, or of materials or equipment submitted for approval prior to Contractor's purchase thereof for incorporation in the Work. The cost of all inspections, tests and approvals in addition to the above which are required by the Contract Documents shall be paid by City (unless otherwise specified).

All inspections, tests or approvals other than those required by Laws or Regulations of any public body having jurisdiction shall be performed by organizations acceptable to City and Contractor (or by Engineer if so specified).

If any Work (including the 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.

If any Work is covered contrary to the written request of Engineer, it must, if requested by Engineer, be uncovered for Engineer's observation and replaced at Contractor's expense.

If Engineer considers it necessary or advisable that covered Work be observed by Engineer or inspected or tested by others, Contractor, at Engineer's request, shall uncover, expose or

otherwise make available for observation, inspection or testing as Engineer may require, that portion of the Work in question, furnishing all necessary labor, material and equipment. If it is found that such Work is *defective*, Contractor shall bear all direct, indirect and consequential costs of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, (including but not limited to fees and charges of engineers, architects, attorneys and other professionals), and City shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, may make a claim therefore as provided in Special Conditions. If, however, such Work is not found to be *defective*, Contractor shall be allowed an increase in the Contract Price or an extension of the Contract Time, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction; and, if the parties are unable to agree as to the amount or extent thereof, Contractor may make a claim therefore as provided in Special Conditions.

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, City may order Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, this right of City to stop the Work shall not give rise to any duty on the part of City to exercise this right for the benefit of Contractor or any other party.

If required by Engineer, Contractor shall promptly either correct all *defective* Work, whether or not fabricated, installed or completed, or, if the Work has been rejected by Engineer, remove it from the site and replace it with *non-defective* Work. Contractor shall bear all direct, indirect and consequential costs of such correction or removal (including but not limited to fees and charges of engineers, architects, attorneys and other professionals) made necessary thereby.

SC-69. **ACCEPTANCE OF DEFECTIVE WORK; CORRECTION OF DEFECTIVE WORK BY THE City** - If, instead of requiring correction or removal and replacement of *defective* Work, City (and, prior to Engineer's recommendation of final payment) prefers to accept it, City may do so. Contractor shall bear all direct, indirect and consequential costs attributable to City's evaluation of and determination to accept such *defective* Work (such costs to be approved by Engineer as to reasonableness and to include but not be limited to fees and charges of engineers, architects, attorneys and other professionals). If any such acceptance occurs prior to Engineer's recommendation of final payment, a Change Order will be issued incorporating the necessary revisions in the Contract Documents with respect to the Work; and City shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, City may make a claim. If the acceptance occurs after such recommendation, an appropriate amount will be paid by Contractor to City.

If Contractor fails within a reasonable time after written notice of Engineer to proceed to correct and to correct *defective* Work or to remove and replace rejected Work as required by Engineer, or if Contractor fails to perform the Work in accordance with the Contract Documents, or if Contractor fails to comply with any other provision of the Contract Documents, City may, after seven days' written notice to Contractor, correct and remedy any such deficiency. In exercising the rights and remedies under this paragraph City shall proceed expeditiously. To the extent necessary to complete corrective and remedial action, City may exclude Contractor from all or part of the site, take possession of all or part of the Work, and suspend Contractor's services related thereto, take possession of Contractor's tools, appliances, construction equip-

ment and machinery at the site and incorporate in the Work all materials and equipment stored at the site or for which City has paid Contractor but which are stored elsewhere. Contractor shall allow City, City's representatives, agents and employees such access to the site as may be necessary to enable City to exercise the rights and remedies under this paragraph. All direct, indirect and consequential costs of City 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 in the Contract Documents with respect to the Work; and City shall be entitled to an appropriate decrease in the Contract Price, and, if the parties are unable to agree as to the amount thereof, City may make a claim. Such direct, indirect and consequential costs will include but not be limited to fees and charges of engineers, architects, attorneys and other professionals, all court and arbitration costs and all costs of repair and replacement of work of others destroyed or damaged by correction, removal or replacement of Contractor's *defective* Work. Contractor shall not be allowed an extension of the Contract Time because of any delay in performance of the Work attributable to the exercise by City of City's rights and remedies hereunder.

SC-70. **ARBITRATION** - Before bringing any action in any court of competent jurisdiction pertaining to any claim, dispute or other matter in question arising out of or relating to the Contract Documents or the breach thereof, in an amount less than \$25,000, except for claims which have been waived by the making and acceptance of final payment, the claimant/objector (Party A) shall first offer to arbitrate the question(s) with the other party to the contract (Party B) by notifying him in writing and setting forth in such notice the question(s) to be arbitrated.

Party B can select to arbitrate or not. If Party B agrees to arbitrate he shall so advise Party A in writing within ten days after receipt of Party A's notice. Notice by Party B that he does not wish to arbitrate or failure of Party B to notify Party A within the ten-day period will give Party A the right to institute a court action.

If Party B agrees to arbitrate, the arbitration shall be in accordance with the Construction Industry Arbitration Rules of the American Arbitration Association except as modified herein. In such event, the agreement to arbitrate shall be specifically enforceable under the provisions of the Florida Arbitration Code, S682, Fla. Stat., as it may be from time to time amended. The award rendered by the arbitrators shall be final, and judgment may be entered upon it in any court having jurisdiction thereof.

If Party B agrees to arbitrate, then Party A shall file its notice of demand for arbitration in writing with Party B and with the American Arbitration Association, and a copy shall be filed with the Engineer. Notice of demand for arbitration shall be served on the parties referred to herein no later than thirty days from the date Party B agrees to arbitrate the issues in question. Failure to serve the notice of demand for arbitration shall constitute a waiver and abandonment of the claims for which arbitration is sought. Notice of demand for arbitration shall in no event be made on any claim, dispute or other matter in questions which would be barred by the applicable statute of limitations.

If the dollar amount of the claim exceeds \$25,000, arbitration may only be utilized if both Party A and party B agree to arbitrate.

The Contractor shall carry on the Work and maintain the progress schedule during any arbitration proceedings, unless otherwise mutually agreed in writing.

The Florida Rules of Civil Procedure pertaining to discovery shall apply to both parties during arbitration, and, at the City's sole option, any and all arbitration arising out of or relating to any of the Contract Documents or any breach thereof shall include by consolidation, joinder, or joint filing any additional person or entity not a party to this Agreement to the extent necessary for the final resolution of the matter in controversy.

At least one of the members of the arbitration panel must be an attorney licensed to practice law in the State of Florida.

The surety shall be bound by the arbitration award to the same extent as the Contractor is bound.

The arbitration panel shall submit a written opinion with findings of fact and conclusions of law stating the basis for the decision made, and including an award of arbitration that may be confirmed by a court of competent jurisdiction.

Unless City agrees to the contrary, the location of any and all arbitration proceedings shall be in Lake County, Florida.

[END OF SECTION]

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**Complete ALL the forms in this section and submit them in a sealed envelope as your bid response.**

General Vendor Information			
Company Name:			
Physical Address:			
Mailing Address:			
Phone No.:		Fax No.:	
State of Fla Registration or Document No.:			
FEIN No.:		No. of Years in Business:	
Financial Status: <input type="checkbox"/> Poor <input type="checkbox"/> Good <input type="checkbox"/> Excellent			
No. of Personnel Currently Employed:		No. of Personnel Available for this Project:	
<b>Principal Name</b>		<b>Title</b>	
Describe the type of work normally performed by your company:			

Provide information regarding who may be contacted regarding this bid response.

Primary Contact	
Name:	_____
Title:	_____
Address:	_____
Phone No.:	_____
	Mobile Phone No.: _____
e-Mail Address:	



## IFB 180021 SCHEDULE OF BID ITEMS

Your Bid MUST BE submitted on this form. Double check the Bid prices.  
Amounts cannot be changed following the Bid due date and time.

**Submitting Vendor Name:** \_\_\_\_\_

### BASE BID

ITEM NO.	DESCRIPTION	UNIT	QTY	UNIT PRICE
1	MOBILIZATION/DEMOBILIZATION (Not to Exceed 8% of Total Base Bid)	LS	1	\$
2	RECORD DRAWINGS	LS	1	\$
3	ENVIRONMENTAL PROTECTION (Not to Exceed 1% of Total Base Bid)	LS	1	\$
4	PRE-ENGINEERED BUILDING, SLAB-ON-GRADE, ACCESS ROADS, AND WALKWAY AND STAIRS	LS	1	\$
5	SKID-MOUNTED TWO-METER BELT FILTER PRESS (including piping, sludge feed pump, wash water booster pump, polymer feed system, belt filter press, cake pump, instrumentation and controls, and other appurtenances)	LS	1	\$
6	YARD PIPING	LS	1	\$
7	ON-SITE LIFT STATION PUMP UPGRADE (Including Replacement of pumps, pump discharge elbows, reducers, guide rails, pump accessories, control panel upgrade, and other appurtenances)	LS	1	\$
8	ALLOWANCE: SCADA SYSTEM INTEGRATION	LS	1	\$ <b>15,000.00</b>
<b>TOTAL BASE BID:</b>		<b>\$</b>		



**TIME FOR COMPLETION**

Completion of project is *desired* within **275 calendar days** from Notice to Proceed (NTP). Bids which do not indicate a completion time that is within this delivery time may be deemed as non-responsive.

Number of CALENDAR DAYS to <u>begin</u> work after receipt of NTP:	_____ Calendar Days
Number of CALENDAR DAYS to <u>completion</u> of work after receipt of NTP:	_____ Calendar Days
State of Florida Contractors License Number:	

[Rest of page intentionally left blank.]



**BIDDER'S CERTIFICATION**

- I have carefully examined the Invitation to Bid, Instructions to Bidders, General and/or Special Conditions, Specifications, the Bid submitted and any other documents accompanying or made a part of this invitation.
- I hereby promise to furnish the goods or services specified in the Invitation to Bid at the prices or rates set forth in my bid. I agree that my bid will remain firm for the period established in the bid document in order to allow the City adequate time to evaluate the bids and make award. Furthermore, I agree to abide by all conditions of the bid.
- I certify that all information contained in this bid is truthful to the best of my knowledge and belief. I further certify that I am duly authorized to submit this bid on behalf of the vendor / contractor as its act and deed and that the vendor / contractor is ready, willing and able to perform if awarded the bid.
- I further certify that this bid is made without prior understanding, agreement, connection, discussion, or collusion with any person, firm or corporation submitting a bid for the same product or service; no officer, employee or agent of the City of Leesburg or of any other bidder interested in said bid; and that the undersigned executed this Bidder's Certification with full knowledge and understanding of the matters therein contained and was duly authorized to do so.
- I further certify that having read and examined the specifications and documents for the designated services and understanding the general conditions for contract under which services will be performed, does hereby propose to furnish all labor, equipment, and material to provide the services set forth in the Solicitation.
- I hereby declare that the following listing states any clarifications, any and all variations from and exceptions to the requirements of the specifications and documents. The undersigned further declares that the "work" will be performed in strict accordance with such requirements, and understands that any exceptions to the requirements of the specifications and documents may render the bidder's submission non-responsive.

**NO EXCEPTIONS WILL BE ALLOWED AFTER THE BID IS SUBMITTED.**

Please check one:

I take NO exceptions

I take the exceptions listed here:

(If more space is needed, please indicate exceptions here and attach additional pages as needed)





**ADDENDUM ACKNOWLEDGMENT**

No Addendum were issued.

The undersigned acknowledges receipt of the following addenda to the Invitation to Bid (indicate number and date of each):

Addendum No.	Dated:	Addendum No.	Dated:
Addendum No.	Dated:	Addendum No.	Dated:
Addendum No.	Dated:	Addendum No.	Dated:

**FAILURE TO SUBMIT ACKNOWLEDGEMENT OF ANY ADDENDUM THAT AFFECTS THE BID PRICES IS CONSIDERED A MAJOR IRREGULARITY AND MAY BE CAUSE FOR REJECTION OF THE BID.**

**LOCAL VENDOR STATUS DECLARATION**

The responding firm and firm that will enter into an agreement with the City, if selected, declares the following selected Local Vendor status. The City will verify all declarations of a Local Vendor Preference.

- My Firm Qualifies as a Tier I - Local Vendor for this solicitation**  
 "Tier I Local Vendor" shall be defined as the primary Business Office or a Full Time Sales Office of the vendor being located within the City of Leesburg or the vendor receiving one or more Utility Services (excluding communications/Internet) from the City of Leesburg.
- My Firm Qualifies as a Tier II - Local Vendor for this solicitation**  
 "Tier II Local Vendor" shall be defined as the primary Business Office or a Full Time Sales Office of the vendor not meeting the definition of a Tier I Local Vendor but nonetheless being located within the 20-Mile Radius as defined in this policy.
- My Firm does not qualify as a local vendor**

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**BID CERTIFICATION SIGNATURES**  
 (this section must be signed and completed.)

\_\_\_\_\_  
 Name of Business

\_\_\_\_\_  
 Telephone Number

By: \_\_\_\_\_  
 Signature

\_\_\_\_\_  
 e-mail Address

\_\_\_\_\_  
 Printed Name

\_\_\_\_\_  
 Mailing Address

\_\_\_\_\_  
 Title

\_\_\_\_\_  
 City, State, Zip Code







**STATEMENT OF EXPERIENCE - "SIMILAR" PROJECTS**

List all SIMILAR projects your firm has completed. Copy this sheet if additional pages are needed. You must use this form. Attaching a separate listing may cause your bid to be deemed non-responsive and rejected.

<b>Project Name/Location:</b>		
<b>Project Owner:</b>		<b>Date Completed:</b>
<b>Project Description and Specific Scope:</b> <i>Be Descriptive. Use additional pages.</i>		
<b>Contract Amounts:</b>	<b>Original \$</b>	<b>At Completion \$</b>
<b>Briefly Explain Any Variance:</b>		
<b>Contact Person:</b>		
<b>Contact e-mail:</b>		
<b>Phone Number:</b>		
<b>Project Name/Location:</b>		
<b>Project Owner:</b>		<b>Date Completed:</b>
<b>Project Description and Specific Scope:</b> <i>Be Descriptive. Use additional pages.</i>		
<b>Contract Amounts:</b>	<b>Original \$</b>	<b>At Completion \$</b>
<b>Briefly Explain Any Variance:</b>		
<b>Contact Person:</b>		
<b>Contact e-mail:</b>		
<b>Phone Number:</b>		
<b>Project Name/Location:</b>		
<b>Project Owner:</b>		<b>Date Completed:</b>
<b>Project Description and Specific Scope:</b> <i>Be Descriptive. Use additional pages.</i>		
<b>Contract Amounts:</b>	<b>Original \$</b>	<b>At Completion \$</b>
<b>Briefly Explain Any Variance:</b>		
<b>Contact Person:</b>		
<b>Contact e-mail:</b>		
<b>Phone Number:</b>		

**STATEMENT OF EXPERIENCE - "SIMILAR" PROJECTS**  
(Continued)

<b>Project Name/Location:</b>		
<b>Project Owner:</b>		<b>Date Completed:</b>
<b>Project Description and Specific Scope:</b> <i>Be Descriptive. Use additional pages.</i>		
<b>Contract Amounts:</b>	<b>Original \$</b>	<b>At Completion \$</b>
<b>Briefly Explain Any Variance:</b>		
<b>Contact Person:</b>		
<b>Contact e-mail:</b>		
<b>Phone Number:</b>		
<b>Project Name/Location:</b>		
<b>Project Owner:</b>		<b>Date Completed:</b>
<b>Project Description and Specific Scope:</b> <i>Be Descriptive. Use additional pages.</i>		
<b>Contract Amounts:</b>	<b>Original \$</b>	<b>At Completion \$</b>
<b>Briefly Explain Any Variance:</b>		
<b>Contact Person:</b>		
<b>Contact e-mail:</b>		
<b>Phone Number:</b>		
<b>Project Name/Location:</b>		
<b>Project Owner:</b>		<b>Date Completed:</b>
<b>Project Description and Specific Scope:</b> <i>Be Descriptive. Use additional pages.</i>		
<b>Contract Amounts:</b>	<b>Original \$</b>	<b>At Completion \$</b>
<b>Briefly Explain Any Variance:</b>		
<b>Contact Person:</b>		
<b>Contact e-mail:</b>		
<b>Phone Number:</b>		

**TRENCH SAFETY AFFIDAVIT**

FOR PROJECT: \_\_\_\_\_

Trench excavations on this Project may be in excess of 5 feet deep. The Occupational Safety and Health Administration excavation safety standards, 29 CFR 1926.650 Subpart P trench safety standards will be in effect during the period of construction of the Project.

Bidder acknowledges that included in the Bid Price are costs for complying with the Florida Trench Safety Act (90-96, Laws of FL) effective October 1, 1990, and hereby gives assurance that, if awarded the Contract, the Contractor or Subcontractor performing trench excavation work on the Project will comply with the applicable trench safety standards.

If your analysis indicates trenching is not necessary or trench depths will NOT exceed 5 feet indicate 'NONE' under items and put a -0- for the cost.

The Bidder further identifies the costs as follows:

**Base Bid**

Trench Safety Item Description	Cost

**Additive Alternates (if applicable)**

Trench Safety Item Description	Cost
<b>Total Cost All Items</b>	<b>\$</b>

NOTE: FAILURE TO COMPLETE AND SUBMIT THIS FORM WITH THE RESPONSE MAY RESULT IN THE BID BEING DECLARED AS NON-RESPONSIVE.

COMPANY NAME: \_\_\_\_\_

BY: \_\_\_\_\_ DATE: \_\_\_\_\_





**BID BOND**

**KNOW ALL MEN BY THESE PRESENTS:** that we \_\_\_\_\_

\_\_\_\_\_ as Principal, hereinafter called Principal, a  corporation  partnership  individual duly authorized by law to do business as a construction contractor in the state of Florida, and \_\_\_\_\_ a corporation organized and existing under the laws of the

State of \_\_\_\_\_, having its primary Administrative Offices at \_\_\_\_\_ and currently licensed to do business in the State of Florida, hereinafter called the Surety, are held firmly bound unto the City of Leesburg, Lake County, Florida, as Obligee, hereinafter called Obligee, in the sum of:

\_\_\_\_\_ Dollars \$ \_\_\_\_\_ OR \_\_\_\_\_ % of the bid.

For the payment of which sum well and truly made, and the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

**WHEREAS**, the Principal contemplates submitting or has submitted a Bid to the CITY for: \_\_\_\_\_

**NOW, THEREFORE**, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof, or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another Party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this \_\_\_\_ day of \_\_\_\_\_, 20\_\_.

In the Presence of:

\_\_\_\_\_  
(Principal) (Seal)

\_\_\_\_\_  
By: (Title)

\_\_\_\_\_  
(Surety) (Seal)

\_\_\_\_\_  
By: (Attorney-in-Fact)

\_\_\_\_\_  
Printed:

**CERTIFICATE AS TO CORPORATE PRINCIPAL**

**\*\* For Corporations Only \*\***

This form to be completed and accompany the foregoing Bid Bond for corporations only.

I, \_\_\_\_\_,  
(Individuals Name – Corporate Office Holder)

certify that I am the \_\_\_\_\_,  
(Office Held – Usually the Secretary)

of the \_\_\_\_\_  
(Corporation Name)

\_\_\_\_\_  
(Corporation Name)

named as principal in the foregoing bond, that the person who signed the said bond on behalf of principal was or were then incumbent(s) in the positions(s) shown above of said corporation that I know his or her signature(s), and his or her signature(s) thereto is or are genuine, and that said bond was duly signed, sealed and attested for and in behalf of said corporation by authority of its governing body.

Date: \_\_\_\_\_

\_\_\_\_\_  
(Signature of Secretary or Other Officer as above)

\_\_\_\_\_  
(Corporate Seal)

**CITY OF LEESBURG  
TURNPIKE WATER RECLAMATION FACILITY  
DEWATERING IMPROVEMENTS**

**BIDDING AND CONSTRUCTION  
CONTRACT DOCUMENTS AND  
TECHNICAL SPECIFICATIONS**

**BID DOCUMENTS**

*Owner:*

**CITY OF LEESBURG**  
1600 County Road 470  
Okahumpka, Florida 34762

*Engineer:*

**JONES EDMUNDS & ASSOCIATES, INC.**  
141 5<sup>th</sup> Street NW  
Suite 200  
Winter Haven, Florida 33881

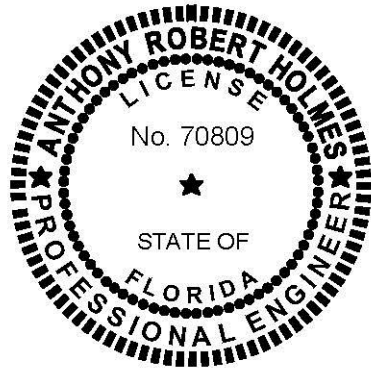
Certificate of Authorization #1841

Jones Edmunds Project: 07810-084-01

October 2017

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**CITY OF LEESBURG  
TURNPIKE WATER RECLAMATION FACILITY  
DEWATERING IMPROVEMENTS**



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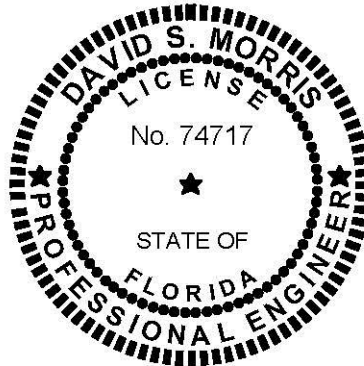
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---

Anthony R. Holmes, PE  
FL Professional Engineer No. 70809  
Jones Edmunds & Associates, Inc.  
324 S. Hyde Park Avenue, Suite 250  
Tampa, Florida 33606  
Certificate of Authorization #1841  
Divisions 01, 02, 09, 11, and 15

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**CITY OF LEESBURG  
TURNPIKE WATER RECLAMATION FACILITY  
DEWATERING IMPROVEMENTS**



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DAVID S. MORRIS ON OCT. 24, 2017.**

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ON ANY ELECTRONIC COPIES.**

---

David S. Morris, PE  
FL Professional Engineer No. 74717  
Wekiva Engineering, LLC  
711 N. Orange Ave., Suite A  
Winter Park, Florida 32789  
Certificate of Authorization #31920  
Divisions 03 and 05, and Section 13121

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**CITY OF LEESBURG  
TURNPIKE WATER RECLAMATION FACILITY  
DEWATERING IMPROVEMENTS**

---

Paul Carastro, PE  
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Tampa, Florida 336099-4134  
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Division 16, and Section 13300

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**DIVISION 1**  
**GENERAL REQUIREMENTS**

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SECTION 01000  
PROJECT REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. 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. The summary of the Work is presented in Section 01100, Summary of Work.
- B. Work Included:
1. The Contractor shall furnish all labor, superintendence, materials, plant power, light, heat, fuel, water, tools, appliances, equipment, supplies, and means of construction necessary for proper performance and completion of the Work. The Contractor shall obtain and pay for all necessary local building permits. The Contractor 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.
  2. The cost of incidental work described in these Project 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.
  3. 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, 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, sewerage, drainage, water, or other public or private property which may be affected by the Work shall be deemed included hereunder.

1. The Contract Documents contain data relative to existing public utility installations and structures above and below the ground surface. These data are not guaranteed as to their completeness or accuracy and it is the responsibility of the Contractor to make his own investigations to inform himself fully of the character, condition, and extent of all such installations and structures as may be encountered and as may affect the construction operations.
2. 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 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 shall be repaired by the Contractor, at his expense. No separate payment shall be made for such protection or repairs to public utility installations or structures.
3. Public utility installations or structures owned or controlled by the Owner or other governmental body which are shown on the Drawings to be removed, relocated, replaced, or rebuilt by the Contractor 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 therefor.
4. Where public utility installations or structures owned or controlled by the Owner or other governmental body are encountered during the Work and are not indicated on the Drawings 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 paid for as extra work as provided in the Agreement.
5. At all times in performance of the Work the Contractor shall employ acceptable methods and exercise reasonable care and skill so as to avoid unnecessary delay, injury, damage, or destruction of public utility installations and structures and shall at all times in the performance of the Work avoid unnecessary interference with or interruption of public utility services and cooperate fully with the owners thereof to that end.

6. The Contractor shall give written notice to the Owner and other governmental utility departments and other owners of public utilities of the location of his proposed construction operations at least 48 hours in advance of breaking ground in any area or on any unit of the Work.
7. 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 owners of such utilities.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 DRAWINGS AND PROJECT MANUAL

- A. Drawings: When obtaining data and information from the Drawings, figures shall be used in preference to scaled dimensions and large-scale drawings in preference to small-scale drawings.
- B. Supplementary Drawings:
  1. 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, the Engineer will prepare drawings known as Supplementary Drawings, with specifications pertaining to such

Drawings, and the Contractor will be furnished one complete set of reproducible black line prints (24 inches by 36 inches) and one reproducible copy of the specifications.

2. The Supplementary Drawings shall be binding upon the Contractor with the same force as the Contract Drawings. Where such Supplementary Drawings require either less or more than the estimated quantities of Work, credit to the Owner or compensation therefor to the Contractor shall be subject to the terms of the Agreement.

C. Contractor to Check Drawings and Data:

1. The Contractor shall verify all dimensions, quantities, and details shown on the Drawings, Supplementary Drawings, Schedules, Specifications, or other data received from the Engineer, and shall notify the Engineer of all errors, omissions, conflicts, and discrepancies found therein. Failure to discover or correct errors, conflicts, or discrepancies shall not relieve the Contractor of full responsibility for unsatisfactory work, faulty construction, or improper operation resulting therefrom, nor from rectifying such conditions at his own expense. He will not be allowed to take advantage of any errors or omissions, as full instructions will be furnished by the Engineer should such errors or omissions be discovered.
2. 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 making estimates of the size, kind, and quantity of materials and equipment included in the Work to be done under the Contract.

D. Specifications: The Technical Specifications each consist of three parts: General, Products, and Execution. The General part of a Specification contains General Requirements which govern the Work. The Products and Execution parts modify and supplement the General Requirements by detailed requirements for the Work and shall always govern whenever there appears to be a conflict.

E. Intent:

1. All Work called for in the Specifications applicable to this Contract, but not shown on the Drawings in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Drawings or in the Specifications but involved in carrying out their intent or in the complete and proper execution of the Work is required and shall be performed by the Contractor as though it were specifically delineated or described.
2. The apparent silence of the Specifications as to any detail or the apparent omission from them of a detailed description concerning any work to be

done and materials to be furnished shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used. The interpretation of these Specifications shall be made upon that basis.

## 1.11 MATERIALS AND EQUIPMENT

### A. Manufacturer:

1. All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request and at the Engineer's option 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.
2. Any two or more pieces of material or equipment of the same kind, type, or classification, and being used for identical types of service, shall be made by the same manufacturer.

### B. Delivery:

1. The Contractor shall deliver materials in ample quantities to ensure the most speedy and uninterrupted progress of the Work so as to complete the Work within the allotted time.
2. The Contractor shall also coordinate deliveries in order to avoid delay in or impediment of the progress of the work of any related Contractor.

### C. Tools and Accessories:

1. Unless otherwise stated in the Contract Documents, the Contractor shall 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 herein and as recommended by the manufacturer necessary for the operation of the equipment, not including materials required for routine maintenance.
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 rate data.

D. Service of Manufacturer's Engineer:

1. The Contract Prices for equipment shall include the cost of furnishing a competent and experienced engineer or superintendent who shall represent the manufacturer and shall help the Contractor, when required, install, adjust, test, and place in operation the equipment in conformity with the Contract Documents.
2. After the equipment is placed in permanent operation by the Owner, the engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that the 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.

1.12 INSPECTION AND TESTING

A. General:

1. 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. Two hard copies and one electronic copy 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.
2. If, in the making of any test of any material or equipment, the Engineer ascertains that the material or equipment does not comply with the Contract Documents, 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.
3. Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with the recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.
4. The Contractor shall be fully responsible for the proper operation of equipment during testing and instruction periods and shall neither have nor make any claim for damage which may occur to equipment before the time when the Owner formally takes over the operation thereof.

B. Costs:

1. The Contractor shall provide all inspection and testing of materials furnished under this Contract by qualified individuals, unless otherwise expressly specified.

2. The Contractor shall bear the cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents, and such costs shall be deemed to be included in the Contract Price.
3. The Owner may test materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract for compliance. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests of materials and equipment that are rejected for non-compliance.

C. Certificate of Manufacture:

1. The Contractor shall furnish the Engineer with authoritative evidence in the form of a certificate of manufacture that the materials to be used in the Work have been manufactured and tested in conformity with the Contract Documents.
2. 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.

D. Shop Tests:

1. Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function, or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents.
2. 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 and/or independent laboratory, shall be submitted to the Engineer for approval.
3. The Contractor shall bear the cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment.

E. Start-up Tests:

1. As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make start-up tests of equipment.
2. If the start-up tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, before demonstration tests, make all changes, adjustments, and replacements required. The furnishing contractor shall assist in the start-up tests as applicable.

F. Demonstration Tests:

1. Before the Contractor's request for a Substantial Completion inspection, all equipment and piping installed under this Contract shall be subjected to demonstration tests as specified or required to prove compliance with the Contract Documents.
2. The Contractor shall furnish labor, fuel, energy, water, and all other materials, equipment, and instruments necessary for all demonstration tests at no additional cost to the Owner. The Contractor shall assist in the demonstration tests as applicable.

1.13 LINES AND GRADES

A. Grade:

1. All work under this Contract shall be constructed in accordance with the lines and grades shown on the Drawings or as given by the Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.
2. The Engineer will establish bench marks and provide coordination points. Reference marks for lines and grades as the Work progresses will be located by the Contractor to cause as little inconvenience to the prosecution of the Work as possible. The Contractor shall place excavation and other materials so as to cause no inconvenience in the use of the reference marks provided. He shall remove any obstructions he places contrary to this provision.

B. Surveys:

1. At his own expense, the Contractor shall furnish and maintain stakes and other such materials.
2. The Contractor shall check such reference marks by such means as he may deem necessary and, before using them, shall call the Engineer's attention to any inaccuracies.
3. At his own expense, the Contractor shall establish all working or construction lines and grades as required from the reference marks set by the Engineer and shall be solely responsible for the accuracy of these lines and grades. He shall, however, be subject to check and review by the Engineer.

C. Safeguarding Marks:

1. The Contractor shall safeguard all points, stakes, grade marks, monuments, and bench marks made or established on the Work, bear the



cost of re-establishing 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.

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01100  
SUMMARY OF WORK

PART 1 GENERAL

1.01 SCOPE OF WORK

Unless otherwise expressly provided in the Contract Documents, the Work must be performed in accordance with best modern practice, with materials and workmanship of the highest quality to the satisfaction of the Owner.

A. Project Title:

City of Leesburg Turnpike Water Reclamation Facility Dewatering Improvements  
City of Leesburg Project No. Task Order No. 6  
Jones Edmunds Project No. 07810-084-01  
Leesburg, Florida

B. The Work of this Project is defined in the agreement and is generally described as modifications to the City of Leesburg's sludge dewatering and handling system at the Turnpike Water Reclamation Facility (WRF). The work includes, but is not limited to:

1. All associated site and civil improvements related to roadway modifications, grading, and storm drainage.
2. Furnish and install a dewatering facility pre-engineered metal canopy building with wall panels. BFP skid, dewatered cake discharge piping, compressed air system, facility lighting and electrical components, related controls, and hose bibbs. This Work will include installing a concrete slab-on-grade and pre-engineered metal canopy building foundation with floor and BFP drainage that includes a belt filter press (BFP) dewatering area and a truck-loading bay area and concrete entrance and exit driveway. The building will also include aluminum elevated walkway with stairs alongside of the BFP that will have mountings for the BFP, a touch screen HMI, and cake pump control panels and two aluminum stair cases for different access points to the BFP skid as show in the Drawings.
3. Furnish and install a skid mounted 2-meter belt filter press (BFP) system, including progressive cavity sludge feed pump, progressive cavity cake pump, polymer feed system, washwater booster pump, and control panels. The progressive cavity cake pump will also be provided with the skid-mounted BFP.
4. Install yard piping for the sludge feed from the digesters, reclaimed water for the washwater booster pump and hose bibbs, potable water for the

polymer feed system, dewatering facility drainage piping, and compressed air piping to replace an existing air compressor used to operate valves on the existing aerobic digesters.

5. Replace the existing submersible non-clog pumps, pump elbows, control panels, and appurtenances at the existing on-site lift station.
6. Integrate the dewatering system into the Turnpike WRF supervisory control and data acquisition (SCADA) system using the City's preferred integrator.
7. Other appurtenances as shown on the Drawings and described in the Project Specifications as required for construction sequencing, maintenance of Turnpike WRF operations, regulatory compliance and a complete and operable system as accepted by the Engineer and Owner.

C. The Specification divisions and Drawings are an integrated part of the Contract Documents and, as such, will not stand alone if used independently as individual sections, divisions, or drawing sheets. The Drawings and Specifications establish minimum standards of quality for this project. They do not purport to cover all details entering into the design and construction of materials and equipment.

#### 1.02 RELATED WORK (NOT USED)

#### 1.03 SUBMITTALS (NOT USED)

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Association of State Highway and Transportation Officials (AASHTO) Formerly (AASHO)
- B. American Concrete Institute (ACI)
- C. American Institute of Steel Construction (AISC)
- D. American Iron and Steel Institute (AISI)
- E. American National Standards Institute (ANSI)
- F. American Standards Association (ASA)
- G. American Society of Mechanical Engineers (ASME)
- H. American Society of Testing and Material (ASTM)
- I. American Water Works Association (AWWA)
- J. American Welding Society (AWS)
- K. Anti-Friction Bearing Manufacturer's Association (AFBMA)
- L. Building Officials and Code Administrators International, Inc. (BOCA)

- M. Construction Specifications Institute (CSI)
- N. Federal Specification (FS)
- O. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, Latest English Edition (Standard Specifications)
- P. FDOT Roadway and Traffic Design Standards Latest English Edition (FDOT Index)
- Q. Geosynthetics Institute (GSI)
- R. National Bureau of Standards (NBS)
- S. National Electrical Manufacturer's Association (NEMA)
- T. National Fire Protection Association (NFPA)
- U. Portland Cement Association (PCA)
- V. Occupational Safety and Health Act (Public Law 91-596), U.S. Department of Labor (OSHA)
- W. Steel Structures Painting Council (SSPC)
- X. Southern Standard Building Code (SSBC)
- Y. Underwriters' Laboratories, Inc. (UL)
- Z. United States of America Standards Institute (USASI)
- AA. Regulations of Florida Industrial Commission Regarding Safety
- BB. All local, state, county, or municipal building codes requirements of the Owner's Insurance

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 GENERAL REQUIREMENTS

- A. Unless otherwise specified on the Construction Drawings or Specifications, all work and the quality of materials shall conform to the referenced sections of the Florida Department of Transportation (FDOT) *Standard Specifications for Road and Bridge Construction, Supplementary Specifications, and Roadway and Traffic Design Standards*. The Contractor shall retain on the job site copies of these

standard FDOT documents. The basis of payment shall conform to Section 01200, Measurement and Payment, of the General Requirements.

1.11 WORKING HOURS

Workdays shall consist of 10 hours maximum, between 7:00 am and 5:00 pm.

If the Contractor deems it necessary to work on Sundays, holidays, or beyond specified working hours to comply with his construction schedule or because of an emergency, the Contractor shall request permission of the Owner to do so. If, in the opinion of the Owner, the need is bona fide, the Owner will authorize the Contractor to work such hours as may be necessary.

1.12 REIMBURSEMENT FEES

A. The following rates shall be applied as the Owner’s reimbursement of the Engineer’s fee to be paid by the Contractor for expenses defined in Supplementary Conditions.

1.	Senior Field Representative (Construction):	\$	90.00
2.	Senior Construction Administrator:	\$	160.00
3.	Engineering Consultant (Senior Project Manager):	\$	190.00
4.	Project Engineer	\$	125.00
5.	Administrative Assistant:	\$	70.00

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01200  
MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This section covers methods of measurement and payment for items of work under this Contract.
- B. The total Contract Price shall cover all work required by the Contract Documents. All cost in connection with the proper and successful completion of the work, including furnishing all materials, equipment, and tools and performing all necessary labor and supervision to fully complete the work, shall be included in the unit price and lump-sum Bid prices. All work not specifically set forth as a pay item in the Bid Form or Bid Schedule shall be considered a subsidiary/ancillary obligation of the Contractor and all costs in connection with these subsidiary/ancillary obligations shall be included in the Bid(s) to provide a complete and functional Project.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

#### 1.10 EXCAVATION, TRENCHING, AND CLEARING

- A. Except where otherwise specified, the unit price or lump-sum price bid for each item of work which involves excavation, trenching, clearing, grubbing, or disposal of cleared and grubbed materials shall include all costs for such work. No direct payment shall be made for clearing, grubbing, disposal of cleared or grubbed materials, excavation, trenching, disposal of surplus excavated material, handling water (and groundwater), and purchasing and hauling of required fill material. All excavation and trenching shall be unclassified as to materials which may be encountered; in addition, trenches shall be unclassified as to depth, unless otherwise stated.

#### 1.11 LUMP SUM

- A. For lump-sum items, payments shall be made to the Contractor in accordance with an accepted Progress Schedule of Values on the basis of actual work completed and accepted by the Owner at the final completion of the Project.

#### 1.12 UNIT PRICE

- A. For unit price items, payment shall be made based on the actual amount of work accepted by the Owner and for the actual amount of materials in place at the final completion of the Project, as confirmed by the final measurements.
- B. After the work is completed and before final payment is made, the Engineer will make final measurements, with all required assistance from the Contractor, to determine the quantities of various items of work accepted as the basis for the final unit price payment.

#### 1.13 PAYMENT FOR INCREASED OR DECREASED QUANTITIES

- A. When alterations in the quantities of unit price work not requiring a Change Order(s), as herein provided for, are ordered and performed, the Contractor shall accept payment in full at the Contract unit price multiplied by the actual quantities of work constructed and accepted by the Owner at the completion of the project.
- B. The actual percentage of each lump sum bid item completed by the Contractor and accepted by the Owner at the final completion of the Project will be paid to the Contractor.

#### 1.14 DELETED ITEMS

- A. Should any items contained in the Bid Schedule(s) be found unnecessary for the proper completion of the work contracted, the Engineer may eliminate such items



from the Contract. This action shall in no way invalidate the Contract and no financial allowance or compensating payment for anticipated profit, overhead, etc., will be made for items so eliminated in making final payment to the Contractor.

#### 1.15 PARTIAL PAYMENTS

- A. Partial payments shall be made monthly as the work progresses. Partial payment shall be made subject to the provisions of the General and Supplementary Conditions.

#### 1.16 PAYMENT FOR STORED MATERIAL DELIVERED TO THE PROJECT

- A. When requested by the Contractor and at the discretion of the Owner, payment may be made for all or part of the value of acceptable materials and equipment to be incorporated into bid items, which have not been used, and which have been delivered to the construction site or placed in storage places acceptable to the Owner. The Contractor shall provide receipts for all stored material items requested for reimbursement which clearly identify the stored material item, where it is to be constructed, the unit cost of the item, as well as the total cost of the delivered item(s), the quantity of the item, the brand name of the item, and the supplier. Note that there are additional documentation requirements and storage requirements within the Contract Documents that must also be met before the Contractor can be reimbursed for these stored materials.
- B. No payment shall be made for fuels, supplies, installation or connection hardware, lumber, false work, or other similar materials or on temporary structures or other work (items) of any kind which are not a permanent part of the Contract. Items having a value of less than \$2,500 shall not be compensated for as a stored material item.

#### 1.17 FINAL PAYMENT

- A. If requested by the Engineer, the Contractor shall field verify all quantities in dispute by using visual observation, taped measurements, or other methods designated by the Engineer. The field verification shall be made in the presence of the Engineer and agreed to by both the Engineer and the Contractor. The Engineer will prepare a final adjusting Change Order which will adjust the final quantities of the project Bid Schedule to reflect the actual work accepted by the Owner and for which the Contractor will be compensated.

#### 1.18 SCHEDULE OF VALUES

- A. A schedule of values for the lump-sum bid items and some of the unit price bid items as required by the Engineer shall be submitted and accepted before the first

pay request is approved by the Engineer. The schedule of values shall be based on the prices bid in the Bid Schedule(s). Prices bid in the Bid Schedule(s) cannot be changed in the schedule of values; they can only be broken down into more detail so that the Engineer can more accurately review and approve the Contractor's pay application for the completed work.

#### 1.19 MISCELLANEOUS CONSTRUCTION ITEMS

- A. The Contractor shall take all precautions necessary to protect existing utilities, roads, and miscellaneous items from damage during construction.
- B. The Contractor shall repair, relocate, or replace existing utilities, roadways, and miscellaneous items to pre-construction conditions.
- C. All repairs, relocations, and replacements necessary are considered incidental to the work and will be at the Contractor's cost, with no cost to the Owner.
- D. The lump-sum bid items for all pipe items shall constitute full compensation for furnishing, laying, jointing, and testing of pipe; dewatering; excavation and backfill; and cleanup.
- E. The Contractor shall have the Engineer observe and document the installation of each underground fitting on the project. If the installation of any fitting is not confirmed and documented by the Engineer, it shall not be paid for by the Owner.

### PART 2 PAY ITEM DESCRIPTIONS

#### 2.01 BID

The descriptions provided in the following Paragraphs are to be used by the Bidder in preparing the Bid Schedule(s). They generally indicate how the major workscope items and their respective costs are to be separated into the line items listed in the Bid Schedule(s). These descriptions are not fully representative nor all inclusive of the work required to complete the project in accordance with the Contract Documents. It is the Bidder's responsibility to include all required costs within the most appropriate line item(s).

#### 2.02 BASE BID

The bid lump sum shall be full compensation for all labor, equipment, and materials necessary for a full and completely operational installation. Measurement shall be based on the percentage complete for each application for payment. Quality control and testing on soils, concrete, paving, and other related tests required by the Contract Documents using an independent testing laboratory for quality control during construction shall be included as part of the Base Bid.

Item 1. Mobilization/Demobilization (not to exceed 8% of Total Base Bid) – This lump-sum item shall include and cover the costs for performing construction, preparatory, and overhead operations including but not limited to movement of personnel and equipment to and from the site, sanitary facilities, project administration and management, insurance, bonds, Owner and Engineer indemnification, temporary utilities, project signs, permits related to construction, and all other similar activities and facilities necessary for executing this project. This item shall not exceed 8% of the Total Base Bid. The Contractor shall be paid 40% of this item upon completion of mobilization, 3% per month for general conditions, with the remainder paid upon demobilization.

Item 2. Record Drawings – Payment of the lump-sum bid in the Bid Form shall be compensation for furnishing of all labor, materials, equipment, transportation, tools, surveying, and incidentals required to complete and provide Record Drawings in accordance with the Contract Documents (Section 01330, Submittals and Acceptance, and 01785, Record Documents) including updating electronic version of the Drawings in AutoCAD, identifying items that were revised during the project or addenda, having all Drawings signed and sealed by a Florida-registered professional land surveyor. Once the Record Drawings have been submitted to the Engineer in AutoCAD format, reviewed, and determined by the Engineer to be complete according to the Specifications requirements, the entire lump-sum price will be paid to the Contractor.

Item 3. Environmental Protection (not to exceed 1% of Total Base Bid) – This lump-sum item shall include but not be limited to all costs for providing a comprehensive environmental protection program for the project site and other areas that may be affected by the construction. This includes providing labor and materials necessary to prevent environmental damage to the ground, water, and air in conformance with all local, state, and federal laws. Examples include control of stormwater, erodible soils, noise, dust, pollutants, trash, waste, pumping discharge, and any other substance or activity that may adversely impact the environment. The Contractor shall be paid 40% upon delivery and setup of the material, and the remainder will be prorated equally over the construction period. This item shall not exceed 1% of the Total Base Bid.

Item 4. Pre-Engineered Building, Slab-On-Grade, Access Roads, and Walkway and Stairs – The Contractor shall furnish all labor, materials, equipment, and services to design fabricate, deliver, and erect the dewatering facility pre-engineered metal canopy building with wall panels, belt filter press (BFP) skid, dewatered cake discharge piping, compressed air system, facility lighting and electrical components, related controls, and hose bibbs. The Contractor shall furnish all labor, material, equipment, and services necessary to install a concrete slab-on-grade pre-engineered metal canopy building foundation with floor and BFP drainage that includes a BFP dewatering area and a truck-loading bay area. The work shall include installation of concrete entrance and exit driveway. The Contractor shall furnish all labor, materials, equipment, and services to design, fabricate, deliver, and erect the aluminum elevated walkway with stairs alongside the BFP that will have mountings for the BFP, a touch-screen human-machine interface (HMI), cake pump control panels, and two aluminum stair cases for different access points to the BFP skid as shown in the Drawings.

Item 5. Skid-Mounted Two-Meter Belt Filter Press – The Contractor shall furnish and install a skid-mounted two-meter BFP system, including progressive-cavity sludge-feed pump, progressive-cavity cake pump, polymer feed system, washwater booster pump, control panels, and other appurtenances and accessories. Also included is the progressing cavity pump dewatered sludge conveyance system including the pump, controls and panel, and air compressor.

Item 6. Yard Piping – The Contractor shall furnish all labor, material, equipment, and services necessary to install yard piping for the sludge feed to the BFP from the digesters, reclaimed water for the washwater booster pump and hose bibbs, potable water for the polymer feed system, dewatering facility drainage piping, and compressed air piping to replace an existing air compressor used to operate valves on the existing aerobic digesters.

Item 7. On-Site Lift Station Pump Upgrade – The Contractor shall furnish all labor, material, equipment, and services necessary to replace the existing submersible non-clog pumps, pump elbows, control panels, and appurtenances at the existing on-site lift station.

#### CASH ALLOWANCE SCHEDULE

Item 8. SCADA System Integration – The Contractor shall employ Vyper Automation to modify the existing Instrumentation & Control (I&C) system to show and monitor the new dewatering facilities in accordance with Division 13 of the Project Specifications and Drawings. The Contractor shall be reimbursed for the approved payments in each appropriate monthly estimate.

END OF SECTION

SECTION 01290  
SCHEDULE OF VALUES

PART 1 GENERAL

1.01 SCOPE OF WORK (NOT USED)

1.02 RELATED WORK

- A. Section 3, General Terms and Conditions.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. To the Engineer, a proposed Schedule of Values allocated to the various portions of the Work, in accordance with Section 01000, Project Requirements, and Section 01200, Measurement and Payment.
- B. Upon request of the Engineer, supporting data that will substantiate the values' correctness.
- C. The accepted Schedule of Values shall be used only as the basis for the Contractor's Applications for Payment.
- D. An update and resubmittal of the Schedule of Values when Change Orders affect the listing or when the actual performance of the Work involves necessary changes of substance to values previously listed and approved.
- E. Schedule of Values.
  - 1. Submit typed schedule on EJCDC 1910-8-E forms provided by the Engineer. The Contractor's standard form or electronic media printout will be considered.
  - 2. Submit Schedule of Values in duplicate within 10 days after the date of Owner-Contractor Agreement.
  - 3. Format – Use the schedule of prices in the Bid Proposal. Show the cost breakdown for each lump-sum item. The lump-sum breakdown shall, at a minimum, use the Table of Contents of this manual outline. Identify each line item with the number and title of the major Specification Section. Identify site mobilization and demobilization, bonds and insurance,

Record Drawings, photographs, and operations and maintenance manuals, etc.

4. For unit cost allowances, identify quantities taken from the Contract Documents multiplied by the unit cost to achieve the total for the item.
5. Include within each line item a direct proportional amount of the Contractor's overhead and profit.
6. Revise the schedule to list approved Change Orders with each Application for Payment.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

1.10 CASH ALLOWANCES

- A. Differences between allowance amounts and actual costs will be adjusted by Change Order before final payment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01300  
CONTRACT ADMINISTRATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section sets forth some of the general project requirements.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01785, Record Documents.

1.03 SUBMITTALS

- A. The Contractor shall furnish the Engineer with revised progress schedules with each Application for Payment in addition to the number required by the Owner.
- B. The Contractor shall furnish the Engineer with revised progress schedules with each Application for Payment in addition to the number required by the Owner.
- C. The Contractor shall furnish the Engineer with required photographs to accompany each Application for Payment.
- D. The Contractor shall furnish the Engineer with one copies of the Application for Payment.
- E. The Contractor shall submit record documents at each progress meeting in accordance with Section 01785, Record Documents.
- F. At Contract closeout, the Contractor shall transmit Record Documents and samples with cover letter to the Engineer listing the following:
  - 1. Date.
  - 2. Project title and number.
  - 3. Contractor's name, address, and telephone number.
  - 4. Number and title of each Record Document.
  - 5. Signature of Contractor or authorized representative.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 FORMAT

- A. The Contractor shall prepare schedules as a time scale logic diagram and bar chart unless otherwise approved by the Engineer. Each major and minor portion of work or operation shall be clearly identified and tied by logical sequence to the shop drawing schedule and schedule of values. All schedules shall be prepared and submitted on 11-inch-by-17-inch paper.

1.11 SCHEDULE CONTENT

- A. The Contractor shall show the complete sequence of construction by activity, with dates for beginning and completion of each element of construction and provide sub-schedules to define critical portions of the entire schedule. Schedules shall also show accumulated percentage of completion of each item and total percentage of work completed as of the first day of each month.

1.12 REVISIONS TO SCHEDULES

- A. The Contractor shall indicate the progress of each activity to the date of submittal and the projected completion date of each activity. Revised schedules shall identify activities modified since previous submittal, major changes in scope, and other identifiable changes. The Contractor shall also provide a narrative report to define problem areas, anticipated delays, and impact on schedule. The Contractor shall also report corrective action taken or proposed and its effect, including the effect of schedule changes on other contractors.



### 1.13 PROGRESS MEETINGS

- A. The Owner and Engineer will organize and conduct progress meeting at least once every two months to discuss the progress of the Work. The Contractor and any subcontractors the Contractor deems necessary shall attend these meetings. At the Engineer's discretion, the frequency of the meetings may be increased if the progress of the Work is not satisfactory or if coordination problems should arise.

### 1.14 RECORD DOCUMENTS

- A. The Contractor shall adhere to the requirements specified in Section 01785, Record Documents.

### 1.15 REQUIRED PHOTOGRAPHS

- A. The Contractor shall adhere to the requirements specified in Section 01325, Construction Photographs.

### PART 2 PRODUCTS (NOT USED)

### PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01310  
CONSTRUCTION COORDINATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall coordinate Work with that of other construction projects as needed.
- B. Before starting Work and from time to time as the Work progresses, the Contractor and each subcontractor shall examine the work and materials installed by others as it applies to its own work and shall notify the Engineer immediately in writing if any conditions exist which will prevent satisfactory results in the installation of the system. Should the Contractor or subcontractor start work without such notification, it shall be construed as an acceptance of all claims or questions as to the suitability of the work of others to receive its Work. The Contractor shall remove and/or replace, at its own expense, all work under this Contract which may have to be removed on account of such defects or omissions.

1.02 RELATED WORK

- A. Section 01000, Project Requirements.
- B. Section 01300, Contract Administration.
- C. Section 01770, Project Closeout.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. The Contractor shall ensure that all drawing, product data, and samples comply with Contract Documents and field dimensions and clearances.
- B. The Contractor shall submit requests for interpretation of Contract Documents in a timely fashion to ensure there are no disruptions with the Work as scheduled. Obtain instructions through the Engineer to resolve all queries.
- C. Process requests for substitutions and Change Orders through the Engineer.
- D. Deliver close-out submittals to the Engineer.

#### 1.04 WORK SEQUENCE

- A. The Contractor shall submit a preliminary Progress Schedule, in accordance with Section 01300, Contract Administration, to the Engineer. After review, the Contractor shall revise and resubmit the Progress Schedule to comply with requested revisions.

#### 1.05 REFERENCE STANDARDS (NOT USED)

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 CONSTRUCTION MOBILIZATION

The Contractor shall do the following:

- A. Cooperate with the Owner in allocating mobilization areas on site for field offices and sheds, access, traffic, and parking facilities. During construction, the Contractor shall coordinate the use of the site and facilities through the Engineer.
- B. Comply with the Engineer's procedures for intra-project communications: submittals, reports and records, schedules, coordination drawings, recommendations, and resolution of ambiguities/conflicts.
- C. Comply with the Engineer's instructions for use of temporary utilities and construction facilities.
- D. Coordinate field engineering and layout work under instructions of the Engineer.
- E. Coordinate scheduling, submittals, and work of the various Sections of Contract Documents to ensure the efficient and orderly sequence of installation of

construction elements, with provisions for accommodating items to be installed later.

- F. Coordinate the sequence of Work to accommodate the Owner occupancy as specified in the Contract Documents.
- G. In addition to Progress Meetings specified in Section 01300, Contract Administration, hold pre-construction conferences with personnel and Subcontractors to ensure coordination of Work. The Engineer shall be informed of such meetings and shall be allowed to attend.
- H. Coordinate the Work of various Sections having interdependent responsibilities for installing equipment, connecting equipment, and placing such equipment in service.
- I. Coordinate the use of project space and the sequence of installing civil, architectural, mechanical, structural, instrumentation, systems, and electrical work. Follow practicable routings for pipes, ducts, and conduits, with due allowance for available physical space; make runs parallel with lines of building. Use space efficiently to maximize accessibility for other installations, maintenance, and repairs.
- J. Coordinate Work at existing facilities to minimize disruption of the Owner's operations.
- K. Assemble and coordinate close-out submittals specified in Section 01770, Project Closeout.

#### 1.11 COORDINATION DRAWINGS

- A. The Contractor shall provide information required by the Engineer for preparing coordination drawings.
- B. The Contractor shall review drawings before submitting them to the Engineer.

#### 1.12 CLOSE-OUT PROCEDURES

The Contractor shall do the following:

- A. Notify the Owner when Work is considered ready for Substantial Completion.
- B. Comply with the Owner's instructions to correct items of Work listed in executed Certificates of Substantial Completion.

- C. Notify the Owner when Work has reached Final Completion.
- D. Comply with the Owner's instructions for completing items of Work found incomplete in the Engineer's final inspection.
- E. Comply with Section 01770, Project Closeout.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

### 3.01 GENERAL

- A. All vehicles on the property or easement must be operational.

### 3.02 UTILITIES

- A. The Contractor shall coordinate the activities of all utility companies with equipment in the construction area with the Contractor's and Subcontractor's Work.

### 3.03 CUTTING AND PATCHING

- A. No cutting and patching of new Work will be accepted. All Work must be new and continuous in its final form.

END OF SECTION

SECTION 01325  
CONSTRUCTION PHOTOGRAPHS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall have digital pictures and DVDs made of the Work from views and at such times as directed by the Engineer. These photographs and videos shall represent a visual history of the Project, from Contract Award through Contract Completion.
- B. The Contractor shall take a preconstruction video of the entire site, including the areas of adjacent properties within 100 feet of the limit of Work. Special effort shall be made to show the existing paved roads, shoulders, signs, and other existing features.
- C. The Contractor shall also use electronic “snap-shot” photography as necessary to record and facilitate resolution of on-site issues through the transmission of electronic photographs by e-mail from the site to the Engineer’s and Owner’s offices.

1.02 RELATED WORK

- A. Section 01000, Project Requirements.
- B. Section 01785, Record Documents.

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## PART 2 PRODUCTS

### 2.01 PRODUCTS

- A. Digital pictures shall be in color. Provide one copy of each digital picture on three CDs.
- B. Provide photographs taken of each of the major items during construction.
- C. View and Quantities Required: A minimum of 30 prints per month clearly showing project status and key elements of construction.
- D. Deliver electronic images and prints to the Engineer with every pay request.

## PART 3 EXECUTION

### 3.01 VIEWS REQUIRED

- A. Photographs shall be from locations to illustrate the condition of construction and the state of progress adequately.
- B. The Contractor shall provide before and after photographs of each portion of the site. The below-ground facilities shall include all equipment, walls, floor, piping, supports, and entrance. At major location photographs shall include before, during, and after prints and all prints shall be placed in binders in ascending date order to show the Work as it progresses.

### 3.02 VIDEOTAPE REQUIREMENTS

- A. Major Locations:
  - 1. The Contractor shall provide color digital video of each major facility and structures and facilities adjacent to the construction before construction starts and when construction has been completed. The Contractor shall submit 15 minutes of digital video to the Engineer..



2. During video recording, the Contractor shall narrate the video, explaining what is being shown. All videos shall be delivered to the Engineer before Final Completion is submitted.

### 3.03 DIGITAL PHOTO DOCUMENTATION

- A. Catalog and manage Electronic “snap-shots” and images of photographs in a secure digital photo management system capable of being linked to the project schedule and document management database. Add captions, descriptions, and key words. Transfer a copy of all “snap-shots” and photos with their related notes, keywords, captions, and activity IDs to the Engineer weekly.

END OF SECTION

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SECTION 01330  
SUBMITTALS AND ACCEPTANCE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall submit documentation that describes the Work to be performed under the Contract as required in this Section. This documentation will be for the Engineer and Owner's review and use. The documentation furnished by the Contractor must enable the Engineer and Owner to verify the Contractor's performance and compliance with Contract requirements. The documentation shall cover all services and deliverables required and secured by the Contract Documents.

1.02 RELATED WORK

- A. The Contractor shall prepare documentation and submittals required by other Sections of the Contract. The format of documents and submittals required by other Sections shall conform to the requirements of this Section.
1. Section 3, General Terms and Conditions.
  2. Section 4, Supplemental Conditions – Construction.
  3. Section 01785, Record Documents.
  4. Section 01820, Training.
  5. Section 01830, Operations and Maintenance Manuals.
  6. All Sections and Divisions that require submittal of documents.

1.03 SUBMITTALS

- A. General—The Contractor shall submit the following:
1. Project documentation: For the Engineer and Owner's internal use and shall include all information that will be essential for the facility's operations, maintenance, training, and repair of equipment and facilities supplied by the Contractor. The Contractor shall submit all documentation necessary to ascertain compliance with technical/contractual provisions.
  2. Shop drawings: Drawings, schedules, diagrams, warrant, and other data prepared specifically for this Contract by the Contractor or through the Contractor by way of subcontractor, manufacturer, supplier, distributor, or other lower-tier contractor to illustrate a portion of the Work.

3. Product data: Preprinted materials such as illustrations, standard schedules, performance charts, instructions, brochures, diagrams, manufacturer's descriptive literature, catalog data, and other data to illustrate a portion of the Work, but not prepared exclusively for this Contract.
4. Samples: Physical examples of products, materials, equipment, assemblies, or workmanship that are physically identical to portions of the Work, illustrating portions of work, or establishing standards for evaluating appearance of finished work or both.
5. Administrative submittals: Data presented for reviews and acceptance to ensure that administrative requirements of the project are adequately met but not to ensure directly that work is in accordance with the design concept and in compliance with Contract Documents.
6. Mockups: Before installing work requiring mockups, the Contractor shall build mockups for each form of construction and finish required using materials indicated for the completed Work, as follows:
  - a. Build mockups in the location and of the size directed by the Engineer.
  - b. Notify the Engineer 7 days in advance of dates and times when mockups will be constructed.
  - c. Demonstrate the proposed range of aesthetic effects and workmanship.
  - d. Obtain the Engineer's acceptance of mockups before starting work, fabrication, or construction.
  - e. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  - f. Demolish and remove mockups when directed by the Engineer.

B. Coordination

1. Submittals and schedules shall be checked and coordinated with the Work of all trades involved before they are submitted and shall bear the Contractor's stamp of approval as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval shall be returned to the Contractor for resubmission.

C. Start of Work

1. Within 30 calendar days after the notice to proceed for the project, the Contractor shall submit to the Engineer a Contract Data Requirements List

that defines all data to be submitted under this Contract. Included in this list shall be the names of all proposed manufacturers furnishing specified items to the extent known. Review of this list by the Engineer shall in no way relieve the Contractor from providing materials, equipment, systems, and structures fully in accordance with the Specifications.

D. General Requirements

1. The Contractor shall prepare, assemble, and submit all documents as described herein. The Contractor shall submit certification that the documents prepared conform to the Contract requirements and will result in a complete and operable project. The Engineer and Owner shall review the Contractor's documents for conformance to the Contract requirements and may comment on the documents.
2. The Contractor shall approve and certify all project documents. The Contractor's failure to certify the documents or failure to provide documents that demonstrate conformance to the Contract requirements are grounds for rejection. The Contractor shall be responsible for and bear all costs for proceeding with any part of the Work that fails to meet the Contract requirements.
3. Submittal of documents for the Engineer's review shall in no way relieve the Contractor of full responsibility for providing a complete, safe, reliable, operating, and coordinated Work (system/equipment/facilities) that is in compliance with these Contract documents.

E. Requests for Substitution

1. All requests for substitution shall clearly and specifically indicate any and all differences or omissions between the products specified as basis of design and the product proposed for substitution. Data shall include but not be limited to differences as follows for both the specified and substituted products:
  - a. Principle of operation.
  - b. Materials of construction or finishes.
  - c. Thickness or gauge of materials.
  - d. Weight of item.
  - e. Deleted features or items.
  - f. Added features or items.
  - g. Changes in other work caused by the substitution.
  - h. If the substitution contains differences or omissions not specifically called to the attention of the Engineer, the Engineer reserves the right to require equal or similar features to be added to the substituted product at the Contractor's expense.

F. Submittal Requirements and Procedures

1. Drawing Formats and Requirements

a. Drawings—All Drawings and Shop Drawings shall be prepared on 22-x-34-inch paper and shall have a blank area of 3 x 4 inches in the lower right hand corner above the title block. Each Drawing shall indicate the following information in the title block:

- (1) Title and Drawing Number.
- (2) Date of Drawing or Revision.
- (3) Name of Building or Facility.
- (4) Name of Contractor or subcontractor.
- (5) Drawing contents and locations.
- (6) Specification Section and Subsection Numbers.

b. Required Copies—All drawings submitted shall have a minimum of eight copies distributed in the following way:

- (1) 2—Owner.
- (2) 4—Jones Edmunds.
- (3) 2—Returned.

2. Product Data

a. Requirements—Product data shall include all catalog cuts, performance surveys, test reports, equipment lists, material lists, diagrams, pictures, and descriptive material. All product data shall be submitted on either 8.5-x-11-inch or folded 11-x-17-inch size paper of 20-lb (9.072 kg) weight. The submittal information shall show the standard and optional product features, as well as all performance data and specifications. The manufacturer's recommendation for special tools shall be supplied.

3. Samples—The Contractor shall furnish samples required by the Contract Documents, for review by the Engineer. Samples shall be delivered to the Engineer as specified or directed.

a. All samples shall be of sufficient size and quantity to illustrate clearly the functional characteristics of the product, with integrally related parts and attachment devices. The samples shall show the full range of color, texture, and pattern.

- b. The Contractor shall submit a minimum of four samples of items submitted. All samples shall be marked with required submittal information, as specified above.

4. Color, Texture, and Pattern Charts

- a. The Contractor shall submit color, texture, or pattern charts of all required finishes.
- b. A minimum of four charts of each item shall be submitted.

5. Submittal Information Requirements

- a. When used in the Contract Documents, the term "Submittal Information" shall be considered to mean the following information at a minimum:

- (1) Contract Name.
- (2) Contract Number.
- (3) Location within Facility.
- (4) Date Submitted.

- b. Drawings—The Contractor shall mark submittal information on all Drawings in the left half of the 4-x-3-inch block as described above.

- c. Product Data and Manufacturer's Literature

The Contractor shall mark all product data and manufacturer's literature with submittal information and note which item is being furnished. The Contractor shall mark the option and supplies to be furnished with the item. At least one original manufacturer product data sheet must be submitted; the balance can be copied. Do not submit the manufacturer's general catalog: submit only items being installed or delivered. When manuals are being submitted, the Contractor shall mark submittal information on both the cover and title page. If manuals being submitted contain more than just one item, each item must be marked and only Contract name and number is to be marked on the cover and title page.

6. Training, Operation and Maintenance Manuals

- a. The Contractor shall submit to the Engineer for review and acceptance of manufacturer's installation, operations, lubrication, maintenance, and training manuals for all equipment installed or

delivered under this Contract. All manuals shall have submittal information marked on the front cover, title page, and three places inside the manual. If the manual being submitted is for different components, mark the front cover and title page only. Each component section must be marked with the Specification Section and subsection numbers. Operations and Maintenance Manuals shall conform to requirements defined in Sections 01830, Operations and Maintenance Manual, and 01820, Training.

## G. Required Submittals

### 1. Architectural and Structural Submittals

- a. This Section specifies general procedural requirements for contractual submittals for the following architectural and structural schedules, product data, samples, and manufacturer's certificates.
  - (1) Product Data—The Contractor shall provide product data for all architectural and structural items, options, and other data and provide supplemental manufacturer's standard data for information unique to the Work and installation. The submittals shall reflect all items delivered or installed under this Contract.
  - (2) Samples—The Contractor shall provide all samples required under this Specification including color charts and product samples.
  - (3) Material, equipment, and installation and demolition Specifications.

### 2. Mechanical and Electrical System Submittals

- a. This Section specifies general procedural requirements for mechanical schedules, performance data, control diagrams, and other submittal data.
- b. The Contractor shall submit the following:
  - (1) Performance Data.
  - (2) Power and Riser Diagrams—Single line riser, power diagrams, and all conduit runs shall be provided for all equipment and facilities.



- (3) Wiring Diagrams—Elementary controls diagrams and separate wiring diagrams for mechanical and electrical unit/subsystem. Drawing for starting and shutdown of equipment including controls shall be provided, including a comprehensive description of operation.
- (4) Finished Data—Complete surface preparation and finished data for all mechanical and electrical unit/subsystems shall be provided, including a complete list of cleaning instructions.
- (5) Factory Testing—Detailed description of factory testing procedures, reporting procedures and criteria for test passing or failing shall be provided for all mechanical and electrical units/subsystems. Testing shall comply with the General Requirements and Technical Requirements Sections.
- (6) Site (Field) Testing and Acceptance—Detailed description of site testing and acceptance tests including descriptions of procedures, testing equipment, reporting procedures, and criteria for passing or failing tests shall be provided for all mechanical and electrical units/subsystems. Testing shall comply with General Requirements and Technical Requirements.
- (7) Factory Test Report—After fabrication and testing, the Contractor shall submit the results of tests. No shipment of any mechanical and electrical unit/subsystem shall be allowed without the written certification from the Contractor that the equipment conforms to the Contract requirements.
- (8) Site Test and Acceptance Report—Site test and acceptance reports shall be submitted to the Owner and Engineer.
- (9) Operations and Maintenance Manuals—The Contractor shall furnish manuals for all mechanical and electrical equipment specified under this Contract. Each manual shall include the following at a minimum:
  - (a) Description of equipment.
  - (b) Record shop drawing.
  - (c) Operation and maintenance instructions.

- (d) Part lists.
- (e) Equipment ratings.
- (f) Valve list.
- (g) Lubrication instructions.

- c. Compliance with this Section does not relieve the Contractor from compliance with the requirements of Section 01830, Operations and Maintenance Manuals.

## H. Submittal Review

1. The Engineer's review of the Contractor's documents shall not relieve the Contractor of the responsibility for meeting all of the requirements of the Contract nor of the responsibility for correcting the documents furnished. The Contractor shall have no claim for additional cost or extension in time because of delays due to revisions of the documents that may be necessary for ensuring compliance with the Contract.
2. The Engineer will review a submittal or re-submittal once, after which the cost of review shall be borne by the Contractor. The cost of Engineering shall be equal to the Engineer's full cost.
3. No partial submittals will be reviewed. A submittal or re-submittal not complete will be returned to the Contractor for completing and re-submittal.
4. Documents submitted by the Contractor for approval by the Engineer will be returned bearing a project-specific stamp bearing the dated signature of the reviewer and one of four boxes checked:
  - a. NO EXCEPTIONS NOTED—This indicates that the submittal appears to be in compliance with the requirements of the performance specifications and that the Work may proceed.
  - b. MAKE CORRECTIONS NOTED—This indicates that the reviewer has added a minor correction to the submission and that the Work (modified in accordance with the correction comment) may proceed. The Contractor shall accept the responsibility of the modified document and resulting Work with no additional compensation.
  - c. AMEND AND RESUBMIT—This indicates that the submittal will require Contractor modifications based on the reviewer's comments that accompanied the returned submittal. The Contractor will be cautioned that work may not proceed under this review status.
  - d. REJECTED—This indicates that the submittal is not in conformance with the requirements of the performance Specifications and cannot

be modified to gain compliance. A new submittal will be required in the instance of a “reject” status and the Contractor will be cautioned that work may not proceed under this condition.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 SUBMITTAL PROCEDURES

- A. Before submitting documents for the Engineer’s review, the Contractor shall review the documentation for conformance to the Contract requirements. Submittals shall be complete and comprise a logical division of the Contract Work.
- B. All documentation submitted by the Contractor to the Engineer shall be accompanied by a letter of transmittal and shall be submitted in a sequence that allows the Engineer to have all of the information necessary for checking and accepting a particular document at the time of submittal.
- C. Each document shall be identified by a document number, Contract number, Contract name, location, Specification Section, subsection numbers, and submittal date. Where a manual/drawing is revised to reflect a change in design or a change for any other reason, each such revision shall be shown by a revision number, date, and subject in a revision block. Indication of official approval by the Contractor's Project Manager shall also be included. To permit rapid location of the revision,

additional notation shall be made in the manual opposite the line or area where the change was made and identified by the corresponding revision number.

### 3.02 DOCUMENTATION CONTROL AND SUBMITTAL SEQUENCING

- A. The Contract Data Requirements List shall be updated and resubmitted to the Engineer monthly, throughout the duration of the Contract. This list shall identify the Contractor's submittal number, proposed and actual submittal date, Contract Specification Section Number, Paragraph, Item of the Work, and type of document.
- B. The Contractor shall work with the Engineer to provide a regulated flow of submittals that allows the Engineer to review the submittals in the defined timeframe without undue delays. Monthly the Contractor shall provide the Engineer a schedule of the approximate quantities and delivery dates for all submittals due for the next 120 days.

### 3.03 FINAL RECORD DRAWINGS

- A. The Contractor shall submit the Final Record Drawing Package to the Engineer for review 60 days before Final Completion. The Contractor shall adhere to the requirements specified in Section 01785, Record Drawings.

### 3.04 REQUIREMENTS FOR SUBMITTAL

- A. Additional documents, drawings, interface data, and other pertinent project submittal data are listed in specific Sections of this Contract.

### 3.05 RECORD PRINTS

- A. The Contractor shall submit one set of all record prints before final completion. The record print or project records shall include submittals, catalog cuts, drawings, calculations, test reports, manufacturer's data, maintenance manuals, installation instructions, and operating manuals. All "record prints" shall be delivered to the Engineer in three-ring binders with dividers and shall be placed in order by Specification Section.

END OF SECTION

SECTION 01350  
ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Work covered by this Section consists of furnishing all labor, materials, and equipment and performing all work required for the prevention of environmental pollution in conformance with applicable laws and regulations during and as the result of construction operations under this Contract. In this Section *environmental pollution* is defined as the presence of chemical, physical, or biological elements or agents that adversely affect human health or welfare, unfavorably alter ecological balances of importance to human life, affect other species of importance to man, or degrade the utility of the environment for aesthetic and/or recreational purposes.
- B. The control of environmental pollution requires considering air, water, and land and involves managing noise and solid waste as well as other pollutants.
- C. The Contractor shall schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the Work. The Contractor shall provide erosion-control measures such as diversion channels, sedimentation or filtration systems, berms, seeding, mulching or other special surface treatments that are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion-control measures shall be in place in an area before any construction activity in that area. Specific requirements for erosion and sedimentation controls are specified in Section 02370, Erosion and Sedimentation Control.
- D. This Section is intended to ensure that construction is achieved with a minimum of disturbance to the existing ecological balance between a water resource and its surroundings. These are general guidelines. It is the Contractor's responsibility to determine the specific construction techniques to meet these guidelines.
- E. All phases of sedimentation and erosion control shall comply with and be subject to the laws of the State of Florida and the Project Environmental Resource Permit.

1.02 RELATED WORK

- A. Section 01100, Summary of Work.
- B. Section 02230, Site Preparation.
- C. Section 02370, Erosion and Sedimentation Control.

### 1.03 SUBMITTALS

- A. The Contractor shall prepare a sedimentation and erosion-control drawing meeting the requirements of the law and furnish two copies of the approved Drawing to the Engineer.

### 1.04 WORK SEQUENCE

- A. Before beginning the Work, the Contractor shall meet with the Engineer to establish agreed-upon compliance with these provisions and administration of the environmental pollution control program.
- B. The Contractor shall remove temporary environmental control features when approved by the Engineer and incorporate permanent control features into the project at the earliest practicable time.

### 1.05 REFERENCE STANDARDS

- A. Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. Where this Section differs from these documents, the requirements of this Section shall apply.
- B. The Contractor shall comply with all applicable Federal, State, and local laws and regulations concerning environmental pollution control and abatement.

### 1.06 QUALITY ASSURANCE (NOT USED)

### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

### 1.09 QUALIFICATIONS (NOT USED)

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

### 3.01 EROSION CONTROL

- A. The Contractor shall provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion-control measures, such as siltation basins, mulching, jute netting, and other equivalent techniques shall be used as appropriate. Surface water shall be prevented from flowing into excavated areas. Ditches shall be used around the construction area to carry away water resulting from dewatering excavated areas. At the completion of the Work, ditches shall be backfilled and the ground surface restored to its original condition.

### 3.02 PROTECTION OF STREAMS AND SURFACE WATERS

- A. Care shall be taken to prevent or reduce to a minimum any damage to any stream or surface water from pollution by debris, sediment, or other material or from the manipulation of equipment and/or materials in or near such streams. Water that has been used for washing or processing or that contains oils or sediments that will reduce the quality of the water in the stream shall not be directly returned to the stream. Such waters shall be diverted through a settling basin or filter before being directed into streams or surface waters.
- B. The Contractor shall not discharge water from dewatering operations directly into any live or intermittent stream, channel, wetlands, surface water, or any storm sewer. Water from dewatering operations shall be treated by filtration, settling basins, or other approved method to reduce the amount of sediment contained in the water to allowable levels.
- C. All preventative measures shall be taken to avoid spillage of petroleum products and other pollutants. In the event of any spillage, prompt remedial action shall be taken in accordance with a contingency action plan approved by the Florida Department of Environmental Protection and the US Environmental Protection Agency. The Contractor shall submit two copies of approved contingency plans to the Engineer.
- D. Water being flushed from structures or pipelines after disinfection with Cl<sub>2</sub> shall be treated with a dechlorination solution approved by the Engineer before discharge.

### 3.03 PROTECTION OF LAND RESOURCES

- A. After completion of construction, the Contractor shall restore land resources within the project boundaries and outside the limits of permanent work to a condition that will appear to be natural and not detract from the appearance of the project. All construction activities shall be confined to areas shown on the Drawings.
- B. Outside of areas requiring earthwork for the construction of the new facilities, the Contractor shall not deface, injure, or destroy trees or shrubs nor remove or cut them without prior approval. No ropes, cables, or guys shall be fastened to or attached to any existing nearby trees for anchorage unless specifically authorized by the Engineer. Where such special emergency use is permitted, the Contractor shall first wrap the trunk with a sufficient thickness of burlap or rags over which softwood cleats shall be tied before any rope, cable, or wire is placed. The Contractor shall in any event be responsible for any damage resulting from such use.
- C. The Contractor shall protect trees that may possibly be defaced, bruised, injured, or otherwise damaged by the construction equipment, dumping, or other operations by placing boards, planks, or poles around them. Monuments and markers shall be protected similarly.
- D. Any trees or other landscape features scarred or damaged by the Contractor's equipment or operations shall be restored as nearly as possible to their original condition. The Owner will decide the method of restoration to be used and whether damaged trees shall be treated and healed or removed and disposed of.
  - 1. All scars made on trees by equipment, construction operations, or by the removal of limbs larger than 1 inch in diameter shall be coated as soon as possible with an approved tree wound dressing. All trimming or pruning shall be performed in an approved manner by experienced workmen with saws or pruning shears. Tree trimming with axes will not be permitted.
  - 2. Climbing ropes shall be used where necessary for safety. Trees that are to remain, either within or outside established clearing limits, that are subsequently damaged by the Contractor and, in the opinion of the Owner, are beyond saving shall be immediately removed and replaced.
- E. The Contractor's storage and other construction buildings required temporarily in the performance of the work shall be located in cleared portions of the job site or areas to be cleared as shown on the Drawings and approved by the Engineer and shall not be within wetlands or floodplains. Preserving the landscape shall be required in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for the Engineer's approval.



- F. If the Contractor proposes to construct temporary roads or embankments and excavations for plant and/or work areas, the Contractor shall submit the following for approval at least 10 days before the scheduled start of such temporary work:
1. A layout of all temporary roads, excavations, embankments, and drainage to be constructed within the work area.
  2. Details of temporary road construction.
  3. Drawings and cross sections of proposed embankments and their foundations, including a description of proposed materials.
  4. Landscaping drawings showing the proposed restoration of the area. The proposed removal of any trees and shrubs outside the limits of the existing clearing area must be indicated. Locations of guard posts or barriers required to control vehicular traffic and protect trees and shrubs to be maintained undamaged must also be indicated. The drawings shall provide for the obliteration of construction scars as such and shall provide for a natural appearing final condition of the area. Modification of the Contractor's approved drawings shall be made only with the written approval of the Engineer. No unauthorized road construction, excavation, or embankment construction including disposal areas will be permitted.
- G. The Contractor shall remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess waste materials, or any other vestiges of construction as directed by the Engineer. It is anticipated that excavation, filling, and plowing of roadways will be required to restore the area to near natural conditions that will permit the growth of vegetation within the roadway areas. The disturbed areas shall be prepared and seeded as approved by the Engineer or Owner.
- H. All debris and excess material will be disposed of outside wetland or floodplain areas in an environmentally sound manner.

### 3.04 PROTECTION OF AIR QUALITY

- A. Burning—Burning will not be permitted at the project site for the disposal of refuse and debris.
- B. Dust Control—The Contractor shall maintain all excavations, embankment, stockpiles, access roads, plant sites, waste areas, borrow areas, and all other work areas within or outside the project boundaries free from dust which could cause the standards for air pollution to be exceeded and which would cause a hazard or nuisance to others.

- C. An approved method of stabilization consisting of sprinkling or other similar methods will be permitted to control dust. The use of petroleum products is prohibited. The use of chlorides may be permitted with approval from the Engineer.
- D. To be approved, sprinkling must be repeated at such intervals as to keep all parts of the disturbed area at least damp at all times, and the Contractor shall have sufficient competent equipment on the job to accomplish this. Dust control shall be performed as the Work proceeds and whenever a dust nuisance or hazard occurs, as determined by the Owner.

### 3.05 NOISE CONTROL

- A. The Contractor shall make every effort to minimize noises caused by the construction operations. Equipment shall be equipped with silencers or mufflers designed to operate with the least possible noise in compliance with Federal and State regulations.

### 3.06 MAINTENANCE OF POLLUTION-CONTROL FACILITIES DURING CONSTRUCTION

- A. During the life of this Contract, the Contractor shall maintain all facilities constructed for pollution control as long as the operations creating the particular pollutant are being carried out or until the material concerned has become stabilized to the extent that pollution is no longer being created.

END OF SECTION

SECTION 01400  
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. General:

1. This Section defines minimum requirements for the Quality Assurance (QA) Program to be provided by the Contractor. The deliverable documents are defined, along with the method of execution of the QA Program.
2. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve the Contractor of responsibility for compliance with the Contract Document requirements.
3. Specified tests, inspections, and related actions do not limit the Contractor's Quality Control (QC) procedures that facilitate compliance with the Contract Documents.

B. Definitions:

1. Quality Assurance services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and ensure that proposed construction complies with Contract requirements.
2. Quality Control services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that completed construction comply with requirements.

C. Payment: Separate payment will not be made for providing and maintaining an effective Quality Assurance and Quality Control Program, and all costs associated with such a program shall be included in the applicable unit prices, lump-sum prices, or allowances contained in the Contract Price Breakdown.

1.02 RELATED WORK

- A. Section 01000, Project Requirements.
- B. Section 01300, Contract Administration.
- C. Section 01330, Submittals and Acceptance.
- D. Section 01650, Delivery, Storage, and Handling.
- E. Section 01780, Warranties and Bonds.

- F. Section 02300, Earthwork for Structures.
- G. Section 02305, Earthwork for Utilities.
- H. Section 03300, Cast-In-Place Concrete.

#### 1.03 SUBMITTALS (NOT USED)

#### 1.04 WORK SEQUENCE

- A. Where reference is made to a particular standard, the revision in effect at the time of Bid opening shall apply except where a specific date is established.
- B. For products or workmanship specified by association, trades, or other consensus standards, the Contractor shall comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable code.
- C. If specified reference standards conflict with Contract Documents, the Contractor shall request clarification from the Engineer before proceeding.

#### 1.05 REFERENCE STANDARDS (NOT USED)

#### 1.06 QUALITY ASSURANCE

- A. The Contractor shall install all materials and equipment in a neat and first-class workman-like manner.
- B. The Contractor shall replace all existing paving, stabilized earth, curbs, driveways, sidewalks, fences, signs, and other improvements with the same type of material that was removed during construction or as directed by the Engineer without increase in the Contract Price or Contract Time.
- C. The Engineer reserves the right to direct the removal and replacement of any items that, in the Engineer's opinion, do not present an orderly and reasonably neat or workman-like appearance, provided such an orderly installation can be made using customary trade methods. The removal and replacement shall be done when directed in writing by the Engineer at the Contractor's own expense and without additional expense to the Owner.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TOLERANCES

- A. Monitor tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.
- B. Comply with manufacturers' tolerances. If manufacturers' tolerances conflict with Contract Documents, request clarification from the Engineer before proceeding.
- C. Adjust products to appropriate dimensions; position before securing products in place.

## 1.11 FIELD SAMPLES

- A. The Contractor shall furnish field samples at the site as required by individual Specifications Sections for review.
- B. Acceptable samples represent a quality level for the Work.
- C. Where field sample is specified in individual Sections to be removed, the Contractor shall clear the area after the field sample had been accepted by the Engineer.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

### 3.01 GENERAL

- A. The Contractor is responsible for quality control and shall establish and maintain an effective QC system in compliance with the Contract Documents. The QC system shall consist of plans, procedures, and organization necessary to produce an end product which complies with the Contract requirements. The system shall cover all Work and shall be keyed to the proposed design and construction sequence. The project QC Officer will be held responsible for the quality of work on the job and is subject to removal by the Engineer for non-compliance with quality requirements specified in the Contract. The project QC Officer in this

context shall mean the individual with the responsibility for the overall management of the project quality.

### 3.02 QUALITY CONTROL PLAN

- A. General: Not later than 30 calendar days after receipt of Notice to Proceed, the Contractor shall furnish for review by the Engineer the QC Plan proposed to implement the requirements of the Contract. The Plan shall identify personnel, procedures, control, instructions, test, records, and forms to be used. The Engineer will consider an interim plan for the first 30 calendar days of operation.
- B. Content of the QC Plan: The QC Plan shall include, at a minimum, the following to cover all construction operations, both on-site and off-site, including work by subcontractors, fabricators, suppliers, and purchasing agents:
  - 1. A description of the quality control organization, including a chart showing lines of authority for all aspects of the Work specified. The staff shall include a Quality Control Officer who shall report to the Project Manager or executive.
  - 2. The name, qualifications (in résumé format), duties, responsibilities, and authorities of each person assigned a QC function.
  - 3. A copy of the letter to the Quality Control Officer signed by an authorized official of the firm which describes the responsibilities and delegates sufficient authorities to adequately perform the functions of the Quality Control Officer, including authority to stop work which is not in compliance with the Contract.
  - 4. Procedures for scheduling, reviewing, certifying, and managing submittals, including those of subcontractors, off-site fabricators, suppliers, and purchasing agents.
  - 5. Procedures for tracking construction deficiencies from identification through acceptable corrective action. These procedures will verify that identified deficiencies have been corrected.
  - 6. Reporting procedures, including proposed reporting formats.
- C. Acceptance of Plan: Acceptance of the Contractor's plan is required before the start of Work. Acceptance is conditional and will be predicated on satisfactory performance during the Work. The Engineer reserves the right to require the Contractor to make changes in its QC Plan and operations, including removing personnel as necessary to obtain the quality specified.
- D. Notification of Changes: After acceptance of the QC Plan, the Contractor shall notify the Engineer in writing of any proposed change. Proposed changes are subject to acceptance by the Engineer.

### 3.03 SUBMITTALS

- A. Submittals shall be made as specified in Section 01330, Submittals and Acceptance. The QC organization shall be responsible for certifying that all submittals are in compliance with the Contract requirements.

### 3.04 TESTS

- A. Testing Services:

1. All tests to determine compliance with the Contract Documents shall be performed by an independent commercial testing firm acceptable to the Owner. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.
2. Testing services provided by the Owner are for the sole benefit of the Owner; however, test results shall be available to the Contractor. Testing necessary to satisfy the Contractor's internal Quality Control Procedures shall be the sole responsibility of the Contractor.
3. When necessary, the Contractor shall interrupt its Work for Owner sampling and testing. The Contractor shall have no Claim for increase in Contract Price or Contract Time due to such interruption. The Contractor shall cooperate in these testing activities as needed.
4. Testing, including sampling, will be performed by the testing firm's laboratory personnel in the general manner indicated in the Specifications.

- B. Transmittal of Test Reports: Written reports of tests and engineering data furnished by the Contractor for the Engineer's review shall be submitted as specified for Shop Drawings.

- C. Manufacturer's Field Services:

1. The manufacturer's field services will be specified in the respective Equipment Sections.
2. An experienced, competent, and authorized representative of the manufacturer of each item of equipment for which field services are indicated shall visit the Site of the Work and inspect, check, adjust if necessary, and approve the equipment installation. In each case, the manufacturer's representative shall be present when the equipment is placed in operation. The manufacturer's representative shall revisit the Site as often as necessary until any and all trouble is corrected and the equipment installation and operation are satisfactory in the opinion of the Engineer.

3. Each manufacturer's representative shall furnish to the Owner, through the Engineer, a written report certifying that the equipment has been properly installed and lubricated, is in accurate alignment, is free from any undue stress imposed by connecting piping or anchor bolts, has been operated under full load conditions, and has operated satisfactorily.

### 3.05 COMPLETION INSPECTION

- A. Final Completion Punch List: Near the completion of all Work the QC Officer shall inspect the Work and develop a "punch list" of items which do not conform to the approved Drawings and Specifications. Such a list of deficiencies shall be included in the QC documentation and shall include the estimated date by which the deficiencies will be corrected. The QC Officer or staff shall make a second inspection to ascertain that all deficiencies have been corrected. Once this is accomplished, the Contractor shall notify the Engineer that the Facility is ready for the Engineer's final inspection.
- B. Final Inspection and Acceptance: The Contractor's Quality Control Officer and the Engineer will be in attendance at this inspection. Additional Engineer personnel may also be in attendance. The final acceptance inspection will be formally scheduled by the Engineer when all punch list deficiencies have been corrected. Notice will be given to the Engineer at least 14 days before the final inspection and must include the Contractor's assurance that all punch list items will be complete and acceptable by the date scheduled for the final inspection. Failure of the Contractor to have all Contract Work acceptably complete for this inspection will be cause for noncertification of final payment by the Engineer.

### 3.06 NOTIFICATION OF NONCOMPLIANCE

- A. The Engineer will notify the Contractor of any detected noncompliance with the foregoing requirements. The Contractor shall take immediate corrective action after receipt of such notice. Such notice, when delivered to the Contractor, shall be deemed sufficient for the purpose of notification. If the Contractor fails or refuses to comply promptly, the Engineer may issue an order stopping all or part of the work until satisfactory corrective action has been taken. No part of the time lost due to such stop orders shall be made the subject of claim for extension of time or for excess costs or damages by the Contractor.

### 3.07 REPAIR AND PROTECTION

- A. On completion of testing, inspection, sampling, and similar services, the Contractor shall repair damaged construction and restore substrates and finishes.



- B. The Contractor shall protect all construction exposed by or for Quality Control service activities.
- C. The repair and protection are the Contractor's responsibilities, regardless of the assignment of responsibility for Quality Control services.

END OF SECTION

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SECTION 01450  
TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The laboratory tests required to determine soil density, concrete compressive strength, and bacteriological clearance of water main shall be at the expense of the Contractor and included in the Bid Items. All required testing shall be coordinated with and scheduled by the Contractor.
  - 1. All tests to determine compliance with the Contract Documents shall be performed by an independent commercial testing firm/laboratory. The testing firm's laboratory shall be staffed with experienced technicians, properly equipped, and fully qualified to perform the tests in accordance with the specified standards.
  - 2. The Contractor shall submit the commercial testing laboratory address, information, and qualifications to the Owner and Engineer for review and approval in accordance with Section 01330, Submittals and Acceptance, before any testing is required.
  - 3. The Contractor shall cooperate with the laboratory to facilitate the execution of required services.
  - 4. Employment of a testing laboratory shall in no way relieve the Contractor of the obligation to perform work in accordance with the requirements of the Contract Documents.

1.02 RELATED WORK

- A. Conditions of the Contract: Inspections and testing required by laws, ordinances, rules, regulations, orders, or approvals of public authorities.
- B. Respective Sections: Certification of products.
- C. Each Section Listed: Laboratory tests required and standards for testing.
- D. Testing Laboratory inspection, sampling, and testing are required for but are not limited to the following:
  - 1. Section 02230, Site Preparation.
  - 2. Sections 02300 and 02305, Earthwork.
  - 3. Section 02700, Paving.
  - 4. Section 03200, Concrete Reinforcement.

5. Section 03300, Cast-in-Place Concrete.
6. Section 15055, Piping Systems—General.
7. Section 15141, Disinfection of Piping.

### 1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Submit to the Owner the independent testing firm/laboratory address, information, and qualifications.
- C. Submit to the Engineer for review a list and schedule of all tests to be conducted.
- D. Describe test procedures along with duration of tests.
- E. After each inspection and test, the laboratory shall promptly submit one copy of the laboratory report to the Engineer, one copy to the Contractor, and one copy to the Owner.
- F. Include the following:
  1. Date issued.
  2. Project title and number.
  3. Name of field testing technician or inspector.
  4. Date and time of sampling or inspection.
  5. Identification of product and Specifications Section.
  6. Location in the Project.
  7. Type of inspection or test.
  8. Date of test.
  9. Results of test.
  10. Conformance with Contract Documents.
- G. When requested by the Engineer, provide interpretation of test results.

### 1.04 WORK SEQUENCE (NOT USED)

### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM E329—Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.
  - 2. ASTM D3740—Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

## 1.06 QUALITY ASSURANCE

- A. The Laboratory is not authorized to do any of the following:
  - 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 Engineer of Record or the Engineer.
  
- B. The Contractor shall be responsible for the following:
  - 1. Cooperating with laboratory personnel, providing access to work and to manufacturer's operations.
  - 2. Securing and delivering to the laboratory adequate quantities of representative samples of materials proposed to be used and which require testing.
  - 3. Providing to the laboratory the preliminary design mix proposed to be used for concrete and other materials mixes that require control by the testing laboratory.
  - 4. Furnishing incidental labor and facilities:
    - a. To provide access to work to be tested.
    - b. To obtain and handle samples at the project site or at the source of the product to be tested.
    - c. To facilitate inspections and tests.
    - d. To store and cure test samples.
  - 5. Notifying the Engineer and laboratory sufficiently in advance of operations to allow the laboratory to assign personnel and schedule tests.
  - 6. Employing and paying for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling, and testing required for the Equipment Supplier or Contractor's (as applicable) convenience.

- C. 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 requirements for quality and workmanship are indicated in the Contract Documents. The Engineer may require the equipment supplier or Contractor (as applicable) 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.
- D. If the test and any subsequent retest results indicate that the materials or equipment fail to meet the requirements of the Contract Documents, the equipment supplier or Contractor (as applicable) shall pay for the laboratory costs directly to the testing firm and these will not be reimbursable to the equipment supplier or Contractor (as applicable).

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS

- A. Comply with requirements of ASTM E329 and ASTM D3740.
- B. Laboratory: Licensed to operate in Florida.
- C. Laboratory Staff: Maintain a full-time Professional Engineer registered in Florida on staff to review the services performed under this project.
- D. Testing Equipment: Calibrated at reasonable intervals with devices of accuracy traceable to either National Bureau of Standards (NBS) or accepted values of natural physical constants.

- E. Provide qualified personnel at the site. Cooperate with the Engineer and Contractor in performing services.
- F. Perform specified inspection, sampling, and testing of products in accordance with specified standards.
- G. Ascertain compliance of materials and mixes with requirements of Contract Documents.
- H. Promptly notify the Engineer and Contractor of observed irregularities or non-conformance of Work or Products.
- I. Perform additional inspections and tests required by Engineer.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01500  
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SCOPE OF WORK (NOT USED)

1.02 RELATED WORK

- A. Section 01650, Delivery, Storage, and Handling.
- B. Section 01780, Warranties and Bonds.

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 RESPONSIBILITY

- A. This Section specifies the minimum requirements for temporary facilities, utilities, and controls required to provide an adequate and safe work site at every stage during construction of the Project. The Contractor is solely responsible for the requirements set forth in this Section.

### 1.11 ONSITE TEMPORARY

- A. Except as otherwise indicated, the Contractor may, at his option, furnish stand-alone utility plants to provide needed services in lieu of connected services from available public utilities, provided such stand-alone plant facilities comply with all governing regulations. Before availability of temporary utility services, the Contractor will provide trucked-in/trucked-out containerized or unitized services for start-up of construction operations at the site.

### 1.12 COSTS

- A. Except as otherwise indicated, the costs of providing and using temporary utility services are included in the contract sum.

### 1.13 TEMPORARY FACILITIES

- A. The types of utility services required for temporary use at the project site include the following (other specific services may be required for specific construction methods of operations):
  - 1. Electrical Power Service.
  - 2. Water Service (potable for certain uses).
  - 3. Sanitary.
  - 4. Storm Sewer or Open Drainage/Run-off Control.
  - 5. Gas (fuel) Service.

### 1.14 TEMPORARY ELECTRICITY

- A. The Contractor shall make the necessary applications and arrangements and pay all fees and charges for electrical energy for power and light necessary for proper completion of the Work and during its entire progress up to time of final acceptance by the Owner. The Contractor shall provide and pay for all temporary switches, connections, and meters.

### 1.15 TEMPORARY WATER

- A. The Contractor shall make all necessary application and arrangements and pay all fees and charges for water necessary for the proper completion of the Project up to the time of final acceptance. The Contractor shall provide and pay for any temporary piping and connections.

## 1.16 TEMPORARY SANITARY FACILITIES

- A. The Contractor shall provide adequate sanitary facilities for the use of those employed on the Work. Such facilities shall be made available when the first employees arrive on the site of the Work, shall be properly secluded from public observation, and shall be constructed and maintained during the progress of the Work in suitable numbers and at such points and in such manner as may be required or approved.

## 1.17 CLEANLINESS OF FACILITIES

- A. The Contractor shall maintain the sanitary facilities in a satisfactory and sanitary condition at all times and shall enforce their use. He shall rigorously prohibit the committing of nuisances on the site of the Work, on the lands of the Owner, or on adjacent property.

## 1.18 TERMINATION AND REMOVAL

- A. At the time the need for a temporary utility service has ended or has been replaced by use of permanent services, or not later than the time of final completion, the Contractor shall promptly remove the installation unless requested by the Engineer to retain it for a longer period. Any work which may have been delayed or affected by the installation and use of the temporary utility, including repairs to construction and grades and restoration and cleaning of exposed surfaces, shall be completed at this time. The Contractor shall replace any work damaged beyond acceptable restoration.

## 1.19 NOISE CONTROL

- A. The Contractor shall provide adequate protection against objectionable noise levels caused by the operation of construction equipment.

## 1.20 DUST CONTROL

- A. The Contractor shall provide for adequate protection against raising objectionable dust clouds caused by moving construction equipment, high winds, or any other cause.

## 1.21 WATER CONTROL

- A. The Contractor shall provide for satisfactory disposal of surplus water and shall submit a plan to the Engineer for review before initiating and implementing the plan. Prior approval shall be obtained from the proper authorities for the use of public or private lands or facilities for such disposal.

## 1.22 POLLUTION CONTROL

- A. The Contractor shall provide for adequate protection against polluting any public or private lands, lakes, ponds, rivers, streams, creeks, and other such areas by the disposal of surplus material in the form of solids, liquids, gases, or from any other cause.

## 1.23 ADVERSE IMPACT

- A. The Contractor shall evaluate and assess the impact of any adverse effects on the natural environment that may result from construction operations and shall operate to minimize pollution of air, ground, or surface waters vegetation, and afford the neighboring community the maximum protection during and up to completion of the construction project.

## 1.24 STREAMS, LAKES, AND OTHER BODIES OF WATER

- A. The Contractor shall take sufficient precautions to prevent pollution of streams, lakes, and reservoirs with fuels, oils, bitumens, calcium chloride, or other harmful materials. He shall conduct and schedule his operations so as to avoid or otherwise prevent pollution of siltation of streams, lakes, and reservoirs and to avoid interference with the movements of migratory fish.

## 1.25 CHEMICALS

- A. 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 US EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

## 1.26 EROSION CONTROL

- A. The Contractor shall not expose by construction operations a larger area of erosive land at any one time than the minimum necessary for efficient construction operations, and the duration of exposure of the uncompleted construction to the elements shall be as short as practicable. Erosion-control features shall be constructed concurrently with other work and at the earliest practicable time.

## 1.27 STORAGE FACILITIES

- A. All products, materials, and equipment shall be stored in accordance with the manufacturer's instructions, with seals and labels intact and legible. Products subject to damage by the elements shall be stored in weathertight enclosures. Temperature and humidity shall be maintained within the ranges required by the manufacturer's instructions. Fabricated products shall be stored above the ground on blocking or skids. Products that are subject to deterioration shall be covered with impervious coatings with adequate ventilation to avoid condensation. Loose granular materials shall be stored in a well-drained area on solid surfaces to prevent mixing with foreign matter. Any products that will come in contact with water shall be stored off the ground to prevent contamination.

## 1.28 INSPECTION

- A. Storage shall be arranged in such a manner to provide easy access for inspection. Periodic inspections shall be made of all stored products to ensure that they are maintained under specified conditions and free from damage or deterioration.

## 1.29 TEMPORARY PROTECTION

- A. After installation, the Contractor shall provide substantial coverings as necessary to installed products to protect them from damage from traffic and subsequent construction operations. Coverings shall be removed when no longer needed.

## 1.30 ADJACENT TO WORK

- A. The Contractor shall protect from damage all property along the line of the Work or in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Wherever such property is damaged due to the activities of the Contractor, it shall be immediately restored to its original condition by the Contractor at no cost to the Owner.

## 1.31 REMEDY BY OWNER

- A. In case of failure on the part of the Contractor to restore such property or make good such damage or injury, the Owner may, after 48 hours' notice to the Contractor, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary and the cost of such repairs, rebuilding, or restoration will be deducted from any monies due or that may become due to the Contractor under this Contract.

### 1.32 PROTECTION FROM DAMAGE

- A. The Contractor shall be responsible for protecting property in the areas in the vicinity of the Project and for protecting his equipment, supplies, materials, and work against any damage resulting from the elements, such as flooding, rainstorm, wind damage, or other such damage, and shall be responsible for damage resulting from the same. The Contractor shall provide adequate drainage facilities, tie-downs, or other protection throughout the contract period for the protection of his, the Owner's, and other properties from such damage.

### 1.33 TRAFFIC REGULATION

- A. Signs, marking barricades, and procedures shall conform to the requirements of the Florida Department of Transportation Manual on Traffic Controls and Safe Practices for Street and Highway Construction, Maintenance, and Utility Operations.

### 1.34 SIGNAGE

- A. The Contractor shall provide and maintain adequate barricades around open excavations.

### 1.35 REMOVAL OF SIGNAGE

- A. On completion of the Work, the Contractor shall remove all debris, excess materials, barricades, and temporary work, leaving walkways and roads clear of obstructions.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01600  
MATERIALS AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

This Section includes the minimum requirements for the furnished materials and equipment for this project. The more stringent requirements in the Technical Specification sections shall take precedence over these requirements for any conflicts.

- A. Materials and equipment furnished by the Contractor shall be new and shall not have been in service at any other installation unless otherwise approved. They shall conform to applicable specifications approved in writing by the Engineer.
- B. Manufactured and fabricated products shall be designed, fabricated, and assembled in accordance with the best engineering and shop practices. Like parts of duplicate units shall be manufactured to standard sizes and gauges so as to be interchangeable.
- C. Quantities of items that are identical shall be by the same manufacturer, regardless of the Design Package breakdown.
- D. Equipment sizes, capacities, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
- E. Materials and equipment shall not be used for any purpose other than that for which they are designed or specified.
- F. Where materials or equipment are specifically shown or specified to be reused in the Work, special care shall be used in removing, handling, storing, and reinstalling to ensure their proper function in the completed Work.
- G. Material and equipment incorporated into the Work:
  - 1. Shall conform to applicable specifications and standards.
  - 2. Shall comply with size, make, type, and quality specified or as specifically approved in writing by the Engineer.

3. Manufactured and fabricated products:
  - a. Rotating machinery shall be designed and fabricated to provide satisfactory operation without excessive wear and without excessive maintenance during its operating life. Rotating parts shall be statically and dynamically balanced and shall operate without excessive vibration.

#### 1.02 RELATED WORK

- A. Section 3, General Terms and Conditions.
- B. Section 4, Supplemental Conditions – Construction.
- C. Section 01000, Project Requirements.
- D. Section 01650, Delivery, Storage, and Handling.
- E. Section 01740, Final Cleaning.
- F. Section 01780, Warranties and Bonds.
- G. Section 01830, Operations and Maintenance Manuals.

#### 1.03 SUBMITTALS (NOT USED)

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS (NOT USED)

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 ACCEPTANCE OF MATERIAL AND EQUIPMENT

- A. Only new materials and equipment shall be incorporated in the Work. All materials and equipment furnished by the Contractor shall be subject to the



inspection and acceptance of the Engineer. No material shall be delivered to the site that does not meet the Contract Specifications.

- B. The Contractor shall submit data and samples sufficiently early to permit consideration and acceptance before materials are necessary for incorporating in the work. Any delay of acceptance resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of claim against the Owner.
- C. The materials and equipment used in the Work shall correspond to the approved samples or other data.
- D. If requested, the Contractor shall be required to submit to the Engineer ample evidence that each and every part of the materials, machinery, and equipment to be furnished is of a reliable make and of a type that has been in successful operation within the continental United States. No equipment will be considered unless the manufacturer has designed and manufactured equipment of a comparable type and size for at least 3 years. The Engineer or Owner will not allow any experimental or untried type of material or machinery to be installed.
- E. The equipment specified shall be carefully designed and installed to ensure that it adequately performs all required functions within the specified degree of precision. Each unit shall operate with each of the other parts of the equipment to provide a completely integrated system that shall operate to the satisfaction of the Engineer and Owner.
- F. All equipment, machinery, parts, and assemblies of equipment, machinery, or parts entering into the Work shall be tested as specified. Unless waived in writing by the Engineer, all field and operating tests shall be made in the presence of the Engineer or the Engineer's authorized representative. When such a waiver is issued, the Contractor or manufacturer shall furnish sworn statements in duplicate of the tests conducted and the results of the tests to the Engineer.
- G. The Contractor shall submit copies of welding procedures for all welding. Welders and welding operators shall be selected in accordance with the qualification requirements of the AWS Code. Welders and welding operators for stainless steel shall pass qualification tests using stainless steel filler metal and procedures developed for stainless steel. Procedures, welder, and operator qualifications shall be certified by an independent testing laboratory retained and paid by the Contractor.
- H. The Contractor shall not start fabrication of the Work until the Contractor receives written acceptance of the proof of welding procedures from the Engineer for each type of weld.

- I. The Contractor shall submit copies of mill certificate for each type of rolled steel and as required in the Specifications. The Contractor shall not start fabrication of the work until the Contractor receives written acceptance of all mill certificates from the Engineer.

#### 1.11 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

- A. The equipment installation details shall suit the existing and furnished equipment and are subject to acceptance by the Engineer.
- B. Any changes or revisions made necessary by the type and dimensions of the equipment furnished shall be made at the expense of the Contractor who shall furnish detailed drawings showing such changes or revision for the acceptance of the Engineer.
- C. The installation of all work shall comply with the manufacturer's printed instructions. The Contractor shall obtain and distribute copies of such instructions to parties involved in the installation, including six copies to the Engineer for distribution. One complete set of instructions shall be maintained at the job site during installation and until the Project is complete.
- D. All products and equipment shall be handled, installed, connected, cleaned, conditioned, and adjusted in accordance with the manufacturer's instructions and specified requirements. Should job conditions or specified requirements conflict with the manufacturer's instructions, such conflicts shall be called to the Engineer's attention for resolution and revised instructions.
- E. The Contractor shall perform work according to the manufacturer's instructions and not omit any preparatory step or installation procedure unless the instructions are specifically modified or the step or procedure exempted by the Contract Documents.

#### 1.12 INSTALLATION OF EQUIPMENT

- A. The cost of the Work shall include the cost of competent manufacturers' representatives of all equipment to supervise the installation, adjustment, and testing of the equipment and to instruct the Owner's operating personnel on operation and maintenance.
- B. A certificate from the manufacturer stating that the installation of the equipment is satisfactory, that the unit has been satisfactorily tested, is ready for operation, and that the operating personnel have been suitably instructed in the operation, lubrication, and care of the unit shall be submitted before Substantial Completion.

The Manufacturer's Certificate of Compliance and Equipment Manufacturer's Certificate of Installation Testing and Instruction are included in Section 11000, General Equipment Requirements.

- C. The Contractor shall furnish the service of competent manufacturers' representatives for Contractor- or Owner-furnished equipment when evident malfunction or over-heating makes such services necessary or as determined by the Engineer. All such equipment shall be installed by skilled mechanics and in accordance with the instructions of the manufacturer.
- D. Special care shall be taken to ensure proper alignment of all equipment with particular reference to mechanical equipment such as pumps and electric drives. These units shall be carefully aligned on their foundations by qualified millwrights after their sole or base plates have been shimmed to true alignment at the anchor bolts. The anchor bolts shall be set in place and the nuts tightened against the shims. After the manufacturer has approved the foundation alignments, the bedplates or wing feet of the equipment shall be securely bolted in place. The alignment of equipment shall be further checked after securing to the foundations. After all alignments are confirmed, the sole or base plates shall be finally grouted in place. The Contractor shall be responsible for the exact alignment of equipment with associated piping, and under no circumstances, will "pipe springing" be allowed. Special installation requirements in the Technical Specifications shall take precedence over the requirements of this Section.
- E. The Contractor shall furnish all wedges, shims, filling pieces, keys, packing, grout, or other materials necessary to properly align, level, and secure an apparatus in place. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper alignment after erection shall be done at the expense of the Contractor.
- F. The Contractor shall furnish the necessary materials and construct suitable concrete foundations or pads for all equipment installed by the Contractor, even though such foundations or pads may not be indicated on the Drawings. The tops of foundations shall be at such elevations as will permit grouting.
- G. In setting pumps, motors, and other items of equipment customarily grouted, the Contractor shall make an allowance of at least 1 inch (2.54 cm) for grout under the equipment bases. Shims used to level and adjust the bases shall be steel. Shims may be left embedded in the grout, in which case they shall be installed neatly and so as to be as inconspicuous as possible in the completed work. Unless otherwise permitted, all grout shall be a suitable non-shrinking grout.
  - 1. Grout shall be mixed and placed in accordance with the recommendations of the manufacturer. Where practicable, the grout shall be placed through

the grout holes in the base and worked outward and under the edges of the base and across the rough top of the concrete foundation to a peripheral form so constructed as to provide a suitable chamfer around the top edge of the finished foundation.

2. Where such procedure is impracticable, the method of placing grout shall be as permitted. After the grout has hardened sufficiently, all forms, hoppers, and excess grout shall be removed, and all exposed grout surfaces shall be patched in an approved manner and, if necessary, as required by the Engineer, given burlap-rubbed finish, and painted with at least two coats of an acceptable paint.

### 1.13 SPECIAL TOOLS

- A. Manufacturers of equipment and machinery shall furnish two sets of any special tools (including grease guns or other lubricating devices) required for normal adjustment, operations and maintenance, and disassembly, together with instructions for their use. The Contractor shall preserve and deliver to the Owner these tools and instructions in good order before completing the Contract. Tools shall be high-grade, smooth, forged, alloy tool steel. Grease guns shall be lever-type.
- B. Special tools are considered to be those tools which because of their limited use are not normally available, but which are necessary for the particular equipment.
- C. Special tools shall be delivered at the same time as the equipment to which they pertain. The Contractor shall properly store and safeguard such special tools until completion of the work, at which time they shall be delivered to the Owner.

### 1.14 LUBRICATION SYSTEM

- A. The minimum design criteria for lubricating moving parts of the equipment shall include 1 week of continuous operation during which no lubricants shall be added to the system.
- B. The system shall be designed to receive lubricants whether in operation or shut down and shall not leak or waste lubricants under either condition. The manufacturer's recommendations of grade and quality and a supply of the lubricants so recommended in quantities sufficient to conduct start-up and testing operations shall be furnished with the equipment.

### 1.15 TESTS AND TEST REPORTS

- A. When used in the Contract Documents, "Factory/Fabricating Shop Performance, Evaluation, Certification, and/or Acceptance Tests and Test Reports" shall be

considered to mean the corresponding manufacturer's, fabricator's, and/or other builder's official test and tests reports. Included in these test reports shall be appropriate substantiating documentation/data ascertaining the correct and complete manufacture, fabrication, and "shop performance" (to the greatest extent normally practicable) of the particular material, equipment, system, and/or facilities proposed for eventual delivery. These are subdivided into three significant tests and test report types: 1) Certification Tests and Test Reports, 2) Factory Tests and Test Reports, and 3) Shop Performance/Evaluation Tests and Test Reports. Minimal requirements are described below.

B. Certification Tests and Test Reports

1. Standard specifications, code references, etc. for minimum quality and workmanship levels are indicated in the Contract Documents and Construction Documents. Statements, certificates, and other substantiating reporting data, called "Certification Test Reports" in this Section, of tests conducted on previously manufactured materials or equipment identical to that proposed for use shall be compiled by the Contractor.
2. At a minimum all Certification Test Reports shall contain an official analysis of sufficient material composition or show evidence of meeting or exceeding the specified material standard(s) referenced, e.g., ASTM, ASME, or other designations. All reports shall also indicate from whom the material was/will be purchased.
3. The Contractor shall pay all costs of certification tests and test reports.

C. Factory Tests and Test Reports

1. Additional tests and reports performed on material or equipment by the manufacturer or fabricator to ascertain quality or workmanship are referred to here as "Factory Tests and Test Reports."
2. Before the delivery of any Factory Test Report, the Contractor shall first submit for review and approval a detailed description of the proposed testing, including reporting procedure and criteria. Such descriptions shall also be delivered to the Engineer for review as part of the first submission of the technical submittal.
3. Materials and equipment used in the performance of the Work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. If Work to be accomplished away from the construction site is to be inspected on behalf of the Owner during its fabrication or manufacture, the Contractor shall give prior notice to the Engineer of the place and time where such fabrication or manufacture is to be done. Such notice shall be in writing and delivered to the Engineer not less than 30 days before the Work is to be done so that the necessary arrangements for the particular factory inspection tests can be made.

4. Upon completion of the factory inspection tests and immediately following manufacture or fabrication, the Contractor shall compile a complete Factory Test Report following the approved format above. All such reports shall be delivered to the Engineer for review as part of the technical submittal corresponding to such tested material or equipment.

D. Shop Performance/Evaluation Tests and Test Reports

1. Material and equipment used in the performance of the Work of this Contract are also subject to evaluation and testing after the complete full-scale assembly into major equipment and/or systems. Shop Performance/Evaluation Tests, i.e., tests of simulated startup, steady-state, variable loading, and other normal operating conditions, for such assembled equipment/systems shall be accomplished in strict accordance with the standard testing practices specified or otherwise accepted by the Engineer.
2. Before the delivery of any Shop Performance/Evaluation Test Report, the Contractor shall submit for review a detailed description of the proposed performance/evaluation tests, including anticipated reporting procedures, data reduction, and criteria used. Where appropriate, such descriptions shall also be delivered to the Engineer for review as part of a first or subsequent submission of the technical submittal.
3. Should such performance/evaluation tests be accomplished away from the construction site, the Contractor shall give prior notice to the Engineer of the places and times where such tests will be accomplished. Such prior notice shall be in writing and delivered not less than 30 days before such events so that necessary arrangements for the particular tests can be made.
4. The requirements above pertaining to Factory Tests and Test Reports shall be incorporated for shop Performance/Evaluation Tests and Test Reports. Unless factory tests are coincident with shop performance tests and vice versa for the same material or equipment, a minimum of 15 days shall be scheduled between such multiple equipment tests where extended travel is required.

E. Cost of Performance Shop Tests

1. The Contractor shall conduct shop performance full-scale tests at its expense on all equipment as specified. Each piece of equipment shall be tested completely assembled and the shop tests performed by the equipment manufacturer until successful tests are achieved.
2. If the performance tests are conducted outside the continental United States, the Contractor shall pay all transportation expenses incurred by the Owner's representatives in witnessing the tests at no additional cost to the Owner.

## 1.16 FIELD TESTING

- A. Field testing shall be conducted when called for in the Technical Specification Sections and on all completed systems in general. The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the field testing specified in this Section. Field testing shall generally consist of performing the pre-startup and startup tests as specified in the Division 11 Specifications and the final mechanical performance test specified in Section 11000, General Equipment Requirements. The Contract Documents may require the Contractor to perform factory testing on equipment items before the Engineer approves their use for this project. The Contractor shall refer to the Division 11 Specifications regarding equipment shop testing requirements.
- B. After completing the installation, the Contractor shall test the system in the presence of the Engineer and under actual operating conditions. Tests shall be performed according to the manufacturer's recommendations.
- C. The Contractor shall include with its bid the services of the equipment manufacturer's field service technician for a period necessary to complete the Work to the satisfaction of the Engineer and the Owner.
- D. This service shall be for the purposes of checkout, initial start-up, certification, and instruction of facilities personnel.
- E. A written report covering the technician's findings and installation approval shall be submitted to the Engineer covering all inspections and outlining in detail any deficiencies noted.

## 1.17 ACCEPTANCE OF INSTALLATION

- A. The Engineer may accept an equipment system installation as ready for Substantial Completion when:
  - 1. The Engineer has accepted all factory tests and all other component testing.
  - 2. The Engineer has accepted all performance shop tests.
  - 3. All components of the system are installed and tested, including without limitation hydrostatic tests, leak tests, continuity tests, insulation resistance tests, phase rotation tests, bump tests, stroke testing, calibration, adjustment for proper operation, and all other component tests as appropriate.
  - 4. Field start-up activities have been completed and approved by the Engineer.
  - 5. The appropriate certificates have been submitted.

6. All equipment has met the performance requirements.
7. The Engineer has accepted integrated system tests and adjustments performed by the Contractor to demonstrate that the system as a whole functions reliably and meets the performance requirements, in manual and automatic modes, without failure, fault, or defect of any component or of the system as a whole.
8. The Engineer has accepted integrated facilities tests performed by the Contractor to demonstrate that the entire Construction functions together reliably as an integrated facility and meets the performance requirements, in manual and automatic modes, without failure, fault, or defect of any component.
9. The Engineer has accepted facilities performance tests which demonstrate that the design criteria and performance criteria are met.
10. The Engineer has accepted the O&M Manuals.
11. All required Owner personnel have been trained.
12. All other Contract requirements for Substantial Completion have been satisfied.

#### 1.18 GREASE, OIL, AND FUEL

- A. All grease, oil, and fuel required for start-up and testing of equipment shall be furnished with the respective equipment.
- B. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment from after initial break-in of the equipment, which shall be no greater than 30 days.

#### 1.19 ELECTRICAL EQUIPMENT ENCLOSURES

- A. All items of electrical equipment that are furnished with process, heating, ventilating, or other equipment shall conform to the requirements specified under the appropriate electrical Sections of the Specifications. Enclosures for electrical equipment, such as switches and starters, shall conform to the requirements specified under the appropriate electrical Sections of the Specifications.

#### 1.20 EQUIPMENT DRIVE GUARDS

- A. Screens, guards, or cages shall be provided for all exposed rotating or moving parts in accordance with accepted practices of applicable governmental agencies. Unless specified otherwise in the Technical Sections, guards shall be constructed of galvanized sheet steel or galvanized woven wires or expanded metal set in a frame of galvanized steel members. Guards shall be secured in position by steel braces or straps, which will permit easy removal for servicing the equipment.



## 1.21 PROTECTION AGAINST ELECTROLYSIS

- A. Where dissimilar metals are used in conjunction with each other, suitable insulation shall be provided between adjoining surfaces so as to eliminate direct contact and any resultant electrolysis. The insulation shall be bituminous-impregnated felt, heavy -bituminous coatings, nonmetallic separators or washers, or other acceptable materials.

## 1.22 CONCRETE INSERTS

- A. Concrete inserts for hangers shall be designed to support safely, in the concrete that is used, the maximum load that can be imposed by the hangers used in the inserts. Inserts for hangers shall be of a type which will permit adjustment of the hangers both horizontally (in one plane) and vertically and locking of the hanger head or nut. All inserts shall be galvanized.

## 1.23 SLEEVES

- A. Unless otherwise indicated on the Drawings or specified, openings for the passage of pipes through floors and walls shall be formed of sleeves of standard-weight, galvanized-steel pipe. Each sleeve shall be of ample diameter to pass the pipe and its insulation, if any, and to permit such expansion as may occur. Sleeves shall be of sufficient length to be flush at the walls and the bottom of the slabs and to project 2 inches above the finished floor surface. Threaded nipples shall not be used as sleeves.
- B. Sleeves in exterior walls below ground or in walls to have liquids on one or both sides shall have a 2-inch annular fin of 1/4-inch plate welded with a continuous weld completely around the sleeve at about mid-length. Sleeves shall be galvanized after the fins are attached.
- C. All sleeves shall be set accurately before the concrete is placed or shall be built-in accurately as the masonry is being built.

## 1.24 SERVICES OF MANUFACTURER'S REPRESENTATIVE

- A. The Contractor shall arrange for a qualified service representative from each company manufacturing or supplying certain equipment as listed in this Section (or in the respective Technical Specification Sections) to perform the duties described in this Section.
- B. After the listed equipment has been installed and the equipment is presumably ready for operation but before it is operated by others, the representative shall

inspect, operate, test, and adjust the equipment. The inspection shall include but not be limited to the following points as applicable:

1. Soundness (without cracked, abraded, or otherwise damaged parts).
  2. Completeness in all details, as specified.
  3. Correctness of setting, alignment, and relative arrangement of various parts.
  4. Adequacy and correctness of packing, sealing, and lubricants.
- C. The operation, testing, and adjustment shall be as required to prove that the equipment is left in proper condition for satisfactory operation under the conditions specified.
- D. On completion of his or her work, the manufacturer's or supplier's representative shall submit in triplicate to the Engineer a complete, signed report of the result of the inspection, operation, adjustments, and tests. The report shall include detailed descriptions of the points inspected, tests and adjustment made, quantitative results obtained if such are specified, and suggestions for precautions to be taken to ensure proper maintenance. The report also shall include a certificate that the equipment conforms to the requirements of the Contract and is ready for permanent operation and that nothing in the installation will render the manufacturer's warranty null and void.
- E. After the Engineer has reviewed the reports from the manufacturer's representatives, the Contractor shall make arrangements to have the manufacturer's representatives present when the field acceptance tests are made.
- F. The Contractor, at a minimum, shall arrange for the service of qualified service representatives from the companies manufacturing or supplying the following equipment and as required in the Technical Specifications:
1. Pumping Equipment
  2. Treatment Process Equipment
  3. Instrumentation and Control Systems
  4. Programmable Controllers
  5. Chemical Storage and Feed Equipment
  6. Electric Motors

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01650  
DELIVERY, STORAGE, AND HANDLING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies the general requirements for the delivery, handling, storage, and protection of all items required in the construction of the Work. Specific requirements, if any, are specified with the related item.

1.02 RELATED WORK

- A. Section 01780, Warranties and Bonds.

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in this Section for storing and protecting the items.
- B. The Contractor shall do the following:
  - 1. Materials and equipment shall be loaded and unloaded by methods affording adequate protection against damage. Every precaution shall be taken to prevent injury to the material or equipment during transportation and handling. Suitable power equipment shall be used and the material or equipment shall be under control at all times. Under no condition shall the material or equipment be dropped, bumped, or dragged. When a crane is used, a suitable hook or lift sling shall be used. The crane shall be so placed that all lifting is done in a vertical plane. Materials or equipment

skid loaded, palletized, or handled on skidways shall not be skidded or rolled against material or equipment already unloaded.

2. Material and equipment shall be delivered to the job site by means that will adequately support it and not subject it to undue stresses. Material and equipment damaged or injured in the process of transportation unloading or handling shall be rejected and immediately removed from the site.
3. The Contractor shall coordinate the delivery of all materials, including those furnished by the Owner. The Contractor shall be responsible for the proper transport, handling, and storing of all materials, and materials shall be protected to ensure their expected performance. Delivery schedules shall be coordinated by the Contractor, in advance, so that the Work will be done in a timely manner.
4. The Contractor shall coordinate deliveries of products with construction schedules to avoid conflict with work and conditions at the site. The Contractor shall also do the following:
  - a. Deliver products in undamaged condition, in the manufacturer's original containers or packaging, with identifying labels intact and legible.
  - b. Immediately on delivery, inspect shipments to ensure compliance with requirements of the Contract Documents and approved submittals and to ensure that the products are properly protected and undamaged.
5. The Contractor shall provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.
6. All materials and equipment shall be stored on-site in complete compliance with the manufacturer's recommendations.
7. Store products subject to damage by the elements in weather-tight enclosures.
8. Maintain temperature and humidity within the ranges required by the manufacturer's instructions.
9. Store fabricated products above the ground, on blocking or skids to prevent soiling or staining. Cover products that are subject to deterioration with impervious sheet coverings, and provide adequate ventilation to avoid condensation.

10. All materials and equipment to be incorporated in the Work shall be handled and stored by the Contractor before, during, and after shipment in a manner that will prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft, or damage of any kind to the material or equipment.
11. All materials which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified shall be promptly removed from the site of the Work, and the Contractor shall receive no compensation for the damaged material or its removal.
12. The Contractor shall arrange storage in a manner to provide easy access for inspection and make periodic inspections of stored products to ensure that products are maintained under specified conditions, free from damage or deterioration.
13. The Contractor shall provide substantial coverings as necessary to protect installed products from traffic damage and subsequent construction operations and shall remove these coverings when they are no longer needed.
14. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract, within 7 days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in the previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may include expenditures for labor, equipment use, administrative, clerical, engineering, and any other costs associated with making the necessary corrections.
15. Schedule delivery to reduce long-term onsite storage before installation and/or operation. Under no circumstances shall equipment be delivered to the site more than 1 month before installation without written authorization from the Engineer.
16. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged, or sensitive to deterioration.
17. Deliver products to the site in the manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting, and installing.

18. Unload and place all items delivered to the site in a manner which will not hamper normal construction operation nor that of subcontractors and other contractors and will not interfere with the flow of necessary traffic.
19. Provide necessary equipment and personnel to unload all items delivered to the site.
20. The Contractor shall store and protect products in accordance with the manufacturer's instructions, with seals and labels intact and legible. Follow storage instructions, review them with the Engineer, and keep a written record of this. Arrange storage to permit access for inspection.
21. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
22. Store cement and lime under a roof and off the ground and keep it completely dry at all times. All structural, miscellaneous, and reinforcing steel shall be stored off the ground or otherwise to prevent accumulations of dirt or grease and in a position to prevent accumulations of standing water and to minimize rusting. Beams shall be stored with the webs vertical. Precast concrete shall be handled and stored in a manner to prevent accumulations of dirt, standing water, staining, chipping, or cracking. Handle and store brick, block, and similar masonry products in a manner to keep breaking, cracking, and spilling to a minimum.
23. Store all mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) in a weathertight building to prevent damage. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Engineer. The building shall be provided with adequate ventilation to prevent condensation. The Contractor shall ensure that temperature and humidity are maintained within the range required by the manufacturer.
  - a. All equipment shall be stored fully lubricated with oil, grease, and other lubricants unless otherwise instructed by the manufacturer.
  - b. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding." Upon installation of the equipment, the Contractor shall start the equipment, at least at half load, once weekly for an adequate period to ensure that the equipment does not deteriorate from lack of use.
  - c. Lubricants shall be changed when installation is complete and as frequently as required thereafter during the period between

installation and acceptance. The Contractor shall put new lubricants into the equipment at the time of acceptance.

- d. Before accepting equipment that has been stored for some time, 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 guarantee 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.

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01720  
FIELD ENGINEERING

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

- A. Provide and pay for the following field engineering services required for the Project:
  - 1. Survey work required in the execution of the Project.
  - 2. Civil, structural, or other professional engineering services specified or required to execute the Contractor's construction methods.
  
- B. Retain the services of a registered land surveyor licensed in Florida to do the following:
  - 1. Identify existing control points and property line corner stakes as required.
  - 2. Verify all existing structure locations and all proposed structure corner locations, tank locations, and equipment locations within the Project site.
  - 3. Maintain an accurate location of all buried piping 4 inches in diameter and larger.

1.02 RELATED WORK

- A. Section 01100, Summary of Work.
- B. Section 01330, Submittals and Acceptance.
- C. Section 01650, Delivery, Storage, and Handling.
- D. Section 01785, Record Documents.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
  
- B. The Contractor shall submit to the Engineer the name and address of the registered land surveyor or professional engineer.
  
- C. On request of the Engineer, the Contractor shall submit documentation to verify the accuracy of field engineering work.

- D. The Contractor shall submit a certificate signed by a registered land surveyor certifying that elevations and locations of improvements are in conformance or non-conformance with Subcontract Documents.
- E. At the end of the Project and before final payment, submit the certified Drawings as specified in Section 01785, Record Documents, with the Surveyor's title block (signed and sealed by the registered land surveyor). These Drawings shall be included with and made a part of the project record documents.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. All work will be performed in accordance with the Minimum Technical Standards set forth by the Board of Professional Surveyors and Mappers.

#### 1.06 QUALITY ASSURANCE

- A. Existing basic horizontal and vertical control points for the project are those designated on Drawings.
- B. Locate and protect control points before starting site work and preserve all permanent reference points during construction:
  - 1. Make no changes or relocations without prior written notice to the Engineer.
  - 2. Report to the Engineer when any reference point is lost or destroyed or requires relocation because of necessary changes in grades or locations.
  - 3. Require the surveyor to correctly replace project control points which may be lost or destroyed.
  - 4. Establish replacements based on original survey control.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS

- A. Registered land surveyor of the discipline required for the specific service on the project, currently licensed in Florida.

## 1.10 SYSTEM DESCRIPTION

- A. The Contractor shall establish a minimum of one permanent benchmark on the site, referenced to data established by survey control points:
  - 1. Record locations, with horizontal and vertical data, on Record Documents.
- B. Establish lines and levels, locate and lay out, by instrumentation and similar appropriate means:
  - 1. Site improvements:
    - a. Stakes for grading, fill, and topsoil placement.
    - b. Utility slopes and invert elevations.
  - 2. Building foundation, column locations, and floor levels.
  - 3. Controlling lines and levels required for mechanical and electrical trades.
- C. From time to time, verify layouts by the same methods.
- D. Maintain a complete and accurate log of all control and survey work as the work progresses.
- E. As a condition for approval of monthly progress payment requests, update the project record drawings monthly based on the work performed during the month ending at the pay request. The Contractor shall coordinate this monthly with the Owner's representative on the site as part of the pay request.
- F. Maintain an accurate record of piping changes, revisions, and modifications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01730  
CUTTING, CORING, AND PATCHING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide all cutting, coring, fitting, and patching, including attendant excavation and backfill, required to complete the Work or to accomplish the following:
  - 1. Make the Work's several parts fit together properly.
  - 2. Uncover portions of the Work to provide for installation of ill-timed work.
  - 3. Remove and replace defective work.
  - 4. Remove and replace work not conforming to requirements of Subcontract Documents.
  - 5. Remove samples of installed work as specified for testing.
  - 6. Provide routine penetrations of non-structural surfaces for installing piping and electrical conduit.

1.02 RELATED WORK

- A. Section 01100, Summary of Work.
- B. Section 01330, Submittals and Acceptance.
- C. Section 01650, Delivery, Storage, and Handling.
- D. Section 01780, Warranties and Bonds.
- E. Division 2, Site Construction.
- F. Division 3, Concrete.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. The Contractor shall submit a written request well in advance of executing any cutting or alteration that affects the following:
  - 1. Work of the Owner or any other Contractor.
  - 2. Structural value or integrity of any element of the Project.
  - 3. The integrity or effectiveness of weather-exposed or moisture-resistant elements or systems.
  - 4. The efficiency, operational life, maintenance, or safety of operational elements.

5. Visual qualities of elements exposed to view.
- C. The written request shall include the following:
1. Identification of the Project.
  2. Description of affected Work.
  3. The necessity for cutting, altering, or excavating.
  4. The effect on the work of the Owner or any other Contractor or on the structural or weatherproof integrity of the Project.
  5. Description of proposed Work:
    - a. Scope of cutting, patching, alteration, or excavation.
    - b. Trades which will execute the Work.
    - c. Products proposed to be used.
    - d. Extent of refinishing to be done.
  6. Alternatives to cutting and patching.
  7. Cost proposal, when applicable.
  8. Written permission of any other Contractor whose work will be affected.
- D. The Contractor shall submit written notice to the Engineer designating the date and the time the Work will be uncovered.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## PART 2 PRODUCTS

### 2.01 MATERIALS

- A. Concrete and grout for rough patching shall be as specified in Division 3.
- B. Materials for finish patching shall be equal to those of adjacent construction.

## PART 3 EXECUTION

### 3.01 INSPECTION

- A. The Contractor shall inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.
- B. After uncovering Work, the Contractor shall inspect conditions affecting installation of products or performance of the Work.
- C. The Contractor shall report unsatisfactory or questionable conditions to the Engineer in writing and shall not proceed with work until the Engineer has provided further instructions.
- D. All cutting and coring shall be performed in such a manner as to limit the extent of patching.
- E. All holes cut through concrete and masonry walls, slabs, or arches shall be core-drilled unless otherwise approved. No structural members shall be cut without approval of the Engineer, and all such cutting shall be done in a manner directed by the Engineer. No holes may be drilled in beams or other structural members without obtaining prior approval. All work shall be performed by mechanics skilled in this type of work.
- F. If holes are cored through floor slabs, they shall be drilled from below.
- G. Rough patching shall be such as to bring the cut or cored areas flush with existing construction unless otherwise shown. Finish patching shall match existing surfaces as approved.

### 3.02 PREPARATION

- A. Provide adequate temporary support as necessary to ensure the structural value or integrity of the affected portion of the Work.
- B. Provide devices and methods to protect other portions of the Project from damage.
- C. Provide protection from elements for that portion of the Project which may be exposed by cutting and patching work and maintain excavations free from water.
- D. Perform coring with an approved non-impact rotary tools with diamond core drills. The size of the holes shall be suitable for pipe, conduit, sleeves, and equipment or mechanical seals to be installed.
- E. Ensure that all equipment conforms to OSHA standards and specifications pertaining to plugs, noise and fume pollution, wiring, and maintenance.
- F. Provide protection for existing equipment, utilities, and critical areas against water or other damage cause by drilling operation.
- G. Following drilling, vacuum or otherwise remove from the area all slurry or tailings resulting from coring operations.

### 3.03 PERFORMANCE

- A. Cut and demolish by methods that will prevent damage to other work and will provide proper surfaces to receive installation of repairs.
- B. Excavate and backfill by methods which will prevent settlement or damage to other work.
- C. Employ the original installer or fabricator to perform cutting and patching for the following:
  - 1. Weather-exposed or moisture-resistant elements.
  - 2. Sight-exposed finished surfaces.
- D. Fit and adjust products to provide a finished installation to comply with specified products, functions, tolerances, and finishes.
- E. Cut with a concrete wall saw and diamond saw blades of proper size.



- F. Control slurry generated by sawing operation on both sides of wall.
- G. When cutting a reinforced concrete wall, cut so as not to damage the bond between the concrete and reinforcing steel left in structure. Make the cut so that steel neither protrudes nor is recessed from the face of the cut.
- H. Install adequate bracing of the area to be cut before cutting starts. Check the area during sawing operation for partial cracking and provide additional bracing as required to prevent a partial release of the cut area during sawing operations.
- I. Provide equipment of adequate size to remove cut panel.
- J. Restore work that has been cut or removed; install new products to provide completed work in accordance with requirements of Subcontract Documents.
- K. Fit work airtight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.
- L. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes:
  - 1. For continuous surfaces, refinish to the nearest intersection.
  - 2. For an assembly, refinish the entire unit.
- M. Provide for Proper Pavement Restoration: The Contractor shall restore existing paving, including underdrains if any are encountered and broken into, and shall replace or rebuild the paving using the same type of construction as was in the original. The Contractor shall be responsible for restoring all such work, including subgrade and base courses where present. The Contractor shall obtain and bear the expense of such local or other governmental permits as may be necessary.

END OF SECTION

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SECTION 01735  
CONTROL OF WORK

PART 1 GENERAL

1.01 SCOPE OF WORK (NOT USED)

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

1.10 PLANT

- A. The Contractor shall furnish plant and equipment, which will be efficient, appropriate, and large enough to secure a satisfactory quality of work and a rate of progress that will ensure the completion of the work within the Contract Time. If at any time the plant appears to be inefficient, inappropriate, or insufficient for securing the quality of work required or for producing the rate of progress stated above, the Engineer may order the Contractor to increase the efficiency, change the character, or increase the plant and equipment and the Contractor shall conform to such an order. Failure of the Engineer to give such an order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.11 PRIVATE LAND

- A. Do not enter or occupy private land outside of easements, except by permission of the land owner.

## 1.12 PIPE LOCATIONS

- A. Locate pipelines substantially as indicated on the Drawings. 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. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him of laying and jointing different or additional items where required.

## 1.13 OPEN EXCAVATIONS

- A. Adequately safeguard all open excavations by providing temporary barricades, caution signs, lights, and other means to prevent accidents to persons and damage to property. Provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workers. Remove bridges provided for access during construction when no longer required. The length or size of excavation will be controlled by the particular surrounding conditions, but shall always be confined to the limits prescribed by the Engineer. 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 the open trench, prohibiting stacking excavated material in the street, and requiring that the trench be closed overnight.
- B. Take precautions to prevent injury to the public due to open trenches. Provide adequate light at all trenches, excavated material, equipment, or other obstacles that could be dangerous to the public at night.

## 1.14 TEST PITS

- A. Excavate test pits, at the direction of the Engineer, to locate underground pipelines or structures in advance of the construction. Backfill test pits immediately after their purpose has been satisfied and restore and maintain the surface in a manner satisfactory to the Engineer.

## 1.15 MAINTENANCE OF TRAFFIC

- A. Plant operations, including sludge hauling and chemical deliveries, shall continue throughout construction.
- B. Unless permission to close a street is received in writing from the proper authority, place all excavated material so that vehicular and pedestrian traffic may be maintained at all times. If the construction operations cause traffic hazards, repair the road surface, provide temporary ways, erect wheel guards or fences, or take other measures for safety satisfactory to the Engineer.

- C. Maintenance of traffic shall be in accordance with FDOT. Detours around construction will be subject to the approval of the Owner and the Engineer. Where detours are permitted, provide all necessary barricades and signs as required to divert the flow of traffic. Expedite construction operations while traffic is detoured. The Owner will strictly control periods when traffic is being detoured.
- D. Take precautions to prevent injury to the public due to open trenches. Night watchmen may be required where special hazards exist or police protection provided for traffic while work is in progress. The Contractor shall be fully responsible for damage or injuries whether or not police protection has been provided.

#### 1.16 CARE AND PROTECTION OF PROPERTY

- A. The Contractor shall be responsible for preserving all public and private property and use every precaution necessary to prevent damage to this property. 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, the Contractor shall restore such property to a condition similar or equal to that existing before the damage was done or make good the damage in other manner acceptable to the Engineer.

#### 1.17 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

- A. The Contractor shall assume full responsibility for protecting all buildings, structures, and utilities, public or private, including poles, signs, services to buildings, utilities in the street, gas pipes, water pipes, hydrants, sewers, drains, and electric and telephone cables, whether or not they are shown on the Drawings. Carefully support and protect all such structures and utilities from injury of any kind. Immediately repair any damage resulting from the construction operations.
- B. Assistance will be given the Contractor in determining the location of existing services. The Contractor, however, shall bear full responsibility for obtaining all locations of underground structures and utilities (including existing water services, drain lines, and sewers). The Contractor shall maintain services to buildings and pay costs or charges resulting from damage to such services.
- C. Notify all utility companies in writing at least 72 hours (excluding Saturdays, Sundays, and Legal holidays) before excavating in any public way. Also notify Sunshine State One Call of Florida, telephone 1-800-638-4097 at least 72 hours before starting work.

- D. If, in the opinion of the Engineer, permanent relocation of a utility owned by the City is required, the Engineer 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 under the General Conditions. If relocation of a privately owned utility is required, the Engineer will notify the Utility to perform the work as expeditiously as possible. The Contractor shall cooperate with the Engineer and Utility. No claim for delay will be allowed due to such relocation.
- E. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be part of the work under the Contract and all costs associated shall be included in the Contract Price.
- F. Coordinate the removal and replacement of traffic loops and signals, if required for the performance of the work, at no additional cost to the Owner.

#### 1.18 WATER FOR CONSTRUCTION PURPOSES

- A. In locations where public water supply is available, the Contractor may be allowed to use water for construction purposes. The cost to obtain water shall be included in the Contract Price.
- B. The express approval of the Owner shall be obtained before water is used. Hydrants shall only be operated under the supervision of the Owner's personnel.
- C. Waste of water by the Contractor shall be sufficient cause for withdrawing the use of water.

#### 1.19 MAINTENANCE OF FLOW

- A. The wastewater treatment facilities shall remain in service during construction. Provide for the flow of sewers, drains, and water courses interrupted during the progress of the work, and immediately cart away and remove all offensive matter. Discuss the entire procedure of maintaining existing flow with the Owner and Engineer well in advance of the interruption of any flow.

#### 1.20 COOPERATION WITHIN THIS CONTRACT

- A. All firms or persons authorized to perform any work under this Contract shall cooperate with the General Contractor and subcontractors or trades and assist in incorporating the work of other trades where necessary or required.
- B. Cutting and patching and drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated in this Section or directed by the Engineer.

## 1.21 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

- A. During the work keep the site of operations as clean and neat as possible. Dispose of all residue resulting from the construction work and at the conclusion of the work remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures, and any other refuse remaining from the construction operations and leave the entire site of the work in a neat and orderly condition.
- B. To prevent environmental pollution arising from the construction activities related to the performance of this Contract, comply with all applicable Federal, State, and local laws and regulations concerning waste material disposal, as well as the specific requirements stated in this Section and in other related Sections.
- C. Disposing of excess excavated material in wetlands, stream corridors, and plains is strictly prohibited even if the permission of the property owner is obtained. Any violation of this restriction by the Contractor or any person employed by the Contractor will be brought to the immediate attention of the responsible regulatory agencies, with a request that appropriate action be taken against the offending parties. The Contractor will be required to remove the fill and restore the area impacted at no increase in the Contract Price.

## 1.22 SPECIAL WORK HOUR LIMITATIONS

- A. The Contractor shall limit hours of operation to between 7:00 am and 4:00 pm Monday through Friday. No work shall be performed at night, weekends, or legal holidays except in cases of emergency. The Engineer must authorize all exceptions to this work-hour limitation in writing.

## 1.23 CHARACTER OF THE CONTRACTOR'S SUPERINTENDENT AND WORKERS

- A. The Contractor's superintendent and project manager shall conduct themselves in a professional manner. If, in the opinion of the Owner and the Engineer, the superintendent and project manager do not conduct themselves in a professional and courteous manner, the Engineer can recommend to the Owner that the superintendent and/or the project manager be relieved of their responsibilities and removed from the project. Upon written notice from the Owner, the Contractor shall immediately remove the superintendent and/or the project manager of their responsibilities and removed from the project. The work of this project must be conducted under the supervision of a full-time superintendent.
- B. Any person employed by the Contractor or by any subcontractor who in the opinion of the Engineer does not conduct him/herself in a professional and courteous manner or is intemperate or disorderly, shall, at written request of the

Engineer, be removed immediately by the Contractor or subcontractor employing such person, and that person shall not be allowed to work on any other portion of work in this Contract without written approval of the Engineer. Should the Contractor fail to remove such person(s) or fail to furnish suitable and sufficient personnel for the proper prosecution of the work, the Engineer may recommend to the Owner that the work be suspended until compliance with such orders has been met. Contract time will not be stopped during this time.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION



SECTION 01740  
FINAL CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall execute cleaning during progress of the Work and at the completion of the Work as required by General Conditions.

1.02 RELATED WORK

- A. Section 01650, Delivery, Storage, and Handling.
- B. Section 01780, Warranties and Bonds.

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 ENVIRONMENTAL CONCERNS

- A. Cleaning and disposal operations shall comply with codes, ordinances, regulations, and anti-pollution laws.

## PART 2 PRODUCTS

### 2.01 CLEANING MATERIALS

The Contractor shall do the following:

- 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 the manufacturer of the surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by the cleaning material manufacturer.

## PART 3 EXECUTION

### 3.01 PERIODIC CLEANING

The Contractor shall do the following:

- A. Execute periodic cleaning to keep the work, the site, and adjacent properties free from accumulations of waste materials, rubbish, and windblown debris.
- B. Provide onsite 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 areas away from the site.

### 3.02 DUST CONTROL

The Contractor shall do the following:

- A. Clean interior spaces before 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

The Contractor shall do the following:

- A. Employ skilled workers for final cleaning.
- B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels, and other foreign materials from interior and exterior surfaces exposed to view.
- C. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- D. Before final completion or Owner occupancy, inspect interior and exterior surfaces exposed to view and all work areas to verify that the entire Work is clean.

END OF SECTION

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SECTION 01745  
MISCELLANEOUS WORK AND CLEANUP

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and perform the miscellaneous work not specified in other Sections but obviously necessary for the proper completion of the work as shown on the Drawings.
- B. When applicable, perform the work in accordance with other related Sections. When no applicable specification exists, perform the work in accordance with the best modern practice and/or as directed by the Engineer.
- C. The work of this Section includes but is not limited to the following:
  - 1. Crossing and relocating existing utilities.
  - 2. Restoring driveways and sidewalks.
  - 3. Cleaning up.
  - 4. Performing incidental work.
  - 5. Restoring and replacing curbing.
  - 6. Protecting and bracing utility poles.
  - 7. Construction signage.
  - 8. Obtaining and complying with construction permits.
- D. Submit to the Engineer a breakdown of the lump sum for miscellaneous work and cleanup, including the above items at a minimum. This breakdown shall be subject to the approval of the Engineer and when so approved shall be the basis for determining progress payments and for negotiating change orders, if required.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a

part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. FDOT Design Standards for Design, Construction, Maintenance, and Utility Operations on the State Highway System

1. Index Series 600, "Traffic Control Through Work Zones."

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS

2.01 MATERIALS

- A. Materials required for this Section shall be the same quality of materials that are to be restored. Where possible, re-use existing materials that are removed.

PART 3 EXECUTION

3.01 CROSSING AND RELOCATING EXISTING UTILITIES

- A. Perform any extra work required in crossing culverts and watercourses; storm drains; gas mains; water mains; electric, telephone, gas and water services; and other utilities. This work shall include bracing, hand excavation, backfill (except crushed stone), and any other work required for crossing the utility or obstruction not included for payment in other items in the Bid Form.
- B. In locations where existing utilities cannot be crossed without interfering with the construction of the work as shown on the Drawings, remove and relocate the utility as directed by the Engineer or cooperate with the Utility Companies concerned if they relocate their own utility.
- C. At pipe crossings and where designated by the Engineer, furnish and place crushed stone bedding so that the existing utility or pipe is firmly supported for its entire exposed length. The bedding shall extend to the mid-diameter of the pipe crossed. Payment for crushed stone at pipe crossings will be made according to the unit price bid in the Bid Form.

### 3.02 RESTORING BITUMINOUS CONCRETE DRIVEWAYS AND SIDEWALKS

- A. Existing public and private driveways disturbed by the construction shall be replaced. Paved drives shall be repaved to the limits and thicknesses existing before construction. Gravel drives shall be replaced and regraded in kind.
- B. Existing public and private sidewalks disturbed by the construction shall be replaced with sidewalks of equal quality and dimension.

### 3.03 CLEANING UP

- A. Remove all construction material, excess excavation, buildings, equipment, and other debris remaining on the job as a result of construction operations and restore the site of the work to a neat and orderly condition.

### 3.04 INCIDENTAL WORK

- A. Perform all incidental work not otherwise specified but obviously necessary to the proper completion of the work as shown on the Drawings and as specified in this Section.

### 3.05 RESTORATION AND REPLACEMENT OF CURBING

- A. The Contractor shall protect concrete, bituminous, or timber curbing. If necessary, remove curbing and replace it after backfilling. Curbing which is damaged during construction shall be replaced with curbing of equal quality and dimension at the Contractor's expense.

### 3.06 CONSTRUCTION SIGNAGE

- A. Furnish, install, maintain, and remove warning devices and traffic and construction signs in accordance with FDOT Index Series 600 and as directed by the Engineer.

### 3.07 PERMITS

- A. The Contractor is responsible for obtaining and complying with all permits or their implementation, including the Minor Impact Wetlands Permit and the NPDES Construction Dewatering Permit.

END OF SECTION

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SECTION 01755  
EQUIPMENT TESTING AND STARTUP

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide a competent field services technician of the manufacturers of all equipment furnished under Divisions 11, 13, 15, and 16 to supervise installation, adjustment, initial operation and testing, performance testing, final acceptance testing, and startup of the equipment.
- B. The Contractor shall perform specified equipment field performance tests, final acceptance tests, and startup services.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operation and Maintenance Manuals.
- E. Section 11000, General Equipment Requirements, for Manufacturer's Certificate of Compliance form.
- F. Divisions 11, 13, 15, and 16, performance and acceptance testing and startup requirements.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit name, address, and résumé of proposed field services technicians at least 30 days in advance of the need for such services.
- B. Submit for review detailed testing procedures for shop tests, field performance tests, and final acceptance tests as specified in the various equipment Specification Sections. Test procedures shall be submitted at least 30 days in advance of the proposed test dates and shall include at least the following information:
  - 1. Name of equipment to be tested, including reference to Specification Section number and title.
  - 2. Testing schedule of proposed dates and times for testing.

3. Summary of power, lighting, chemical, water, sludge, gas, etc., needs and identification of who will provide them.
  4. An outline of specific assignments of the responsibilities of the Contractor and manufacturers' factory representatives or field service personnel.
  5. Detailed description of step-by-step testing requirements, with reference to appropriate standardized testing procedures and laboratory analyses by established technical organizations (e.g., ASTM, WPCF Standard Methods, etc.).
  6. Samples of forms to be used to collect and record test data and to present tabulated test results.
- C. Submit copies of test reports upon completion of specified shop, performance, and acceptance tests. Test reports shall incorporate the information provided in the test procedures submittals, modified to reflect the actual conducting of the tests and the following additional information:
1. Copies of all test data sheets and results of lab analyses.
  2. Summary comparison of specified test and performance requirements vs. actual test results.
  3. Should actual test results fail to meet specified test and performance requirements, a description of actions to be taken before re-testing equipment.
- D. Submit copies of the manufacturer's field service technician's report summarizing the results of the initial inspection, operation, adjustment, and pre-tests. The report shall include detailed descriptions and tabulations of the points inspected, tests and adjustments made, quantitative results obtained, suggestions for precautions to be taken to ensure proper maintenance, and the equipment supplier's Certificate of Installation in the format specified in this Section.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Water Works Association (AWWA)
1. AWWA C653 - Disinfection for Water Treatment Plants.
- B. American Society for Testing and Materials (ASTM)

- C. Water Pollution Control Federation (WPCF)
- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

#### 1.06 QUALITY ASSURANCE

- A. Field service technicians shall be competent and experienced in the proper installation, adjustment, operation, testing, and startup of the equipment and systems being installed.
- B. Manufacturers' sales and marketing personnel will not be accepted as field service technicians.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS (NOT USED)

### PART 2 PRODUCTS (NOT USED)

### PART 3 EXECUTION

#### 3.01 PRELIMINARY REQUIREMENTS

- A. After the equipment has been installed and the equipment is presumably ready for operation but before it is operated by others, the manufacturer's field service technician shall inspect, operate, test, and adjust the equipment. The inspection shall include at least the following points where applicable:
  - 1. Soundness (without cracks or otherwise damaged parts).
  - 2. Completeness in all details, as specified and required.
  - 3. Correctness of setting, alignment, and relative arrangement of various parts.
  - 4. Adequacy and correctness of packing, sealing, and lubricants.

- B. The operation, testing, and adjustment shall be as required to prove that the equipment has been left in proper condition for satisfactory operation under the conditions specified.
- C. Upon completion of this work, the manufacturer's field service technician shall submit a signed report of the results of his/her inspection, operation, adjustments, and tests.

### 3.02 WITNESS REQUIREMENTS

- A. Shop tests or factory tests may be witnessed by the Owner and/or the Owner's representatives, as required by the various equipment specifications.
- B. Field performance and acceptance tests shall be performed in the presence of the Owner, the Owner's designated personnel, and/or the Owner's representatives.

### 3.03 STARTUP AND ACCEPTANCE OF THE TREATMENT PLANT AND RELATED SYSTEMS

#### A. General Requirements

1. Successfully execute the step-by-step procedure of startup and performance demonstration specified in this Section.
2. The startup and performance demonstration shall be successfully executed before Substantial Completion and acceptance by the Owner of the treatment plant and its related systems.
3. All performance tests and inspections shall be scheduled at least 5 working days in advance or as otherwise specified with the Owner and the Engineer. All performance tests and inspections shall be conducted during Monday through Friday, unless otherwise specified.

#### B. Preparation for Startup

1. Upon completion of the wastewater treatment facility and all its related systems, all channels, basins, and tanks shall be flushed with reclaimed water and hydraulically checked for leaks, cracks, and defects.
2. All mechanical and electrical equipment shall be checked to ensure that it is in good working order and properly connected. Preliminary run-ins of the various pumps, compressors, and other remaining equipment shall be made. All systems shall be cleaned and purged as required. All sumps, tanks, basins, chambers, pump wells, and pipelines which are hydraulically checked shall be drained and returned to their original condition once the water testing is complete.

3. All instruments and controls shall be calibrated through their full range. All other adjustments required for proper operation of all instrumentation and control equipment shall be made.
4. The Contractor shall perform all other tasks needed for preparing and conditioning the treatment facilities for proper operation.
5. No testing shall be conducted or equipment operated until the Engineer has verified that all specified safety equipment has been installed and is in good working order.
6. No testing shall be conducted or equipment operated until the Engineer has verified that all lubricants, tools, maintenance equipment, spare parts, and approved equipment operation and maintenance manuals have been furnished as specified.

### C. Facilities Startup

1. The startup period shall not begin until all new treatment facilities and equipment have been tested as specified and are ready for operation. The Owner shall receive spare parts, safety equipment, tools and maintenance equipment, lubricants, approved operation and maintenance data, and the specified operation and maintenance instruction before the startup with waste water. All valves shall be tagged before this startup.
2. Demonstrate five consecutive days of successful operation of the facility as a prerequisite of Substantial Completion and Acceptance.
3. If the facility fails to demonstrate satisfactory performance on the first or any subsequent attempt, the Contractor shall make all necessary alterations, adjustments, repairs, and replacements. When the facility is again ready for operation, it shall be brought on line and a new test shall be started. This procedure shall be repeated as often as necessary until the facility has operated continuously to the satisfaction of the Owner and Engineer for the specified duration.
4. The Owner will furnish all operating personnel (other than vendor's or subcontractor's service personnel) needed to operate equipment during the final test period; however, these personnel will perform their duties under the Contractor's direct supervision. Until performance tests are completed and units and systems are accepted by the Owner as substantially complete, the Contractor shall be fully responsible for the operation and maintenance of all new facilities.
5. The Owner will provide all necessary chemicals and electricity. However, the Contractor shall provide all necessary personnel of the various construction trades, i.e., electricians, plumbers, etc., and field service

personnel of the major equipment suppliers on an 8-hour-per-day basis at the facilities and on a 24-hour-per-day basis locally during the startup period. Major equipment suppliers shall include but not be limited to the following:

- a. Telemetry, Instrumentation, and Control Equipment
  - b. Treatment Units
  - c. Chemical Feed Pumps
  - d. All Pumping Equipment
  - e. Boilers and Associated Control Systems
6. At no time during startup shall the Contractor allow the facility to be operated in a manner that subjects equipment to conditions that are more severe than the maximum allowable operating conditions for which the equipment was designed.

END OF SECTION

SECTION 01770  
PROJECT CLOSEOUT

PART 1 GENERAL

1.01 SCOPE OF WORK (NOT USED)

1.02 RELATED WORK

- A. Section 3, General Terms and Conditions.
- B. Section 4, Supplemental Conditions – Construction.
- C. Section 01000, Project Requirements.
- D. Section 01650, Delivery, Storage, and Handling.
- E. Section 01740, Final Cleaning.
- F. Section 01780, Warranties and Bonds.
- G. Section 01785, Record Documents.
- H. Section 01830, Operations and Maintenance Manuals.

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

## 1.10 SUBSTANTIAL COMPLETION

- A. When the Contractor considers that the Work or designated portion of the Work is Substantially Complete, the Contractor shall submit written notice to the Engineer with a list of items to be completed or corrected.
- B. If the Engineer's inspection finds that the Work is not substantially complete, the Engineer will promptly notify the Contractor in writing, listing observed deficiencies.
- C. The Contractor shall remedy deficiencies and send a second written notice of Substantial Completion.
- D. When the Engineer finds the Work is Substantially Complete the Engineer will prepare a Certificate of Substantial Completion.

## 1.11 FINAL COMPLETION

- A. When the Contractor considers that the Work or designated period of the Work is complete, the Contractor shall submit written certification to the Engineer indicating the following:
  - 1. The Contract Documents have been reviewed.
  - 2. The Work has been inspected for compliance with the Contract Documents.
  - 3. The Work has been completed in accordance with the Contract Documents and deficiencies listed with Certificates of Substantial Completion have been corrected.
  - 4. The Work is complete and ready for final inspection.
  - 5. All required shop drawings, catalog cuts, maintenance manuals, instruction manuals, test reports, samples, operational manuals, and all other submittals have been submitted and reviewed by the Engineer.
  - 6. All deliverables have been delivered or placed as accepted by the Engineer.
- B. If the Engineer's inspection reveals that the Work is incomplete, the Engineer will promptly notify the Contractor in writing listing observed deficiencies.
- C. The Contractor shall remedy deficiencies and send a second certification of Final Completion.
- D. When the Engineer finds that the Work is complete, the Engineer will consider closeout submittals.



## 1.12 REINSPECTION FEES

- A. If the status of Completion of Work requires more than one re-inspection by the Engineer due to failure of the Work to comply with the Contractor's claims on initial inspection, the Owner will deduct from the final payment to the Contractor the amount of the Engineer's compensation for additional re-inspection services.

## 1.13 CLOSEOUT SUBMITTALS

- A. Evidence of Compliance with Requirements of Governing Authorities:
  - 1. Certificate of Occupancy.
  - 2. All required Certificates of Inspection.
- B. Operation and Maintenance Manuals: Under provisions of Section 01830, Operations and Maintenance Manuals.
- C. Record Documents: Under provisions of Section 01785, Record Documents.
- D. Evidence of Payment and Release of Liens: In accordance with Conditions of the Contract.
- E. Consent of Surety to Final Payment.

## 1.14 STATEMENT OF ADJUSTMENT OF ACCOUNTS

- A. Submit final statement reflecting adjustments to total Contract Price, indicating the following:
  - 1. Original total Contract Price.
  - 2. Previous change orders.
  - 3. Changes under allowances.
  - 4. Changes under unit prices.
  - 5. Deductions for uncorrected Work.
  - 6. Penalties and bonuses.
  - 7. Deductions for liquidated damages.
  - 8. Deductions for re-inspection fees.
  - 9. Other adjustments to total Contract Price.
  - 10. Total Contract Price as adjusted.
  - 11. Previous payments.
  - 12. Sum remaining due.
- B. The Engineer will issue a final Change Order reflecting approved adjustments to the total Contract Price not previously made by change orders.

1.15 APPLICATION FOR FINAL PAYMENT

- A. Submit application for final payment in accordance with provisions of Conditions of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01780  
WARRANTIES AND BONDS

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

- A. Compile specified warranties and bonds.
- B. Co-execute submittals when so specified.
- C. Review submittals to verify compliance with Contract Documents.
- D. Submit submittals to the Engineer for review.

1.02 RELATED WORK

- A. Section 3, General Terms and Conditions.
- B. Section 4, Supplemental Conditions – Construction.
- C. Section 01330, Submittals and Acceptance.
- D. Section 01600, Materials and Equipment.
- E. Section 01650, Delivery, Storage, and Handling.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- 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 sequence of the Specifications. Provide completion information for each item as follows:
  - 1. Product or work item.
  - 2. Firm, address, telephone and fax numbers, and name and email of principal.
  - 3. Scope.
  - 4. Date of beginning of warranty, bond, or service and maintenance contract.

5. Duration of warranty, bond, or service and maintenance contract.
  6. Provide information for Owner's personnel:
    - a. Proper procedure in case of failure.
    - b. Instances that might affect the validity of warranty or bond.
  7. Contractor, with address, telephone and fax numbers, and the name and email of responsible principal.
- D. Submittal of warranties, bonds, and service and maintenance contracts shall be included in submittals for review and before Final Completion with actual dates included.
- E. The Contractor's obligation to correct defective or nonconforming Work shall run for 1 year (or such longer period may otherwise be specified in the Contract Documents) beginning from the date Substantial Completion is achieved.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and this Section.
- B. All mechanical and electrical equipment together with devices of whatever nature and all components that are furnished and/or installed by the Contractor shall be guaranteed.
- C. The guarantee shall be against the manufacturing and/or design inadequacies, materials, and workmanship not in conformity, improper assembly, hidden damage, failure of devices and/or components, excessive leakage, or other circumstances which would cause the equipment to fail under normal design and/or specific operating conditions for 1 year or such longer period as may be shown and/or specified from and after the date of Substantial Completion.
- D. The Contractor shall replace and install each piece of equipment, device, or component which shall fail within the term specified above of the guarantee with reasonable promptness without increase in the Contract Price. If the Contractor

fails to provide timely repairs as specified in this Section, the Owner shall issue a claim against the Contractor's Bond. In some instances, if approved by the Owner, the Contractor may be allowed to repair the equipment.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01785  
RECORD DOCUMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section details the minimum requirements for the Contractor for maintenance and recording of Record Documents and Record Drawings.

1.02 RELATED WORK

- A. Section 01000, Project Requirements.
- B. Section 01300, Contract Administration.
- C. Section 01330, Submittals and Acceptance.
- D. Section 01650, Delivery, Storage, and Handling
- E. Section 01770, Project Closeout.
- F. Section 01780, Warranties and Bonds.

1.03 SUBMITTALS

The Contractor shall submit submittals for review during construction in accordance with Section 01330, Submittals and Acceptance. Record documents shall be submitted as specified below:

- A. The Contractor shall institute a computerized record control program.
- B. The Contractor shall make documents and samples available at all times for inspection by the Engineer.
- C. At Contract closeout, the Contractor shall transmit Record Documents, including Record Drawings, and samples with cover letter to the Engineer, listing the following:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name and addresses
  - 4. Number and title of each Record Document
  - 5. Signature of Contractor or its authorized representative
  - 6. Contract Section and Subsection numbers
  - 7. Location

- D. Before assembling and submitting records, the Contractor shall review for completeness the records maintained by its subcontractors.
- E. Tracings of all Construction Documents and Shop Drawings made by the Contractor, subcontractors, and suppliers of materials or equipment shall be corrected to show the Work as actually completed or installed.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PROJECT RECORD

- A. The Contractor shall label and file Record Documents and samples in accordance with the corresponding Specification Section number. Each document shall be labeled "PROJECT RECORD" in neat, large, printed letters. Record Documents shall be maintained in a clean, dry, and legible condition. Record documents shall not be used for construction purposes.



### 3.02 RECORDING

The Contractor shall record construction information as follows:

- A. Record and update daily Record information from field notes on a set of opaque drawings and to the satisfaction of the Engineer.
  - 1. The Contractor shall maintain a separate field log book containing swing ties to all underground infrastructure including, but not limited to, fittings, service taps, disinfection ports, buried valves, capped lines for future connections, and ends of water mains placed out of service. Swing ties shall be from permanent structures. The log book shall become property of the Owner at the conclusion of the project.
- B. Provide felt tip marking pens, maintaining separate colors for each major system, for recording information.
- C. Record information concurrently (daily) with construction progress. Work shall not be concealed until required information is recorded.
- D. Record Drawings shall be a special revision of the construction Drawings and shall reflect the following:
  - 1. Measured horizontal and vertical locations of underground utilities and appurtenances referenced to permanent surface improvements.
  - 2. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of construction.
  - 3. Field changes of dimension and detail.
  - 4. Changes made by modifications.
  - 5. Top of wall elevations, northing and easting coordinates, and slab elevations of all new and modified structures.
  - 6. For underground piping, northing and easting coordinates of valves elbows, tees, and invert elevations.
  - 7. Details not on original construction Drawings.
  - 8. At locations where a top of pipe elevation or centerline is required for pipeline, a top of ground or top of pavement elevation shall also be measured and noted on the Drawings.
  - 9. On Record Drawings, at locations where the horizontal positions of constructed pipelines or other utility structures deviate by more than 2 feet (as scaled on the Drawings) from the horizontal positions that were shown on the construction Drawings, the actual positions of the pipelines or structures shall be measured and they shall be depicted in their actual positions on the Record Drawings and their original design positions shall be crossed-hatched out or screen shaded.

10. Record information shall include a thorough description of the pipes that have been installed, including type of pipe material, size, class, diameter ratio, and other basic information.
11. For new valves, the manufacturer type (e.g., gate, plug, ball), size (pipe nominal diameter), and make (manufacturer) of each valve shall be noted on the Record Drawings.
12. The drawings scales used in the Record Drawings shall be the same as were used in the construction Drawings, and the sheet number of each Record Drawing sheet shall be the same as the sheet numbers that were used on the construction Drawings from which the Record Drawings originate.
13. Record Drawings shall accurately depict all existing improvements lying within the immediate vicinity of the constructed facilities. Existing improvements shall include, but not be limited to, sidewalks, fences, road surfaces, buildings, and other utilities. Immediate vicinity includes areas within utility easements includes areas within rights-of-way, and also includes areas within 15 feet of potable water mains, sanitary force mains, and gravity sewer mains. Immediate vicinity also includes areas within 10 feet of potable water meters, backflow preventers, and fire hydrants. Right-of-way, easements, and property corners shall be shown and shall be of sufficient detail as to determine if the constructed utilities are within the easements or rights-of-way. A reference to the recording document (O.R. Book or Plat Book and Page) shall be included with any depiction of a right-of-way or easement.
14. Each roadway depicted on the Drawings shall have the correct roadway name noted on it.
15. Horizontal locations required for valves, fittings, services, and other utility structures shall be to the center of each installation. Top of ground or pavement elevations required along pipelines shall be reported to the nearest 0.1 foot. Top of pipe elevations shall be reported to the nearest 0.1 foot. Elevations of manhole rims and manhole pipe inverts shall be reported to the nearest 0.1 foot. Top of wall elevations shall be reported to the nearest 0.02 foot. Weir and gate elevations shall be reported to the nearest 0.02 foot.
16. All sheets that were used to depict locations and elevations of utility structures in the construction Drawings shall be included in the Record Drawings set.
17. Record information shall be presented in a clear and comprehensible form.

E. CAD Requirements for Record Drawings: The Contractor shall provide the Engineer with a complete set of Record Drawings in the 2016 version of AutoCAD format upon completion of the Work. No additional compensation will be allowed for the Contractor to provide the Record Drawings. The Contractor shall use the AutoCAD drawings furnished by the Engineer for this purpose.

Record Drawings must be submitted in the AutoCAD format of the contract drawings. No other CAD software or format will be accepted. It is Contractor's sole responsibility to ensure that the Record Drawings conform to the following CAD requirements:

1. Two sets of hard copy drawings shall be submitted to the Engineer as well as digital AutoCAD (2016 version) on a CD-ROM. Each CD shall be clearly labeled with the appropriate project number, client name, date, and file names included on each CD. If files are compressed, a description of the compression software must be included along with a copy of the appropriate uncompressing software.
  2. All changes to drawings must be done in accordance with the appropriate scale of the drawing revised and shall be delineated by placing a "cloud" around the areas revised and adding a revision triangle indicating the appropriate revision number.
  3. Each drawing must have the revision block completed to indicate the revision number, date, and initials of the person revising the drawing. The description of the revision must say "Record Drawing." This procedure must be followed for every drawing even when no changes are made to the drawing.
  4. All revisions to drawings must be put on separate layers with the layer names prefixed Record followed by the appropriate existing layer name. The colors and line types of the appropriate existing layers shall be adhered to when creating new layers.
  5. The Contractor shall supply one full set of Record Drawings on reproducible black line prints and five full sets of opaque copies.
- F. The Contractor shall have the Licensed Land Surveyor certify the Record Drawings as being true, correct, and complete, and data were collected in the field by the surveyor or by a representative under the direct supervision of the surveyor. All visible record features, including sewer and drainage inverts, must be measured and located by the surveyor or by personnel under his or her direct supervision. The certifying surveyor shall be fully responsible for the accuracy of the record locations and elevations shown on the Record Drawings.
1. The Contractor's surveyor shall resurvey all visible surface structures as part of the Record Drawings submittal, including, but not limited to, valve boxes, hydrants, relocated or new water meter boxes, automatic blow-off assemblies, walls, gates, and weirs.
  2. Horizontal location shall be tied to NAD83.
  3. Vertical elevations shall be in NAVD88.

END OF SECTION

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SECTION 01815  
MAINTENANCE OF PLANT OPERATION  
AND SEQUENCE OF CONSTRUCTION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The existing Leesburg Turnpike Water Reclamation Facility (WRF) will be maintained in continuous operation by the Owner at all times during the entire construction period. The Contractor shall schedule and conduct his work such that it will not impede any treatment process, create potential hazards to operating equipment and/or personnel, reduce the quality of the plant effluent, or cause odor or other nuisance.
- B. The Contractor shall schedule his operations to conform to the requirements specified herein and shall include in his construction schedule all events that will impact operation of the existing treatment facilities.
- C. The Owner will continue to operate the treatment facilities during the construction period and will be responsible for maintaining effluent quality. The Contractor shall fully cooperate with the Owner, coordinate the construction schedule with the Owner and Engineer, and provide the necessary labor, equipment, and materials to prevent interruption to flow and treatment. The Owner and Engineer reserve the right to modify or expand the schedule during construction to meet prevailing conditions.
- D. The Contractor shall not make any alterations to affect operation of the treatment facility without giving two weeks prior written notice to the Owner and Engineer requesting authorization to proceed. Except as noted herein, the Owner will perform all operation of existing valves or equipment.
- E. Operation of valves or equipment by the Owner may be limited on specific occasions because of process limitations or unavailability of personnel. Delays caused by such limitations shall be expected and shall not be the basis for claim of extra costs by the Contractor.
- F. The work specified in this Section shall be accomplished at such times that will be convenient to the Owner. Overtime work by the Contractor to conform to these requirements shall be considered as normal procedure under this Contract, and the Contractor shall make no claim for extra compensation as a result of this overtime work.

- G. To maintain continuous treatment facilities operation during construction a phased removal and construction sequence shall be required. Specific constraints are outlined in this Section. The Contractor shall submit to the Engineer a detailed sequence of construction to complete the work while maintaining plant operation.
- H. The Contractor shall furnish all temporary materials and equipment that may be required to complete the work of this Contract.

## 1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance, for construction schedule.
- B. Section 02220, Demolition and Modifications.

## 1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit a complete description of procedures to maintain plant operation to supplement the construction schedule developed. The description shall include step-by-step procedures, required duration, and specific procedures required to be performed by the Owner's personnel.
- B. Submit complete plans of temporary systems required as part of this contract to maintain plant operations. The plans shall clearly delineate the intended location of these items and the Contractor's proposed method for phasing from existing to temporary to completed facilities.

## 1.04 WORK SEQUENCE (NOT USED)

## 1.05 REFERENCE STANDARDS (NOT USED)

## 1.06 QUALITY ASSURANCE (NOT USED)

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 MAINTAIN OPERATIONS

- A. The Contractor shall in no way hinder or interfere existing operation and production of sludge through the aerobic digestion and thickening process. If a temporary interruption of the decant of supernatant into the existing manhole that will be modified as shown in the Drawings is required, the Contractor shall coordinate with the Owner and Engineer and shall provide a minimum of 1 week notice to the Owner and Engineer in writing before beginning the Work.
- B. The Contractor shall allow access to the existing aerobic digester, sludge pumps, MCC building, and truck access for sludge hauling. Temporary closure shall be coordinated with the Owner and Engineer, and a minimum of 1 weeks' notice shall be provided to the Owner and Engineer in writing before beginning the Work.
- C. The Contractor shall be fully responsible for providing all staff, temporary pumping, temporary bypassing, piping, fuels, lubricants, plumbing, electrical hook-ups and power, lighting, temporary structures, or whatever may be required to maintain the on-site lift station capabilities to receive and send flow during the period when the Contractor is to replace the two submersible non-clog pumps, pump discharge elbows, discharge fittings, electrical and controls, and other appurtenances and accessories. Details of temporary piping and temporary construction are not shown in the Drawings or covered in the Project Specifications. However, this does not relieve the Contractor of the responsibility to maintain provisions for the operation of the on-site lift station.

## 1.11 COORDINATION

- A. Interconnecting piping, utilities, and structures that are required to incorporate existing treatment system, structures, or facilities with the new treatment system, structures, or facilities shall be performed at one time so that disruption to operations is minimized.
- B. All Contractors and Subcontractors working on the site are subject to this requirement for cooperation, and all shall abide by the Engineer's decision in resolving project coordination problems without additional cost to the Owner.
- C. FDEP and/or the Owner may require modifications or alterations to the Contractor's sequence of construction. The Contractor shall cooperate with the Owner and regulatory agencies to the maximum extent possible.

- D. The Contractor shall cooperate fully in the coordination of his/her activities in a manner that will provide the least interference with the Owner's operations and other contractors and utility companies working in the area and in the interfacing and connection of the separate elements of the overall project Work.

#### 1.12 CONSTRUCTION SEQUENCE OVERVIEW

- A. The Contractor shall ensure that the belt filter press is in its final location and setting as shown on the Drawings before the erection of the pre-fabricated metal canopy building.
- B. The temporary facilities are critical to the operation of the wastewater treatment facilities. Availability of these facilities must be maintained at all times. The Contractor must respond to requests from the Engineer for repair and maintenance immediately (7 days per week, 24 hours per day, including holidays). If the Contractor fails to immediately respond to requests for repair and maintenance, such repair and maintenance may be performed by the Owner. All costs associated with such repair and maintenance performed by the Owner shall be the responsibility of the Contractor.

#### 1.13 PROGRESS OF THE WORK

- A. The Work shall be started within the period stated in the Bid Form, and the Work shall be executed to prevent any delay to the general completion of the project.
- B. The Work shall be executed at such times in or on such parts of the project and with such forces, materials, and equipment to ensure completion of the Work in the time established by the Contract.
- C. If the Contractor for his/her convenience and at his/her own expense desires to carry on the Work outside the regular hours described in Section 01100, Summary of Work, the Contractor shall submit written notice to the Engineer and Owner and allow ample time for satisfactory arrangements to be made for the Owner and/or Engineer to observe the work in progress. The Contractor shall pay the expenses for extra work observation required of the Engineer for the Work outside regular work hours. The Contractor shall provide sufficient work lighting and any other necessary safety precautions for the different parts of the project as required to comply with all applicable federal, state, and local regulations and with the approval of the Owner.

#### PART 2 PRODUCTS (NOT USED)



## PART 3 EXECUTION

### 3.01 GENERAL

- A. The following constraints shall be applied to all equipment, treatment units, and appurtenances and utility systems on the plant site.
1. Vehicular access for the Owner's personnel to the plant site and to all operating treatment units shall be maintained at all times.
  2. Plant operating personnel shall have access to all areas that remain in operation.
  3. Potable water supply to the plant shall remain operational at all times.
  4. Sanitary facilities shall remain operational at all times.
  5. Electric power and lighting service shall be uninterrupted.
  6. If underground piping or utilities not shown on the Drawings are encountered, such piping or utilities shall not be disturbed without prior approval of the Engineer.
  7. Before making a change in existing piping, electrical, or control systems, the Contractor shall inform the Owner and Engineer of such change and assist in instructing operations and maintenance personnel in any new operating procedures.
  8. Portions of some pipelines must remain in service while alterations are being made on other portions. Piping systems that must remain in service shall be isolated by placing blind flanges, plugs, or caps on all open ends.
  9. Flow to and through the treatment plant shall not be interrupted.
  10. Before shutting down a piece of equipment to allow for rebuilding or re-piping, the Contractor shall have on hand all materials required to reconstruct the piping system in its new arrangement.
  11. All temporary facilities provided by the Contractor must be demonstrated to be operational to the satisfaction of the Owner/Engineer before any existing systems can be removed from use.

END OF SECTION

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SECTION 01820  
TRAINING

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

- A. Instruct and train the Owner's personnel in the operation and maintenance of the equipment and systems supplied and/or installed under this Contract.
- B. Incorporate operation and maintenance data and training services furnished by the suppliers into the training program such as shop drawings, equipment manuals, and start-up engineering and training assistance.
- C. Ensure that system suppliers provide a qualified training instructor to help the Contractor train the Owner's employees in the proper operation and maintenance of all equipment and systems.
- D. Prepare instructors and training materials required for complete factory, field, classroom, and hands-on training.
- E. Furnish training videos and manuals during the training program.
- F. Include in the total Contract Price the cost for training equipment; preparing training manuals; conducting classroom instructions; performing field, factory, and hands-on training; and coordinating and incorporating training service provided by suppliers and all other activities required to provide a comprehensive training program of sufficient length, as determined by the Owner.

1.02 RELATED WORK

- A. Section 3, General Terms and Conditions.
- B. Section 4, Supplemental Conditions – Construction.
- C. Section 01000, Project Requirements.
- D. Section 01600, Materials and Equipment.
- E. Section 01650, Delivery, Storage, and Handling.
- F. Section 01780, Warranties and Bonds.
- G. Section 01830, Operations and Maintenance Manuals.

1.03 SUBMITTALS (NOT USED)

#### 1.04 WORK SEQUENCE

- A. All factory training programs, if required, shall be completed before start-up of the Owner's system and shall use equipment similar to the Owner's equipment.
- B. The field training programs shall be conducted in accordance with the approved schedule.
- C. Individuals requiring training shall be trained in small groups during Mondays through Fridays. The Contractor will normally provide training during the dayshift.
- D. The hands-on training shall be conducted with a maximum of 10 students per instructor.
- E. The Contractor shall coordinate and submit a training schedule to the Engineer 30 days before the first training event.

#### 1.05 REFERENCE STANDARDS (NOT USED)

#### 1.06 QUALITY ASSURANCE

- A. Preparation of training materials and instructions to be provided shall be performed by personnel:
  - 1. Trained and experienced in operation and maintenance of equipment and systems installed under this Contract.
  - 2. Familiar with the training requirements of the Owner.
- B. The Contractor shall furnish résumés, including three outside references, for each instructor to be used in the training program.
- C. The Engineer and Owner may review the résumés. Based on the review of the résumés and contacts with references, the Engineer shall approve, request additional information, or reject proposed instructors for the training program. If a proposed instructor is rejected, the Contractor shall submit the résumé and references of another candidate within a reasonable time.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TRAINING PLAN

- A. At the completion of the Work, the Contractor shall provide a competent and experienced person thoroughly familiar with the Work for not less than 3 days to instruct permanent operating personnel in the operation of equipment and control systems.
- B. At least 30 days before training, the Contractor shall submit to the Engineer a detailed training plan including the following:
  - 1. Title and objectives.
  - 2. Training schedule.
  - 3. Prerequisite training and experience of attendees.
  - 4. Recommended types of attendees (e.g., managers, engineers, operators, maintenance staff).
  - 5. Course description and outline of course content.
  - 6. Duration.
  - 7. Location (e.g., training center or site).
  - 8. Format (e.g., lecture, self-study, demonstration, hands-on).
  - 9. Instruction materials and equipment requirements.

## 1.11 FORM OF TRAINING MANUALS

- A. The Contractor shall prepare training packages in the form of an instruction manual for use by the Owner's personnel. At least 30 days before the training, the Contractor shall submit the training packages to the Engineer for acceptance.
- B. Format
  - 1. Size: 8 1/2 x 11 inches (21.59 x 27.94 cm).
  - 2. Paper: 20-lb (9.072 kg) minimum, white, for typed pages.

3. Text: Manufacturer's printed data or neatly word processed including the following:
  - a. Table of contents.
  - b. Pretest.
  - c. Learning objectives.
  - d. General operations, theory, and specific equipment information.
4. Drawings:
  - a. Provide reinforced punched binder tab, bind in with text.
  - b. Reduce larger drawings and fold to size of text pages, not larger than 11 x 17 inch (27.94 x 43.18 cm).
5. Cover: Identify each volume with the following:
  - a. Title of Project.
  - b. Identity of separate structure or system as applicable.
  - c. Identity of general subject matter covered in the manual.
  - d. Locations.

C. Binders

1. Commercial quality three-post binders with durable and cleanable plastic covers.
2. Maximum post width shall be 3 inches (7.62 cm).
3. When multiple binders are used, correlate the information into related consistent groupings.

- D. All training packages, manuals, and materials shall also be provided electronically in CD-ROM.

## 1.12 VIDEOTAPED TRAINING MATERIAL

The Contractor shall do the following:

- A. Produce or provide video training material subject to approval of the Owner.
- B. Furnish four copies of each videotape in DVD format in plastic case with title, the Owner's name, and time on a label in a clear plastic sleeve.
- C. Bear all costs associated with production and provision of the DVDs.

## 1.13 INSTRUCTIONS

- A. At the completion of Work, the Contractor shall provide a competent and experienced person thoroughly familiar with the Work for a period of time as directed by the Owner to instruct permanent operating personnel in the operation of equipment and control systems.
- B. The Contractor shall furnish four complete sets of operating instructions applying to each piece of equipment installed in conjunction with this Contract.
- C. An “As-Installed” diagram of all control wiring and operating instructions shall be mounted in a watertight pocket on the inside door of the control panel of each unit.
- D. Unless otherwise specified, the Contractor shall provide engraved metal, plastic tags, or instructions on any valve, switch, control, pipe or other piece of equipment which is not self evident as to its function or mode of operation. This includes, but is not limited to, all exposed piping and all switches. This shall particularly apply to operations that must be manually sequenced.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01830  
OPERATIONS AND MAINTENANCE MANUALS

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall do the following:

- A. Compile product data and related information appropriate for the Owner's maintenance and operation of products furnished under the Contract.
  - 1. Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent Sections of the Specifications. The data presented in the O&M Manuals shall be specifically related to this Contract and application.
  - 2. Incorporate maintenance and operation data furnished by the Owner, if any.
- B. Furnish all labor, equipment, materials, and all other items to supply and deliver to the Engineer O&M Manuals for the Work in accordance with the requirements of this Section.
- C. Provide O&M Manuals for all equipment, including instrumentation, electrical, and process control system equipment and software for the entire Facility.

1.02 RELATED WORK

- A. Section 01000, Project Requirements.
- B. Section 01330, Submittals and Acceptance.
- C. Section 01650, Delivery, Storage, and Handling
- D. Section 01780, Warranties and Bonds.
- E. Section 01785, Record Documents.
- F. Section 01820, Training.

### 1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Manuals, in general, shall have two levels: a facilities-wide systems level and an individual-component level.
  - 1. The facilities-wide systems level shall do the following:
    - a. Describe the facilities-wide systems, including diagrams.
    - b. Explain start-up, shutdown, normal operations, and malfunctions of the facilities-wide systems.
    - c. Tabulate a lubrication schedule for the facilities-wide systems.
    - d. Describe preventive maintenance checking procedures for the facilities-wide systems.
    - e. Include a cross-reference to all individual component manuals.
  - 2. The individual-component level shall contain the following:
    - a. Storage requirements.
    - b. Installation instructions.
    - c. Alignment instructions and tolerances.
    - d. Operating instructions.
    - e. Troubleshooting instructions.
    - f. Lubrication requirements.
    - g. Maintenance instructions.
    - h. Parts list.
    - i. Recommended spare parts list and how to obtain same.
- B. Format:
  - 1. Size: 8 1/2 x 11 inch (21.59 x 27.94 cm).
  - 2. White paper: 20-lb (9.072 kg) minimum.
  - 3. Text: Manufacturer's printed data or neatly word-processed.
  - 4. Drawings:
    - a. Provide reinforced, punched binder tab, bind in with text.
    - b. Reduce larger drawings and fold to size of text pages but not larger than 11 x 17 inches (27.94 x 43.18 cm).

- c. Place all drawings at the end of each Section and drawing shall be printed on one side only.
  - 5. Provide a blank page for each separate product or each piece of operation equipment.
    - a. Provide a word-processed description of the product and major component parts of equipment.
    - b. Provide indexed tabs.
  - 6. Cover: Identify each volume with typed or printed title, "OPERATION AND MAINTENANCE INSTRUCTIONS," listing the following:
    - a. Title of Project.
    - b. Identity of separate structure as applicable.
    - c. Identity of general subject matter covered in the manual.
- C. Media
- 1. Original word-processed CD shall be delivered to the Engineer.
  - 2. All word processing must be done using the latest version of Microsoft Word or as directed by the Engineer.
  - 3. All drawings except control system configuration drawings must be submitted on CD using AutoCAD.
- D. Binders
- 1. Filled to not more than 75% capacity.
  - 2. When multiple binders are used, arrange the data into related consistent groupings.
- E. All O&M Manuals shall also be provided electronically on CD-ROM.
- F. The Contractor shall submit the following:
- 1. Equipment Manuals—One electronic and one hard copy of the O&M Instruction Manual for each piece of equipment shall be submitted to the Engineer with delivery of the equipment for review by the Engineer and Owner. O&M manuals will not include the manufacturer's test results and Record specifications.
  - 2. Systems O&M Manuals—One electronic and one hard copy of the systems O&M Manuals, bound and indexed and submitted to the Engineer no later than 60 days before the Facility's Phase I start-up for review by the

Engineer and Owner. Systems O&M Manuals will be complete except for field results and refinements added as result of demonstrations.

3. Final O&M Manuals—One electronic and five hard copies of the Final Equipment and Systems O&M Manuals, bound and indexed and submitted to the Engineer before the Substantial Completion under this Contract.
4. The cost of these Manuals submitted shall be included in the total Contract Price. Copies supplied under Item 2 will not be included under Item 3.

- G. Any modifications required after final O&M submission shall be made to the manuals by issuance of addenda in the form of change pages to the manual. The addenda will identify where the new data are to be inserted, what data are to be removed, and new index sheets as necessary and list of shop drawings and submittals.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification Section differs from these documents, the requirements of this Section shall apply.

- A. Florida Administrative Code, 62-600.410, “Operation and Maintenance of Domestic Wastewater Facilities.”

#### 1.06 QUALITY ASSURANCE

- A. Data shall be prepared by personnel:
1. Trained and experienced in maintaining and operating the described products.
  2. Familiar with requirements of this Section.
  3. Skilled as a technical writer to the extent required to communicate essential data.
  4. Skilled as a draftsman competent to prepare required drawings.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 CONTENTS, EACH VOLUME

- A. Neatly word-processed table of contents for each volume, arranged in systematic order, to include the following:
  - 1. Contractor, name of responsible principal, address, fax number, and telephone number.
  - 2. A list of each product required to be included, indexed to content of the volume.
  - 3. A list with each product, name, address, fax number, and telephone number of the following:
    - a. Subcontractor or installer.
    - b. A list of each product to be included, indexed to content of the volume.
    - c. Identify area of responsibility of each subcontractor or installer, if more than one.
    - d. Local source of supply for parts and replacement.
    - e. Manufacturer.
  - 4. Identify each product by product name and other identifying symbols as set forth in the Contract Documents.
- B. Product Data
  - 1. Include only those sheets that are pertinent to the specific product.
  - 2. Annotate each sheet to achieve the following:
    - a. Clearly identify the specific product or part installed.
    - b. Clearly identify data applicable information.
    - c. Delete references to inapplicable information.

C. Drawings

1. Supplement product data with drawings as necessary to illustrate the following clearly:
  - a. Relations of component parts of equipment and systems.
  - b. Control and flow diagrams.
  - c. Owner Tag Numbers.
2. Coordinate drawings with information in Record Documents to ensure correct illustration of completed installation.
3. Do not use Record Documents as maintenance drawings.

D. Written text as required to supplement product data for the particular installation:

1. Organize in consistent format under separate headings for different procedures.
2. Provide a logical sequence of instructions for each procedure.
3. Describe how the complete system is to operate.

E. Copy of pertinent information related to warranty, bond, and service Contract issued.

1. Provide information sheet for Owner's personnel with the following information:
  - a. Proper procedures in event of failure.
  - b. Instances that might affect the validity of warranties or bonds.

F. Training manuals used in training courses will become part of this Manual.

## 1.11 MANUAL FOR MATERIALS AND FINISHES

A. Content, for architectural products, applied materials, and finishes:

1. Manufacturer's data, giving full information on products:
  - a. Catalog number, size, composition.
  - b. Color and texture designations.
  - c. Information required for re-ordering special-manufactured products.

2. Instructions for care and maintenance:
  - a. Manufacturer's recommendation for types of cleaning agents and methods.
  - b. Cautions against cleaning agents and methods that are detrimental to product.
  - c. Recommended schedule for cleaning and maintenance.
- B. Content, for moisture-protected and weather-exposed products:
  1. Manufacturer's data, giving full information on products:
    - a. Applicable standards.
    - b. Chemical composition.
    - c. Details of installation.
  2. Instructions for inspection, maintenance, and repair.
- C. Additional requirements for maintenance data as required by other Sections of the Specifications.

## 1.12 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Content, for each electrical, mechanical, instrumentation, and communication system, as appropriate:
  1. A table identifying each piece of equipment, each associated control or instrument, the location of the control or instrument, and the function of the control or instrument.
  2. A description of the system and its component parts:
    - a. Function, normal operating characteristics, and limiting conditions for the system, the sub-system, and the component parts.
    - b. Performance curves, engineering data, and tests.
    - c. Complete nomenclature and commercial numbers of replaceable parts.
  3. Circuit directories of panel board:
    - a. Electrical service.
    - b. Controls.
    - c. Communications.

4. As-installed color-coded wiring diagrams.
5. Instrument loop diagrams showing the path that a control or instrumentation signal takes from its origin to the action it takes.
  - a. An electrical schematic for each item.
  - b. A chart listing the controls/instruments in a loop identifying the equipment's abbreviated symbol, a description of the symbol, design criteria, process flow, quantity supplied, and manufacturer's model and serial number.
6. Operating procedures:
  - a. Routine and normal operating instructions.
  - b. Sequences required.
  - c. Special operating instructions.
7. Maintenance procedures:
  - a. Routine operations.
  - b. Guide to "trouble-shooting."
  - c. Disassembly, repair, and re-assembly.
  - d. Alignment, adjustment, and checking.
8. The manufacturer's printed operating and maintenance instructions.
9. A list of the original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
10. Other data as required under other Sections of the Specifications.
11. Abnormal and emergency operations:
  - a. Potential overloads.
  - b. Procedures for equipment breakdown.
  - c. Action to be taken in a power outage.
  - d. Identity of alarms by equipment location and action to correct.
  - e. Equipment safety features, requirements, and potential hazards.
12. Programming manuals for programmable devices including list of standard programming.



- B. Content, for each unit of equipment and system, as appropriate:
1. Description of unit and component parts:
    - a. Function, normal operating characteristics, and limiting conditions.
    - b. Performance curves, engineering data, and tests.
    - c. Complete nomenclature and commercial number of replaceable parts.
    - d. Model number and name plate data for each piece of equipment.
    - e. Assembly drawings.
    - f. List of all special tools required to service equipment and/or systems including where the tools are stored.
  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.
    - e. Control settings and ranges.
  3. Maintenance procedures:
    - a. Type and frequency of preventive maintenance activities required for each piece of equipment.
    - b. Guide to "trouble-shooting."
    - c. Disassembly, repair, and re-assembly.
    - d. Alignment, adjusting, and checking.
  4. Servicing and lubrication schedule:
    - a. List of lubricants required.
    - b. Period between lubrications.
  5. Manufacturer's printed operating and maintenance instructions. (This is not to be a generalized catalog of the entire product line.)
  6. Description of sequence of operation.

7. The original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance:
    - a. Predicted life of parts subject to wear.
    - b. Items recommended to be stocked as spare parts.
  8. As-installed control diagrams.
  9. Each Contractor's coordination drawings.
  10. List of the original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
  11. Other data as required under pertinent Sections of the Specifications.
  12. Charts of equipment, instrument, and valve tag numbers with location and function:
    - a. Reference drawing which shows equipment, instrument, or valve location.
    - b. Manufacturer's model and serial number.
    - c. Valve actuator type (manual, hydraulic, electric, or pneumatic).
  13. Local services (process water and air, drains, HVAC, natural gas, and steam).
- C. The Contractor shall prepare and include additional data when the need for such data becomes apparent during instruction of the Owner's personnel.
- D. Additional requirements for O&M data required by other Sections of the Specifications.

## PART 2 PRODUCTS

### 2.01 O&M MANUALS

- A. Binders: The manuals shall be supplied in binders that are the same as those provided in Paragraph 1.03D. above.
- B. Electronic Version: Word-processed portions of the manuals shall also be provided on CDs. The electronic version manuals must be capable of being read, edited, and printed with Microsoft Word or Owner-approved file format at the time of the transmittal of documents. The format will be provided to the

Contractor upon request. All Drawings shall be generated using personal computer and plotter with the software package program from AutoCAD.

PART 3 EXECUTION (NOT USED)

END OF SECTION

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**DIVISION 2**  
**SITE CONSTRUCTION**

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SECTION 02220  
DEMOLITION AND MODIFICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and demolish, modify, remove, and dispose of work shown on the Drawings and as specified in this Section.
- B. The work includes but is not limited to demolishing, modifying, and removing existing materials, equipment, or work necessary to install the new work as shown on the Drawings and as specified in this Section and to connect with existing work in an approved manner.
- C. Demolition, modifications, and removals which may be specified under other Sections shall conform to requirements of this Section.
- D. Demolition and modifications include:
  - 1. Removal and disposal, unless deemed salvageable by the Owner, of associated piping and miscellaneous items as shown on the Drawings.
  - 2. Removal and disposal, unless deemed salvageable by the Owner, of existing WRF on-site lift station submersible pumps, discharge elbows, discharge fittings, guide rails, control panel, electrical components, and other appurtenances.
  - 3. Off-site disposal of excess and unacceptable materials.
- E. Blasting and the use of explosives will not be permitted for any demolition work.

1.02 RELATED WORK

- A. Section 01100, Summary of Work.
- B. Section 01330, Submittals and Acceptance.
- C. Section 01350, Environmental Protection Procedures.
- D. Section 01650, Delivery, Storage, and Handling.
- E. Section 01780, Warranties and Bonds.
- F. Section 01815, Maintenance of Plant Operation and Sequence of Construction.

### 1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit to the Engineer proposed methods and operations of demolition of the structures and modifications before beginning work. Include in the schedule the coordination of shutoff, capping, and continuation of utility service as required.
- B. Furnish a detailed sequence of demolition and removal work to ensure the uninterrupted progress of the Owner's operations. The sequence shall be compatible with sequence of construction and shutdown coordination requirements.
- C. Before beginning demolition work, the Contractor shall complete all modifications necessary to bypass the affected structure. Actual work shall not begin until the Engineer or Owner has observed and approved the modifications and authorized beginning the demolition work in writing.

### 1.04 WORK SEQUENCE (NOT USED)

### 1.05 REFERENCE STANDARDS (NOT USED)

### 1.06 QUALITY ASSURANCE

- A. The Contractor shall engage the service of a professional engineer registered in the State of Florida for the design of the temporary shoring/bracing of the existing structure and hung utilities during the demolition of the valley gutter.

### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

### 1.09 QUALIFICATIONS (NOT USED)

### 1.10 TESTING REQUIREMENTS (NOT USED)



1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

1.13 JOB CONDITIONS

A. Protection

1. The Contractor shall conduct the demolition and removal work to prevent damage or injury to structures, equipment, piping, instrumentation, conduit, light fixtures, etc., and occupants of the structures and to adjacent features which might result from falling debris or other causes, and so as not to interfere with the use and free and safe passage to and from adjacent structures.

B. Scheduling

1. Carry out operations so as to avoid interference with operations and work in the existing facilities.

C. Notification

1. At least 48 hours before beginning demolition or removal, notify the Engineer in writing of the proposed schedule of the demolition or removal. The Owner shall inspect the existing equipment and identify and mark those items that are to remain the property of the Owner. No removals shall be started without the permission of the Engineer.

D. Conditions of Structures

1. The Owner and the Engineer assume no responsibility for the actual condition of the structures to be demolished or modified.
2. Conditions existing at the time of inspection for bidding purposes will be maintained by the Owner insofar as practicable. However, variations within a structure may occur before the start of demolition work.

E. Repairs to Damage

1. The Contractor shall promptly repair damage caused to adjacent facilities by demolition operation when directed by the Engineer and at no cost to the Owner. Repairs shall be made to a condition at least equal to that which existed before construction.

F. Traffic Access

1. The Contractor shall conduct demolition and modification operations and remove equipment and debris to ensure minimum interference with roads onsite and to ensure minimum interference with occupied or used facilities.
2. Special attention is directed towards maintaining safe and convenient access to the existing facilities by plant personnel and plant associated vehicles.

1.14 RULES AND REGULATIONS

- A. The City shall control the demolition, modification or alteration of the existing buildings or structures.
- B. No building or structure or any part thereof shall be demolished until an application has been filed with the Building Inspector and a permit issued. The fee for this permit shall be the Contractor's responsibility.

1.15 DISPOSAL OF MATERIAL

- A. Salvageable material and equipment shall become the property of the Owner. The Contractor shall dismantle all such items to a size that can be readily handled and deliver them to a designated storage area.
- B. All other material and items of equipment shall become the Contractor's property and must be removed from the site.
- C. Storing or selling removed items on the site will not be allowed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. All materials and equipment removed from existing work shall become the property of the Contractor, except for those that the Owner has identified and marked for his/her use. All materials and equipment marked by the Owner to remain shall be carefully removed so as not to be damaged and shall be cleaned and stored on or adjacent to the site in a protected place specified by the Engineer or loaded onto trucks provided by the Owner.

- B. The Contractor shall dispose of all demolition materials, equipment, debris, and all other items—except those marked by the Owner to remain—off the site and in conformance with all existing applicable laws and regulations.
- C. Pollution Controls
  - 1. Use water sprinkling, temporary enclosures, and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Comply with governing regulations pertaining to environmental protection.
    - a. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
    - b. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations. Return adjacent areas to conditions existing before starting the work.

### 3.02 STRUCTURAL REMOVALS

- A. The Contractor shall remove structures to the lines and grades shown unless otherwise directed by the Engineer.
- B. All demolition debris shall be removed and taken from the site, unless otherwise approved by the Engineer.
- C. After parts or all of slabs and like work which tie into new work or existing work are removed, the point of junction shall be neatly repaired so as to leave only finished edges and surface exposed.

### 3.03 DEMOLITION, REPLACEMENT, AND REPAIR

- A. Structural elements shall not be overstressed. The Contractor shall be responsible for shoring and/or bracing as required and indicated on the Drawings for adequate structural support as a result of work performed.
- B. Before demolishing the valley gutter, the Contractor shall provide temporary shoring and/or bracing of the valley gutter and hung utilities as indicated on the Drawings.
- C. The temporary shoring and/or bracing shall be used in specified locations during the phasing of sequence of construction indicated in Section 01815, Maintenance of Plant Operation and Sequence of Construction.

- D. The shoring and/or bracing shall remain in place until the repair mortar and/or concrete in each stage has attained design strength.

#### 3.04 CLEAN-UP

- A. The Contractor shall remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, the Contractor shall remove all materials, equipment, waste, and debris of every sort and shall leave the premises clean, neat, and orderly.

END OF SECTION

SECTION 02230  
SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, and equipment required and perform all site preparation, complete as shown on the Drawings and as specified in this Section.
- B. The Contractor shall obtain all permits required for site preparation before proceeding with the work, including clearing and tree removal.
- C. The areas to be cleared, grubbed, and stripped within public rights-of-way and utility easements shall be minimized to the extent possible for the scope of pipeline work and in consideration of the actual means and methods of construction used. No unnecessary site preparation shall be performed within these areas.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01350, Environmental Protection Procedures.
- C. Section 01650, Delivery, Storage, and Handling.
- D. Section 01780, Warranties and Bonds.
- E. Section 02300, Earthwork for Structures.
- F. Section 02305, Earthwork for Utilities.
- G. Section 02920, Sodding.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Submit to the Engineer copies of all permits required before clearing, grubbing, and stripping work.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEARING

- A. The Contractor shall cut and remove all timber, trees, stumps, brush, shrubs, roots, grass, weeds, rubbish, and any other objectionable material resting on or protruding through the surface of the ground.
- B. The Contractor shall preserve and protect trees and other vegetation designated on the Drawings or directed by the Engineer to remain as specified below.

3.02 GRUBBING

- A. The Contractor shall grub and remove all stumps, roots in excess of 1-1/2 inches in diameter, matted roots, brush, timber, logs, concrete rubble, and other debris encountered to a depth of 18 inches below original grade or 18 inches beneath the bottom of foundations, whichever is deeper.
- B. The Contractor shall refill all grubbing holes and depressions excavated below the original ground surface with suitable materials and compact to a density

conforming to the surrounding ground surface in accordance with Sections 02300, Earthwork for Structures, and 02305, Earthwork for Utilities.

### 3.03 STRIPPING

- A. The Contractor shall strip topsoil from all areas to be occupied by buildings, structures, and roadways and all areas to be excavated or filled.
- B. Topsoil shall be free from brush, trash, large stones, and other extraneous material. Avoid mixing topsoil with subsoil.
- C. The Contractor shall stockpile and protect topsoil until it is used in landscaping, loaming, and seeding operations and dispose of surplus topsoil after all work is completed.

### 3.04 DISPOSAL

- A. Dispose of material and debris from site preparation operations by hauling such materials and debris to an approved offsite disposal area. No rubbish or debris of any kind shall be buried on the site.
- B. Burning of cleared and grubbed materials or other fires for any reason will not be permitted.

### 3.05 PROTECTION

- A. Trees and other vegetation designated on the Drawings or directed by the Engineer to remain shall be protected from damage by all construction operations by erecting suitable barriers, guards and enclosures, or by other approved means. The Contractor shall conduct clearing operations in a manner to prevent falling trees from damaging trees and vegetation designated to remain and to the work being constructed. The Contractor shall provide for the safety of employees and others.
- B. The Contractor shall maintain protection until all work in the vicinity of the work being protected has been completed.
- C. The Contractor shall not operate heavy equipment or stockpile materials within the branch spread of existing trees.
- D. The Contractor shall immediately repair any damage to existing tree crowns, trunks, or root systems. Roots exposed and/or damaged during the work shall immediately be cut off cleanly inside the exposed or damaged area. Treat cut

surfaces with an acceptable tree wound paint and topsoil spread over the exposed root area.

- E. When work is completed the Contractor shall remove all dead and downed trees. Live trees shall be trimmed of all dead and diseased limbs and branches. All cuts shall be cleanly made at their juncture with the trunk or preceding branch without injury to the trunk or remaining branches. Cuts over 1 inch in diameter shall be treated with an acceptable tree wound paint.
- F. The Contractor shall restrict construction activities to those areas within the limits of construction designated on the Drawings, within public rights-of-way, and within easements provided by the Owner. Adjacent properties and improvements on these properties, public or private, which become damaged by construction operations shall be promptly restored to their original condition to the full satisfaction of the property owner.
- G. The Contractor shall remove trees damaged beyond saving, through no fault of the Contractor, as directed by the Engineer.

END OF SECTION



SECTION 02240  
DEWATERING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section covers the work necessary to complete the dewatering activities. All work in this Section shall be done in accordance with the requirements of the Environmental Resource Permit as issued by the FDEP.
- B. In addition to the requirements listed in this Section, the Contractor shall obtain, if required, and comply with all requirements of the Generic Permit for the Discharge of Ground Water From Any Non-Contaminated Site Activity as described in FAC 62-621-300.
- C. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control groundwater flow into excavations and permit construction to proceed on dry, stable subgrades.
  - 1. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
  - 2. Prevent surface water from entering excavations by grading, dikes, or other means.
  - 3. Remove dewatering system if no longer needed.
- D. The Contractor shall dewater so as to prevent damage to existing work. The Contractor shall repair or replace damage resulting from the dewatering activities promptly, remedy environmental damage as approved by the Engineer, and pay any and all fines levied to Contractor at no additional cost or time to the Owner.
- E. The Dewatering Plan shall be signed and sealed by the licensed professional engineer responsible for its preparation.
- F. The Contractor shall design the dewatering system. The Contractor shall be responsible for obtaining whatever investigations are necessary, before bidding, to design the dewatering system.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance
- B. Section 01350, Environmental Protection Procedures and the Contract Drawings.

- C. Section 01650, Delivery, Storage, and Handling.
- D. Section 01780, Warranties and Bonds.

### 1.03 SUBMITTALS

The Contractor shall submit the following in accordance with Section 01330, Submittals and Acceptance:

- A. Before construction, the Contractor shall obtain a dewatering permit from the St. John's River Water Management District as required. At a minimum, the dewatering plan submitted with the dewatering application shall include the following:
  - 1. Duration of dewatering for each area.
  - 2. Number and size of pumps.
  - 3. Method of dewatering each area.
  - 4. Methods for routing/containing the discharge.
  - 5. Methods of isolating dewatering areas.
  - 6. Time dewatering structure will be in place.
  - 7. Proposed discharge points.

Five copies of the plan shall be submitted to the Engineer for record purposes only.

- B. The Contractor shall be responsible for determining if a Water Use Permit will be required. If a Water Use Permit is required, it is the Contractor's responsibility to obtain the required information from the Engineer and Owner to complete the Water Use Permit application to submit with the Dewatering Plan. If a Water Use Permit is required, the Contractor shall submit five copies of the application to the Owner/Engineer for submittal purposes only.
- C. The Contractor shall be responsible for obtaining a Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity as set forth in FDEP Rule 62-621.300(2), FAC. The Contractor shall obtain the required permit form 62-621.300(2) and the required information from the Engineer and Owner to complete the Generic Permit for the Discharge of Produced Ground Water from any Non-Contaminated Site Activity application to submit with the Dewatering Plan. The Contractor shall submit five copies of the application to the Owner/Engineer for submittal purposes only.
- D. Provide photographs or videotape, sufficiently detailed, of existing conditions of adjoining properties, facilities, and other construction and site improvements that might be later misconstrued as damage caused by dewatering operations.

E. Submit Record Drawings at Project closeout identifying and locating utilities and other subsurface structural, electrical, or mechanical items encountered during dewatering.

1. Note locations and capping depth of wells and well points.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS (NOT USED)

#### 1.06 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.
- B. Pre-installation Conference: Conduct conference at the Project site to present and discuss dewatering means, methods, and monitoring program.
- C. Identify a person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly familiar with the dewatering system being installed for this Project, the referenced standards, environmental and permit requirements, the requirements of this Work, and who shall direct all work performed under this section.
- D. It shall be the responsibility of the Contractor to determine the water levels before and during the dewatering work.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS

- A. The Contractor shall provide at least one person who shall be present at all times during the execution of this portion of the Work and who shall be thoroughly familiar with the dewatering system being installed, the referenced standards, the

requirements of this Work, and who shall direct all work performed under this Section.

- B. The Contractor shall be responsible for determining the water level before beginning excavation and construction.

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 MAINTENANCE (NOT USED)

#### 1.12 RECORD DRAWINGS (NOT USED)

#### 1.13 PRE-BID INSPECTION AND TESTING

- A. The Contractor is advised that site soil borings, if any, may indicate groundwater levels below the levels which may occur in response to normal, seasonal, extreme, or prolonged rainfall. The Contractor is further advised that site soil borings may not necessarily represent soil conditions to be encountered elsewhere on the job site, other than at the specific boring locations.
- B. Before bidding, the Contractor shall perform a detailed site inspection and, if desired, obtain the Owner's permission to perform site-specific testing as he deems necessary to obtain all required information relative to project dewatering requirements.
- C. The Contractor shall include as part of his Bid the total cost of all surface and subsurface dewatering as required to construct the Project in complete compliance with the Drawings and these Specifications.

#### 1.14 PROJECT CONDITIONS

- A. The Contractor shall not interrupt utilities serving facilities occupied by Owner or others unless approved by the Owner and Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
- B. A geotechnical report has been prepared for this Project and is available for information only. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by the geotechnical engineer. The Owner will not be responsible for interpretations or conclusions drawn from these data.
  - 1. The geotechnical report is included in an Appendix section of these specifications.

2. Make additional test borings and conduct other exploratory operations necessary for dewatering.
- C. Survey adjacent structures and improvements, employing a professional land surveyor licensed in Florida to establish exact elevations at fixed points to monitor settlement. Clearly identify monitoring points and reference vertical datum, and benchmarks. Monitor and record existing initial elevations.
1. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify the Engineer if changes in elevations occur or if cracks, sags, or other damage is evident in adjacent construction and existing structures.

## PART 2 PRODUCTS (NOT USED)

## PART 3 EXECUTION

### 3.01 DEWATERING SYSTEM

- A. The dewatering system shall be adequate to drain the soils to be excavated to the extent that the piezometric water level in the construction area is a minimum of 2 feet below the bottom of the excavation, side slopes of excavations, or bottom of the footings at all times, or as otherwise required to obtain the specified compaction and installation conditions. Pipeline trenches must be dewatered at least 1 foot below the trench bottom.
- B. If layered soils are encountered, the hydrostatic head in the zone below the subgrade elevation shall be relieved to prevent uplift.
- C. Unless otherwise noted and before any excavating below or within 2 feet above the groundwater level, a dewatering system shall be placed into operation to lower water levels to the extent specified previously and then shall be operated continuously 24 hours a day, 7 days a week, throughout the excavation to maintain and protect all work until the work has been completed to the satisfaction of the Engineer.
- D. Where used, well points shall be installed in an Engineer-approved manner and in sufficient numbers to provide the necessary removal of water as stated previously. Well points and header piping shall be installed so that traffic on public thoroughfares and site access roads will not be impeded.
- E. The Contractor shall be solely responsible for the arrangement, location, and depths of the dewatering system necessary to accomplish the specified work. The

dewatering system shall stay in full operation until not less than 90% of the total building load is applied, as will be determined by the Engineer, or until excavations and trenches have been backfilled and compacted.

- F. To prevent excessive noise, exhaust from all pumps and engines shall be silenced and muffled.
- G. Wellpoint or surface water pump discharge shall be controlled to prevent erosion, undermining, and all other damage and be piped to approved locations.
- H. With the Engineer's assistance, the Contractor is responsible for determining what approvals and permits are required to comply with any and all applicable regulations and permitting requirements relating to dewatering activities. With the Engineer's assistance the Contractor shall obtain all necessary approvals and permits and comply with any and all applicable regulations and permitting requirements concerning all dewatering activities, including pumpage and discharge. The Contractor is solely responsible for all costs associated with the proper implementation of dewatering activities.
- I. The Contractor shall perform all dewatering work in strict compliance with Section 01350, Environmental Protection Procedures and the Contract Drawings.
- J. Excavations shall be kept free from water during the placing of concrete and for 36 hours after or until concrete forms are removed.
- K. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.
  - 1. Prevent surface water and subsurface or groundwater from entering excavations, ponding on prepared subgrades, or flooding the site and surrounding area.
  - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- L. Install dewatering system to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.
  - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from the Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

- M. Install sufficient dewatering equipment to drain water-bearing strata above and below the bottom of foundations. If excavating through layered soils, relieve any potential groundwater hydrostatic head in the zones below to prevent uplift.
  - 1. Open-sump pumping which leads to loss of fines, subgrade softening, and slope instability shall not be permitted.
- N. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids flooding or accumulation on private property. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

### 3.02 OBSERVATION WELLS

- A. The Contractor shall install observation wells as may be required to record accurate water levels.
- B. The Contractor shall be responsible for maintaining all observation wells and observing and recording the elevation of the piezometric water levels daily.
- C. Wells damaged or destroyed shall be replaced at no additional cost to the Owner.

### 3.03 CLEANUP

- A. Upon completing dewatering elsewhere on the Project, the Contractor shall remove all equipment and leave the project site in a neat, clean, and acceptable condition satisfactory to the Owner. Wellpoint holes and excavations shall be adequately backfilled and compacted to prevent settlement.

END OF SECTION

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SECTION 02300  
EARTHWORK FOR STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, equipment, tools, appliances, and materials and perform all operations necessary for the following:
  - 1. Preparing subgrades for slab-on-grade, walks, pavements, and lawns and grasses.
  - 2. Excavating and backfilling for buildings and structures.
  - 3. Laying the subbase course for concrete sidewalks and pavements.
  - 4. Excavating and backfilling for utility trenches.
  - 5. Excavating and backfilling for trenches for buried mechanical and electrical utilities and pits for buried utility structures, as indicated on the Contract Drawings and described in this Section.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01350, Environmental Protection Procedures.
- C. Section 01500, Temporary Facilities and Controls.
- D. Section 01650, Delivery, Storage, and Handling
- E. Section 01780, Warranties and Bonds.
- F. Section 02230, Site Preparation.
- G. Section 02240, Dewatering.
- H. Section 03300, Cast-in-Place Concrete.

1.03 SUBMITTALS

The Contractor shall submit the following shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
  - 1. Classification according to ASTM D2487 of each onsite and borrow soil material proposed for fill and backfill.
  - 2. Laboratory compaction curve according to ASTM D1557 for each onsite and borrow soil material proposed for fill and backfill.

- B. The Contractor shall submit records before the start of this work. The Contractor shall verify that the existing conditions are correct as shown on the plans and mentioned in these Specifications. The Contractor shall note any discrepancies found immediately and notify the Owner and Engineer.

The records shall include the following:

1. The location of all underground utilities, structures, etc. surrounding the areas to be excavated that may be impacted by the work.
2. The location of test excavations.
3. The location of inspections.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C33—Standard Specification for Concrete Aggregates.
2. ASTM D698—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>)).
3. ASTM D1556—Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
4. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
5. ASTM D2167—Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
6. ASTM D2487—Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
7. ASTM D2937—Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
8. ASTM D2940—Standard Specification for Graded Aggregate Material For Bases or Subbases for Highways or Airports.
9. ASTM D3740—Standard Practice for Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction.

10. ASTM D6938—Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
11. ASTM E329—Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

## 1.06 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E329 to conduct soil materials and definition testing, as documented according to ASTM D3740.
- B. The Contractor shall do the following:
  1. Ensure that excavations provide adequate working space and clearance for the work to be performed and for installing piping and buried utilities. In no case shall excavation faces be undercut.
  2. Ensure that foundation surfaces are clean and free of loose material of any kind when pipelines and buried utilities are placed on them.
  3. Excavate, trench, and backfill in compliance with applicable requirements of governing authorities having jurisdiction.
  4. Ensure that shoring and sheeting for excavations are designed by a Florida-registered Professional Engineer and are in accordance with the Occupational Safety and Health Administration (OSHA) Document 2226, *Safe Working Practices—Excavating and Trenching*.
  5. Before beginning any excavation or grading, ensure the accuracy of all survey data indicated on the Contract Drawings and in the Specifications and/or as provided. If the Contractor discovers any inaccuracies, errors, or omissions in the survey data, the Contractor shall immediately notify the Owner so that proper adjustments can be anticipated or ordered. If the Contractor begins any excavation or grading, this shall be considered an acceptance of the survey data by the Contractor, after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the survey data.
  6. Ensure that tolerances for excavation are plus or minus 0.10 foot to the required line and to the required grade. Tolerance for compaction of in-place material shall be plus or minus 0.10 foot to the required grade, unless otherwise noted.
  7. Remove unsatisfactory materials and unsuitable materials including muck, silts, peat, and other loose and very loose compressible soils from excavations before placing pipe foundation, bedding, and buried utilities.

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 MAINTENANCE (NOT USED)

## 1.12 RECORD DRAWINGS (NOT USED)

## 1.13 PROJECT CONDITIONS

- A. Existing Utilities: The Contractor shall not interrupt utilities serving facilities occupied by the Owner or others unless permitted to do so in writing by the Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
  - 1. Notify the Engineer not less than 2 days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without the Engineer's written permission.
  - 3. Contact a utility-locator service and obtain utility locations for the Project area before excavating.
- B. The Contractor shall demolish and completely remove from the site underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

## 1.14 DEFINITIONS

- A. *Backfill*: Soil material or controlled low-strength material used to fill an excavation.
  - 1. *Initial Backfill*: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. *Final Backfill*: Backfill placed over initial backfill to fill a trench.
- B. *Base Course*: The course placed between the subbase course and hot-mix asphalt paving.
- C. *Bedding Course*: The course placed over the excavated subgrade in a trench before laying pipe.
- D. *Borrow Soil*: Satisfactory soil imported from off-site for use as fill or backfill.
- E. *Drainage Course*: The course supporting the slab-on-grade that also minimizes the upward capillary flow of pore water.
- F. *Excavation*: Removing material encountered above subgrade elevations and to lines and dimensions indicated.
1. *Authorized Additional Excavation*: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Engineer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices.
  2. *Unauthorized Excavation*: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Engineer. Unauthorized excavation as well as remedial work directed by the Engineer shall be without additional compensation.
- G. *Fill*: Soil materials used to raise existing grades.
- H. *Structures*: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- I. *Subgrade*: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- J. *Utilities*: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

## PART 2 PRODUCTS

### 2.01 SOIL MATERIALS

- A. *General*: The Contractor shall provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

- B. Satisfactory Soils: ASTM D2487 Soil Classification Groups SW and SP or a combination of these groups, free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsuitable Soils: Soil Classification Groups GW, GP, GM, GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D2487, or a combination of these groups.
  - 1. Unsuitable soils also include satisfactory soils not maintained within 2% of optimum moisture content at time of compaction.
- D. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 95% passing a 1-1/2-inch sieve and not more than 8% passing a No. 200 sieve.
- E. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; with at least 90% passing a 1-1/2-inch sieve and not more than 12% passing a No. 200 sieve.
- F. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D2940; except with 100% passing a 1-inch sieve and not more than 8% passing a No. 200 sieve.
- G. Sand: ASTM C33; fine aggregate, natural, or manufactured sand.
- H. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. The Contractor shall protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. The Contractor shall prepare subgrade for earthwork operations including removing vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface as specified in Section 02230, Site Preparation.
- C. The Contractor shall protect and maintain erosion and sedimentation controls, which are specified in Section 01350, Environmental Protection Procedures.

### 3.02 DEWATERING

- A. The Contractor shall prevent surface water and groundwater from entering excavations, from ponding on prepared subgrades, and from flooding the Project site and surrounding area.
- B. The Contractor shall protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
  - 1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
  - 2. Install a dewatering system, specified in Section 02240, Dewatering, to keep subgrades dry and convey groundwater away from excavations. Maintain until dewatering is no longer required.

### 3.03 EXPLOSIVES

- A. Explosives: Do not use explosives.

### 3.04 EXCAVATION, GENERAL

- A. Unclassified Excavation: The Contractor shall excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.
  - 1. If excavated materials intended for fill and backfill include unsuitable soil materials, replace with satisfactory soil materials.

### 3.05 EXCAVATION FOR STRUCTURES

- A. The Contractor shall excavate to indicated elevations and dimensions within a tolerance of plus or minus 0.10 foot. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
  - 1. Excavations for Footings and Foundations: Do not disturb the bottom of the excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
  - 2. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within

a tolerance of plus or minus 0.10 foot. Do not disturb the bottom of excavations intended as bearing surfaces.

### 3.06 EXCAVATION FOR WALKS AND PAVEMENTS

- A. The Contractor shall excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

### 3.07 SUBGRADE INSPECTION AND PREPARATION

- A. The Contractor shall notify the Engineer when excavations have reached the required subgrade.
- B. If the Engineer determines that unsuitable soil is present, the Contractor shall continue excavation and replace with compacted backfill or fill material as directed.
- C. Prepare subgrade for earthwork operations by removing roots, organics, debris, stumps, and other deleterious materials.
- D. The Contractor shall proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
  - 1. Completely proof-roll the subgrade in one direction, repeating proof-rolling in the direction perpendicular to the first direction. Limit vehicle speed to 3 miles per hour (mph).
  - 2. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by the Engineer, and replace with compacted backfill or fill as directed.
- E. Authorized additional excavation and replacement material will be paid for according to Contract provisions for unit prices or additional work.
- F. As directed by the Engineer, the Contractor shall reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities without additional compensation.

### 3.08 UNAUTHORIZED EXCAVATION

- A. The Contractor shall fill unauthorized excavation under foundations or wall footings by extending the bottom elevation of concrete foundation or footing to the excavation bottom without altering top elevation. Lean concrete fill, with



28-day compressive strength of 2,500 psi, may be used when approved by the Engineer.

1. Fill unauthorized excavations under other construction or utility pipe as directed by the Engineer.

### 3.09 STORAGE OF SOIL MATERIALS

A. The Contractor shall stockpile excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water.

1. Stockpile soil materials away from edge of excavations. Do not store within the drip line of remaining trees.

### 3.10 BACKFILL

A. The Contractor shall place and compact backfill in excavations promptly, but not before completing the following:

1. Constructing below finish grade, including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
2. Surveying locations of underground utilities for Record Documents.
3. Testing and inspecting underground utilities.
4. Removing concrete formwork.
5. Removing trash and debris.
6. Removing temporary shoring, bracing, and sheeting.
7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. The Contractor shall place backfill on subgrades free of mud.

### 3.11 SOIL FILL

A. The Contractor shall plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. The Contractor shall place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under building slabs, use engineered fill.
4. Under footings and foundations, use engineered fill.

- C. The Contractor shall place soil fill on subgrades free of mud.

### 3.12 SOIL MOISTURE CONTROL

- A. The Contractor shall uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compacting to within 2% of optimum moisture content.
  - 1. Do not place backfill or fill soil material on surfaces that are muddy.
  - 2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2% and is too wet to compact to the specified dry unit weight.

### 3.13 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. The Contractor shall place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. The Contractor shall place backfill and fill soil materials evenly on all sides of structures to required elevations and uniformly along the full length of each structure.
- C. The Contractor shall compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D698:
  - 1. Under structures, building slabs, steps, and pavements, scarify and recompact the top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95%.
  - 2. Under walkways, scarify and recompact the top 6 inches below subgrade and compact each layer of backfill or fill soil material at 92%.
  - 3. Under lawn or unpaved areas, scarify and recompact the top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90%.

### 3.14 GRADING

- A. General: The Contractor shall uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
  - 1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
1. Lawn or Unpaved Areas: Plus or minus 1 inch.
  2. Walks: Plus or minus 1 inch.
  3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

### 3.15 FIELD QUALITY CONTROL

- A. The number and location of the tests shall be as specified in these Specifications and as directed by the Engineer during construction.
- B. The Contractor shall coordinate activity with the Engineer and the testing agency to permit testing as directed in the presence of the Engineer.
- C. The cost of all testing to achieve specified requirements shall be borne by the Contractor. The Contractor shall include the cost of testing in the Bid Items.
- D. The costs of any and all retests due to failure to achieve specified requirements shall be solely borne by the Contractor and are not reimbursable under this Contract.
- E. All materials proposed for use shall be tested as follows:

Material	Required Test	Min No. Tests
Satisfactory Soil Materials	Soil Classification using ASTM D2487 (including all tests contained therein)	One per source of materials to determine conformance with materials specified herein; additional test whenever there is any apparent change.
	Soil moisture-density relationship using Modified Proctor ASTM D1557	One per source of material or apparent change in material.

- F. The Contractor shall allow the testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after the test results for previously completed work comply with requirements.
- G. Footing Subgrade: At footing subgrades, the testing agency will perform at least one test of each soil stratum to verify design-bearing capacities. Subsequent

verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Engineer.

- H. The testing agency will test compaction of soils in place according to ASTM D1556, ASTM D2167, ASTM D2937, and ASTM D6938 as applicable. Tests will be performed at the following locations and frequencies:
1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2,000 square feet or less of paved area or building slab, but in no case fewer than three tests.
  2. Foundation Wall Backfill: At each compacted backfill layer, at least one test for each 100 feet or less of wall length but no fewer than two tests.
- I. When the testing agency reports that subgrades, fills, or backfills have not achieved the degree of compaction specified, the Contractor shall scarify and moisten or aerate or remove and replace soil to the depth required and recompact and retest until specified compaction is obtained.
- J. The approved testing agency shall transmit copies of field testing results as follows:
1. One copy to the Owner.
  2. One copy to the Engineer.
  3. Two copies to the Contractor.
- The field test reports shall include, at a minimum, project title; project location; location of sample(s) tested; time of testing; date of testing; testing person's full name; testing agency name, address, and telephone number; and test results.
- K. No soil material shall be used until (1) the Engineer has reviewed and approved test reports and (2) the Contractor submits certification that the soil material proposed for construction is clean and meets gradation and other parameters specified in this Specification.
- L. At no cost to the Owner, the Contractor shall remove and replace or correct all materials and work which tests indicate do not conform, in the opinion of the Engineer, to the requirements of these Specifications.
- M. The results of in-place density tests shall be considered satisfactory if the density in each instance is equal to or greater than the specified density. Soil moisture content at the time of testing shall conform to requirements of these Specifications.

- N. Where unsatisfactory compaction is revealed by the tests, the Contractor shall re-excavate, backfill, recompact, and/or rework the backfill as required to obtain the required degree of compaction over the entire depth of the excavation.
- O. The testing agency shall transmit to the Engineer copies of all testing agency invoices submitted to the Contractor for payment. Invoices shall clearly indicate specific services and date and time services are rendered and shall indicate if the invoiced testing cost is an initial test of the Contractor's work or is a re-test required due to the Contractor's failure to initially achieve the specified requirements.

### 3.16 PROTECTION

- A. Protecting Graded Areas: The Contractor shall protect newly graded areas from traffic and erosion and keep them free of trash and debris.
- B. The Contractor shall repair and reestablish grades to the specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.
  - 1. Scarify or remove and replace soil material to depth as directed by the Engineer and reshape and recompact.
- C. Where settling occurs before the Project Correction Period elapses, The Contractor shall remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
  - 1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to the greatest extent possible.

### 3.17 DISPOSAL OF SURPLUS AND WASTE MATERIALS

- A. Disposal: The Contractor shall transport surplus satisfactory soil to designated storage areas on the Owner's property and stockpile and spread this soil as directed by the Engineer.
  - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off the Owner's property.

END OF SECTION

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SECTION 02305  
EARTHWORK FOR UTILITIES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide all materials, equipment, labor, and work necessary to completely construct the project in accordance with the Contract Documents. This work includes but is not limited to the following:
1. Excavating and removing unsatisfactory materials.
  2. Preparing trench foundations.
  3. Providing satisfactory material for all trenches as specified and as required.
  4. Obtaining, storing, maintaining, and disposing of materials.
  5. Dewatering, shoring, and sheeting.
  6. Placing, compacting, testing, final grading, and demolishing subgrade.
  7. Performing all other work required by the Contract Documents.
- B. The Contractor is responsible for performing all work so as not to damage existing roadways, facilities, utilities, structures, etc. and shall repair and replace such damage to equal or better than its original undamaged condition without cost to the Owner.
- C. The Contractor shall examine the site before submitting a bid, taking into consideration all conditions that may affect the work.
- D. The Contractor shall coordinate all additional subsurface investigations and testing included with this work with the Engineer before performing the excavation and foundation preparation work. In general, if the Contractor finds different and unsuitable/unsatisfactory soil conditions during the work, the Contractor shall notify the Engineer and the Owner immediately.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01350, Environmental Protection Procedures.
- C. Section 01650, Delivery, Storage, and Handling.
- D. Section 01780, Warranties and Bonds.
- E. Section 02230, Site Preparation.
- F. Section 02300, Earthwork for Structures.
- G. Section 02240, Dewatering.

### 1.03 SUBMITTALS

The Contractor shall submit the following shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
  - 1. Classification according to ASTM D2487 of each on site and borrow soil material proposed for fill and backfill.
  - 2. Laboratory compaction curve according to ASTM D1557 for each onsite and borrow soil material proposed for fill and backfill.
- B. The Contractor shall submit records before the start of this work. The Contractor shall verify that the existing conditions are correct as shown on the plans and mentioned in these Specifications. The Contractor shall note any discrepancies found immediately and notify the Owner and Engineer.

The records shall include the following:

- 1. Location of all existing underground utilities, structures, etc. surrounding the areas to be excavated that may be impacted by the work.
- 2. Location of test excavations.
- 3. Location of inspections.

### 1.04 WORK SEQUENCE (NOT USED)

### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply:

- A. OSHA Excavation Safety Standards, 29 CFR 1926, Subpart P
- B. Florida Trench Safety Act (90-96, Laws of Florida)
- C. American Society for Testing and Materials (ASTM)
  - 1. ASTM D1556—Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.



2. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
3. ASTM D2937—Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method.
4. ASTM D2487—Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D3282—Standard Practice for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes.
6. ASTM D3740—Standard Practice for Evaluation of Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used In Engineering Design and Construction.
7. ASTM D6938—Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).
8. ASTM E329—Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

D. American Wood Protection Association (AWPA)

1. AWPA C1—All Timber Products—Preservative Treatment by Pressure Processes.
2. AWPA C3—Piles – Preservative Treatment by Pressure Processes.

## 1.06 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E329 to conduct soil materials and definition testing, as documented according to ASTM D3740.
- B. The Contractor shall do the following:
  1. Ensure that excavations provide adequate working space and clearance for the work to be performed and for installing piping and buried utilities. In no case shall excavation faces be undercut.
  2. Ensure that foundation surfaces are clean and free of loose material of any kind when pipelines and buried utilities are placed on them.
  3. Excavate, trench, and backfill in compliance with applicable requirements of governing authorities having jurisdiction.
  4. Ensure that shoring and sheeting for excavations are designed by a Florida-registered Professional Engineer and are in accordance with the Occupational Safety and Health Administration (OSHA) Document 2226, *Safe Working Practices—Excavating and Trenching*.
  5. Before beginning any excavation or grading, ensure the accuracy of all survey data indicated on the Contract Drawings and in these Specifications

and/or as provided. If the Contractor discovers any inaccuracies, errors, or omissions in the survey data, the Contractor shall immediately notify the Owner so that proper adjustments can be anticipated or ordered. If the Contractor begins any excavation or grading, this shall be considered an acceptance of the survey data by the Contractor, after which time the Contractor has no claim against the Owner resulting from alleged errors, omissions, or inaccuracies of the survey data.

6. Ensure that tolerances for excavation are  $\pm 0.10$  foot to the required line and to the required grade. Tolerance for compaction of in-place material shall be  $\pm 0.10$  foot to the required grade.
7. Ensure that all trench materials derived from the project site and imported to this site are examined, tested, and classified by an Engineer-approved soils testing laboratory.
8. Remove unsatisfactory materials and unsuitable materials including muck, silts, peat, and other loose and very loose compressible soils from excavations before placing pipe foundation, bedding, and buried utilities.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 PROJECT CONDITIONS

- A. Existing Utilities: The Contractor shall not interrupt utilities serving facilities occupied by the Owner or others unless permitted to do so in writing by the Engineer and then only after arranging to provide temporary utility services according to the requirements indicated.
  1. Notify the Engineer not less than 2 days in advance of proposed utility interruptions.
  2. Do not proceed with utility interruptions without the Engineer's written permission.
  3. Contact utility-locator service and obtain utility locations for the Project Area before excavating.

- B. The Contractor shall demolish and completely remove from the site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

## 1.11 DEFINITIONS

- A. *Backfill*: Soil material or controlled low-strength material used to fill an excavation.
  - 1. *Initial Backfill*: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.
  - 2. *Final Backfill*: Backfill placed over initial backfill to fill a trench.
- B. *Base Course*: The course placed between the subbase course and hot-mix asphalt paving.
- C. *Bedding Course*: The course placed over the excavated subgrade in a trench before laying pipe.
- D. *Borrow Soil*: Satisfactory soil imported from off-site for use as fill or backfill.
- E. *Drainage Course*: The course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. *Excavation*: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
  - 1. *Authorized Additional Excavation*: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Engineer. Authorized additional excavation and replacement material will be paid for according to the Contract provisions for unit prices.
  - 2. *Bulk Excavation*: Excavation more than 10 feet in width and more than 30 feet in length.
  - 3. *Unauthorized Excavation*: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Engineer. Unauthorized excavation, as well as remedial work directed by the Engineer, shall be without additional compensation.
- G. *Fill*: Soil materials used to raise existing grades.
- H. *Structures*: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

- I. *Subgrade*: The surface or elevation remaining after completing excavation, or the top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- J. *Utilities*: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.12 TESTING REQUIREMENTS

- A. The Contractor shall furnish a soil survey for satisfactory material and samples of materials.
- B. Testing for source material, for classification, and for prequalification of material (on or off site) shall be performed by an independent testing agency retained by the Contractor and approved by the Engineer.
- C. Testing for in-place compacted fill shall be performed by the same independent testing agency as approved by the Engineer and retained by the Contractor.
- D. The number and location of the tests shall be as specified in these Specifications and as directed by the Engineer during construction.
- E. The Contractor shall coordinate activity with the Engineer and the testing agency to permit testing as directed in the presence of the Engineer.
- F. The cost of all testing to achieve specified requirements shall be borne by the Contractor. The Contractor shall include the cost of testing in the Bid Items.
- G. The costs of any and all retests due to failure to achieve specified requirements shall be solely borne by the Contractor and are not reimbursable under this contract.
- H. All materials proposed for use shall be tested as follows:

Material	Required Test	Min. No. Tests
Satisfactory Soil Materials	Soil Classification using ASTM D2487 (including all tests contained therein)	One per source of materials to determine conformance with materials specified in these Specifications; additional tests whenever there is any apparent change.
	Soil moisture-density relationship using Modified Proctor ASTM D1557	One per source of material or apparent change in material.

I. Soil materials shall be tested during construction as follows:

Material	Required Test	Min. No. Tests
Satisfactory Soil Material in-place after compaction	Field Density ASTM D1556-Sand Cone Method, or ASTM D6938-Nuclear Density Method, or ASTM D2937-Drive Cylinder Method	For each layer of trench bottom subgrade before addition of soil materials, refill, bedding, and backfill, and for each 400 lineal feet of trench or fraction thereof, whichever is greater; two tests for each drainage, manhole, or wet well structure; additional test whenever there is any change in native soil, groundwater, or soil moisture conditions.

J. The approved testing agency shall transmit copies of required laboratory test results as follows:

1. One copy to the Owner.
2. One copy to the Engineer.
3. Two copies to the Contractor.

The laboratory test reports shall include, at a minimum, project title; project location; location of sample; source, time, and date of testing; testing agency's name, address, and telephone number; and test results. Each test report shall be signed and sealed by the Professional Engineer representing the testing agency as specified in these Specifications.

K. The approved testing agency shall transmit copies of field testing results as follows:

1. One copy to the Owner.
2. One copy to the Engineer.
3. Two copies to the Contractor.

The field test reports shall include, at a minimum, project title; project location; location of sample(s) tested; time of testing; date of testing; testing person's full name; testing agency name, address, and telephone number; and test results.

L. No soil material shall be used until 1) the Engineer has reviewed and approved test reports and 2) the Contractor submits certification that the soil material proposed for construction is clean and meets gradation and other parameters specified in these Specifications.

M. At no cost to the Owner, the Contractor shall remove and replace or correct all materials and work which tests indicate do not conform, in the opinion of the Engineer, to the requirements of these Specifications.

- N. The results of in-place density tests shall be considered satisfactory if the density in each instance is equal to or greater than the specified density. Soil moisture content at the time of testing shall conform to requirements of these Specifications.
- O. Where the tests reveal unsatisfactory compaction, the Contractor shall re-excavate, backfill, recompact, and/or rework the backfill as required to obtain the required degree of compaction over the entire depth of the excavation.
- P. The testing agency shall transmit to the Engineer copies of all testing agency invoices submitted to the Contractor for payment. Invoices shall clearly indicate specific services and date and time services are rendered and shall indicate if the invoiced testing cost is an initial test of the Contractor's work or is a re-test required due to the Contractor's failure to initially achieve the specified requirements.

1.13 MAINTENANCE (NOT USED)

1.14 RECORD DRAWINGS (NOT USED)

PART 2 PRODUCTS

2.01 STRUCTURAL MATERIALS

- A. Materials used for shoring and bracing, such as sheet piling, uprights, stringers, and crossbraces, shall be in good serviceable condition. Any timber used shall be sound and free from large or loose knots.
- B. Pressure-treated timber shall be used where wood sheeting or piling is specified or indicated to be cut and left in place.

2.02 TRENCH SOIL MATERIALS

- A. Materials used for trench construction shall be free of clumps of clay, rock or gravel, debris, waste, frozen materials, and other deleterious matter as determined by the Engineer and shall be satisfactory soil materials as follows:

Area Classification	Soil Materials
In excavations and trenches	Excavated and borrow material that has been sampled, tested, and approved as "Satisfactory Soil Material."

B. Satisfactory Soil Materials

1. Soil Classification Groups

Satisfactory soil materials for each trench shall be as follows:

Satisfactory Soil Material (ASTM D3282, Soil Classification Groups)		
In-situ Foundation	Bedding, Haunching, and Initial Backfill	Final Backfill
SW SP	SW SP	SW SP

2. Maximum Particle Size Limitations for Satisfactory Soil Materials

The maximum allowable particle size for satisfactory soil materials within each trench for each type of utility shall be as follows:

Conduit	Maximum Allowable Particle Size		
	In-situ Foundation	Bedding, Haunching, and Initial Backfill	Final Backfill
Plastic Pipe (PVC, CPVC, HDPE, etc.) less than 6-inch-diameter	See Note 1	1/2 inch	3 inches
Plastic Pipe (PVC, CPVC, HDPE, etc.) 6-inch-diameter and Larger	See Note 1	3/4 inch	3 inches
Concrete Pipe			
Steel Pipe			
Ductile Iron Pipe			
Fiberglass Pipe	See Note 1	3/4 inch or three times the wall thickness, whichever is less	3 inches
Other Conduit Materials	See Note 2	See Note 2	See Note 2

- (1) There is no requirement when satisfactory undisturbed native soil material is used. Disturbed portions of the foundation and/or unsatisfactory native soil material shall be replaced with satisfactory soil materials meeting all the requirements for Bedding.
- (2) The maximum allowable particle size shall be in accordance with the manufacturer's written recommendation.

3. Additional Requirements of Satisfactory Materials

Satisfactory soil materials shall be free of debris, waste, frozen materials, vegetation, or other deleterious matter. Soils within 4 inches of the exterior surface of the pipe shall be free of gravel, stones, or other materials that may abrade the pipe surface.

C. Unsatisfactory Materials

Unsatisfactory soil materials shall mean ASTM D2487, Soil Classification Groups GW, GP, GM, GC, SC, CL, ML, OL, CH, MH, OH, and PT and other highly organic soils and soil materials of any classification that have a moisture content at the time of compaction beyond the range of 1 percentage point below and 3 percentage points above the optimum moisture content of the soil material as determined by moisture-density relations test.

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

The Contractor shall do the following:

- A. Carefully verify by hand methods the location of all surrounding underground utilities before performing utility excavations and trenches.
- B. Protect utilities to be left in place from damage.
- C. Do not interrupt existing utilities serving facilities occupied and used by the Owner, except when permitted in writing by the Owner.
- D. Protect bench marks, survey points, and existing structures, roads, sidewalks, monitoring wells, paving, curbs, etc. against damage from equipment, vehicular or foot traffic, settlement, lateral movement, undermining, washout, and all construction-related activities.
- E. Repair and replace damage to existing facilities to equal or better than their original undamaged condition without cost to the Owner and to the approval of the Engineer.
- F. Excavate and trench in ways that will prevent surface water and subsurface water from flowing into excavations and will also prevent flooding of the site and surrounding area.
- G. Protect excavations and trenching by shoring, bracing, sheet piling, underpinning, or other methods as required to prevent cave-ins or loose dirt from falling into excavations and trenches.
- H. Do not operate earth-moving equipment within 5 feet of walls of concrete structures for depositing or compacting backfill material.



- I. Compact the backfill material placed next to concrete walls with hand-operated tampers or similar equipment that will not damage the structure.
- J. Excavate, fill, backfill, and grade to elevations required by the Contract Documents.
- K. Pile excavated materials suitable for backfill in an orderly manner a sufficient distance from excavations to prevent overloading, slides, and cave-ins.
- L. Do not obstruct access ways, roadways, and plant facilities.
- M. Dewater excavations and trenches in accordance with Section 02240, Dewatering.
- N. Refer to the Contract Drawings for additional requirements related to earthwork and protection of existing features.

### 3.02 TRENCH EXCAVATION

- A. Before excavating the trench, the Contractor shall prepare the surface including clearing and grubbing as specified in Section 02230, Site Preparation.
- B. The Contractor shall be required to fully comply with all applicable OSHA Excavation Safety Standards and to abide by them as covered by the most current version of the Florida Trench Safety Act (90-96, Laws of Florida).
- C. The Contractor shall ensure that mechanical equipment used for trench excavation shall be of a type, design, and construction and shall be so operated that conduit/utility, when accurately laid to specified alignment, will be centered in the trench with adequate clearance between the conduit/utility and sidewalls of the trench. Undercutting the trench sidewall to obtain clearance will not be permitted.
- D. The Contractor shall not use mechanical equipment in locations where its operation would cause damage to trees, buildings, culverts, other existing property, utilities, structures, etc. above or below ground. In all such locations, the Contractor shall use hand excavating methods.
- E. The Contractor shall not use blasting.
- F. The Contractor shall cut trenches sufficiently wide to enable proper installation of services and to allow for testing and inspection. The Contractor shall also trim and shape trench bottoms and leave them free of irregularities, lumps, and projections. Trench width shall be excavated as specified on the Contract Drawings.

- G. The Contractor shall construct trench walls so as to avoid side wall collapse or sloughing. Trenches shall be either braced or open construction in accordance with the Contract Documents. No separate payment will be made for any special procedure used in connection with the excavation.
- H. Where sheeting and bracing are not required, the Contractor shall construct trench walls in the bottom of the excavation as vertical as possible to the maximum height allowable by OSHA. Trench walls above this height shall be sloped to guard against side wall collapse or sloughing as specified on the Contract Drawings.
- I. Where sheeting and bracing are required, the sheeting and bracing system shall meet the requirements in these Specifications.
- J. Excavations shall be to the design elevations shown on the Contract Drawings or as specified, unless unsatisfactory or unsuitable foundation materials are encountered in the bottom of the excavation. Where unsatisfactory or unsuitable foundation materials are encountered, this material shall be undercut and removed as indicated on the Contract Drawings and replaced with satisfactory soil material meeting all the requirements for Bedding. The lift thicknesses and compaction requirements for the replacement soil shall also meet the requirements for Bedding.
- K. The Contractor shall be careful not to overexcavate except where necessary to remove unsatisfactory or unsuitable materials, irregularities, lumps, rock, and projections. Unnecessary overexcavation shall be replaced as specified in these Specifications at the Contractor's sole expense.
- L. The Contractor shall accurately grade bedding soil materials at the bottoms of the trenches to provide uniform bearing and support for each section of conduit/utility at every point along its entire length except where it is necessary to excavate the bedding for conduit/utility bells (e.g., pipe bells), etc. or for proper sealing of conduit/utility joints. Abrupt changes in grade of the trench bottom shall be avoided.
- M. The Contractor shall dig bell holes and depressions after the bedding has been graded to ensure that the conduit/utility rests on the prepared bedding for as much of its full length as practicable. Bell holes and depressions shall be only of such length, depth, and width as required to make the joint.
- N. The Contractor shall do the following:
  - 1. Pile all excavated material in a manner that will not endanger the work or erode the stormwater management facilities or water courses.

2. Avoid obstructing sidewalks, driveways, and plant facilities.
  3. Leave hydrants, valve pit covers, valve boxes, or other utility controls unobstructed and accessible.
  4. Keep gutters, drainage inlets, natural water courses, and miscellaneous drainage structures clear or make other satisfactory provisions for their proper operation.
- O. The Contractor shall keep all satisfactory materials that are suitable for use/reuse in the trench construction separated from unsatisfactory materials.
- P. Except where otherwise authorized, indicated, or specified, the Contractor shall replace, at the Contractor's own expense, all materials excavated below the bottom of concrete walls, footings, slabs on grade, and foundations with concrete or flowable fill, as directed by the Engineer.
- Q. The Contractor shall adhere to these Additional Excavation Requirements for piping:
1. Excavate trenches so that the piping can be laid to the lines, grades, and elevations indicated on the Contract Drawings.
  2. For piping designated to be laid to a minimum cover requirement, grade trenches to avoid high and low points to the extent practical. Record Drawings of such pipes shall present top-of-pipe and grade elevations at all high and low points along each pipe segment, at the end points of each pipe segments, and at intervals not to exceed 100 feet along each pipe segment. If, in the opinion of the Engineer, additional air release and/or vacuum relief valves are required, the Contractor shall install the additional items as directed by the Engineer.
  3. Except at locations specifically indicated otherwise on the Contract Drawings, the required minimum cover over the top of the pipe from finished grade for various pipe diameters shall be as follows:

	Pipe Diameter			
	48 inch or less	66 inch	72 inch	96 inch
Minimum Cover	3 feet	4 feet	4.5 feet	5 feet

Continue dewatering operations along each pipe segment until the required minimum cover is provided. During the dewatering operations, the ground water level in the trench shall remain at all times a minimum of 1 foot below bottom of trench excavations.

R. The Contractor shall adhere to these Additional Excavation Requirements for Electrical Utilities:

1. Avoid abrupt changes in grade of the trench bottom.
2. The required minimum cover over the top of electrical conduits from finished grade shall be as follows:

	Electrical Conduits (Lines less than 5 kV)	Electrical Conduits (Lines 5 kV and up)
Minimum Cover	2 feet	3 feet

3. The required minimum clearance from the bottom of mat foundations and/or footings shall be 2 feet. Provide additional cover where necessary to satisfy the minimum clearance requirement.
4. Provide additional cover depth if necessary to avoid interference of other cables, ducts, piping, structures, and other utilities.

S. The Contractor shall adhere to this Additional Excavation Requirement for Appurtenances:

1. Ensure that excavations for valves and similar appurtenances shall be sufficient to leave at least 12 inches in the clear between the outer surfaces and the embankment or timber used to hold and protect the walls.

### 3.03 PROTECTION OF PERSONS AND PROPERTY

A. The Contractor shall do the following:

1. Barricade and post excavations with warning signs for the safety of persons. Provide warning lights during hours of darkness.
2. Protect structures, utilities, sidewalks, pavements, and other facilities immediately adjacent to excavations against damage including loading, settlement, lateral movement, undermining, and washout.

B. Conduct topsoil removal operations to ensure the safety of persons and to prevent damage to existing structures and utilities, construction in progress, trees and vegetation to remain standing, and other property.

### 3.04 SHEETING AND BRACING

A. Where sheeting and bracing are required to support the side walls of the excavation, the Contractor shall retain a Professional Engineer, registered in

Florida, to design sheeting and bracing. The design shall establish requirements for sheeting and bracing and shall comply with all applicable codes; authorities having jurisdiction; and federal, state, and local regulations.

- B. The sole responsibility for the design, methods of installation, and adequacy of sheeting and bracing shall be and shall remain that of the Contractor and the Contractor's Professional Engineer. The Contractor shall provide all necessary sheeting and bracing or other procedures as required to ensure safe working conditions and to protect the excavations.
- C. Sheeting and bracing shall consist of braced steel sheet piling, trench box, braced wood lagging, and soldier beams or other approved methods.
- D. The Contractor shall immediately fill and compact voids formed outside the sheeting. Where soil cannot be properly compacted to fill the void, the Contractor shall use Class B concrete as backfill at no additional cost to the Owner.
- E. The Contractor shall install sheeting outside the required clearances and dimensions. Sheeting shall be plumb, securely braced, and tied in position. Sheeting shall be adequate to withstand all pressure to which it may be subjected. The Contractor shall correct any movement or bulging at no expense to the Owner so as to provide the necessary clearances and dimensions.
- F. The Contractor shall maintain sheeting and bracing in excavations and trenches for the entire time excavations will be open.
- G. The Contractor shall not brace sheeting against pipe being laid. Sheeting shall be braced so that no concentrated load of horizontal thrust is transmitted to the pipe.
- H. Sheeting shall not be withdrawn if driven below the spring line of any pipe. The Contractor shall cut off tops as indicated on the Contract Drawings and leave bottoms permanently in place.

### 3.05 DEWATERING, WATER REMOVAL, AND DRAINAGE MAINTENANCE

- A. Water shall not be permitted to accumulate in excavations. The Contractor shall provide dewatering systems to convey water away from excavations so that softening of foundations bottoms, footing undercutting, and soil changes detrimental to subgrade stability and foundation will not occur. Dewatering systems and methods of disposal shall be as specified in Section 02240, Dewatering, and as approved by the Engineer before being installed by the Contractor. Groundwater levels shall be maintained a minimum of 1 foot below bottom of trenches or excavations.

- B. Dewatering systems and equipment shall be in place as required to eliminate water during the excavation period until the work is completed. The Contractor shall provide ample means and equipment with which to remove promptly and dispose of properly all water entering any excavation. This includes the use of sand or gravel as required to maintain adequate flow during the pipe laying or installation of other items of work within the excavation.
- C. Water pumped or drained shall be disposed of in a suitable manner without damage to adjacent property, to other work under construction, or to roads. Water shall not be discharged onto surface improvements without adequate protection of the surface at the point of discharge. All gutter, drains, culverts, sewers, and inlets shall be kept clean and open for surface drainage. Water shall not be directed across or over pavements except through approved pipes or properly constructed troughs. The Contractor shall obtain permission from the Owner of any property involved before constructing water courses or installing discharge pipe or hose for removal of water and provide for disposal of the water without ponding or creating a public nuisance.
- D. All pumps used for dewatering shall have noise-reduction features and shall be able to run continuously with minimal attendance. If required by the Owner or Engineer, the pumps shall be enclosed on all sides with a plywood enclosure, with padded material suitable for outdoor conditions on the inside of the enclosure, to further reduce pump engine noise to an acceptable level. All applicable ordinances and codes for noise abatement shall be followed. The Contractor shall maintain pumps at all times, as necessary. When pumps are no longer required, the Contractor shall remove the pumps, wellpoints, pipes, and other apparatus from the area.
- E. It is essential that the discharge of the trench dewatering pumps be conducted to natural drainage channels, drains, or storm sewers.
- F. Trenches shall be constructed on the upstream side of the traffic way across roadways, driveways, or other traffic ways adjacent to drainage ditches or water to prevent impounding water after the pipe has been laid. The Contractor shall construct and maintain bridges and other temporary structures required to maintain traffic across such unfilled trenches. Backfilling shall be done so that water will not accumulate in unfilled or partially filled trenches. After backfilling is completed, the Contractor shall immediately remove all material deposited in roadway ditches or other water courses crossed by the line of trench and restore the original section, grades, and contours of ditches or water courses. Surface drainage shall not be obstructed longer than necessary.
- G. Where trenches are constructed in ditches or other water courses, backfill shall be protected from surface erosion. Where the grade of the ditch exceeds 1%, the

Contractor shall install ditch checks. Unless otherwise indicated on the Contract Drawings, ditch checks shall be concrete or as otherwise approved by the Engineer. Ditch checks shall extend not less than 2 feet below the original ditch or water course bottom for the full bottom width and at least 18 inches into the side slopes and shall be at least 12 inches thick.

### 3.06 BACKFILLING AND COMPACTION

- A. The Contractor shall not backfill trenches until required tests are performed.
- B. Trenches improperly backfilled shall be reopened to the depth required for proper compaction, then refilled and compacted as specified, or the condition shall be otherwise corrected as directed.
- C. The Contractor shall perform the following steps to ensure compaction at the bottom of the trench or excavation before bedding:
  - 1. Remove disturbed native soil material and/or any soils not meeting the requirement of satisfactory soil material as indicated on the Contract Drawings.
  - 2. Compact the bottom of the trench excavation (undisturbed native subsurface soil) to no less than 95% of the Modified Proctor maximum dry density in accordance with ASTM D1557, before placement of foundation, bedding, piping, and backfill.
- D. To backfill below and around pipe to the spring line of the pipe, the Contractor shall do the following:
  - 1. Construct foundation and bedding as indicated on the Contract Drawings before placement of pipe.
  - 2. Install each pipe at proper grade, alignment, and final position.
  - 3. Deposit satisfactory soil material uniformly and simultaneously on each side of pipe in completed course layers to prevent lateral displacement.
  - 4. Compact under pipe haunches and on each side of pipe to the pipe spring line as shown on the Contract Drawings to hold the pipe in the proper position during subsequent pipe backfilling and compaction operations.
  - 5. Construct haunching as indicated on the Contract Drawings.
- E. To trench backfill above pipe spring line to finished grade, the Contractor shall do the following:
  - 1. Deposit satisfactory soil material around and above pipe in uniform layers as shown on the Contract Drawings.

2. Backfill and compact trenches from the spring line of the pipe to the top of the trench in completed course layers as shown on the Contract Drawings.
3. Use material previously defined in these Specifications as satisfactory soil material.
4. Compact by hand or mechanical tampers.

### 3.07 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. The Contractor shall remove and legally dispose of waste materials, including excavated material classified as unsatisfactory soil material, trash, and debris from the property at no additional cost to the Owner.

END OF SECTION



SECTION 02370  
EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall take every reasonable precaution throughout construction to prevent the erosion of soil and the sedimentation of streams, bays, storm systems, or other water impoundments, ground surfaces, or other property as required by federal, state, and local regulations.
- B. The Contractor shall provide protective covering for disturbed areas upon suspension or completion of land-disturbing activities. Permanent vegetation shall be established at the earliest practicable time. Temporary and permanent erosion-control measures shall be coordinated to ensure economical, effective, and continuous erosion and siltation control throughout the construction and post-construction period.

1.02 RELATED WORK

- A. Section 02920, Sodding.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. Florida Department of Transportation (FDOT)
  - 1. FDOT Section 103—Temporary Work Structures.
  - 2. FDOT Section 104—Prevention, Control, and Abatement of Erosion and Water Pollution.
  - 3. FDOT Section 530—Riprap.

4. FDOT Section 982—Fertilizer.
5. FDOT Section 985—Geotextile Fabrics.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 RECORD DRAWINGS (NOT USED)

1.13 REGULATORY REQUIREMENTS

- A. The Contractor shall prevent damage to properties outside the construction limits from siltation due to construction of the project and assume all responsibilities to the affected property owners for correction of damages that may occur. Erosion-control measures shall be performed conforming to the requirements of and in accordance with plans approved by applicable state and local agencies and as specified by the erosion-control portion shown on the Drawings and as required by these Specifications. The Contractor shall not allow mud and debris to accumulate in the streets or enter drainage ditches, canals, or waterways. Should the Contractor pump water from excavations during construction, appropriate siltation preventative measures shall be taken before the pumped water is discharged into any drainage ditch, canal, or waterway.

1.14 PRACTICES

The Contractor shall adhere to the following:

- A. Avoid dumping soil or sediment into any stream bed, pond, ditch, or water course.

- B. Maintain an undisturbed vegetative buffer where possible between a natural watercourse and trenching and grading operations.
- C. Avoid equipment crossings of streams, creeks, and ditches where practicable.

#### 1.15 EROSION AND SEDIMENT-CONTROL DEVICES AND FEATURES

- A. The Contractor shall construct all devices (silt fences, retention areas, etc.) for sediment control at the locations required to protect federal, state, and local water bodies and water courses and drainage systems before beginning to excavate the site. All devices shall be properly maintained in place until a structure or paving makes the device unnecessary or until directed to permanently remove the device.
- B. Filter fabric, hay bales, or other approved methods shall be placed and secured over the grates of each existing inlet, grating, or storm pipe opening near the area of excavation to prevent silt and debris from entering the storm systems.
- C. The Contractor shall use silt fences, hay bales, and floating turbidity barriers as shown on the plans or as directed by the Owner or Owner's Representative to restrict movement of sediment from the site.
- D. The Contractor shall establish vegetative cover on all unpaved areas disturbed by the work.

### PART 2 PRODUCTS

#### 2.01 GENERAL

- A. Open-mesh biodegradable mulching cloth.
- B. Fertilizer shall be 10-10-10 grade or equivalent.
- C. Lime shall be Dolomitic Agricultural Ground limestone, in accordance with FDOT Section 982.
- D. Grass shall be in accordance with Section 02920, Sodding.
- E. Silt fence shall consist of non-biodegradable filter fabric (Trevira, Mirafi, etc.), in accordance with FDOT Section 985, wired to galvanized wire mesh fencing and supported by wood or metal posts.
- F. Floating or staked turbidity barriers as specified in FDOT Section 985 and FDOT Standard Index 103.

- G. Erosion Stone: FDOT Section 530
  - 1. Sand-Cement Riprap.
  - 2. Concrete Block.
  - 3. Rubble 20 to 300 pounds each.
- H. Filter Fabric for placing under Riprap shall meet the requirements of FDOT Section 985.
- I. Baled hay or straw in accordance with FDOT Section 104.

## PART 3 EXECUTION

### 3.01 CLEARING

- A. The Contractor shall schedule and perform clearing and grubbing so that subsequent grading operation and erosion-control practices can follow immediately after. Excavation, borrow, and embankment operations will be conducted as a continuous operation. All construction areas not otherwise protected shall be planted with permanent vegetative cover within 30 working days after completing active construction.

### 3.02 STABILIZING

- A. The angle for graded slopes and fills shall be no greater than the angle that can be retained by vegetative cover or other adequate erosion-control devices or structures. All disturbed areas outside of embankment left exposed will, within 30 working days of completion of any phase of grading, be planted or otherwise provided with either temporary or permanent ground cover, devices, or structures sufficient to restrain erosion.

### 3.03 REGULATORY REQUIREMENTS

- A. Whenever land-disturbing activity is undertaken on a tract, a ground cover sufficient to restrain erosion must be planted or otherwise provided within 30 working days on that portion of the tract upon which further active construction is to be undertaken.
- B. If any earthwork is to be suspended for any reason for longer than 30 calendar days, the areas involved shall be sodded or otherwise protected against excessive erosion during the suspension period. Suspension of work in any area of operation does not relieve the Contractor of the responsibility to control erosion in that area.

### 3.04 VEGETATIVE COVER

- A. Disturbed areas shall be permanently sodded as specified in Section 02920, Sodding.

### 3.05 MAINTENANCE

- A. The Contractor shall maintain all temporary and permanent erosion-control measures in functioning order. Temporary structures shall be maintained until such time as vegetation is firmly established and grassed areas shall be maintained until completion of the project. Areas which fail to show a suitable stand of grass or which are damaged by erosion shall be immediately repaired. No additional payment will be made to the Contractor for re-establishing erosion-control devices, which may become damaged, destroyed, or otherwise rendered unsuitable for their intended function during the construction of the project.
- B. The Contractor shall remove all silt, sediment, and debris buildup regularly to maintain functioning storm systems and erosion-control devices.

### 3.06 REMOVAL OF SEDIMENT CONTROL DEVICES

- A. Near completion of the project, when directed by the Engineer, the Contractor shall dismantle and remove the temporary devices used for sediment control during construction. All erosion-control devices shall be left in place until the grass is established.
- B. The Contractor shall clean up all areas at the completion of the project.

END OF SECTION

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SECTION 02530  
PIPEWORK, GRAVITY SEWERS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide all work necessary for constructing a gravity sewer system. This work shall include the installation of all gravity sewer lines, services, manholes, fittings, and appurtenances as may be required to complete the work as indicated in the plans.

1.02 RELATED WORK

- A. The General Conditions and Special Conditions of these Specifications are a part of this Section as if incorporated in this Section.
- B. Other related Specifications are listed below:
  - 1. Section 01330, Submittals and Acceptance.
  - 2. Section 01650, Delivery, Storage, and Handling.
  - 3. Section 01780, Warranties and Bonds.
  - 4. Section 03300, Cast-in-Place Concrete.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Shop Drawings: The Contractor shall submit catalog cut sheets, manufacturer's descriptive literature, and other necessary information to the Engineer for approval before installing pipe and manholes.
- C. Certifications: The Contractor shall submit a certification from the pipe manufacturer that the pipe and fittings supplied are new, have been manufactured for this project, and have been inspected at the plant.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

- A. Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time.

The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- B. The latest edition of the Ten States Standards and applicable Standard Details and Specifications shall be referred to for both specific and general standards for materials, construction, workmanship, and quality control as specified in this Section, with exceptions as noted.
1. American Society of Testing and Materials (ASTM):
    - a. ASTM A48—Standard Specification for Gray Iron Castings.
    - b. ASTM A536—Standard Specification for Ductile Iron Castings.
    - c. ASTM A746—Standard Specification for Ductile Iron Gravity Sewer Pipe.
    - d. ASTM C32—Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale).
    - e. ASTM C144—Standard Specification for Aggregate for Masonry Mortar.
    - f. ASTM C150—Standard Specification for Portland Cement.
    - g. ASTM C443—Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets.
    - h. ASTM C478—Standard Specification for Precast Reinforced Concrete Manhole Sections.
    - i. ASTM D1248—Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.
    - j. ASTM D1557—Standard Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
    - k. ASTM D1748—Standard Standard Test Method for Rust Protection by Metal Preservatives in the Humidity Cabinet.
    - l. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
    - m. ASTM D2241—Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
    - n. ASTM D2321—Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.
    - o. ASTM D3034—Standard Specification for Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings.
    - p. ASTM D3212—Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
    - q. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.



- r. ASTM F679—Standard Specification for Poly (Vinyl Chloride) (PVC) Large Diameter Plastic Gravity Sewer Pipe and Fittings.
  - s. ASTM F794—Standard Specification for Poly (Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter.
  - t. ASTM F1417—Standard Test Method for Installation Acceptance of Plastic Gravity Sewer Lines Using Low-Pressure Air.
2. American National Standards Institute (ANSI) Standards:
- a. ANSI A21.5/AWWA C105—Polyethylene Encasement for Ductile-Iron Pipe Systems.
  - b. ANSI A21.10/AWWA C110—Ductile-Iron and Gray-Iron Fittings for Water.
  - c. ANSI A21.11/AWWA C111—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  - d. ANSI A21.51/AWWA C151—Ductile-Iron Pipe, Centrifugally Cast.
  - e. ANSI/AWWA-C900—Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-Inch through 12-Inch (100 mm through 300 mm), for Water Transmission and Distribution.
3. Federal Specifications and Standards (FSS):
- a. A-A-60005—Frames, Covers, Gratings, Steps, Sump and Catch Basin, Manhole.

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storage and protection of the items specified in this Section.
- B. Delivery, storage, and handling shall be in accordance with the manufacturer's recommendations.

- 1.09 QUALIFICATIONS (NOT USED)
- 1.10 TESTING REQUIREMENTS (NOT USED)
- 1.11 MAINTENANCE (NOT USED)
- 1.12 RECORD DRAWINGS (NOT USED)

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. The Contractor shall provide all new materials free from defects impairing strength and durability and of the best commercial quality for the purpose specified. All material supplied shall have structural properties sufficient to safely sustain or withstand strains and stresses to which it is normally subjected and be true to detail.

### 2.02 PIPE

- A. Polyvinyl Chloride (PVC): Manufacture in accordance with ASTM D3034, minimum SDR 25, for pipe depths up to 12 feet deep only. For pipe over 12 feet deep, use AWWA C-900 PVC, DR 18, or ductile iron pipe (DIP) epoxy lined. PVC pipe shall have a cell classification of 12454B or 12364C as defined under ASTM D1748. PVC pipe shall comply with and be labeled as approved by the National Sanitation Foundation (NSF) for use in a sanitary sewer. No solvent-cement weld pipe will be accepted. The color must be green.
  - 1. Fittings and Joints: Bell and spigot type with elastomeric gasket installed in accordance with ASTM D3212 and ASTM D3034. Gaskets shall conform to ASTM F477 for joining plastic pipe.
  - 2. Nonmetallic Marking Tape: Install continuous marking tape approximately 1 foot above and on line with all nonmetallic pressure piping. Marking tape shall be "Extra-Stretch" marking tape equal to Allen Marking Tape, Allen Systems; Terra Tape, Division Reef Industries, for sanitary sewer, colored green. Extra-Stretch marking tape shall consist of 6-ply copolymer film bonded together without the use of adhesives, specifically formulated for prolonged use underground. It shall be highly resistant to alkalis, acids, and other destructive agents found in the soil. Extra Stretch tape shall have a minimum thickness of 6 mils, minimum tensile strength of 80 lb per 3-inch-wide strip, and a minimum elongation of 600%. Tape shall bear a continuous printed message repeated every 16 to 36 inches warning of the installation buried below. Installation instructions for the tape shall be printed with each message along the entire length.

3. Tracer Wire: Install two strands of minimum #14 gauge stranded THWN wire with green insulation. Insulation shall be polyvinylchloride (PVC) or low-density, high-molecular-weight polyethylene for applications up to 600 volts. Wire shall run continuously through test stations for the entire length of the pipe line. Leave enough slack in the wire so it can be extended 12 inches above the valve box at the test station. Attach wire along the sides of pipe line 5 feet-0 inches on center, using duct tape or approved equal. Wire shall meet National Electric Codes and Underwriter Laboratories, Inc. requirements.

## 2.03 MANHOLES

- A. Precast Concrete Manholes: Manholes shall meet the requirements of ASTM C478 with the exceptions specified in this Section. Manholes shall be designed and constructed to withstand a minimum H-20 type loading. Cement shall meet the requirements of ASTM C150, Type II. Reinforcing steel shall be as shown on the standard manhole detail. Concrete shall meet the minimum requirements of 4,000 psi, as specified in the concrete section of these Specifications. Minimum wall thickness shall be 5 inches. The required minimum strength of concrete shall be confirmed by making and testing three standard cylinders at 7 days in accordance with the concrete section of these Specifications. Rings shall be custom made with openings to meet indicated pipe alignment conditions and invert elevations. Submit shop drawings consisting of the manufacturer's standard details of various sections for approval before placing an order for manholes. Drawings of individual manholes showing invert elevations, pipe sizes, and required construction details shall be submitted. Provide certification of proper cure period and Independent Testing Laboratory tests confirming concrete moisture less than 6%.
  1. Bases and Slabs: Bases and slabs for manholes shall be precast.
  2. Joints: Form joint contact surfaces with machined castings. Surfaces shall be exactly parallel with nominal 1/16-inch clearance and the tongue equipped with a proper recess for the installation of an O-ring rubber gasket. Gaskets shall meet the requirements of Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets. Pre-formed flexible joint sealant may be used in lieu of O-ring rubber gaskets. If joints are sealed with "RAM-NEK" by K.T. Snyder, Kent-Seal No. 2 by Hamilton-Kent, or Engineer- approved equal, the recess in the tongue for an O-ring gasket may be omitted.
  3. Portland Cement: Shall conform to ASTM C150, Type II. Approved: Atlas; Florida; Lehigh; or equal.
  4. Sand: Washed silica sand shall conform to ASTM C144.
  5. Mortar: Consists of one part cement and two parts sand.

- B. Manhole Frames and Lids: Shall conform to ASTM A48, Class 30B (Gray iron), or Grade 65-45-12 (ductile iron) meeting the requirements of ASTM A536, cast in a true symmetrical pattern of tough, dense, and even-grained iron free from warping, scales, lumps, blisters, sandholes, or any defects of any kind. Ring and cover shall be U.S. Foundry-USF "195" Ring and "W" cover or approved equal. Provide indented pattern lids with lettering as shown on the Drawings. Machine or grind frames and lids at touching surfaces to provide firm seats and prevent rocking. Remove and replace any set not matching perfectly.
1. Heavy Duty: Designed to withstand minimum H-20 type loading as defined in Federal Specifications and Standards A-A-60005. Minimum weight, 360 pounds total. Approved: U.S. Foundry No. 195-W, or equal.
- C. Non-shrink Grout: Inorganic, non-shrink, nonmetallic type grout similar to U.S. Grout or equal. Grout shall be placed with a tamping stick to ensure complete filling in holes and space around pipe.
- D. Coating:
1. General: All manhole exterior and interior surfaces shall be lined and coated as specified in this Section. The Contractor shall use an approved coating and lining subcontractor for all manhole preparation and application of coatings and/or linings.
  2. Exterior: The exterior manhole surfaces shall receive a coating with an approved coal tar epoxy paint.
  3. Interior-Exposure to Hydrogen Sulfide Environment: The interior surfaces shall be coated with approved coating, suitable for high hydrogen sulfide atmospheric conditions and immersion in typical domestic sanitary sewage after installation. The manhole walls shall be coated with one of the following systems, following the manufacturer's recommendation:
    - a. Inner Guard System consisting of Inner-Crystal Waterproofing, Inner-Krete Calcium Aluminate cementitious mortar lining and Inner-Kote epoxy coating.
    - b. High-Performance Calcium Aluminate mortar as manufactured by Strong Systems, Inc.
    - c. Polymorphic Polymer Coating System consisting of prime coat, lining coat, and pigmented final coat as manufactured by Polymorphic Polymers Corporation, Miami, Florida.
    - d. Mainstay Composite Liner consisting of ML-72 Microsilica Concrete Repair Mortar and DS-4 Chemical-Resistant Epoxy Corrosion Barrier.

4. Interior-Non-Hydrogen Sulfide Exposure Environment: Coat with the same coating as the exterior coating system.

## 2.04 FLEXIBLE MANHOLE-TO-PIPE CONNECTOR

- A. The manhole-to-pipe connector shall be manufactured from Neoprene EPDM. The connector shall be a minimum of 3/8-inch thick and shall conform to ASTM C443. The connector shall be resistant to ozone, weathering, aging, chemicals, animal and vegetable fats, oils, and petroleum products.
- B. The connector shall be sized for the specific type and size pipe entering and leaving each manhole. The connector shall be precast into the manhole by the manhole manufacturer in accordance with the connector manufacturer's written instructions. A 304 stainless steel band and screw assembly shall be provided to seal the flexible neoprene connector against the pipe.
- C. Acceptable Manufacturers: PSX, Kor-N-Seal, or approved equal.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. General: The Contractor shall install all pipework meeting the requirements of AWWA for installing polyvinyl chloride for the various types and classes of pipe. Lay all gravity sewers using laser beam methods. Obtain exact grade and alignment for each pipe by measuring to the invert of the pipe. Lay pipe upgrade, beginning at the lower end of the sewer, with pipe bell ends up-grade. Exercise extreme care to keep the pipe in exact alignment and elevation. It is the Contractor's responsibility to make exploratory excavations and/or use other methods available to locate existing utilities before constructing any gravity sewers. If necessary, the Contractor shall adjust the new sewers and/or laterals, subject to approval by the Engineer, to avoid conflicts with existing piping. Install pipe joints on each line entering or leaving manhole, including stub lines, as close to the manhole exterior wall as practical. In no case shall the pipe be walked on either before or after the joints have been made. Securely close all openings such as stubs, wyes, or other services along the lines with approved stoppers that fit into the bells of the pipe and are recommended by the pipe manufacturer. Install stoppers in such a manner that they may be removed at some future time without injury to the pipe bells. No bricking or grouting plugs in lines will be permitted.
- B. Laying Pipe: Take all necessary precautions to prevent mud, sand, or other obstructing matter entering the pipelines. Lay pipe on bedding prepared in accordance with ASTM D1557 and a minimum of 90% density bedding for the

pipe installed, in accordance with the plans and Earthwork section of these Specifications; provide uniform bearing under the full length of the pipe barrel. Excavate for pipe bells and carefully lay pipe true to line and grade. Make adjustments to line and grade by scraping away or filling in and tamping under the pipe barrel and not by wedging or blocking up any portion of the pipe. Abut the spigot end of each pipe against the base of the socket of the adjacent pipe in such a manner that there will be no unevenness of any kind along the bottom halves of the pipes. Immediately after the pipe has been jointed and inspected, compact sufficient backfill to protect the pipe adequately from injury and movement. At the close of each day's work and at other times when pipe is not being laid, protect the end of the pipe with a close-fitting stopper approved by the Engineer. Replace with sound pipe any defective pipe which may have been laid. Upon completion, installed pipe lines shall show a full circle of light when lamped between manholes.

- C. Joints: The Contractor shall submit the specific type of joint to be used on all pipe, including complete data on all material to be used, to the Engineer for approval before beginning any pipework. Make all joints conform to the requirements of the manufacturer's printed instructions as approved for the type of joint installed.
- D. Manhole Construction: The Contractor shall construct manholes as shown and specified or directed in these documents. Install manhole watertight seal on pipe passing through manhole walls or install approved manhole connectors in manhole walls for connection of pipe. Manhole installation shall be as shown and in strict compliance with the manufacturer's printed instructions where specials are used for connections.
  - 1. Inverts: Form manhole invert-channels of cut pipe or mortar and brick to provide a smooth-flowing self-cleaning channel of the shape and size of the sewers to which it connects.
    - a. Straight Run Manholes: Shape inverts while manholes are under construction. Lay pipe continuously through manhole, build invert, cut or break out pipe above mid-point, and smooth broken edges with cement mortar.
    - b. Junction Manholes: Shape inverts while manholes are under construction. Lay pipe continuously through manhole, build invert, break out pipe above mid-point, and smooth broken edges with cement mortar or cut off pipe at inside faces of manhole and construct invert to exact shape and size of pipe indicated. Construct smooth inverts following grades of pipes leaving manholes. Provide a true curve of the largest radius possible for changes in direction of the sewer and entering branch or branches.

2. Precast Concrete Manhole Installation: Set precast concrete sections vertical and in true alignment. Install O-ring rubber gasket in the recess in the base of previously set section or prime and double seal joint surfaces with “RAM-NEK” premolded plastic joint sealer or approved equal.
    - a. Grouting: Completely plug seal and smooth all holes in sections used for their handling and the annular space between the wall and entering pipes with nonmetallic, nonshrink grout equal to Sauereisen F-100. Finish grout smooth and flush with the adjoining interior and exterior manhole wall surfaces and make watertight with coatings.
  3. Setting Manhole Frames: Spacer risers for the top riser under frame: Use no mortar that has begun to set. Lay concrete risers in mortar bed on the top of corbel. Joints shall be struck flush and the interior and exterior of the manhole plastered with 1/2-inch-thick coat of mortar to leave a dense, smooth finish so that the manhole shall be watertight. Set manhole frames and lids flush with finish pavement or 0.1 foot above the finished grade unless shown or directed otherwise by the Engineer. Set frames on manholes concentric with the masonry and in a full bed of mortar so that the space between the top of the manhole masonry and the bottom flanges of the frame will be completely filled and made watertight. Place a ring of mortar around the outside of the bottom flange at least 1 inch thick and pitched to shed water away from the frame. Extend mortar to the outer edge of the masonry and finish smooth and flush with the top of the flange.
- E. Drop Connections: Where shown on the Drawings or directed by the Engineer, the Contractor shall construct drop connections to the manholes as shown and specified in this Section. Provide pipe restraints and supports as required.
- F. Stub Lines: The Contractor shall provide plugged stub lines where shown or directed by the Engineer for the connection of future sewer lines to manholes. Provide bell end closed with an approved stopper, as specified in Article 3.01, Installation, at the end of each stub line. Install bell of stub line as close to the manhole exterior’s surface as practical. Accurately reference each stub line size for direction and record complete with the actual invert elevation. Furnish the Engineer with two copies of the data on stub lines.
- G. Cleanouts: Construct as detailed using pipe and fittings as specified in this Section. Applicable portions of these Specifications shall apply to the construction of this item.

## 3.02 INSPECTION AND TESTING

### A. General

1. The Contractor shall inspect all work constructed for faults or defects and any deviation from these documents or omissions shall be corrected at once. The Contractor shall conduct all tests and shall provide necessary equipment and personnel for lamping the system in the presence of the Engineer. The Contractor shall bear all costs for these tests and inspections.
2. Sewers shall be tested by a low-pressure air test.
3. Pipe testing shall closely follow pipe laying. No more than 1,000 feet of pipe shall remain untested at any time.

### B. Gravity Piping

1. The Contractor shall submit the proposed method of testing to the Engineer for approval. Air testing shall be performed in accordance with the procedures described in ASTM F1417. The equipment shall be specifically designed and manufactured for testing pipelines with low-pressure air and shall be provided with an air regulator valve or air safety valve set to prevent the air pressure in the pipeline from exceeding 8 psig. If the results of the air test are unsatisfactory, perform the exfiltration test as outlined above.
2. The following low-pressure air testing procedures may be used. The sewer line shall have an orifice through which to pass air into the pipe. An air supply shall be connected to the orifice at one end of the line. The air supply line will contain an on/off gas valve and a pressure gauge with a range of 0 to 5 psi. The gauge shall have minimum divisions of 0.10 psi and shall have an accuracy of  $\pm 0.04$  psi. The seals at each manhole shall be properly blocked to prevent displacement while the line is under pressure. The pipe line under test shall be pressurized to 4 psig. The line will be allowed to stabilize between 4 psig and 3.5 psig for no less than 5 minutes. If necessary, air shall be added to the line to maintain the pressure above 3.5 psig. After the stabilization period, the gas valve shall be closed. When the line pressure drops to 3.5 psig, timing will begin with a stop watch. The stop watch shall be allowed to run until the line pressure drops to 2.5 psig. The watch shall then be stopped and the time lapse shall be compared to the allowable time lapse in these Specifications. If the time lapse is greater than that specified, the section undergoing the test shall have passed the low-pressure air test and the test will be discontinued at that time. If the time is less than that specified, the line has not passed the test (see Table 1 for test times).



Length (feet)	4	6	8	10	12	15	18	21	24
25	0:04	0:10	0:18	0:28	0:40	1:02	1:29	2:01	2:38
50	0:09	0:20	0:35	0:55	1:19	2:04	2:58	4:03	5:17
75	0:13	0:30	0:53	1:23	1:59	3:06	4:27	6:04	7:55
100	0:18	0:40	1:10	1:50	2:38	4:08	5:56	8:05	10:34
125	0:22	0:50	1:28	2:18	3:18	5:09	7:26	9:55	11:20
150	0:26	0:59	1:46	2:45	3:58	6:11	8:30	--	--
175	0:31	1:09	2:03	3:13	4:37	7:05	--	--	--
200	0:35	1:19	2:21	3:40	5:17	--	--	--	12:06
225	0:40	1:29	2:38	4:08	5:40	--	--	10:25	13:36
250	0:44	1:39	2:56	4:35	--	--	8:31	11:35	15:07
275	0:48	1:49	3:14	4:43	--	--	9:21	12:44	16:38
300	0:53	1:59	3:31	--	--	--	10:12	13:53	18:09
350	1:02	2:19	3:47	--	--	8:16	11:54	16:12	21:10
400	1:10	2:38	--	--	6:03	9:27	13:36	18:31	24:12
450	1:19	2:50	--	--	6:48	10:38	15:19	20:50	27:13
500	1:28	--	--	5:14	7:34	11:49	17:01	23:09	30:14

- C. Infiltration: After the work is complete, the sewers or sections shall be tested for infiltration. Any section in which the infiltration of water is detected will be rejected until corrective work has been performed. No infiltration will be allowed for any one trunk, main, lateral, or segment between manholes.
- D. Exfiltration: The Engineer may require tests for exfiltration. Exfiltration shall be in accordance with the requirements of ASTM requirements as modified by the Engineer. An allowance of 10 % of exfiltration gallonage shall be permitted for each additional 10-foot head over the basic top-of-manhole head.
- E. Television Inspection: All new sewer mains shall be inspected by internal television inspection, providing accurate distances to all services, with logs and video record of inspection. The Contractor shall provide all equipment and labor for such inspection. Any Sub-Contractor must be approved by the Owner before work. Acceptable procedures for televising and video recording are available at the Public Works Department. Digital video recordings shall be taken of all inspection, including the manholes. The Contractor shall prepare the DVD and after review by the Engineer it shall be delivered to the Owner. The Engineer or Owner's representative shall observe the television inspection.
- F. Alignment and Deflection: Lines shall show full circle of light when lamped between manholes for line sections with complete pipe replacement.
1. A nine-point mandrel shall be passed through each new flexible pipe section installed after full backfill has been placed. The maximum pipe diameter deflection shall not exceed 5 %.

- G. Warranty Test: To ensure the adequacy of the pipe described above and the manhole installation procedures, the Contractor shall remobilize to the work site 10 months after final approval-acceptance of the complete project, such time being within the 1-year warranty period, as stated in the General Conditions. The date for such remobilization will be stated in the Final Approval issued by the Engineer.
1. The Contractor, together with representatives of the Engineer and the Owner, shall visually inspect every manhole and new line sections installed in the project area for cracks, damaged lining, leaks, or abnormal conditions. The line sections will be chosen by the Engineer/Owner at random subsequent to the manhole inspections.
  2. The Contractor shall appropriately correct any deficiencies that are found by such visual inspection, as approved by the Engineer. To adequately locate certain deficiencies, the Contractor shall be required to use closed-circuit television inspection and other methods.
  3. All costs involved in remobilizing, inspecting, or correcting deficiencies will be considered incidental to the project and shall be the responsibility of the Contractor at no additional cost to the Owner.
- H. Repair of PVC Piping: At the option of the Engineer, if PVC piping is found to be defective during the warranty test period and if the Engineer does not approve a method of pipe repair by the Contractor, the Contractor shall remove and replace the faulty pipe in an approved manner at no additional cost to the Owner.

END OF SECTION

SECTION 02610  
TRENCH DRAIN

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, and incidental required to install a concrete trench drain system as shown on the Drawings and specified herein.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling
- C. Section 01780, Warranties and Bonds.
- D. Section 03300, Cast-In-Place Concrete.

1.03 SUBMITTALS

- A. Submit under provisions of Section 01330, Submittals and Acceptance.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
  - 1. Preparation instructions and recommendations.
  - 2. Storage and handling requirements and recommendations.
  - 3. Installation methods.
- C. Shop Drawings: Provide a general layout indicating invert and outlet elevation with slope at each trench section. Locate catch basins required and outlet piping connection locations and details. Provide details at field installed connections and components.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

- A. AASHTO M306-FAA—Standard Specification for Drainage, Sewer, Utility and Related Castings.
- B. American Welding Society (AWS)
  - 1. AWS D1.1—Welding Code.
  - 2. AWS D1.6—Structural Welding Code.

C. ASTM International (ASTM)

1. ASTM A36—Standard Specification for Carbon Structural Steel.
2. ASTM A48—Standard Specification for Gray Iron Castings.
3. ASTM A276—Standard Specification for Stainless Steel Bars and Shapes.
4. ASTM A536—Standard Specification for Ductile Iron Castings.
5. ASTM C578—Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation.
6. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.

D. Federal Specifications (FS)

1. FS A-A-60005—Frames, Covers, Gratings, Steps, Sum and Catch Basin, Manhole.

1.06 QUALITY ASSURANCE

A. Components of the system shall be from one manufacturer.

B. Grate Rail Frames: Comply with the following:

1. Steel Angle Rails: ASTM A36.
2. Concrete Anchors: AWS D1.1 (steel).

C. Gratings: Comply with the following:

1. H20 load performance.
2. Ductile Iron: ASTM A536, 60-45-12.

1.07 WARRANTIES

A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specifications Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS

- A. Acceptable Manufacturer: Multi-Drain Systems, or approved equal by the Engineer.

### 2.02 POLYMER CONCRETE TRENCH DRAINS

- A. Product: Alfa Channel Trench Drain as manufactured by MultiDrain Systems, or approved equal by the Engineer, including channels, frame, grating and system accessories.
  - 1. Construction: The system consists of interlocking sloped and non-sloped channels.
    - a. The non-sloped channels can be inserted at specified intervals in order to extend channel runs.
    - b. Catch basins, horizontal outlet plates, closed end plates and vertical outlet plate adapters shall be installed at designated locations. Closed end plates terminate channel runs.
  - 2. Drain Trench: Fabricated of polyester polymer concrete, 6.1 inches (155 mm) wide, 4 inches (100 mm) ID with radius bottom, having the following attributes:
    - a. Length: Nominal 19.6 inches (0.06 meter) and 39.19 inches (1.0 meter).
    - b. Bottoms: Sloped to provide 0.6 percent slope.
    - c. Anchoring Ribs: Full length.
    - d. Grate Locking Slots: Blind, vibration damping, thermoplastic.
    - e. Interlocking ends.
  - 3. Grate: Ductile Iron slotted grate and independently anchored frame with a Load Class E rating. Assembly 2504-AF Alfa Channel as manufactured by MultiDrain Systems, or Engineer-approved equal.
  - 4. Accessories:
    - a. End plates.
    - b. Outlet plates.
    - c. Locking devices.
    - d. Sealant.

- e. Installation devices.
- f. Flexible connector to bridge construction joint in concrete slab.

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.
- B. If substrate preparation is the responsibility of another installer, notify Engineer of unsatisfactory preparation before proceeding.

### 3.02 PREPARATION

- A. Overall concrete thickness and reinforcement steel shall be per Structural Engineer's specification for the application and service loading.
- B. Clean surfaces thoroughly before installation.
- C. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

### 3.03 INSTALLATION

- A. Install trench drain system in accordance with manufacturer's instructions.
- B. Provide bracing to assure alignment and stability of formwork during concreting operations.

### 3.04 PROTECTION

- A. Protect installed products until completion of project.
- B. Touch-up, repair, or replace damaged products before Substantial Completion.

END OF SECTION

SECTION 02700  
PAVING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section covers the work necessary to provide for the construction of all pavement where indicated on the Drawings.

1.02 RELATED WORK

- A. Section 01350, Environmental Protection Procedures.
- B. Section 02300, Earthwork for Structures.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Limerock material submittal is to be made to include liquid limit, plastic index, gradation, certification regarding deleterious material, limerock bearing ratio (LBR), Florida Department of Transportation (FDOT) pit number, and other information as required to indicate performance in accordance with the specifications.
- B. Information regarding asphaltic and Portland cement concrete materials and mix shall be submitted as required by the referenced FDOT specifications.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time, unless otherwise noted. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. The latest edition of the FDOT Standard Specifications for Road and Bridge Construction (Standard Specifications) and Roadway and Traffic Design Standards shall be referred to for construction, workmanship, and quality control as specified with exceptions as noted in this Section.

1. Where the referenced FDOT Specifications cite "the Department," this shall be modified to "the Owner and/or Engineer" by this contract.
2. The Contractor shall retain an independent testing agency, as approved by the Engineer, to perform all tests, including tests referenced to be performed by the Engineer.
3. Payment for this project is on a Lump-Sum Basis if defined as Lump Sum on the Bid Form. The FDOT sections defining the Basis of Payment shall be applied only when unit price work is defined on the Bid Form.

B. American Society of Testing and Materials (ASTM)

1. ASTM D1556—Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
2. ASTM D1557—Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft<sup>3</sup> (2,700 kN-m/m<sup>3</sup>)).
3. ASTM D2167—Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
4. ASTM D6938—Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.06 QUALITY ASSURANCE

- A. The Contractor shall perform field-density tests along the centerline of construction or as directed by the Engineer and in accordance with the FDOT's *Standard Specifications for Road and Bridge Construction*, latest edition.
- B. The Contractor shall field check the depth of stabilization and/or limerock at each road crossing with a pipeline.
- C. The Engineer may require additional testing as deemed necessary. The Engineer shall interpret test results and the Contractor shall perform remedial work as directed by the Engineer. The Contractor shall provide labor to the Engineer for help in performing tests and/or checking line and grade at no additional cost to the Owner.
- D. Laboratory maximum dry density of soil mixtures at optimum moisture shall be determined by ASTM D1557 for subgrade, stabilized subgrade, and limerock base course.
- E. Field density of stabilized subgrade and soils or soil mixtures in fill or backfill shall be determined by ASTM D1556, D2167, or D6938 for limerock base course.



- F. Bearing value of stabilized subgrade shall be determined by the methods required for determining limerock bearing ratio (LBR) according to the FDOT, Standard Specification FM 5-515.
- G. Field density of stabilized subbase shall be 98% or greater of the Modified Proctor maximum dry density, ASTM D1557.
- H. The Engineer shall have sole responsibility for interpreting all test results. The Contractor shall bear the cost of all retests due to failure to achieve specified requirements.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 MAINTENANCE (NOT USED)

#### 1.12 RECORD DRAWINGS (NOT USED)

### PART 2 PRODUCTS

#### 2.01 GENERAL (NOT USED)

#### 2.02 ROCK BASE

- A. The following sections of the Standard Specifications shall apply:
  - 1. Section 200-1, Description.
  - 2. Section 200-2, Materials.

## 2.03 STABILIZING MATERIALS

A. The following sections of the Standard Specifications shall apply:

1. Section 160-1, Description.
2. Section 160-2, Stabilized Subgrade, Type B.
3. Section 160-4, Materials.

## 2.04 PRIME AND TACK COATS FOR BASE COURSES

A. The following sections of the Standard Specifications shall apply:

1. Section 300-1, Description.
2. Section 300-2, Materials.
3. Section 300-3, Equipment.

## 2.05 SUPERPAVE ASPHALT

A. The following sections of the Standard Specifications shall apply:

1. Section 334-1, Description.
2. Section 334-2, Materials.
3. Section 334-3, General Composition of Mixture.
4. Section 334-4, Acceptance of the Mixture at the Plant.
5. Section 334-5, Acceptance of the Mixture on the Roadway.

## 2.06 CEMENT CONCRETE PAVEMENT

A. The following sections of the Standard Specifications shall apply:

1. Section 350-1, Description.
2. Section 350-2, Materials.

## 2.07 TRAFFIC STRIPES AND MARKINGS

A. The following sections of the Standard Specifications shall apply:

1. Section 711-1, Description.
2. Section 711-2, Materials.

## PART 3 EXECUTION

### 3.01 EXCAVATION AND EMBANKMENT

A. The following sections of the Standard Specifications shall apply:

1. Section 120-1, Description.
2. Section 120-2, Classifications of Excavation.
3. Section 120-3, Preliminary Soils Investigation.
4. Section 120-4, Removal of Unsuitable Materials and Existing Roads.
5. Section 120-5, Disposal of Surplus and Unsuitable Material.
6. Section 120-6.1, Materials for Borrow.
7. Section 120-7, Materials for Embankment.
8. Section 120-8, Embankment Construction.
9. Section 120-9, Compaction Requirements.
10. Section 120-10, Acceptance Program.
11. Section 120-11, Maintenance and Protection of Work.
12. Section 120-12, Construction.

B. Exceptions

1. Section 120-4.1, Subsoil Excavation: Unsuitable soils shall be those in Classifications A-6, A-7, or A-8 in the American Association of State Highway and Transportation Officials (AASHTO) System.
2. Section 120-4.2, Construction Over Existing Old Road: Where removal of existing pavement is called for, it shall be removed to the full depth as indicated in the cross-sections and replaced with new limerock and paving or other treatment in accordance with the Drawings and details.
3. Section 120-5.3, Disposal of Paving Materials: Disposing of muck on side slopes shall not apply.
4. Section 120-9.2.1, General: Laboratory maximum dry density shall be determined by Modified Proctor, ASTM D1557. Field densities shall be determined by ASTM D1556, D2167, or D6938. All embankments shall be compacted to not less than 95% of the maximum dry density, as determined by modified Proctor, ASTM D1557.
5. Section 120-12.1, Construction Tolerances: No tolerance greater than 0.1 foot above or below the plan cross-section will be allowed.

### 3.02 STABILIZING

A. The following sections of the Standard Specifications shall apply:

1. Section 160-1, Description.
2. Section 160-2, Stabilized Subgrade.

3. Section 160-3, Stabilized Subbase.
4. Section 160-4, Materials.
5. Section 160-5, Construction Methods.
6. Section 160-6, Stabilized Subbase (Additional Strengthening of Upper Portion).
7. Section 160-7, Acceptance Program.
8. Section 160-8, Density Requirements.

B. Exceptions

1. The Contractor shall stabilize the road bed to a minimum depth of 12 inches as shown on the Drawings.
2. Section 160-4.2.1.2, Undertolerance in Bearing Value Requirements: no undertolerance will be acceptable.

### 3.03 LIMEROCK BEARING RATIO AND DENSITIES

- A. Stabilized finish grade and stabilized shoulders shall have a minimum Limerock Bearing Ration (LBR) value of 40.
- B. Field density of stabilized finished grade shall be a minimum of 98% of the Modified Proctor maximum dry density as specified in ASTM D1557 to a minimum depth of 12 inches as shown on the Drawings.

### 3.04 PRIME AND TACK COATS

- A. The following sections of the Standard Specifications shall apply:
  1. Section 300-3, Equipment.
  2. Section 300-5, Cleaning Base and Protection of Adjacent Work
  3. Section 300-6, Weather Limitations
  4. Section 300-7, Application of Prime Coat
  5. Section 300-8, Application of Tack Coat

### 3.05 ROCK BASE

- A. The following sections of the Standard Specifications shall apply:
  1. Section 200-3, Equipment.
  2. Section 200-4, Transporting Rock.
  3. Section 200-5, Spreading Rock.
  4. Section 200-6, Compacting and Finishing Base.
  5. Section 200-7, Acceptance Program.
  6. Section 200-8, Priming and Maintaining.

B. Exceptions

1. Section 200-7.2.1, Density: The minimum density which will be acceptable for paved areas will be 98% of the maximum dry density as determined by Modified Proctor, ASTM D1557.
2. Section 200-7.3.1.2, Depth and Surface Testing Requirements: Thickness of base shall be measured at intervals not to exceed 200 feet.

3.06 ASPHALT

A. The following sections of the Standard Specifications shall apply:

1. Section 320-5, Paving Equipment.
2. Section 330-1, Description.
3. Section 330-2, Quality Control by Contractor.
4. Section 330-3, Limitations of Operations.
5. Section 330-4, Preparation of Asphalt Cement.
6. Section 330-5, Preparation of Aggregates.
7. Section 330-6, Preparation of the Mixture.
8. Section 330-7, Transportation of the Mixture.
9. Section 330-8, Preparation of the Application Surfaces.
10. Section 330-9, Placing Mixture.
11. Section 330-10, Compacting Mixture.
12. Section 330-11, Joints.
13. Section 330-12, Surface Requirements.
14. Section 330-13, Protection of Finished Surface.
15. Section 334-3, General Composition of Mixture.
16. Section 334-4, Acceptance of Mixture.

3.07 CEMENT CONCRETE PAVEMENTS

A. The following sections of the Standard Specifications shall apply:

1. Section 350-3, Equipment.
2. Section 350-4, Subgrade Preparation.
3. Section 350-5, Setting Forms.
4. Section 350-6, Protection from Weather.
5. Section 350-7, Placement of Reinforcement.
6. Section 350-8, Placing Concrete.
7. Section 350-9, Striking-off, Consolidating, and Finishing Concrete.
8. Section 350-10, Final Finish.
9. Section 350-11, Curing.

### 3.08 PAVEMENT REPAIR

- A. At his own expense the Contractor shall repair all damage to pavement as a result of work under this Contract in a manner satisfactory to the Engineer. Pavement shall be repaired to match the original surface material thickness and original grade. However, the asphalt concrete thickness shall not be less than 2 inches. The repair shall include preparing the subgrade, placing and compacting the applicable base, priming the limerock base, and placing and maintaining the surface treatment as specified in this Section.
- B. The width of all repairs shall extend at least 12 inches beyond the limit of the damage. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other approved method so as to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

### 3.09 JOINTS

- A. General pavement joints within asphalt or concrete driveways and roadways and where specified or directed by the Engineer, shall be mechanically sawed butt joints. The edges of asphalt pavement shall be trimmed to straight lines that a roller can follow or formed.

### 3.10 TRAFFIC STRIPES AND MARKINGS

- A. The following sections of the Standard Specifications shall apply:
  - 1. Section 711-3, Equipment.
  - 2. Section 711-4, Application.
  - 3. Section 711-5, Contractor's Responsibility for Notification.
  - 4. Section 711-6, Protection of Newly Applied Traffic Stripes and Markings.
  - 5. Section 711-7, Method of Measurement.

END OF SECTION

SECTION 02920  
SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes requirements for the following areas of work:
  - 1. Fine grading.
  - 2. Preparation of areas to receive sodding.
  - 3. Fertilizing of areas to receive sodding.
  - 4. Maintenance.
  - 5. Sodding of new areas.

1.02 RELATED WORK

- A. Section 02370, Erosion and Sedimentation Control.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. Certificates:
  - 1. Fertilizer and sod shall be accompanied by certificates from vendors certifying these items meet the requirements of these Specifications, stating botanical name, percentage by weight, and percentage of purity.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. FS O-F-241—Fertilizers, Mixed, Commercial.

- B. American Society for Testing and Materials (ASTM)—Equivalent AASHTO standards may be substituted as approved.
- C. The Florida Department of Transportation (DOT) Standard Specifications for Road Bridge Construction (Standard Specifications) shall be referred to for both specific and general standards for materials, construction, workmanship, and quality control as specified in this Section with exceptions, as noted herein. Note that any reference in the Standard Specifications to the terms “Department” or “District Materials Engineer” shall be replaced by the term “Owner.”

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. Deliver, store, protect, and handle products to the site and prevent damage from wetness and weather conditions.
- C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of the manufacturer.
- D. No sod that has been cut for more than 72 hours may be used unless specifically authorized. A letter of certification from the grassing Contractor as to when the sod was cut and what type shall be provided to the Engineer upon delivery of the sod to the job site.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 MAINTENANCE

- A. Maintenance shall be as indicated under Part 3, Execution, of this Specification Section.



## 1.12 RECORD DRAWINGS (NOT USED)

## 1.13 DEFINITIONS

- A. *Weeds:* Weeds include but are not limited to Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

## 1.14 REGULATORY REQUIREMENTS

- A. The Contractor shall comply with regulatory agencies for fertilizer and herbicide composition.

## PART 2 PRODUCTS

### 2.01 TOPSOIL

- A. The Contractor shall provide topsoil from off-site borrow or from project on-site excavation as approved by the Engineer.

### 2.02 SOD

- A. The Contractor shall provide strongly rooted sod, not less than 2 years old and free of weeds and undesirable native grasses. Provide only sod capable of growth and development when planted (viable, not dormant) and in strips not more than 18 inches wide x 4 feet long. Provide sod composed principally of the following:

1. Argentine Bahia (Palletized Sod)

### 2.03 FERTILIZER FOR SOD

- A. The Contractor shall provide commercial fertilizer of neutral character, with some elements derived from organic sources, containing not less than 8% phosphoric acid, 8% potassium, and percentage of nitrogen required to provide less than 1.0 lb. of actual nitrogen per 1,000 square feet of area. Provide nitrogen in form that will be available to the sodded area during initial period of growth. The chemical designation shall be 5-10-10.
- B. The Contractor shall ensure that the fertilizer is delivered to the site in labeled bags or containers.

## 2.04 WATER FOR SODDING

- A. Water shall be free of acid, alkali, or organic materials and shall have a pH of 7.0 to 8.5. The Contractor shall provide all water needed for grassing by providing permanent or temporary piping valves and temporary trucks to convey water from the source to the point of use. The Contractor shall provide any meters required and pay for water used if the water is taken from a public water system. Water shall be free of petroleum products, pesticides, and any other deleterious impurities.

## 2.05 EROSION-CONTROL FABRIC

- A. The Contractor shall provide 70% agricultural straw with 30% coconut fiber matrix stitches with degradable nettings designed to degrade within 18 months. Erosion-control anchors shall be as recommended by the manufacturer.

## PART 3 EXECUTION

### 3.01 COORDINATION OF WORK

- A. The Contractor shall coordinate all work activities to provide for establishing grass cover at the earliest possible time in the construction schedule to minimize erosion of topsoil.

### 3.02 SOIL PREPARATION

Concerning soil preparation, the Contractor shall do the following:

- A. Dispose of any existing sod, growth, rocks, or other obstructions that might interfere with tilling, sodding, or later maintenance operations. Remove stones over 1-1/2 inches in any dimensions and sticks, roots, rubbish, and other extraneous matter. Remove from work area or site: do not stockpile.
- B. Till to a depth of not less than 12 inches. Thoroughly loosen and pulverize topsoil.
- C. Grade areas to be sodded to a smooth, even surface with loose, uniformly firm texture. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas which can be planted in the immediate future.
- D. Moisten prepared areas to be sodded before planting if the soil is dry. Water thoroughly and allow the surface to dry off before sodding. Do not create a muddy soil condition.

- E. Restore prepared areas to specified condition if eroded or otherwise disturbed after the fine grading and before planting.
- F. Spread the planting soil mixture to depth required to meet thickness, grades, and elevations indicated after light rolling and natural settlement. Do not spread if the material is frozen or if the subgrade is frozen.
- G. Preparing Unchanged Grades:
  - 1. Where sodding in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil as follows:
    - a. Till to a depth of not less than 12 inches.
    - b. Apply soil amendments and initial fertilizers.
    - c. Remove high areas and fill in depressions.
    - d. Till soil to a homogeneous mixture of fine texture, free of lumps, clods, stones, roots, and other extraneous matter.
- H. Allow for a 3-inch sod thickness in areas to be added next to paving.
- I. Before preparing unchanged areas, remove existing grass, vegetation, and turf. Dispose of such material outside of the Owner's property: do not turn over into soil being prepared for sodding.
- J. Place approximately one-half of the total amount of planting soil required. Work into the top of the loosened subgrade to create a transition layer and then place the remainder of the planting soil.

### 3.03 SODDING NEW AREAS

When sodding new areas, the Contractor shall do the following:

- A. Before laying sod, contact the Engineer to observe soil preparation work. Lay sod within 24 hours of the time of stripping. Do not plant dormant sod or if the ground is frozen.
- B. Lay sod to form a solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger to offset joints in adjacent courses. Employ installation methods to avoid damage to subgrade or sod. On slopes install the sod with an overlap that allows water to flow over the adjacent strip and not under it. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering adjacent grass.

- C. Anchor sod on slopes greater than 3:1 with wood pegs as required to prevent slippage.
- D. Water sod thoroughly with a fine spray immediately after planting.

### 3.04 RECONDITIONING SODDED AREAS

The Contractor shall ensure that sodded areas are properly reconditioned by doing the following:

- A. Recondition sodded areas that are damaged by work operations, including storage of materials or equipment and movement of vehicles. Also recondition sodded areas where settlement or washouts occur or where minor regrading is required. Recondition other existing sodded areas where indicated.
- B. Provide fertilizer, topsoil, or sod amendments as specified for new sodded areas and as required to provide satisfactory reconditioning. Provide new planting soil as required to fill low spots and meet new finish grades.
- C. Cultivate bare and compacted areas thoroughly to provide a good deep planting bed.
- D. Remove diseased or unsatisfactory sodded areas; do not bury into soil. Remove topsoil containing foreign materials resulting from operations including oil drippings, stone, gravel, and other construction materials. Replace with new topsoil.
- E. Where substantial sodding remains (but is thin), mow, rake, aerate if compacted, fill low spots, remove humps and cultivate soil, and fertilize. Remove weeds or, if extensive, apply selective chemical weed killers as required.
- F. Water newly planted areas and keep moist until new grass is established.

### 3.05 PROTECTION

- A. The Contractor shall erect barricades, warning signs, and fencing to protect newly planted areas from traffic. Maintain barricade fencing and warning signs throughout the maintenance period until project is substantially completed.

### 3.06 MAINTENANCE

To maintain the sodded area, the Contractor shall do the following:

- A. Mow sod to a height of 2 inches as soon as there is enough top growth to cut with a mower. Remove no more than 40% of grass leaf growth in initial or subsequent mowing. Do not delay mowing until grass blades bend over and become matted.
- B. Maintain grass growth by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, re-grading, and replanting as required to establish a smooth, acceptable sodding, free from eroded or bare areas.
- C. Remove weeds by pulling or chemical treatment.
- D. Perform maintenance until the date of final completion of project.
- E. Apply the second fertilizer application after the first mowing and when grass is dry. Use fertilizer which will provide not less than 1.0 pound of actual nitrogen per 1,000 square feet of sodded areas.
- F. Replant bare areas using the same materials specified for sodded areas.
- G. Watering: Provide and maintain temporary piping, hoses, and watering equipment as required to convey water from water sources and to keep sodded areas uniformly moist as required for proper growth. Do not apply more than 1 inch of water per week to sustain grass growth.
- H. Lay out temporary watering system and arrange watering schedule to avoid walking over muddy areas. Use equipment and water to prevent puddling and water erosion and displacing mulch (if any).
- I. Apply water in sufficient quantities and as often as seasonal conditions require to keep the grassed areas moist.
- J. Provide supplemental water and irrigation to sod areas when the rainfall is not adequate to maintain soil moisture necessary for growth of the grass. The Contractor is responsible for determining the quantities of water required and when to irrigate. This obligation shall remain in full force and effect until final acceptance of the work by the Owner and shall be provided at no additional cost to the Owner.
  - 1. The Owner, at its discretion, may relieve the Contractor of this obligation at such time as the Owner is able to provide irrigation if available. This

action, however, does not relieve the Contractor of the provisions and guarantees set forth in the Contract Documents.

### 3.07 ACCEPTANCE OF SODDED AREAS

- A. When sodding work, including maintenance, is substantially complete, the Engineer and the Owner will, upon request, observe to determine satisfactory growth and acceptability:
  - 1. The term "Satisfactory Growth" as used in this Section is defined as even plant growth in healthy condition without bare spots in sodded areas. Bare spots in sodded areas shall be resodded. The Contractor shall maintain all sodded areas until satisfactory growth has been demonstrated at project final completion. If the subsequent stand of grass is found contaminated with weeds or other obnoxious or undesirable growth, the Contractor shall eliminate such undesirable growth at the Contractor's own expense.
- B. The Contractor shall re-plant rejected work and continue specified maintenance until the work is accepted by the Engineer and the Owner and found to be acceptable.
- C. Sodded areas will be acceptable provided requirements, including maintenance, have been complied with and a healthy, well-rooted, even-colored, viable sodded area is established, free of weeds, open joints, bare areas, and surface irregularities.

### 3.08 CLEANUP

- A. The Contractor shall promptly remove soil and debris created by sodding work from paved areas. Clean wheels of vehicles before they leave the site to avoid tracking soil onto surfacing of roads, walks, or other paved areas.

END OF SECTION

**DIVISION 3**

**CONCRETE**

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SECTION 03100  
CONCRETE FORMWORK

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required to design, install, and remove formwork for cast-in-place concrete complete as shown on the Drawings and specified herein.
- B. Secure to forms as required or set for embedment as required, all miscellaneous metal items, sleeves, reglets, anchor bolts, inserts, and other items furnished under other Sections and required to be cast into concrete, or approved in advance by the Engineer.

1.02 RELATED WORK

- A. Section 03200, Concrete Reinforcement.
- B. Section 03250, Concrete Joints and Joint Accessories.
- C. Section 03300, Cast-In-Place Concrete.
- D. Section 03600, Grout.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit shop drawings and product data showing materials of construction and details of installation for:
  - 1. Form release agent.
  - 2. Form ties.
- B. Samples
  - 1. Demonstrate to the Engineer on a designated area of the concrete substructure exterior surface that the form release agent will not adversely affect concrete surfaces to be painted, coated, or otherwise finished and will not affect the forming materials.

C. Certificates

1. Statement of qualification for the formwork designer retained by Contractor. Formwork designer shall be a professional engineer registered in the same state as the project site. Designer shall at a minimum 5 years of experience designing the required formwork and falsework systems.
2. Certify that form release agent is suitable for use in contact with potable water after 30 days (non-toxic and free of taste and odor).

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification Section differs from these documents, the requirements of this Section shall apply.

A. American Concrete Institute (ACI)

1. ACI 301—Standard Specification for Structural Concrete.
2. ACI 318—Building Code Requirements for Reinforced Concrete.
3. ACI 347—Formwork for Concrete.

B. American Plywood Association (APA)

1. Material grades and designations as specified.

C. NSF International (NSF) / American National Standards Institute (ANSI)

1. NSF/ANSI 61—Drinking Water System Components – Health Effects.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 WEATHER CONSTRAINTS (NOT USED)

## 1.12 SYSTEM DESCRIPTION

- A. Formwork shall be designed and erected in accordance with the requirements of ACI 301 and ACI 318 and as recommended in ACI 347 and shall comply with all applicable regulations and codes. The design shall consider any special requirements due to the use of plasticized and/or retarded set concrete. Design forms and ties to withstand concrete pressures without budging, spreading, or lifting forms.
- B. Architectural Concrete is wall, slab, beam, or column concrete which will have surfaces exposed to view in the finished work. It includes similar exposed surfaces in water containment structures from the top of walls to 2 feet below the normal water surface in open tanks and basins.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. The usage of a manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configurations desired.

### 2.02 MATERIALS

- A. General: Forms for cast-in-place concrete shall be made of wood, metal, or other approved material. Construct wood forms of sound lumber or plywood of suitable dimensions and free from knotholes and loose knots. Where used for exposed surfaces, dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Metal forms may be used when approved by the Engineer and shall be of an appropriate type for the class of work involved. All forms shall be designed and constructed to provide a flat, uniform concrete surface requiring minimal finishing or repairs.
- B. Wall Forms
  - 1. Forms for all exposed exterior and interior concrete walls shall be "Plyform" exterior grade plywood panels manufactured in compliance with the APA and bearing the trademark of that group, or equal acceptable to the Engineer. Provide B grade or better veneer on all faces to be placed against concrete during forming. The class of material and grades of interior plies shall be of sufficient strength and stiffness to provide a flat, uniform concrete surface requiring minimal finishing and grinding.
  - 2. All joints or gaps in forms shall be taped, gasketed, plugged, and/or caulked with an approved material so that the joint will remain watertight and will withstand placing pressures without bulging.

3. Circular Structures: Use forms conforming to the circular shape of the structure. Straight panels may be substituted for circular form provided panels to not exceed 2 feet in horizontal width and angular deflection is no greater than 3-1/2 degrees per joint.

C. Column Forms

1. Rectangular Columns: As specified for walls.
2. Circular Columns: Fabricated steel or fiber reinforced plastic with bolted together sections or spirally wound laminated fiber form internally treated with form release agent for height of columns.

- D. Rustication strips shall be at the location and shall conform to the details shown on the Drawings. Moldings for chamfers and rustications shall be milled and planed smooth. Rustications and corner strips shall be of a nonabsorbent material, compatible with the form surface and fully sealed on all sides to prohibit the loss of paste or water between the two surfaces.

E. Form Release Agent

1. Coat all forming surfaces in contact with concrete using an effective, non-staining, non-residual, water based, bond-breaking form coating unless otherwise noted. Form release agents used in potable water containment structures shall be suitable for use in contact with potable water and shall be non-toxic and free of taste or odor and meet the requirements of NSF/ANSI 61. Form release agent shall be Farm Fresh by Unitex or Engineer approved equal.

F. Form Ties

1. Form ties encased in concrete other than those specified in the following paragraphs shall be designed so that, after removal of the projecting part, no metal shall remain within 1-1/2 inches of the face of the concrete. The part of the tie to be removed shall be at least 1/2 inch diameter or be provided with a wood or metal cone at least 1/2 inch diameter and 1-1/2 inches long. Form ties in concrete exposed to view shall be the cone washer type.
2. Form ties for exposed exterior and interior walls shall be as specified in the preceding paragraph except that the cones shall be of approved wood or plastic.
3. Flat bar ties for panel forms, is used, shall have plastic or rubber inserts having a minimum depth of 1-1/2 inches and sufficient dimensions to permit proper patching of the tie hole.
4. Ties for liquid containment structures shall have an integral waterstop that is tightly welded to the tie.

5. Common wire shall not be used for form ties.
6. Alternate form ties consisting of tapered through-bolts at least 1 inch in diameter at smallest end or through-bolts that use a removable tapered sleeve of the same minimum size may be used at the Contractor's option. Obtain Engineer's acceptance of system and spacing of ties before ordering or purchase of forming. Clean, fill, and seal form tie hole with non-shrink cement grout. A vinyl plug shall be inserted into the hole to serve as a waterstop. The Contractor shall be responsible for water-tightness of the form ties and any repairs needed.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Forms shall be used for all cast-in-place concrete including sides of footings. Forms shall be constructed and placed so that the resulting concrete will be of the shape, lines, dimensions, and appearance indicated on the Drawings.
- B. Forms for walls shall have removable panels at the bottom for cleaning, inspection, and joint surface preparation. Forms for walls of considerable height (15 feet or greater) shall have closable intermediate inspection ports. Tremies and hoppers for placing concrete shall be used to allow concrete inspection, to prevent segregation, and to prevent the accumulation of hardened concrete on the forms above the fresh concrete.
- C. Molding, bevels, or other types of chamfer strips shall be placed to produce block outs, rustications, or chamfers as shown on the Drawings or as specified herein. Chamfer strips shall be provided at horizontal and vertical projecting corners to produce a 3/4 inch chamfer. Rectangular or trapezoidal moldings shall be placed in locations requiring sealants where specified or shown on the Drawings. Sizes of moldings shall conform to the sealants manufacturer's recommendations.
- D. Forms shall be sufficiently rigid to withstand construction loads and vibration and to prevent displacement or sagging between supports. Construct forms so that the concrete will not be damaged by their removal. The Contractor shall be entirely responsible for the adequacy of the forming system.
- E. Before form material is re-used, all surfaces to be in contact with concrete shall be thoroughly cleaned, all damaged places repaired, all projecting nails withdrawn, and all protrusions smoothed. Reuse of wooden forms for other than rough finish will be permitted only if a "like new" condition of the form is maintained.

### 3.02 FORM TOLERANCES

- A. Forms shall be surfaced, designed, and constructed in accordance with the recommendations of ACI 301 and ACI 347 and shall meet the following additional requirements for the specified finishes:
  - 1. Formed Surface Exposed to View: Edges of all form panels in contact with concrete shall be flush within 1/16 inch and forms for plane surfaces shall be such that the concrete will be plane within 3/16 inch in 4 feet. Forms shall be tight to prevent the passage of mortar, water, and grout. The maximum deviation of the finish wall surface at any point shall not exceed 1/4 inch from the intended surface as shown on the Drawings. Form panels shall be arranged symmetrically and in an orderly manner to minimize the number of seams.
  - 2. Formed surfaces not exposed to view or buried shall meet requirements of Class "C" Surface in ACI 301 and wACI 347.
  - 3. Formed rough surfaces including mass concrete, pipe encasement, electrical duct encasement, and other similar installations shall have no minimum requirements for surface smoothness and surface deflections. The overall dimensions of the concrete shall be plus or minus 1 inch.

### 3.03 FORM PREPARATION

- A. Wood forms in contact with the concrete shall be coated with an effective release agent before form installation.
- B. Steel forms shall be thoroughly cleaned and mill scale and other ferrous deposits shall be sandblasted or otherwise removed from the contact surface for all forms, except those used for surfaces receiving a rough finish. All forms shall have the contact surfaces coated with a release agent.

### 3.04 REMOVAL OF FORMS

- A. The Contractor shall be responsible for all damage resulting from removal of forms. Forms and shoring for structural slabs or beams shall remain in place in accordance with ACI 301. Form removal shall conform to the requirements specified in Section 03300, Cast-In-Place Concrete, including curing requirements.
- B. Repair all damages resulting from removal of forms.
- C. Clean, fill, and seal form tie hole with non-shrink cement grout. The Contractor shall be responsible for the watertightness of the form ties holes and any repair necessary to maintain watertightness of tie holes.

### 3.05 INSPECTION

- A. The Engineer on site shall be notified when the forms are complete and ready for inspection at least 6 hours before the proposed concrete placement.
- B. Failure of the forms to comply with the requirements specified herein or to produce concrete complying with the requirements of Section 03300, Cast-In-Place Concrete, shall be grounds for rejection of that portion of the concrete work. Rejected work shall be repaired or replaced as directed by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of this Section and approval of the Engineer.

END OF SECTION

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SECTION 03200  
CONCRETE REINFORCEMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install all concrete reinforcement complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Section 03100, Concrete Formwork.
- B. Section 03300, Cast-In-Place Concrete.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit shop drawings and product data showing materials of construction and details of installation for:
  - 1. Reinforcing steel. Placement Drawings shall conform to the recommendations of the CRSI Manual of Standard Practice and ACI SP-66. All reinforcement in a concrete placement shall be included on a single Placement Drawing or cross-referenced to the pertinent main Placement Drawing. The main Drawing shall include the additional reinforcement (around openings, at corners, etc) shown on the standard detail sheets. Bars to have special coatings and/or to be of special steel or special yield strength are to be clearly identified. For all cast-in-place concrete tanks, retaining walls, building stem walls, wall sections shall be included in the Drawings.
  - 2. All splice and joint locations shall be indicated on Placement Drawings. Splice lengths shall be clearly dimensioned.
  - 3. Reinforcement cover shall be clearly indicated.
  - 4. Submit reinforcement shop drawing for each structure as a complete package. Submittal showing portions of a structure will not be acceptable, unless accepted by the Engineer in advance.
  - 5. Submittals consisting of schedules without accompanying Placement Drawings will not be acceptable, unless accepted by the Engineer in advance.

6. Bar bending details. The bars shall be referenced to the same identification marks shown on the Placement Drawings and shipping tags. Schedules shall be located on the same sheet where the bar marks are referenced. Schedule of all placements to contain synthetic reinforcing fibers. The amount of fibers per cubic yard to be used for each of the placements shall be noted on the schedule. The name of the manufacturer of the fibers and the product data shall be included with the submittal.

B. Test Reports

1. Certified copy of mill test on each steel proposed for use showing the physical properties of the steel and the chemical analysis.
2. Mechanical Reinforcing Bar Couplers: Current Evaluation Report prepared by ICC-ES or by other approved testing agency.

C. Certificates

1. Welder's certification. The certification shall be in accordance with AWS D1.4 when welding of reinforcement is required.
2. Weld Procedures: Provide procedure for each type of welded reinforcing splice in accordance with AWS D1.4 when welding of reinforcing is required.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification Section differs from these documents, the requirements of this Section shall apply.

A. American Concrete Institute (ACI)

1. ACI 301—Standard Specification for Structural Concrete.
2. ACI 315—Details and Detailing of Concrete Reinforcement.
3. ACI 318—Building Code Requirements for Structural Concrete.
4. ACI SP-66—ACI Detailing Manual.

B. American Society for Testing and Materials (ASTM)

1. ASTM A82—Standard Specification for Steel Wire, Plain, for Concrete Reinforcement.
2. ASTM A184—Standard Specification for Welded Deformed Steel Bar Mats for Concrete Reinforcement.

3. ASTM A615—Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
4. ASTM A616—Standard Specification for Rail-Steel Deformed and Plain Bars for Concrete Reinforcement.
5. ASTM A617—Standard Specification for Axle-Steel Deformed and Plain Bars for Concrete Reinforcement.
6. ASTM A704—Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
7. ASTM A706—Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
8. ASTM A767—Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement.
9. ASTM A775—Standard Specification for Epoxy-Coated Steel Reinforcing Bars.
10. ASTM A884—Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement.
11. ASTM A934—Standard Specification for Epoxy-Coated Prefabricated Steel Reinforcing Bars.
12. ASTM A1064—Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.

C. American Welding Society (AWS)

1. AWS D1.4—Structural Welding Code Reinforcing Steel.

D. Concrete Reinforcing Steel Institute (CRSI)

1. Manual of Standard Practice.

E. International Code Council (ICC)

1. ICC-ES—ICC Evaluation Service.

## 1.06 QUALITY ASSURANCE

- A. Provide services of a manufacturer's representative, with at least 2 years of experience in the use of the reinforcing fibers for a preconstruction meeting and assistance during the first placement of the material.

## 1.07 WARRANTIES (NOT USED)

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Reinforcing steel shall be substantially free from mill scale, rust, dirt, grease, or other foreign matter.

- B. Reinforcing steel shall be shipped and stored with bars of the same size and shape fastened in bundles with durable tags, marked in a legible manner with waterproof markings showing the same "mark" designations as those shown on the submitted Placement Drawings.
- C. Reinforcing steel shall be stored off the ground and kept free from dirt, oil, or other injurious contaminants

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 WEATHER CONSTRAINTS (NOT USED)

### PART 2 PRODUCTS

#### 2.01 MATERIALS

- A. Materials shall be new, of domestic manufacture, and shall comply with the following material specifications.
- B. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.
- C. Concrete Reinforcing Bars required on the Drawings to be Welded: ASTM A706.
- D. Welded Steel Wire Fabric: ASTM A1064. Provide in flat sheets.
- E. Welded Deformed Steel Wire Fabric: ASTM A497. Provide in flat sheets.
- F. Welded Plain Bar Mats: ASTM A704 and ASTM A615 Grade 60 plain bars.
- G. Fabricated Deformed Steel Bar Mats: ASTM A184 and ASTM A615 Grade 60 deformed bars.
- H. Reinforcing Steel Accessories:
  - 1. Plastic Protected Bar Supports: CRSI Bar Support Specifications, Class 1 - Maximum Protection.
  - 2. Stainless Steel Protected Bar Supports: CRSI Bar Support Specifications, Class 2 - Moderate Protection.
  - 3. Precast Concrete Block Bar Supports: CRSI Bar Support Specifications, Precast Blocks. Blocks shall have equal or greater strength than the surrounding concrete.
  - 4. Steel Protected Bar Supports: #4 Steel Chairs with plastic or rubber tips.

- I. Tie Wire: Tie Wires for Reinforcement shall be 16-gauge or heavier, black annealed wire or stranded wire.
  
- J. Mechanical Reinforcing Bar Couplers:
  - 1. General: Use only at locations indicated on the Drawings or where written approval has been obtained from the Engineer.
  - 2. Mechanical reinforcing steel butt splices shall be positive connecting taper threaded type employing a hexagonal coupler such as Lenton rebar splices as manufactured by Erico Products Inc., Solon, OH or equal. They shall meet all ACI 318 Building Code requirements. Bar ends must be taper threaded with coupler manufacturer's bar threader to ensure proper taper and thread engagement.
  - 3. Bar couplers shall be torqued to manufacturer's recommended value.
  - 4. Unless otherwise noted on the Drawings, mechanical tension splices shall Type 2 and be designed to produce a splice strength in tension or compression of not less than ultimate strength of the rebar being spliced.
  - 5. Compression type mechanical splices shall provide concentric bearing from one bar to the other bar and shall be capable of developing the ultimate strength of the rebar in compression.
  - 6. Form saver type mechanical couplers shall have flanges with nailing holes to positively attach coupler to formwork.
  
- K. Fiber Reinforcement: Synthetic reinforcing fiber for concrete shall be 100 percent polypropylene collated, fibrillated fibers as manufactured by Fibermesh Company of Synthetic Industries Inc., Chattanooga, TN - Fibermesh or equal. Fiber length and quantity for the concrete mix shall be in strict compliance with the manufacturer's recommendations as approved by the Engineer.

## 2.02 FABRICATION

- A. Fabrication of reinforcement shall be in compliance with the CRSI Manual of Standard Practice and ACI SP-66.
  
- B. Bars shall be cold bent. Bars shall not be straightened or rebent.
  
- C. Bars shall be bent around revolving collar having a diameter of not less than that recommended by the ACI SP-66.
  
- D. Bar ends that are to be butt spliced, placed through limited diameter holes in metal, or threaded, shall have the applicable end(s) saw-cut. Such ends shall terminate in flat surfaces within 1-1/2 degrees of a right angle to the axis of the bar.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Surface condition, bending, spacing and tolerances of placement of reinforcement shall comply with the CRSI Manual of Standard Practice and ACI SP-66. The Contractor shall be solely responsible for providing and adequate number of bars and maintaining the spacing and clearances shown on the Drawings.
- B. Except as otherwise indicated on the Drawings, the minimum concrete cover of reinforcement shall be as follows:
  - 1. Concrete cast against and permanently exposed to earth: 3 inches.
  - 2. Concrete exposed to soil, water, sewage, sludge, and/or weather: 2 inches (including bottom cover of slabs over water or sewage).
  - 3. Concrete not exposed to soil, water, sewage, sludge, and/or weather:
    - a. Slabs (top and bottom cover), walls, joists, shells and folded plate members: 3/4 inch.
    - b. Beams and columns (principal reinforcement, ties, spirals, and stirrups): 1-1/2 inches.
- C. Reinforcement which will be exposed for a considerable length of time after being placed shall be coated with a heavy coat of neat cement slurry.
- D. No reinforcing steel bars shall be welded either during fabrication or erection unless specifically shown on the Drawings or specified herein, or unless prior written approval has been obtained from the Engineer. All bars that have been welded, including tack welds, without such approval shall be immediately removed from the work. When welding of reinforcement is approved or called for, it shall comply with AWS D1.4.
- E. Reinforcing steel interfering with the location of other reinforcing steel, conduits, or embedded items, may be moved within the specified tolerances or one bar diameter, whichever is greater. Greater displacement of bars to avoid interference shall only be made with the approval of the Engineer. Do not cut reinforcement to install inserts, conduits, mechanical openings, or other items without the prior approval of the Engineer.
- F. Securely support and tie reinforcing steel to prevent movement during concrete placement. Secure dowels in place before placing concrete.

- G. Reinforcing steel bars shall not be field-bent except where shown on the Drawings or specifically authorized in writing by the Engineer. If authorized, bars shall be cold-bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. If the reinforcing steel is damaged, replace, Cadweld, or otherwise repair as directed by the Engineer. Do not bend reinforcement after it is embedded in concrete unless specifically shown otherwise on the Drawings.

### 3.02 REINFORCEMENT AROUND OPENINGS

- A. Unless specific additional reinforcement around openings is shown on the Drawings, provide additional reinforcing steel on each side of the opening equivalent to one-half of the cross-sectional area of the reinforcing steel interrupted by an opening. The bars shall have sufficient length to develop bond at each end beyond the opening or penetration.

### 3.03 SPLICING OF REINFORCEMENT

- A. Splices designated as compression splices on the Drawings, unless otherwise noted, shall be 30-bar diameters, but not less than 12 inches. The lap splice length for column vertical bars shall be based on the bar size in the column above.
- B. Tension lap splices shall be provided at all laps in compliance with ACI SP-66. Splices in adjacent bars shall be staggered. Class A splices may be used when 50 percent or less of the bars are spliced within the required lap length. Class B splices shall be used at all other locations.
- C. Splicing of reinforcing steel in concrete elements noted to be "tension members" on the Drawings shall be avoided whenever possible. However, if required for constructability, splices in the reinforcement subject to direct tension shall be welded to develop, in tension, at least 125% of the specified yield strength of the bar. Splices in adjacent bars shall be offset the distance of a Class B splice.
- D. Install wire fabric in as long lengths as practicable. Wire fabric from rolls shall be rolled flat and firmly held in place. Splices in welded wire fabric shall be lapped in accordance with the requirements of ACI SP-66 but not less than 12 inches. The spliced fabrics shall be tied together with wire ties spaced not more than 24 inches on center and laced with wire of the same diameter as the welded wire fabric. Do not position laps midway between supporting beams, or directly over beams of continuous structures. Offset splices in adjacent widths to prevent continuous splices.
- E. Mechanical reinforcing steel splicers shall be used only where shown on the Drawings. Splices in adjacent bars shall be offset by at least 30-bar diameters.

Mechanical reinforcing splices are only to be used for special splice and dowel conditions approved by the Engineer.

### 3.04 ACCESSORIES

- A. Determine, provide, and install accessories such as chairs, chair bars, and the like in sufficient quantities and strength to adequately support the reinforcement and prevent its displacement during the erection of the reinforcement and the placement of concrete.
- B. Use precast concrete blocks where the reinforcing steel is to be supported over soil.
- C. Stainless steel bar supports or steel chairs with stainless steel tips shall be used where the chairs are set on forms for a concrete surface that will be exposed to weather, high humidity, or liquid (including bottom of slabs over liquid containing areas). Use of galvanized or plastic tipped metal chairs is permissible in all other locations unless otherwise noted on the Drawings or specified herein.
- D. Alternate methods of supporting top steel in slabs, such as steel channels supported on the bottom steel or vertical reinforcing steel fastened to the bottom and top mats, may be used if approved by the Engineer.

### 3.05 INSPECTION

- A. In no case shall any reinforcing steel be covered with concrete until the installation of the reinforcement, including the size, spacing, and position of the reinforcement, has been observed by the Engineer and the Engineer's release to proceed with the concreting has been obtained. The Engineer shall be given ample prior notice of the readiness of placed reinforcement for observation. The forms shall be kept open until the Engineer has finished his/her observations of the reinforcing steel.

END OF SECTION



SECTION 03250  
CONCRETE JOINTS AND JOINT ACCESSORIES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install accessories for concrete joints as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Section 03100, Concrete Formwork.
- B. Section 03200, Concrete Reinforcement.
- C. Section 03300, Cast-In-Place Concrete.
- D. Section 03360, Concrete Finishes.
- E. Section 03600, Grout.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit shop drawings and product data. Submittals shall include at least the following:
  - 1. Standard Waterstops: Product data including catalogue cut, technical data, storage requirements, splicing methods, and conformity to ASTM standards.
  - 2. Special Waterstops: Product data including catalogue cut, technical data, location of use, storage requirements, splicing methods, installation instructions, and conformity to ASTM standards.
  - 3. Premolded Joint Fillers: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.
  - 4. Bond Breaker: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.
  - 5. Expansion Joint Dowels: Product data on the complete assembly including dowels, coatings, lubricants, spacers, sleeves, expansion caps, installation requirements, and conformity to ASTM standards.
  - 6. Compressible Joint Filler: Product data including catalogue cut, technical data, storage requirements, installation requirements, location of use, and conformity to ASTM standards.

7. Bonding Agents: Product data including catalogue cut, technical data, storage requirements, product life, application requirements, and conformity to ASTM standards.

B. Certifications

1. Certification that all materials used within the joint system is compatible with each other.
2. Certifications that materials used in the construction of joints are suitable for use in contact with potable water 30 days after installation.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM A675—Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality, Mechanical Properties.
2. ASTM C881—Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
3. ASTM C1059—Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete.
4. ASTM D570—Standard Test Method for Water Absorption of Plastics.
5. ASTM D624—Standard Test Method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.
6. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
7. ASTM D746—Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.
8. ASTM D747—Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.
9. ASTM D792—Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
10. ASTM D1751—Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types).
11. ASTM D1752—Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

- B. US Army Corps of Engineers (CRD)
  - 1. CRD-C572—Specification for Polyvinylchloride Waterstops.
- C. Federal Specifications (FS)
  - 1. FS SS-S-210A—Sealing Compound for Expansion Joints.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 WEATHER CONSTRAINTS (NOT USED)

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. All materials used together in a given joint (bond breakers, backer rods, joint fillers, sealants, etc.) shall be compatible with one another. Coordinate selection of suppliers and product to ensure compatibility. Under no circumstances shall asphaltic bond breakers or joint fillers be used in joints receiving sealant.
- C. All chemical sealant type waterstops shall be products specifically manufactured for the purpose for which they will be used and the products shall have been successfully used on similar structures for more than 5 years.

### 2.02 MATERIALS

- A. Standard Waterstops
  - 1. PVC Waterstops: The waterstop shall be made by extruding elastomeric plastic compound with virgin polyvinylchloride as the basic resins. The compound shall contain no reprocessed materials. Minimum tensile strength of waterstop shall be 1,750 psi. The waterstop shall conform to CRD-C572. The waterstop shall be Greenstreak Group, Inc. Model

No. 679 or approved equal for construction joints. The waterstop shall be Sika Greenstreak model No. 732 or approved equal for control joints, and Sika Greenstreak Model No. 738 for expansion joints. Provide grommets or pre-punched holes spaced at 12 inches on center along length of waterstop.

2. Factory Fabrications: Provide factory made waterstop fabrications for all changes of direction, transitions, and intersections, leaving only straight butt joints of sufficient length for splicing in the field.

#### B. Special Waterstops

1. Preformed adhesive waterstops: The waterstop shall be a rope type preformed plastic waterstop meeting the requirements of FS SS-S-210A. The rope shall have a cross-section of approximately 1 square inch unless otherwise specified or shown on the Drawings. The waterstop shall be Synko-Flex waterstop as manufactured by Henry Company, Lockstop by Sika Greenstreak, or equal. Primer and surface preparation for the material shall be as recommended by the waterstop manufacturer.

#### C. Expansion Joint Material

1. Joint Material at structures: Self-expanding cork, expansion joint material shall conform to ASTM D1752, Type III. The thickness shall be 3/4 inch unless shown otherwise on the Drawings.
2. Joint Material at sidewalk and roadway concrete pavements or where fiber joint filler is specifically noted on the Drawings: The joint filler shall be asphalt-impregnated fiber board conforming to ASTM D1751. Thickness shall be 3/4 inch unless otherwise shown on the Drawings.

#### D. Bond Breaker

1. Bond breaker tape shall be an adhesive-backed glazed butyl or polyethylene tape which will satisfactorily adhere to the expansion joint material or concrete surface as required. The tape shall be the same width as the joint.
2. Except where tape is specifically called for on the Drawings, bond breaker for concrete shall be either bond breaker tape or a nonstaining type bond prevention coating such as Maxi-Tilt with Dye by Dayton Superior, Inc.; Silco seal 77, by SCA Construction Supply Division, Superior Concrete Accessories or equal.

#### E. Expansion Joint Dowels

1. Dowels shall be smooth steel conforming to ASTM A675, Grade 70. Dowels must be straight and clean, free of loose flaky rust and loose scale.

Dowels may be sheared to length provided deformation from true shape caused by shearing does not exceed 0.04 inch on the diameter of the dowel and extends no more than 0.04 inch from the end. Bars shall be coated with a bond breaker on the expansion end of the dowel. Expansion caps shall be provided on the expansion end. Caps shall allow for at least 1-1/2 inches of expansion.

2. Dowel Bar Sleeves: Provide two component Speed Dowel System by Sika, to accept 1-inch-diameter x 12-inch-long slip dowels. Speed Dowel System is comprised of a reusable base and a plastic sleeve. Both pieces shall be manufactured from polypropylene plastic.

F. Bonding Agent

1. Epoxy bonding agent shall be a two-component, solvent-free, moisture insensitive, epoxy resin material conforming to ASTM C881, Type II. The bonding agent shall be Sikadur 32 Hi-Mod by Sika Corporation of Lyndhurst, N.J.; MasterEmaco ADH 326 by BASF or equal. Acrylic may be used if approved by the Engineer.

G. Compressible Joint Filler

1. The joint filler shall be a non-extruded watertight strip material use to fill expansion joints between structures. The material shall be capable of being compressed at least 40% for 70 hours at 68 degrees F and subsequently recovering at least 20% of its original thickness in the first 1/2 hour after unloading. Compressible Joint filler shall be Wabo®Evasote, by BASF, Inc., or equal.

H. Joint Sealant

1. The joint sealant shall be a one-component, polyurethane-based, non-sag elastomeric sealant. Joint sealant shall be Sikaflex-1a or equal.

## PART 3 EXECUTION

### 3.01 INSTALLATION

A. Standard Watershops

1. Install waterstops for all joints where indicated on the Drawings. Waterstops shall be continuous around all corners and intersections so that a continuous seal is provided. Provide factory made waterstop fabrications for all changes in direction, intersections, and transitions leaving only straight butt joints splices for the field.

2. Horizontal waterstops in slabs shall be clamped in position by the bulkhead (unless previously set in concrete).
3. Waterstops shall be installed so that half of the width will be embedded on each side of the joint. Care shall be exercised to ensure that the waterstop is completely embedded in void-free concrete. All waterstops shall be tied to reinforcement with reinforcing tie wire through the factory provided grommets.
4. Waterstops shall be terminated 3 inches below the exposed top of walls. Expansion joint waterstop center bulbs shall be plugged with foam rubber, 1 inch deep, at point of termination.

#### B. Special Waterstops

1. Install special waterstops at joints where specifically noted on the Drawings. Waterstops shall be continuous around all corners and intersections so that a continuous seal is provided. Provide factory made waterstop fabrications for all changes in direction, intersections, and transitions leaving only straight butt joints splices for the field.
2. Each piece of the waterstop shall be of maximum practicable length to provide a minimum number of connections or splices. Connections and splices shall conform to the manufacturer's recommendations and as specified herein.
3. Waterstops shall be terminated 3 inches below the exposed top of walls.

#### C. Construction Joints

1. Make construction joints only at locations shown on the Drawings or as approved by the Engineer. Any additional or relocation of construction joints proposed by the Contractor must be submitted to the Engineer for written approval. Joints shall be spaced at a maximum of 40 feet o.c. unless noted otherwise on the Drawings.
2. Additional or relocated joints should be located where they least impair strength of the member. In general, locate joints within the middle third of spans of slabs, beams, and girders. However, if a beam intersects a girder at the joint, offset the joint a distance equal to twice the width of the member being connected. Locate joints in walls and columns at the underside of floors, slabs, beams, or girders and at tops of footings or floor slabs. Do not locate joints between beams, girders, column capitals, or drop panels and the slabs above them. Do not locate joints between brackets or haunches and walls or columns supporting them.
3. All joints shall be perpendicular to main reinforcement. Continue reinforcing steel through the joint as indicated on the Drawings. When joints in beams are allowed, provide a shear key and inclined dowels as approved by the Engineer.
4. Provide sealant grooves for joint sealant where indicated on the Drawings.

5. At all construction joints and at concrete joints designated on the Drawings to be "roughened", uniformly roughen the surface of the concrete to a full amplitude (distance between high and low points or side to side) of approximately 1/4 inch to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by water-blasting or sandblasting and prepare for bonding.
6. Provide waterstops in all wall and slab construction joints in liquid containment structures and at other locations shown on the Drawings.
7. Keyways shall not be used in construction joints unless specifically shown on the Drawings or approved by the Engineer.

#### D. Expansion Joints

1. Do not extend through expansion joints, reinforcement, or other embedded metal items that are continuously bonded to concrete on each side of joint.
2. Position premolded joint filler material accurately. Secure the joint filler against displacement during concrete placement and compaction. Place joint filler over the face of the joint, allowing for sealant grooves as detailed on the Drawings. Tape all joint filler splices to prevent intrusion of mortar. Seal expansion joints as shown on the Drawings.
3. Expansion joints shall be 3/4 inch in width unless otherwise noted on the Drawings.
4. Where indicated on Drawings, install smooth dowels at right angles to expansion joints. Align dowels accurately with finished surface. Rigidly hold in place and support during concrete placement. Unless otherwise shown on the Drawings, apply oil or grease to one end of all dowels through expansion joints. Provide plastic expansion caps on the lubricated ends of expansion dowels.
5. Provide center bulb type waterstops in all wall and slab expansion joints in liquid containment structures and at other locations shown on the Drawings.

#### E. Control Joints

1. Provide sealant grooves, sealants, and waterstops at control joints in slabs on grade or walls as detailed. Provide waterstops at all wall and slab control joints in water containment structures and at other locations shown on the Drawings.
2. Control joints may be sawed if specifically approved by the Engineer. If control joint grooves are sawed, properly time the saw cutting with the time of the concrete set. Start cutting as soon as concrete has hardened sufficiently to prevent aggregates from being dislodged by the saw. Complete cutting before shrinkage stresses have developed sufficiently to induce cracking. No reinforcing shall be cut during sawcutting.

3. Extend every other bar of reinforcing steel through control joints or as indicated on the Drawings. Where specifically noted on the Drawings, coat the concrete surface with a bond breaker before placing new concrete against it. Avoid coating reinforcement or waterstops with bond breaker at these locations.

END OF SECTION



SECTION 03300  
CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor and materials required and install cast-in-place concrete complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 03100, Concrete Formwork.
- C. Section 03200, Concrete Reinforcement.
- D. Section 03250, Concrete Joints and Joint Accessories.
- E. Section 03360, Concrete Finishes.
- F. Section 03600, Grout.
- G. Section 03740, Modifications and Repair to Concrete.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit shop drawings and product data including the following:
  - 1. Sources of cement, pozzolan, and aggregates.
  - 2. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.
  - 3. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, and conformity to ASTM standards.
  - 4. Water-reducing admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, and conformity to ASTM standards.
  - 5. High-range water-reducing admixture (plasticizer). Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations, retarding effect, slump

range, and conformity to ASTM standards. Identify proposed locations of use.

6. Concrete mix for each formulation of concrete proposed for use including constituent quantities per cubic yard, water-cementitious materials ratio, concrete slump, type, and manufacturer of cement. Provide either a. or b. below for each mix proposed.
  - a. Standard deviation data for each proposed concrete mix based on statistical records.
  - b. The curve of water-cementitious materials ratio versus concrete cylinder strength for each formulation of concrete proposed based on laboratory tests. The cylinder strength shall be the average of the 28-day cylinder strength test results for each mix. Provide results of 7- and 14-day tests if available.
7. Sheet curing material. Product data including catalogue cut, technical data and, conformity to ASTM standard.
8. Liquid curing compound. Product data including catalogue cut, technical data, storage requirements, product life, application rate, and conformity to ASTM standards. Identify proposed locations of use.
9. Independent testing agency information, address, certifications, and qualifications for performing the testing required.

B. Samples

1. Fine and coarse aggregates if requested by the Engineer.

C. Test Reports

1. Fine aggregates: Sieve analysis, physical properties, and deleterious substance.
2. Coarse aggregates: Sieve analysis, physical properties, and deleterious substances.
3. Cements: Chemical analysis and physical properties for each type.
4. Pozzolans: Chemical analysis and physical properties.
5. Proposed concrete mixes: Compressive strength, slump, and air content.

D. Certifications

1. Certify admixtures used in the same concrete mix are compatible with each other and the aggregates.

2. Certify admixtures are suitable for use in contact with potable water after 30 days of concrete curing.
3. Certify curing compound is suitable for use in contact with potable water after 30 days (non-toxic and free of taste or odor).

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification Section differs from these documents, the requirements of this Section shall apply.

##### A. American Concrete Institute (ACI)

1. ACI 301—Standard Specification for Structural Concrete.
2. ACI 304.1—Guide for the Use of Preplaced Aggregate Concrete for Structural and Mass Concrete Applications.
3. ACI 305.1—Standard Specification for Hot Weather Concreting.
4. ACI 306.1—Standard Specification for Cold Weather Concreting.
5. ACI 318—Building Code Requirements for Structural Concrete and Commentary.

##### B. American Society for Testing and Materials (ASTM)

1. ASTM C31—Standard Practice for Making and Curing Concrete Test Specimens in the Field.
2. ASTM C33—Standard Specification for Concrete Aggregates.
3. ASTM C39—Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
4. ASTM C42—Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
5. ASTM C94—Standard Specification for Ready-Mixed Concrete.
6. ASTM C143—Standard Test Method for Slump of Hydraulic-Cement Concrete.
7. ASTM C150—Standard Specification for Portland Cement.
8. ASTM C171—Standard Specification for Sheet Materials for Curing Concrete.
9. ASTM C173—Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
10. ASTM C231—Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
11. ASTM C260—Standard Specification for Air-Entraining Admixtures for Concrete.

12. ASTM C309—Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
13. ASTM C494—Standard Specification for Chemical Admixtures for Concrete.
14. ASTM C618—Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
15. ASTM C989—Standard Specification for Slag Cement for Use in Concrete and Mortars.
16. ASTM C1017—Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.

C. National Ready Mixed Concrete Association (NRMCA)

#### 1.06 QUALITY ASSURANCE

- A. Reinforced concrete shall comply with specifications and standards noted above. The most stringent requirement of the specifications, standards, and this Section shall apply when conflicts exist.
- B. Only one source of cement and aggregates shall be used on any one structure. Concrete shall be uniform in color and appearance.
- C. Well in advance of placing concrete, discuss with the Engineer the sources of individual materials and batched concrete proposed for use. Discuss placement methods, waterstops, and curing. Propose methods of hot and cold weather concreting as required. Before the placement of any concrete containing a high-range water-reducing admixture (plasticizer), the Contractor, accompanied by the plasticizer manufacturer, shall discuss the properties and techniques of batching and placing plasticized concrete.
- D. If, during the progress of the work, it is impossible to secure concrete of the required workability and strength with the materials being furnished, the Engineer may order such changes in proportions or materials, or both, as may be necessary to secure the desired properties. All changes so ordered shall be made at the Contractor's expense.
- E. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, the Contractor shall, at his/her expense, make new acceptance tests of aggregates and establish new design mixes.
- F. Testing of the following materials shall be furnished by the Contractor to verify conformity with this Specification Section and the stated ASTM Standards.
  1. Fine aggregates for conformity with ASTM C33: Sieve analysis, physical properties, and deleterious substances.

2. Coarse aggregates for conformity with ASTM C33: Sieve analysis, physical properties, and deleterious substances.
  3. Cements for conformity with ASTM C150: Chemical analysis and physical properties.
  4. Pozzolans for conformity with ASTM C618: Chemical analysis and physical properties.
  5. Proposed concrete mix designs: Compressive strength, slump and air content.
- G. Field testing and inspection services shall be provided by the Contractor using an independent agency and in conformance with applicable testing standards. The cost of such work, except as specifically stated otherwise, shall be included in the Bid Items.

Testing of the following items shall be completed to verify conformity with this Specification Section.

1. Concrete placements: Compressive strength (cylinders), compressive strength (cores), slump, and air content.
  2. Other materials or products that may come under question.
- H. The approved testing agency shall transmit copies of required laboratory test results as follows:
1. One copy to the Owner.
  2. One copy to the Engineer.
  3. Two copies to the Contractor.
- I. All materials incorporated in the work shall conform to accepted samples.

#### 1.07 WARRANTIES (NOT USED)

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Cement: Store in weathertight buildings, bins, or silos to provide protection from dampness and contamination and to minimize warehouse set.
- B. Aggregate: Arrange and use stockpiles to avoid excessive segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding 3 feet in thickness. Complete each layer before the next is started. Do not use frozen or partially frozen aggregate.

- C. Sand: Arrange and use stockpiles to avoid contamination. Allow sand to drain to uniform moisture content before using. Do not use frozen or partially frozen aggregates.
- D. Admixtures: Store in closed containers to avoid contamination, evaporation, or damage. Provide suitable agitating equipment to assure uniform dispersion of ingredients in admixture solutions that tend to separate. Protect liquid admixtures from freezing and other temperature changes that could adversely affect their characteristics.
- E. Pozzolan: Store in weathertight buildings, bins, or silos to provide protection from dampness and contamination.
- F. Sheet Curing Materials: Store in weathertight buildings or off the ground and under cover.
- G. Liquid Curing Compounds: Store in closed containers.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 WEATHER CONSTRAINTS (NOT USED)

### PART 2 PRODUCTS

#### 2.01 GENERAL

- A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Cement: U.S. made Portland cement complying with ASTM C150. Air entraining cements shall not be used. Cement brand shall be subject to approval by the Engineer and one brand shall be used throughout the work.

#### 2.02 MATERIALS

- A. Materials shall comply with this Section and any applicable State or local requirements.
- B. Cement: The following cement type(s) shall be used:
  - 1. All Classes – Type I/II or Type II.

- C. Fine Aggregate: Washed inert natural sand conforming to the requirements of ASTM C33.
- D. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to the requirements of ASTM C33. Grading requirements shall be as listed in ASTM C33 Table 2 for the specified coarse aggregate size number. Limits of Deleterious Substances and Physical Property Requirements shall be as listed in ASTM C33 Table 3 for severe weather regions. Size numbers for the concrete mixes shall be as shown in Table 1 herein.
- E. Water: Potable water free from injurious amounts of oils, acids, alkalis, salts, organic matter, or other deleterious substances.
- F. Admixtures: Admixtures shall be free of chlorides and alkalis (except for those attributable to water). When it is required to use more than one admixture in a concrete mix, the admixtures shall be from the same manufacturer. Admixtures shall be compatible with the concrete mix including other admixtures and shall be suitable for use in contact with potable water after 30 days of concrete curing.
  - 1. Air-Entraining Admixture: The admixture shall comply with ASTM C260. Proportioning and mixing shall be in accordance with manufacturer's recommendations.
  - 2. Water-Reducing Agent: The admixture shall comply with ASTM C494, Type A. Proportioning and mixing shall be in accordance with manufacturer's recommendations.
  - 3. High-Range Water-Reducer (Plasticizer): The admixture shall comply with ASTM C494, Type F and shall result in non-segregating plasticized concrete with little bleeding and with the physical properties of low water/cement ratio concrete. The treated concrete shall be capable of maintaining its plastic state in excess of 2 hours. Proportioning and mixing shall be in accordance with manufacturer's recommendations. Where walls are 14 inches thick or less and the wall height exceeds 12 feet, a mix including a plasticizer must be used.
  - 4. Admixtures causing retarded or accelerated setting of concrete shall not be used without written approval from the Engineer. When allowed, the admixtures shall be retarding or accelerating water reducing or high range water reducing admixtures.
- G. Pozzolan (Fly Ash): Pozzolan shall be Class C or Class F fly ash complying with ASTM C618 except the Loss on Ignition (LOI) shall be limited to 3% maximum.
- H. Ground-Granulated Blast Furnace Slag: Ground-granulated blast furnace slag shall conform to the following:
  - 1. ASTM C989.

2. Slag activity classification: Grade 100 or 120.
  - I. Sheet Curing Materials. Waterproof paper, polyethylene film, or white burlap-polyethylene sheeting all complying with ASTM C171.
  - J. Liquid Curing Compound. Liquid membrane-forming curing compound shall comply with the requirements of ASTM C309, Type 1-D (clear or translucent with fugitive dye) and shall contain no wax, paraffin, or oil. Curing compound shall be approved for use in contact with potable water after 30 days (non-toxic and free of taste or odor). Curing compound shall comply with Federal, State, and local VOC limits.

### 2.03 MIXES

- A. Development of mix designs and testing shall be by an independent testing laboratory acceptable to the Engineer engaged by and at the expense of the Contractor.
- B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce concrete having proper placability, durability, strength, appearance, and other required properties. Proportion ingredients to produce a homogenous mixture which will readily work into corners and angles of forms and around reinforcement without permitting materials to segregate or allowing excessive free water to collect on the surface.
- C. The design mix shall be based on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if such data is not available, be developed by a testing laboratory, acceptable to the Engineer, engaged by and at the expense of the Contractor. Acceptance of mixes based on standard deviation shall be based on the modification factors for standard deviation tests contained in ACI 318. The water content of the concrete mix, determined by laboratory testing, shall be based on a curve showing the relation between water cementitious ratio and 7- and 28-day compressive strengths of concrete made using the proposed materials. The curves shall be determined by four or more points, each representing an average value of at least three test specimens at each age. The curves shall have a range of values sufficient to yield the desired data, including the specified design strengths as modified below, without extrapolation. The water content of the concrete mixes to be used, as determined from the curve, shall correspond to strengths 16% greater than the specified design strengths. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content as specified in Table 1.



- D. Compression Tests: Provide testing of the proposed concrete mix or mixes to demonstrate compliance with the specified design strength requirements in conformity with the above paragraph.
- E. Entrained air, as measured by ASTM C231, shall be as shown in Table 1.
1. If the air-entraining agent proposed for use in the mix requires testing methods other than ASTM C231 to accurately determine air content, make special note of this requirement in the admixture submittal.
- F. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 1. If a high-range water-reducer (plasticizer) is used, the slump indicated shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 5 to 8 inches.
- G. Proportion admixtures according to the manufacturer's recommendations. Two or more admixtures specified may be used in the same mix provided that the admixtures in combination retain full efficiency and have no deleterious effect on the concrete or on the properties of each other.

TABLE 1 CONCRETE MIX REQUIREMENTS						
Class	Design Strength (1)	Cement (2)	Fine Aggregate (2)	Coarse Aggregate (3)		Cementitious Content (4)
A	2,500	C150 Type II	C33	57		440 minimum
B	3,000	C150 Type II	C33	57		480 minimum
C	4,000	C150 Type II	C33	57		560 minimum
D	5,000	C150 Type II	C33	57		600 minimum
Class	W/cm Ratio (5)	Fly Ash	AE Range (6)	WR (7)	HRWR (8)	Slump Range Inches
A	0.63 maximum	--	3.5 to 5	Yes	*	1-4
B	0.54 maximum	--	3.5 to 5	Yes	*	1-3
C	0.44 maximum	25% maximum	3.5 to 5	Yes	*	3-5
D	0.40 maximum	--	3.5 to 5	Yes	*	3-5

NOTES:

- (1) Minimum compressive strength in psi at 28 days.
- (2) ASTM designation.
- (3) Size number in ASTM C33.
- (4) Cementitious content in pounds/cubic yard.
- (5) W/Cm is water-cementitious ratio by weight.
- (6) AE is percent air-entrainment.
- (7) WR is water-reducer admixture.
- (8) HRWR is high-range water-reducer admixture.
- \* HRWR used at the Contractor's option except where walls are 14 inches thick or less and the wall height exceeds 12 feet, a mix including a plasticizer must be used.

## PART 3 EXECUTION

### 3.01 MEASURING MATERIALS

- A. Concrete shall be composed of Portland cement, fine aggregate, coarse aggregate, water and admixtures as specified and shall be produced by a plant acceptable to the Engineer. All constituents, including admixtures, shall be batched at the plant except a high-range water-reducer may also be added in the field.
- B. Measure materials for batching concrete by weighing in conformity with and within the tolerances given in ASTM C94 except as otherwise specified. Scales shall have been certified by the local Sealer of Weights and Measures within 1 year of use.
- C. Measure the amount of free water in fine aggregates within 0.3% with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as-batched on printed batching tickets.
- D. Admixtures shall be dispensed either manually using calibrated containers or measuring tanks, or by means of an automatic dispenser approved by the manufacturer of the specific admixture.
  - 1. Charge air-entraining and chemical admixtures into the mixer as a solution using an automatic dispenser or similar metering device.
  - 2. Inject multiple admixtures separately during the batching sequence.

### 3.02 MIXING AND TRANSPORTING

- A. Batch plants shall have a current NRMCA Certification or equal.
- B. Concrete shall be ready-mixed concrete produced by equipment acceptable to the Engineer. No hand-mixing will be permitted. Clean each transit mix truck drum and reverse drum rotation before the truck proceeds under the batching plant. Equip each transit-mix truck with a continuous, nonreversible, revolution counter showing the number of revolutions at mixing speeds.
- C. Ready-mix concrete shall be transported to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.
- D. Keep the water tank valve on each transit truck locked at all times. Any addition of water above the appropriate W/Cm ratio must be directed by the Engineer. Added water shall be incorporated by additional mixing of at least 35 revolutions. All added water shall be metered and the amount of water added shall be shown on each delivery ticket.

- E. All central plant and rolling stock equipment and methods shall comply with ACI 318 and ASTM C94.
- F. Select equipment of size and design to ensure continuous flow of concrete at the delivery end. Metal or metal-lined non-aluminum discharge chutes shall be used and shall have slopes not exceeding 1 vertical to 2 horizontal and not less than 1 vertical to 3 horizontal. Chutes more than 20 feet long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.
- G. Retempering (mixing with or without additional cement, aggregate, or water) of concrete or mortar which has reached initial set will not be permitted.
- H. Handle concrete from mixer to placement as quickly as practicable while providing concrete of required quality in the placement area. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required, thus avoiding excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms.
- I. Furnish a delivery ticket for ready mixed concrete to the Engineer as each truck arrives. Each ticket shall provide a printed record of the weight of cement and each aggregate as batched individually. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Clearly indicate the weight of fine and coarse aggregate, cement, and water in each batch, the quantity delivered, the time any water is added, and the numerical sequence of the delivery. Show the time of day batched and time of discharge from the truck. Indicate the number of revolutions of the truck mixer.
- J. Temperature and Mixing Time Control
  - 1. In cold weather, do not allow the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms to drop below 40 degrees F.
  - 2. If water or aggregate has been heated, combine water with aggregate in the mixer before cement is added. Do not add cement to mixtures of water and aggregate when the temperature of the mixture is greater than 90 degrees F.
  - 3. In hot weather, cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. If necessary, substitute well-crushed ice for all or part of the mixing water.
  - 4. The maximum time interval between the addition of mixing water and/or cement to the batch and the placing of concrete in the forms shall not exceed the values shown in Table 2.

TABLE 2 MAXIMUM TIME TO DISCHARGE OF CONCRETE	
Air or Concrete Temperature (whichever is higher)	Maximum Time
80 to 90 Degree F (27 to 32 Degree C)	45 minutes
70 to 79 Degree F (21 to 26 Degree C)	60 minutes
40 to 69 Degree F (5 to 20 Degree C)	90 minutes

5. If an approved high-range water-reducer (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

### 3.03 CONCRETE APPEARANCE

- A. Concrete mix showing either poor cohesion or poor coating of the coarse aggregate with paste shall be remixed. If this does not correct the condition, the concrete shall be rejected. If the slump is within the allowable limit, but excessive bleeding, poor workability, or poor finishability are observed, changes in the concrete mix shall be obtained only by adjusting one or more of the following:
  1. The gradation of aggregate.
  2. The proportion of fine and coarse aggregate.
  3. The percentage of entrained air, within the allowable limits.
- B. Concrete for the work shall provide a homogenous structure which, when hardened, will have the required strength, durability, and appearance. Mixtures and workmanship shall be such that concrete surfaces, when exposed, will require no finishing. When concrete surfaces are stripped, the concrete, when viewed in good lighting from 10 feet away, shall be pleasing in appearance, and at 20 feet shall show no visible defects.

### 3.04 PLACING AND COMPACTING

- A. Placing
  1. Verify that all formwork completely encloses concrete to be placed and is securely braced before concrete placement. Remove ice, excess water, dirt, and other foreign materials from forms. Confirm that reinforcement and other embedded items are securely in place. Have a competent workman at the location of the placement who can assure that reinforcing steel and embedded items remain in designated locations while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of

water from the mix. Seal extremely porous subgrades in an approved manner.

2. Deposit concrete as near its final position as possible to avoid segregation due to rehandling or flowing. Place concrete continuously at a rate which ensures the concrete is being integrated with fresh plastic concrete. Do not deposit concrete which has partially hardened or has been contaminated by foreign materials or on concrete which has hardened sufficiently to cause formation of seams or planes of weakness within the section. If the section cannot be placed continuously, place construction joints as specified or as approved.
3. Pumping of concrete will be permitted. Use a mix design and aggregate sizes suitable for pumping and submit for approval.
4. Remove temporary spreaders from forms when the spreader is no longer useful. Temporary spreaders may remain embedded in concrete only when made of galvanized metal or concrete and if prior approval has been obtained.
5. Do not place concrete for supported elements until concrete previously placed in the supporting element (columns, slabs and/or walls) has reached adequate strength.
6. Where surface mortar is to form the base of a finish, especially surfaces designated to be painted, work coarse aggregate back from forms with a suitable tool to bring the full surface of the mortar against the form. Prevent the formation of excessive surface voids.
7. Slabs
  - a. After suitable bulkheads, screeds, and jointing materials have been positioned, the concrete shall be placed continuously between construction joints beginning at a bulkhead, edge form, or corner. Each batch shall be placed into the edge of the previously placed concrete to avoid stone pockets and segregation.
  - b. Avoid delays in casting. If there is a delay in casting, the concrete placed after the delay shall be thoroughly spaded and consolidated at the edge of that previously placed to avoid cold joints. Concrete shall then be brought to correct level and struck off with a straightedge. Bullfloats or darbies shall be used to smooth the surface, leaving it free of humps or hollows.
  - c. Where slabs are to be placed integrally with the walls below them, place the walls and compact as specified. Allow 1 hour to pass

between placement of the wall and the overlying slab to permit consolidation of the wall concrete. Keep the top surface of the wall moist so as to prevent cold joints.

8. Formed Concrete

- a. Place concrete in forms using tremie tubes and taking care to prevent segregation. Bottom of tremie tubes shall preferably be in contact with the concrete already placed. Do not permit concrete to drop freely more than 4 feet. Place concrete for walls in 12- to 24-inch lifts, keeping the surface horizontal. If plasticized concrete is used, the maximum lift thickness may be increased to 4 feet.

9. Underwater concreting shall be performed in conformity with the recommendations of ACI 304.1. The tremie system shall be used to place underwater concrete. Tremie pipes shall be in the range of 8 to 12 inches in diameter and be spaced at not more than 16 feet on centers nor more than 8 feet from an end form. Where concrete is being placed around a pipe, there shall be at least one tremie pipe on each side of each pipe. Where the tremie system is not practical, direct pumped concrete for underwater placement may be used subject to approval of the system including details by the Engineer.

B. Compacting

1. Consolidate concrete by vibration, puddling, spading, rodding, or forking so that concrete is thoroughly worked around reinforcement, embedded items and openings, and into corners of forms. Puddling, spading, etc., shall be continuously performed along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting, or planes of weakness.
2. All concrete shall be placed and compacted with mechanical vibrators. The number, type, and size of the units shall be approved by the Engineer in advance of placing operations. No concrete shall be ordered until sufficient approved vibrators (including standby units in working order) are on the job.
3. A minimum frequency of 7,000 rpm is required for mechanical vibrators. Insert vibrators and withdraw at points from 18 to 30 inches apart. At each insertion, vibrate sufficiently to consolidate concrete, generally from 5 to 15 seconds. Do not over-vibrate so as to segregate. Keep a spare vibrator on the site during concrete placing operations.

4. Concrete Slabs: Concrete for slabs less than 8 inches thick shall be consolidated with vibrating screeds; slabs 8 to 12 inches thick shall be compacted with internal vibrators and (optionally) with vibrating screeds. Vibrators shall always be placed into concrete vertically and shall not be laid horizontally or laid over.
5. Walls and Columns: Internal vibrators (rather than form vibrators) shall be used unless otherwise approved by the Engineer. In general, for each vibrator needed to melt down the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize, and perfect the surface. The vibrators shall be inserted vertically at regular intervals, through the fresh concrete and slightly into the previous lift, if any.
6. Amount of Vibration: Vibrators are to be used to consolidate properly placed concrete but shall not be used to move or transport concrete in the forms. Vibration shall continue until:
  - a. Frequency returns to normal.
  - b. Surface appears liquefied, flattened, and glistening.
  - c. Trapped air ceases to rise.
  - d. Coarse aggregate has blended into surface, but has not disappeared.

### 3.05 CURING AND PROTECTION

- A. Protect all concrete work against injury from the elements and defacements of any nature during construction operations.
- B. Curing Methods
  1. Curing Methods for Concrete Surfaces: Cure concrete to retain moisture and maintain specified temperature at the surface for a minimum of 7 days after placement. Curing methods to be used are as follows:
    - a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling, or covered with saturated burlap. Begin wet cure as soon as concrete attains an initial set and maintain wet cure 24 hours a day.
    - b. Sheet Material Curing: Cover entire surface with sheet material. Securely anchor sheeting to prevent wind and air from lifting the sheeting or entrapping air under the sheet. Place and secure sheet as soon as initial concrete set occurs.

- c. Liquid Membrane Curing: Apply over the entire concrete surface except for surfaces to receive additional concrete. Curing compound shall NOT be placed on any concrete surface where additional concrete is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Curing compound shall be applied as soon as the free water on the surface has disappeared and no water sheen is visible, but not after the concrete is dry or when the curing compound can be absorbed into the concrete. Application shall be in compliance with the manufacturer's recommendations.
2. Specified applications of curing methods:
    - a. Slabs for Water Containment Structures: Water curing only.
    - b. Slabs on Grade and Footings (not used to contain water): Water curing, sheet material curing, or liquid membrane curing.
    - c. Structural Slabs (other than water containment): Water curing or liquid membrane curing.
    - d. Horizontal Surfaces which will Receive Additional Concrete, Coatings, Grout, or Other Material that Requires Bond to the substrate: Water curing.
    - e. Formed Surfaces: None if nonabsorbent forms are left in place for 7 days. Water cure if absorbent forms are used. Water cure if forms are removed before 7 days. Exposed horizontal surfaces of formed walls or columns shall be water cured for 7 days or until next placement of concrete is made.
    - f. Surfaces of Concrete Joints: Water cured or sheet material cured.
  3. Finished surfaces and slabs shall be protected from the direct rays of the sun to prevent checking and crazing.

C. Cold Weather Concreting:

1. *Cold weather* is defined as a period when for more than 3 successive days, the average daily outdoor temperature drops below 40 degrees F. The average daily temperature shall be calculated as the average of the highest and the lowest temperature during the period from midnight to midnight.
2. Cold weather concreting shall conform to ACI 306.1 and the additional requirements specified herein. Temperatures at the concrete placement shall be recorded at 12-hour intervals (minimum).



3. Discuss a cold weather work plan with the Engineer. The discussion shall encompass the methods and procedures proposed for use during cold weather including the production, transportation, placement, protection, curing, and temperature monitoring of the concrete. The procedures to be implemented upon abrupt changes in weather conditions or equipment failures shall also be discussed. Cold weather concreting shall not begin until the work plan is acceptable to the Engineer.
4. During periods of cold weather, concrete shall be protected to provide continuous warm, moist curing (with supplementary heat when required) for a total of at least 350 degree-days of curing.
  - a. Degree-days are defined as the total number of 24-hour periods multiplied by the weighted average daily air temperature at the surface of the concrete (eg: 5 days at an average 70 degrees F = 350 degree-days).
  - b. To calculate the weighted average daily air temperature, sum hourly measurements of the air temperature in the shade at the surface of the concrete taking any measurement less than 50 degrees F as 0 degrees F. Divide the sum thus calculated by 24 to obtain the weighted average temperature for that day.
5. Salt, manure, or other chemicals shall not be used for protection.
6. The protection period for concrete being water cured shall not be terminated during cold weather until at least 24 hours after water curing has been terminated.

D. Hot Weather Concreting

1. *Hot weather* is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation estimated in accordance with ACI 305.1, approaching or exceeding 0.2 lbs/sq ft/hr).
2. Concrete placed during hot weather shall be batched, delivered, placed, cured, and protected in compliance with the recommendations of ACI 305.1 and the additional requirements specified herein.
  - a. Temperature of concrete being placed shall not exceed 90 degrees F and every effort shall be made to maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall be such that it will cause no difficulties from loss of slump, flash set, or cold joints.

- b. All necessary precautions shall be taken to promptly deliver, to promptly place the concrete upon its arrival at the job, and to provide vibration immediately after placement.
  - c. The Engineer may direct the Contractor to immediately cover plastic concrete with sheet material.
3. Discuss with the Engineer a work plan describing the methods and procedures proposed to use for concrete placement and curing during hot weather periods. Hot weather concreting shall not begin until the work plan is acceptable to the Engineer.

### 3.06 REMOVAL OF FORMS

- A. Except as otherwise specifically authorized by the Engineer, forms shall not be removed before the concrete has attained a strength of at least 70% of its specified design strength for beams and slabs and at least 30% of its specified design strength for walls and vertical surfaces, nor before reaching the following number of day-degrees of curing (whichever is the longer):

TABLE 3 MINIMUM TIME TO FORM REMOVAL	
Forms for	Degree Days
Beams and Slabs	500
Walls and Vertical Surfaces	100

NOTE: See definition of degree-days in Paragraph 3.05D above.

- B. Shores shall not be removed until the concrete has attained at least 70% of its specified design strength and sufficient strength to support safely its own weight and construction live loads.

### 3.07 INSPECTION AND FIELD TESTING

- A. The batching, mixing, transporting, placing, and curing of concrete shall be subject to the inspection of the Engineer at all times. The Contractor shall advise the Engineer of his/her readiness to proceed at least 24 hours before each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete; the reinforcing steel; and the alignment, cleanliness, and tightness of formwork. No placement shall be made without the inspection and acceptance of the Engineer.
- B. Sets of field control cylinder specimens will be taken by the Engineer (or inspector) during the progress of the work, in compliance with ASTM C31. The number of sets of concrete test cylinders taken of each class of concrete placed each day shall not be less than one set per day, nor less than one set for each

150 cubic yards of concrete nor less than one set for each 5,000 square feet of surface area for slabs or walls.

1. A "set" of test cylinders consists of five cylinders: one to be tested at 7 days and two to be tested and their strengths averaged at 28 days. The fourth may be used for a special test at 3 days or to verify strength after 28 days if the 28-day test results are low. The fifth is to be used at 28 days or 56 days where test results are low.
  2. When the average 28-day compressive strength of the cylinders in any set falls below the specified design strength or below proportional minimum 7-day strengths (where proper relation between 7- and 28-day strengths have been established by tests), proportions, water content, or temperature conditions shall be changed to achieve the required strengths.
- C. Cooperate in the making of tests by allowing free access to the work for the selection of samples, providing an insulated closed curing box for specimens, affording protection to the specimens against injury or loss through the operations, and furnish material and labor required for the purpose of taking concrete cylinder samples. All shipping of specimens will be paid for by the Owner. Curing boxes shall be acceptable to the Engineer.
- D. Slump tests will be made in the field immediately before placing the concrete. Such tests shall be made in accordance with ASTM C143. If the slump is greater than the specified range, the concrete shall be rejected.
- E. Air Content: Test for air content shall be made on fresh concrete samples. Air content for concrete made of ordinary aggregates having low absorption shall be made in compliance with either the pressure method complying with ASTM C231 or by the volumetric method complying with ASTM C173.
- F. The Engineer may have cores taken from any questionable area in the concrete work such as construction joints and other locations as required for determination of concrete quality. The results of tests on such cores shall be the basis for acceptance, rejection, or determining the continuation of concrete work.
- G. Cooperate in obtaining cores by allowing free access to the work and permitting the use of ladders, scaffolding, and such incidental equipment as may be required. Repair all core holes. The work of cutting and testing the cores will be at the expense of the Owner.

### 3.08 FAILURE TO MEET REQUIREMENTS

- A. Should the strengths shown by the test specimens made and tested in compliance with the previous provisions fall below the values given in Table 1, the Engineer

shall have the right to require changes in proportions outlined to apply to the remainder of the work. Furthermore, the Engineer shall have the right to require additional curing on those portions of the structure represented by the test specimens that failed. The cost of such additional curing shall be at the Contractor's expense. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer shall have the right to require strengthening or replacement of those portions of the structure that fail to develop the required strength. The cost of all such core borings and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be entirely at the expense of the Contractor. In such cases of failure to meet strength requirements, the Contractor and Engineer shall confer to determine what adjustment, if any, can be made in compliance with Sections titled "Strength" and "Failure to Meet Strength Requirements" of ASTM C94. The "purchaser" referred to in ASTM C94 is the Contractor in this Section.

- B. When the tests on control specimens of concrete fall below the specified strength, the Engineer will permit check tests for strengths to be made by means of typical cores drilled from the structure in compliance with ASTM C42 and C39. In the case of cores not indicating adequate strength, the Engineer, in addition to other recourses, may require, at the Contractor's expense, load tests on any one of the slabs, beams, piles, caps, and columns in which such concrete was used. Tests need not be made until concrete has aged 60 days.
- C. Should the strength of test cylinders fall below 60% of the required minimum 28-day strength, the concrete shall be rejected and shall be removed and replaced.

### 3.09 PATCHING AND REPAIRS

- A. It is the intent of this Section to require quality work including adequate forming, proper mixture and placement of concrete, and curing so completed concrete surfaces will require no patching.
- B. Defective concrete and honeycombed areas as determined by the Engineer shall be repaired as specified by the Engineer.
- C. As soon as the forms have been stripped and the concrete surfaces exposed, fins and other projections shall be removed; recesses left by the removal of form ties shall be filled; and surface defects that do not impair structural strength shall be repaired. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete, to approval of the Engineer.
- D. Immediately after removal of forms remove plugs and break off metal ties as required by Section 03100, Concrete Formwork. Promptly fill holes upon

stripping as follows: Moisten the hole with water, followed by a 1/16 inch brush coat of neat cement slurry mixed to the consistency of a heavy paste. Immediately plug the hole with a 1 to 1.5 mixture of cement and concrete sand mixed slightly damp to the touch (just short of "balling"). Hammer the grout into the hole until dense, and an excess of paste appears on the surface in the form of a spiderweb. Trowel smooth with heavy pressure. Avoid burnishing.

- E. When patching exposed surfaces the same source of cement and sand as used in the parent concrete shall be employed. Adjust color if necessary by addition of proper amounts of white cement. Rub lightly with a fine Carborundum stone at an age of 1 to 5 days if necessary to bring the surface down with the parent concrete. Exercise care to avoid damaging or staining the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.

### 3.10 SCHEDULE

- A. Table 4 presents the general applications for the various concrete classes and design strengths:

TABLE 4 CONCRETE SCHEDULE		
Class	Design Strength (psi)	Description
A	2,500	Concrete fill and duct encasement
B	3,000	Concrete overlay slabs and pavements
C	4,000	Walls, slabs on grade, suspended slab and beam systems, columns, grade beams, and all other structural concrete
D	5,000	Prestressed concrete

END OF SECTION

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SECTION 03360  
CONCRETE FINISHES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and finish cast-in-place concrete surfaces as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 03100, Concrete Formwork.
- C. Section 03300, Cast-In-Place Concrete.
- D. Section 03600, Grout.

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM C33—Standard Specification for Concrete Aggregates.

1.06 QUALITY ASSURANCE

- A. Finishes
  - 1. For concrete that will receive additional applied finishes or materials, the surface finish specified is required for the proper application of the specified manufacturer's products. Where alternate products are approved for use, determine if changes in finishes are required and provide the proper finishes to receive these products.

2. Changes in finishes made to accommodate products different from those specified shall be performed at no additional cost to the Owner. Submit the proposed new finishes and their construction methods to the Engineer for approval.
3. Services of Manufacturer's Representative:
  - a. Make available at no extra cost to the Owner, upon 72 hours notification, the services of a qualified field representative of the manufacturer of curing compound, sealer, or hardener to instruct the user on the proper application of the product under prevailing job conditions.

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING (NOT USED)

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 WEATHER CONSTRAINTS (NOT USED)

## PART 2 PRODUCTS

2.01 MATERIALS (NOT USED)

## PART 3 EXECUTION

3.01 FORMED SURFACES

- A. Forms shall not be removed before the requirements of Section 03300, Cast-In-Place Concrete, have been satisfied.
- B. Exercise care to prevent damaging edges or obliterating the lines of chamfers, rustications, or corners when removing the forms or performing any other work adjacent thereto.
- C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.



D. Rough-Form Finish

1. Immediately after stripping forms and before concrete has changed color, carefully remove all fins and projections.
2. Promptly fill holes left by tie cones and defects as specified in Section 03300, Cast-In-Place Concrete.

E. Rubbed Finish

1. Immediately upon stripping forms and before concrete has changed color, carefully remove all fins. While the wall is still damp, apply a thin coat of medium consistency neat cement slurry by means of bristle brushes to provide a bonding coat within all pits, air holes, or blemishes in the parent concrete. Avoid coating large areas with the slurry at one time.
2. Before the slurry has dried or changed color, apply a dry (almost crumbly) grout proportioned by volume and consisting of 1 part cement to 1-1/2 parts of clean masonry sand having a fineness modulus of approximately 2.3 and complying with the gradation requirements of ASTM C33 for such a material. Grout shall be uniformly applied by means of damp pads of coarse burlap approximately 6 inches square used as a float. Scrub grout into the pits and air holes to provide a dense mortar in all imperfections.
3. Allow the mortar to partially harden for 1 or 2 hours depending upon the weather. If the air is hot and dry, keep the wall damp during this period using a fine, fog spray. When the grout has hardened sufficiently so it can be scraped from the surface with the edge of a steel trowel without damaging the grout in the small pits or holes, cut off all that can be removed with a trowel. (Note: Grout allowed to remain on the wall too long will harden and will be difficult to remove.)
4. Allow the surface to dry thoroughly and rub it vigorously with clean dry burlap to completely remove any dried grout. No visible film of grout shall remain after this rubbing. The entire cleaning operation for any area must be completed the day it is started. Do not leave grout on surfaces overnight. Allow sufficient time for grout to dry after it has been cutoff with the trowel so it can be wiped off clean with the burlap.
5. On the day following the repair of pits, air holes, and blemishes, the walls shall again be wiped off clean with dry, used pieces of burlap containing old hardened mortar which will act as a mild abrasive. After this treatment, there shall be no built-up film remaining on the parent surface. If, however, such a film is present, a fine abrasive stone shall be used to remove all such material without breaking through the surface film of the original concrete. Such scrubbing shall be light and sufficient only to remove excess material without changing the texture of the concrete.

6. A thorough wash-down with stiff bristle brushes shall follow the final bagging or stoning operation. No extraneous materials shall remain on the surface of the wall. The wall shall be sprayed with a fine fog spray periodically to maintain a continually damp condition for at least 3 days after the application of the repair grout.
7. It is the intent of this finish to provide a surface that is uniform in appearance with no blemishes, imperfections, discolorations, etc.

F. Abrasive Blast Finish

1. Coordinate with rubbed finish application. Do not begin until rubbed finish operation is complete or before concrete has reached minimum 7-day strength. The rubbed finish application may be deleted by the Engineer if the unfinished concrete surface is of superior quality. Apply the abrasive blast finish only where indicated on Drawings.
2. Prepare a sample area of minimum 4 feet high by 16 feet wide. Blast finish as directed by Engineer on a portion of new wall construction that will not be exposed in the final work. Sample area shall contain a variety of finishes obtained with different nozzles, nozzle pressures, grit materials, and blasting techniques for selection by Engineer. Final accepted sample shall remain exposed until completion of all blast finish operations.
3. Blast finish operation shall meet all regulatory agency requirements. Blast finish contractor shall be responsible for obtaining all required permits and/or licenses.
4. Perform abrasive blast finishing in as continuous an operation as possible, using the same work crew to maintain continuity of finish on each surface or area of work. Maintain patterns or variances in depths of blast as present on the accepted sample.
5. Use an abrasive grit of proper type and gradation as well as equipment and technique to expose aggregate and surrounding matrix surfaces as follows:
  - a. Medium: Generally expose coarse aggregate – 1/4 inch to 3/8 inch reveal.
6. Abrasive blast corners and edge of patterns carefully, using back-up boards, to maintain uniform corner or edge line. Determine type of nozzle, nozzle pressure, and blasting techniques required to match Architect's samples.

7. Upon completion of the blast finish operation, thoroughly flush finished surfaces with clean clear water to remove residual dust and grit. Allow to air dry until curing of concrete is complete.
8. After the concrete has cured for a minimum of 28 days, apply a clear acrylic sealer as directed by manufacturer.

### 3.02 FLOORS AND SLABS

#### A. Floated Finish

1. Machine Floating
  - a. Screed floors and slabs with straightedges to the established grades shown on the Drawings. Immediately after final screeding, a dry cement/sand shake in the proportion of two sacks of Portland cement to 350 pounds of coarse natural concrete sand shall be sprinkled evenly over the surface at the rate of approximately 500 pounds/1,000 square feet of floor. Do not sprinkle neat, dry cement on the surface.
  - b. The application of the cement/sand shake may be eliminated at the discretion of the Engineer if the base slab concrete exhibits adequate fattiness and homogeneity and the need is not indicated. When the concrete has hardened sufficiently to support the weight of a power float without its digging into or disrupting the level surface, thoroughly float the shake into the surface with a heavy revolving disc type power compacting machine capable of providing a 200-pound compaction force distributed over a 24-inch-diameter disc.
  - c. Start floating along walls and around columns and then move systematically across the surface leaving a matte finish.
  - d. The compacting machine shall be the "Kelly Power Float with Compaction Control" as manufactured by Kelley Industries of SSP Construction Equipment Inc., Pomona, CA, or equal. Troweling machines equipped with float (shoe) blades that are slipped over the trowel blades may be used for floating. Floating with a troweling machine equipped with normal trowel blades will not be permitted. The use of any floating or troweling machine which has a water attachment for wetting the concrete surface during finishing will not be permitted.

2. Hand Floating

- a. In lieu of power floating, small areas may be compacted by hand floating. The dry cement/sand shake previously specified shall be used unless specifically eliminated by the Engineer. Screenshot the floors and slabs with straightedges to the established grades shown on the Drawings. While the concrete is still green, but sufficiently hardened to support a finisher and kneeboards with no more than 1/4 inch indentation, wood float to a true, even plane with no coarse aggregate visible. Use sufficient pressure on the wood floats to bring moisture to the surface.

3. Finishing Tolerances

- a. Level floors and slabs to a tolerance of plus or minus 1/8 inch when checked with a 10-foot straightedge placed anywhere on the slab in any direction. Where drains occur, pitch floors to drains such that there are no low spots left undrained. Failure to meet either of the above requirements shall be cause for removal, grinding, or other correction as directed by the Engineer.

B. Broom Finish

1. Screenshot slabs with straightedges to the established grades indicated on the Drawings. When the concrete has stiffened sufficiently to maintain small surface indentations, draw a stiff bristle broom lightly across the surface in the direction of drainage, or, in the case of walks and stairs, perpendicular to the direction of traffic to provide a non-slip surface.

C. Steel Trowel Finish

1. Finish concrete as specified in Paragraphs 3.04 and 3.05. Then hand steel trowel to a perfectly smooth hard even finish free from high or low spots or other defects.

3.03 CONCRETE RECEIVING CHEMICAL HARDENER (NOT USED)

3.04 APPROVAL OF FINISHES

- A. All concrete surfaces, when finished, will be inspected by the Engineer.
- B. Surfaces which, in the opinion of the Engineer, are unsatisfactory shall be refinished or reworked.

- C. After finishing horizontal surfaces, regardless of the finishing procedure specified, the concrete shall be cured in compliance with Section 03300, Cast-In-Place Concrete, unless otherwise directed by the Engineer.

### 3.05 SCHEDULE OF FINISHES

- A. Concrete shall be finished as specified either to remain as natural concrete to receive an additional applied finish or material under another Section.
- B. Concrete for the following conditions shall be finished as noted on the Drawings and as further specified herein:
  - 1. Concrete to Receive Dampproofing: Rough-form finish. See Paragraph 3.01D above.
  - 2. Concrete Not Exposed to View and Not Scheduled to Receive an Additional Applied Finish or Material: Rough-form finish. See Paragraph 3.01D above.
  - 3. Exterior Vertical Concrete Above Grade Exposed to View: Rubbed finish. See Paragraph 3.01E above.
  - 4. Interior Vertical Concrete Exposed to View Except in Water Containment Areas: Rubbed finish. See Paragraph 3.01E above.
  - 5. Vertical Concrete in Water Containment Areas – Rubbed Finish on Exposed Surfaces and Extending to 2 Feet Below Normal Operating Water Level: Rough-form finish on remainder of submerged areas. See Paragraphs 3.01E and 3.01D above.
  - 6. Interior and Exterior Underside of Concrete Exposed to View: Rubbed finish. See Paragraph 3.01E above.
  - 7. Exterior Surfaces Exposed to View and Indicated to Have an Abrasive Blast Finish. See Paragraph 3.01F above.
  - 8. Interior or Exterior Horizontal Concrete not Requiring Floor Hardener or Sealer: Floated finish. See Paragraph 3.02A above.
  - 9. Concrete for Exterior Walks, Interior and Exterior Stairs: Broomed finish perpendicular to direction of traffic. See Paragraph 3.02B above.
  - 10. Concrete Slabs On Which Process Liquids Flow or In Contact with Sludge: Steel trowel finish. See Paragraph 3.02C above.
  - 11. Concrete to Receive Hardener: See Paragraph 3.03 above.
  - 12. Concrete to Receive Floor Sealer: See Paragraph 3.02D above.
  - 13. Concrete Tank Bottoms to be Covered with Grout: See Section 03600, Grout.

END OF SECTION

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SECTION 03600  
GROUT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install grout complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Section 03100, Concrete Formwork.
- B. Section 03200, Concrete Reinforcement.
- C. Section 03250, Concrete Joints and Joint Accessories.
- D. Section 03300, Cast-In-Place Concrete.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit to the Engineer shop drawings and product data showing materials of construction and details of installation for:
  - 1. Commercially manufactured nonshrink cementitious grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature consideration, conformity to required ASTM standards, and Material Safety Data Sheet.
  - 2. Commercially manufactured nonshrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards, and Material Safety Data Sheet.
  - 3. Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures, and the proposed mix of the grout.
  - 4. Concrete grout. The submittal shall include data as required for concrete as delineated in Section 03300, Cast-In-Place Concrete, and for fiber reinforcement as delineated in Section 03200, Concrete Reinforcement. This includes the mix design, constituent quantities per cubic yard, and the water/cement ratio.

B. Laboratory Test Reports

1. Submit laboratory test data is required under Section 03300, Cast-In-Place Concrete, for concrete to be used as concrete grout.

C. Certifications

1. Certify that commercially manufactured grout products and concrete grout admixtures are suitable for use in contact with potable water after 30 days of curing.

D. Qualifications

1. Grout manufacturers shall submit documentation that they have at least 10 years of experience in the production and use of the proposed grouts which they will supply.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification Section differs from these documents, the requirements of this Section shall apply.

A. American Society for Testing and Materials (ASTM)

1. ASTM C33—Standard Specification for Concrete Aggregates.
2. ASTM C150—Standard Specification for Portland Cement.
3. ASTM C531—Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
4. ASTM C579—Standard Test Methods for Compressive Strength of Chemical-Resistant Mortars, Grouts, Monolithic Surfacing, and Polymer Concretes.
5. ASTM C827—Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens of Cementitious Mixtures.
6. ASTM C1107—Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
7. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.



B. U.S. Army Corps of Engineers Standard (CRD)

1. CRD C-621—Corps of Engineers Specification for Nonshrink Grout.

1.06 QUALITY ASSURANCE

- A. Qualifications: Grout manufacturer shall have a minimum of 10 years of experience in the production and use of the type of grout proposed for the work.
- B. Pre-Installation Conference: Well in advance of grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing, and curing procedures for each product proposed for use. Parties concerned with grouting shall be notified of the meeting at least 10 days before its scheduled date.
- C. Services of Manufacturer's Representative: A qualified field technician of the nonshrink grout manufacturer, specifically trained in the installation of the products, shall attend the pre-installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided, as required to correct installation problems.
- D. Field Testing
  1. Field testing and inspection services shall be provided by the Contractor using an independent agency and in conformance with applicable testing standards. The cost of such work, except as specifically stated otherwise, shall be included in the Bid Items. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc., for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.
  2. The field testing of concrete grout shall be as specified for concrete in Section 03300, Cast-In-Place Concrete.

1.07 WARRANTIES (NOT USED)

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the manufacturer's name, product identification, batch numbers, and printed instructions.
- B. Store materials in full compliance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.

- C. Material that becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.
- D. Nonshrink cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.
- E. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three-component systems requiring only blending as directed by the manufacturer.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 WEATHER CONSTRAINTS (NOT USED)

#### 1.12 DEFINITIONS

- A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state, and bonds to a clean base plate.

### PART 2 PRODUCTS

#### 2.01 GENERAL

- A. The use of a manufacturer's name and product or catalog number is for the purpose of establishing the standard of quality desired.
- B. Like materials shall be the products of one manufacturer or supplier in order to provide standardization of appearance.

#### 2.02 MATERIALS

- A. Nonshrink Cementitious Grout
  - 1. Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107, Grades B or C and CRD C-621. Grouts shall be Portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and shall require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement

or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827.

- a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Set Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford Hill & Co.; Euco NS by the Euclid Chemical Co.; NBEC Grout by U.S. Grout Corp.; or equal.
  - b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders, Inc.; Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U.S. Grout Corp.; or equal.
- B. Nonshrink Epoxy Grout Nonshrink epoxy-based grout shall be a pre-proportioned, three-component, 100% solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of  $30 \times 10^{-6}$  when tested in conformity with ASTM C531. The grout shall be MasterFlow 648 by Master Builders Inc.; Five Star Epoxy Grout by U.S. Grout Corp.; Sikadur 42 Grout-Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid Chemical Co.; or equal.
- C. Cement Grout: Cement grouts shall be a mixture of one part portland cement conforming to ASTM C150, Types I, II, or III, and 1 to 2 parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.
- D. Concrete Grout:
1. Concrete grout shall conform to the requirements of Section 03300, Cast-In-Place Concrete, except as specified herein. It shall be proportioned with cement, coarse and fine aggregates, water, water reducer, and air entraining agent to produce a mix having an average strength of 2,900 psi at 28 days, or 2,500-psi nominal strength. Coarse aggregate size shall be 1/2 inch maximum. Slump should not exceed 5 inches and should be as low as practical yet still retain sufficient workability.
  2. Synthetic reinforcing fibers as specified in Section 03200, Concrete Reinforcement, shall be added to the concrete grout mix at the rate of 1.5 pounds of fibers per cubic yard of grout. Fibers shall be added from the manufacturer's premeasured bags and according to the manufacturer's recommendations in a manner which will ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout.

- E. Water: Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

## PART 3 EXECUTION

### 3.01 PREPARATION

- A. Grout shall be placed over cured concrete that has attained its full design strength unless otherwise approved by the Engineer.
- B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt, grease, oil, curing compounds, laitance, and paints, and free of all loose material or foreign matter that may effect the bond or performance of the grout.
- C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to a minimum of 1/4 inch amplitude or provide a raked finish in order to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance, and firmly embedded into the parent concrete.
  - 1. Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.
- D. Remove all loose rust, oil, or other deleterious substances from metal embedments or bottom of baseplates before the installation of the grout.
- E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours before the placement of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24-hour period, visible water shall be removed from the surface before grouting. The use of an adhesive bonding agent in lieu of surface saturation shall only be used when approved by the Engineer for each specific location of grout installation.
- F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.
- G. Construct grout forms or other leakproof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place, and shored to resist the forces imposed by the grout and its placement.

- H. Forms for epoxy grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.
- I. Level and align the structural or equipment bearing plates in accordance with the structural requirements and the recommendations of the equipment manufacturer.
- J. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks, or other approved means. The shims, wedges, and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

### 3.02 INSTALLATION – GENERAL

- A. Mix, apply, and cure products in strict compliance with the manufacturer's recommendations and this Section.
- B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.
- C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90 degrees F during grouting and for at least 24 hours thereafter or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.
- D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90 degrees F range.
- E. Install grout in a manner that will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or control joint.
- F. Reflect all existing underlying expansion, control, and construction joints through the grout.

### 3.03 INSTALLATION – CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

- A. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel, or admixtures without prior approval by the Engineer.
- B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.
- C. Placements greater than 3 inches in depth shall include the addition of clean, washed pea gravel to the grout mix when approved by the manufacturer. Comply with the manufacturer's recommendations for the size and amount of aggregate to be added.
- D. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
- E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.
- F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45-degree angle from the lower edge of bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.
- G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding, or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem, or curing is finished.

### 3.04 INSTALLATION – NONSHRINK EPOXY GROUTS

- A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout

mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener, and aggregate.

- B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90 degrees F.
- C. Place grout into the designated areas in a manner that will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
- D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.
- E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.
- F. Epoxy grouts are self curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

### 3.05 INSTALLATION – CONCRETE GROUT

- A. Screed underlying concrete to the grade shown on the Drawings. Prepare the surface according to Paragraph 3.01.B. Protect and keep the surface clean until placement of concrete grout.
- B. Remove the debris and clean the surface by sweeping and vacuuming of all dirt and other foreign materials. Wash the tank slab using a strong jet of water. Flushing of debris into tank drain lines will not be permitted.
- C. Saturate the concrete surface for at least 24 hours before placement of the concrete grout. Saturation may be maintained by ponding, by the use of soaker hoses, or by other methods acceptable to the Engineer. Remove excess water just before placement of the concrete grout. Place a cement slurry immediately ahead of the concrete grout so that the slurry is moist when the grout is placed. Work the slurry over the surface with a broom until it is coated with approximately 1/16 to 1/8 inch thick cement paste. (A bonding grout composed of 1 part Portland cement, 1.5 parts fine sand, an approved bonding admixture and water, mixed to achieve the consistency of thick paint, may be substituted for the cement slurry.)

- D. Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to ensure high and low spots are eliminated where application is at clarifier bottom. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms shall not be used as a finishing machine or screed.
- E. Provide synthetic reinforcing fibers in all applications unless steel reinforcement is indicated in the Drawings.
- F. Provide grout control joints as indicated on the Drawings.
- G. Finish and cure the concrete grout as specified for cast-in-place concrete.

### 3.06 SCHEDULE

- A. The following list indicates where the particular types of grout are to be used:
  1. General purpose nonshrink cementitious grout: Use at all locations where nonshrink grout is called for on the plans except for base plates greater in area than 3 feet wide by 3 feet long and except for the setting of anchor rods, anchor bolts, or reinforcing steel in concrete.
  2. Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3 feet by 3 feet. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout.
  3. Nonshrink epoxy grout: Use for the setting of anchor rods, anchor bolts, and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.
  4. Cement grout: Cement grout may be used for grouting of incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting of primary structural steel members such as columns and girders.

END OF SECTION



SECTION 03740  
MODIFICATIONS AND REPAIR TO CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and cut, remove, repair, or otherwise modify parts of existing concrete structures or appurtenances as shown on the Drawings and as specified herein. Work under this Section shall also include bonding new concrete to existing concrete.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance
- B. Section 03100, Concrete Formwork.
- C. Section 03200, Concrete Reinforcement.
- D. Section 03250, Concrete Joints and Joint Accessories.
- E. Section 03300, Cast-In-Place Concrete.
- F. Section 03600, Grout.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit to the Engineer a Schedule of Demolition and the detailed methods of demolition to be used at each location.
- B. Submit manufacturer's technical literature on all product brands proposed for use, to the Engineer for review. The submittal shall include the manufacturer's installation and/or application instructions.
- C. When substitutions for acceptable brands of materials specified herein are proposed, submit brochures and technical data of the proposed substitutions to the Engineer for approval before delivery to the project.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section.

Where this Specification Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM C881—Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete.
  - 2. ASTM C882—Standard Test Method for Bond Strength of Epoxy-Resin Systems Used with Concrete by Slant Shear.
  - 3. ASTM D570—Standard Test Method for Water Absorption of Plastics.
  - 4. ASTM D638—Standard Test Method for Tensile Properties of Plastics.
  - 5. ASTM D695—Standard Test Method for Compressive Properties of Rigid Plastics.
  - 6. ASTM D732—Standard Test Method for Shear Strength of Plastics by Punch Tool.
  - 7. ASTM D790—Standard Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials.

#### 1.06 QUALITY ASSURANCE

- A. No existing structure or concrete shall be shifted, cut, removed, or otherwise altered until authorization is given by the Engineer.
- B. When removing materials or portions of existing structures and when making openings in existing structures, all precautions shall be taken and all necessary barriers, shoring, and bracing and other protective devices shall be erected to prevent damage to the structures beyond the limits necessary for the new work, protect personnel, control dust, and to prevent damage to the structures or contents by falling or flying debris. Unless otherwise permitted, shown, or specified, line drilling will be required in cutting existing concrete.
- C. Manufacturer Qualifications: The manufacturer of the specified products shall have a minimum of 10 years' experience in the manufacture of such products and shall have an ongoing program of training, certifying, and technically supporting the Contractor's personnel.

#### 1.07 WARRANTIES (NOT USED)

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver the specified products in original, unopened containers with the manufacturer's name, labels, product identification, and batch numbers.
- B. Store and condition the specified product as recommended by the manufacturer.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 WEATHER CONSTRAINTS (NOT USED)

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials shall comply with the Section and any State or local regulations.

B. Epoxy Bonding Agent

1. General

- a. The epoxy bonding agent shall be a two-component, solvent-free, asbestos-free, moisture insensitive epoxy resin material used to bond plastic concrete to hardened concrete complying with the requirements of ASTM C881, Type II and the additional requirements specified herein.

2. Material

- a. Properties of the cured material:

- (1) Compressive Strength (ASTM D695): 8,500 psi minimum at 28 days.
- (2) Tensile Strength (ASTM D638): 4,000 psi minimum at 14 days.
- (3) Flexural Strength (ASTM D790 - Modulus of Rupture): 6,300 psi minimum at 14 days.
- (4) Shear Strength (ASTM D732): 5,000 psi minimum at 14 days.
- (5) Water Absorption (ASTM D570 - 2-hour boil): 1% maximum at 14 days.
- (6) Bond Strength (ASTM C882) Hardened to Plastic: 1,500 psi minimum at 14 days moist cure.
- (7) Color: Gray.

3. Approved manufacturers include: Sika Corporation, Lyndhurst, NJ - Sikadur 32, Hi-Mod; Master Builder's, Cleveland, OH - Concrecive Liquid (LPL); or equal.

C. Epoxy Paste

1. General

- a. Epoxy Paste shall be a two-component, solvent-free, asbestos free, moisture insensitive epoxy resin material used to bond dissimilar materials to concrete and shall comply with the requirements of ASTM C881, Type I, Grade 3 and the additional requirements specified herein. It may also be used to patch existing surfaces where the glue line is 1/8 inch or less.

2. Material

- a. Properties of the cured material:

- (1) Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.
- (2) Tensile Strength (ASTM D638): 3,000 psi minimum at 14 days. Elongation at Break: 0.3% minimum.
- (3) Flexural Strength (ASTM D790 - Modulus of Rupture): 3,700 psi minimum at 14 days.
- (4) Shear Strength (ASTM D732): 2,800 psi minimum at 14 days.
- (5) Water Absorption (ASTM D570): 1.0% maximum at 7 days.
- (6) Bond Strength (ASTM C882): 2,000 psi at 14 days moist cure.
- (7) Color: Concrete gray.

3. Approved manufacturers include:

- a. Sika Corporation, Lyndhurst, N.J. - Sikadur Hi-mod LV 32; Master Builders, Inc., Cleveland, OH - Concrecive 1438; or equal.
- b. Overhead applications: Sika Corporation, Lyndhurst, NJ - Sikadur Hi-mod LV 31; Master Builders, Inc., Cleveland, OH - Concrecive 1438; or equal.

D. Repair Mortar

1. General

- a. Repair mortar shall be a two-component, polymer modified, cement based, fast-setting, trowel grade, structural repair mortar suitable for use on horizontal, vertical, and overhead surfaces prepackaged product specifically formulated for the repair of concrete surface defects.

2. Material

- a. Properties of the cured material:

- (1) Compressive Strength (2 hours 50% RH): 150 psi minimum.
- (2) Compressive Strength (28 days 50% RH): 150 psi minimum.
- (3) Bond Strength (pull off method): 100% concrete substrate failure.
- (4) This system shall conform with ANSI/NSF standards for surface contact with potable water.

3. Approved manufacturers include:

- a. Sika Corporation, Lyndhurst, N.J. – SikaTop 122 PLUS; or equal.
- b. Overhead applications: Sika Corporation, Lyndhurst, N.J. – SikaTop 123 PLUS; or equal.

E. Non-Shrink Precision Cement Grout, Non-Shrink Cement Grout, Non-Shrink Epoxy Grout, and Polymer Modified mortar are included in Section 03600, Grout.

F. Adhesive capsule type anchoring system for steel reinforcing shall be equal to the HIT-HY 200 adhesive Anchoring System by Hilti Fastening Systems, Tulsa, OK. The capsule shall consist of a sealed glass capsule containing premeasured amounts of polyester or vinylester resin, quartz sand aggregate, and a hardener contained in a separate vial within the capsule. Installation of adhesive system shall be in strict accordance with the manufacturer's printed installation instructions included with each adhesive unit packaging.

G. Acrylic latex bonding agents shall not be used for this project.

## H. Crack Repair Epoxy Adhesive

### 1. General

- a. Crack repair epoxy adhesive shall be a two-component, solvent-free, moisture insensitive epoxy resin material suitable for crack grouting by injection or gravity feed. It shall be formulated for the specific size of opening or crack being injected.
- b. All concrete surfaces containing potable water or water to be treated for potable use that are repaired by the epoxy adhesive injection system shall be coated with an acceptable epoxy coating system that conforms with ANSI/NSF standards for surface contact with potable water.

### 2. Material

- a. Properties of the cured material:
  - (1) Compressive Properties (ASTM D695): 10,000 psi minimum at 28 days.
  - (2) Tensile Strength (ASTM D638): 5,300 psi minimum at 14 days. Elongation at Break: 2 to 5%.
  - (3) Flexural Strength (ASTM D790 - Modulus of Rupture): 12,000 psi minimum at 14 days (gravity); 4,600 psi minimum at 14 days (injection).
  - (4) Shear Strength (ASTM D732): 3,700 psi minimum at 14 days.
  - (5) Water Absorption (ASTM D570 - 2-hour boil): 1.5% maximum at 7 days.
  - (6) Bond Strength (ASTM C882): 2,000 psi at 2 days dry; 1,400 psi at 14 days dry plus 12 days moist.

### 3. Approved manufacturers include:

- a. For standard applications: Sika Corporation, Lyndhurst, NJ - Sikadur Hi-Mod; Master Builders Inc., Cleveland, OH - Concessive 1380; or equal.
- b. For very thin applications; Sika Corporation, Lyndhurst, NJ - Sikadur Hi-Mod LV; Master Builders Inc., Cleveland, OH - Concessive; 1468 or equal.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Cut, repair, reuse, demolish, excavate, or otherwise modify parts of the existing structures or appurtenances as indicated on the Drawings, specified herein, or necessary to permit completion of the Work. Finishes, joints, reinforcements, sealants, etc., are specified in respective Sections. All work shall comply with other requirements of this of Section and as shown on the Drawings.
- B. All commercial products specified in this Section shall be stored, mixed, and applied in strict compliance with the manufacturer's recommendations.
- C. In all cases where concrete is repaired in the vicinity of an expansion joint or control joint the repairs shall be made to preserve the isolation between components on either side of the joint.
- D. When drilling holes for dowels/bolts at new or existing concrete, drilling shall stop if rebar is encountered. As approved by the Engineer, the hole location shall be relocated to avoid rebar. Rebar shall not be cut without prior approval by the Engineer. Where possible, rebar locations shall be identified before drilling using "rebar locators" so that drilled hole locations may be adjusted to avoid rebar interference.

### 3.02 CONCRETE REMOVAL

- A. Concrete designated to be removed to specific limits as shown on the Drawings or directed by the Engineer shall be done by line drilling at limits followed by chipping or jack-hammering as appropriate in areas where concrete is to be taken out. Remove concrete in such a manner that surrounding concrete or existing reinforcing to be left in place and existing in place equipment is not damaged. Sawcutting at limits of concrete to be removed shall only be done if indicated on the Drawings or after obtaining written approval from the Engineer.
- B. Where existing reinforcing is exposed due to saw cutting/core drilling and no new material is to be placed on the sawcut surface, a coating or surface treatment of epoxy paste shall be applied to the entire cut surface to a thickness of 1/4 inch.
- C. In all cases where the joint between new concrete or grout and existing concrete will be exposed in the finished work, except as otherwise shown or specified, the edge of concrete removal shall be a 1 inch deep saw cut on each exposed surface of the existing concrete.

- D. Concrete specified to be left in place which is damaged shall be repaired by approved means to the satisfaction of the Engineer.
- E. The Engineer may from time to time direct the Contractor to make additional repairs to existing concrete. These repairs shall be made as specified or by such other methods as may be appropriate.

### 3.03 SURFACE PREPARATION

- A. Connection surfaces shall be prepared as specified below for concrete areas requiring patching, repairs, or modifications as shown on the Drawings, specified herein, or as directed by the Engineer.
- B. Remove all deteriorated materials, dirt, oil, grease, and all other bond inhibiting materials from the surface by dry mechanical means, i.e. sandblasting, grinding, etc, as approved by the Engineer. Be sure that the areas are not less than 1/2 inch in depth. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded into parent concrete, subject to the Engineer's final inspection.
- C. If reinforcing steel is exposed, it must be mechanically cleaned to remove all contaminants, rust, etc, as approved by the Engineer. If half of the diameter of the reinforcing steel is exposed, chip out behind the steel. The distance chipped behind the steel shall be a minimum of 1/2 inch. Reinforcing to be saved shall not be damaged during the demolition operation.
- D. Reinforcing from existing demolished concrete which is shown to be incorporated in new concrete shall be cleaned by mechanical means to remove all loose material and products of corrosion before proceeding with the repair. It shall be cut, bent, or lapped to new reinforcing as shown on the Drawings and provided with a minimum cover all around as specified on the Drawings or 2 inches.
- E. The following are specific concrete surface preparation "methods" are to be used where called for on the Drawings, specified herein, or as directed by the Engineer. All installation of anchors shall be according to the manufacturer's recommendations.
  - 1. Method A: After the existing concrete surface at connection has been roughened and cleaned, thoroughly moisten the existing surface with water. Brush on a 1/16 inch layer of cement and water mixed to the consistency of a heavy paste. Immediately after application of cement paste, place new concrete or grout mixture as detailed on the Drawings.
  - 2. Method B: After the existing concrete surface has been roughened and cleaned, apply epoxy bonding agent at connection surface. The field



preparation and application of the epoxy bonding agent shall comply strictly with the manufacturer's recommendations. Place new concrete or grout mixture to limits shown on the Drawings within time constraints recommended by the manufacturer to ensure bond.

3. Method C: Drill a hole 1/4 inch larger than the diameter of the dowel. The hole shall be blown clear of loose particles and dust just before installing epoxy. The drilled hole shall first be filled with epoxy paste, and then dowels/bolts shall be buttered with paste then inserted by tapping. Unless otherwise shown on the Drawings, deformed bars shall be drilled and set to a depth of ten bar diameters and smooth bars shall be drilled and set to a depth of fifteen bar diameters. If not noted on the Drawings, the Engineer will provide details regarding the size and spacing of dowels.
4. Method D: Combination of Method B and C.
5. Method E: Capsule anchor system shall be set in existing concrete by drilling holes to the required depth to develop the full tensile and shear strengths of the anchor material being used. The anchor bolts system shall be installed in accordance with the manufacturer's recommendation in holes sized as required. The anchor stud bolt, rebar, or other embedment item shall be tipped with a double 45-degree chamfered point, securely fastened into the chuck of all rotary percussion hammer drill, and drilled into the capsule filled hole.

### 3.04 GROUTING

- A. Grouting shall be as specified in Section 03600, Grout.

### 3.05 CRACK REPAIR

- A. Cracks on horizontal surfaces shall be repaired by gravity feeding crack sealant into cracks in accordance with the manufacturer's recommendations. If cracks are less than 1/16 inch in thickness, they shall be pressure injected.
- B. Cracks on vertical surfaces shall be repaired by pressure injecting crack sealant through valves sealed to surface with crack repair epoxy adhesive in accordance with the manufacturer's recommendations.
- C. Cracks shall be repaired according to the following generalized procedure:
  1. Remove any efflorescence, dirt, oil, etc, off the surfaces in the vicinity of the observed seepage. Where loose cementitious surfacer/slurry is encountered, it shall be removed to reveal the original concrete surface. Removal shall be performed using mechanical methods or chemical solutions provided they are approved by other product manufacturers which are to be used (i.e., paint).

2. Apply adequate surface seal to crack to prevent leakage of epoxy.
3. Establish injection points at a distance along crack not less than thickness of cracked member.
4. Crack injection sequence:
  - a. Ensure that tank is full of water.
  - b. Inject epoxy into crack from exterior at first port with sufficient pressure to advance epoxy to adjacent port.
  - c. Seal original port and shift injection to port where epoxy appears.
  - d. Continue port-to-port injection until crack has been injected for its entire length.
5. For small amounts of epoxy, or where excessive pressure developed by injection pump might further damage structure, premix epoxy and use hand caulking gun to inject epoxy if acceptable to the Engineer.
6. Seal ports, including adjacent locations where epoxy seepage occurs, as necessary to prevent drips or run out.
7. The crack is considered to be sealed once no moisture is transferred from the concrete to a dry hand for a minimum of 24 hours after injections. Continue injection procedures if the crack does not meet this condition.
8. After epoxy injection is complete, remove surface seal material and refinish concrete in area where epoxy was injected to match existing concrete including applying new surfacer patch material to match existing in thickness, texture, etc. All materials used for patching or repairs shall be coordinated with other products to be used such as paint to ensure conformance and applicability.

END OF SECTION

**DIVISION 5**

**METALS**

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SECTION 05500  
MISCELLANEOUS METAL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install all miscellaneous metal complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 03350, Concrete Joints and Accessories.
- C. Section 09900, Painting and Coating.
- D. Division 11, Equipment – Sluice gates, slide gates, operators and appurtenances, including wall thimbles.
- E. Division 15, Mechanical – Pipe hangers and sleeves.
- F. Divisions 11, Equipment, and 15, Mechanical – Equipment anchor bolts.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Submit to the Engineer shop drawings and product data showing materials of construction and details of installation for:
  - 1. Shop drawings, showing sizes of members, method of assembly, anchorage, and connection to other members.
- B. Samples
  - 1. Submit samples as requested by the Engineer during the course of construction.
- C. Design Data
  - 1. Submit calculations sealed by a Professional Engineer registered in the State of Florida or submit load tables and test data demonstrating that the railings and their attachments will resist the loads specified in the 2014 FBC at the post spacing provided.
  - 2. Submit manufacturer's load and deflection tables for grating.

D. Test Reports

1. Certified copy of mill test reports on each aluminum proposed for use showing the physical properties and chemical analysis.

E. Certificates

1. Submit certification that the railing system is in compliance with OSHA requirements and the 2014 FBC.
2. Certify that welders have been qualified under AWS within the previous 12 months to perform the welds required under this Section.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to herein shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Specification Section differs from these documents, the requirements of this Section shall apply.

A. Aluminum Association (AA)

1. AA ABH21—Aluminum Brazing Handbook.
2. AA ASD1—Aluminum Standards and Data.
3. AA DAF45—Designation System for Aluminum Finishes.
4. AA SAA46—Standards for Anodized Architectural Aluminum.

B. American Iron and Steel Institute (AISI)

1. AISI/ANSI/AISC 360—Specification for Structural Steel Buildings.

C. American Society for Testing and Materials (ASTM)

1. ASTM A36—Standard Specification for Carbon Structural Steel.
2. ASTM A48—Standard Specification for Gray Iron Castings.
3. ASTM A53—Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
4. ASTM A108—Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
5. ASTM A123—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.

6. ASTM A153—Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
7. ASTM A240—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
8. ASTM A276—Standard Specification for Stainless Steel Bars and Shapes.
9. ASTM A307—Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 Psi Tensile Strength.
10. ASTM A500—Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
11. ASTM A501—Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
12. ASTM A536—Standard Specification for Ductile Iron Castings.
13. ASTM A992—Standard Test Method for Conducting Temperature Uniformity Surveys of Furnaces Used to Heat Treat Steel Products.
14. ASTM A1008—Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
15. ASTM A1011—Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
16. ASTM B209—Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
17. ASTM B221—Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes.
18. ASTM B429—Standard Specification for Aluminum-Alloy Extruded Structural Pipe and Tube.
19. ASTM B695—Standard Specification for Coatings of Zinc Mechanically Deposited on Iron and Steel.
20. ASTM F593—Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
21. ASTM F1154—Standard Practices for Qualitatively Evaluating the Comfort, Fit, Function, and Durability of Protective Ensembles and Ensemble Components.
22. ASTM F1554—Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
23. ASTM F3125—Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi (830 MPa) and 150 ksi (1,040 MPa) Minimum Tensile Strength, Inch and Metric Dimensions.

D. American Welding Society (AWS)

1. AWS D1.1—Structural Welding Code – Steel.
2. AWS D1.2—Structural Welding Code – Aluminum.

- 3. AWS D1.6—Structural Welding Code – Stainless Steel.
- E. Federal Specifications (FS)
  - 1. FS FF-B-575C—Bolt, Hexagon and Square.
- F. Florida Building Code (FBC)
- G. Occupational Safety and Health Administration (OSHA)

#### 1.06 QUALITY ASSURANCE

- A. The work of this Section shall be completely coordinated with the work of other Sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this Section before fabrication and installation of items herein specified.
- B. Furnish to the pertinent trades all items included under this Section that are to be built into the work of other Sections.
- C. All welding shall be performed by qualified welders and shall conform to the applicable AWS welding code. Welding of steel shall conform to AWS D1.1 and welding of aluminum shall conform to AWS D1.2.

#### 1.07 WARRANTIES (NOT USED)

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked before installation.
- B. Repair items which have become damaged or corroded to the satisfaction of the Engineer before incorporating them into the work.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 WEATHER CONSTRAINTS (NOT USED)

#### 1.12 PROJECT/SITE REQUIREMENTS

- A. Field measurements shall be taken at the site before fabrication of items to verify or supplement indicated dimensions and to ensure proper fitting of all items.



## PART 2 PRODUCTS

### 2.01 GENERAL

- A. The use of manufacturer's name and model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- B. Like items of materials shall be the end products of one manufacturer in order to provide standardization for appearance, maintenance, and manufacturer's service.

### 2.02 MATERIALS

- A. Unless otherwise noted, materials for miscellaneous metals shall conform to the following standards:
  - 1. Structural Steel:
    - a. W Shapes: ASTM A992, Grade 50.
    - b. M Shapes: ASTM A36.
    - c. S, C, and MC Shapes: ASTM A36.
    - d. L Shapes: ASTM A36.
    - e. Plates, Rods, and Bars: ASTM A36.
  - 2. HSS Rectangular Shapes: ASTM A500, Grade B, 42 ksi.
  - 3. HSS Round Shapes: ASTM A500, Grade B, 35 ksi.
  - 4. Welded and Seamless Steel Pipe: ASTM A501 or ASTM A53, Type E or S, Grade B, Schedule 40. Use standard malleable iron fittings, galvanized for exterior work.
  - 5. Steel Sheets: ASTM A1008.
  - 6. Gray Iron Castings: ASTM A48, Class 35.
  - 7. Ductile Iron Castings: ASTM A536, Grade 65-45-12.
  - 8. Aluminum Extruded Pipe: ASTM B429, Alloy 6063 T6.
  - 9. Aluminum Extruded Shapes: ASTM B221, Alloy 6061 T6.

10. Aluminum Sheet and Plate: ASTM B209, Alloy 6061 T6.
11. Stainless Steel Plates, Sheets, and Structural Shapes:
  - a. Exterior, Submerged, or Industrial Use: ASTM A240, Type 316 (Type 316L for welded).
  - b. Interior and Architectural Use: ASTM A240, Type 304.
12. Stainless Steel Bolts, Nuts, and Washers: ASTM A276, Type 316.
13. Carbon Steel Bolts and Studs: ASTM A307, Grade A, or ASTM F1154, Grade 36 (galvanized unless noted otherwise).
14. High Strength Steel Bolts, Nuts, and Washers: ASTM F3125 (mechanically galvanized in accordance with ASTM B695, Class 50, where noted):
  - a. Elevated Temperature Exposure: Type I.
  - b. General Application: Type I or Type II.
15. Galvanizing: ASTM A123, Zn w/0.5% minimum Ni.
16. Galvanizing, Hardware: ASTM A153, Zn w/0.5% minimum Ni.

### 2.03 ANCHORS, BOLTS, AND FASTENERS

- A. Furnish anchors, bolts, fasteners, etc., as necessary for installation of the work of this section or as specified for securing the work of other sections.
- B. Anchor bolt material shall be ASTM F1154, Grade 36, or ASTM A307, Grade A standard headed bolts with heavy hex nuts, Grade A washers, hot-dipped galvanized, unless noted otherwise on drawings.
- C. Unless otherwise noted, bolts for the connection of carbon steel or iron shall be steel bolts; bolts for the connection of galvanized steel or iron shall be galvanized steel or stainless steel bolts; and bolts for the connection of aluminum or stainless steel shall be stainless steel bolts.
- D. Unless otherwise noted, expansion anchors shall be zinc plated carbon steel wedge type anchors complete with nuts and washers. Type 316 stainless steel, wedge type anchors shall be used where they will be submerged or exposed to the weather or where stainless steel wedge type anchors are required. When the length or embedment of the bolt is not noted on the Drawings, provide length sufficient to place the wedge and expansion sleeve portion of the bolt at least 1 inch behind

the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwick-bolt TZ; ITW Ramset; Redhead trubolt; or equal.

- E. Unless otherwise noted, adhesive anchors shall be a two-component chemical resin anchoring system. Capsules shall be self-contained, exactly premeasured amounts of polyester or vinyl ester resin, aggregate, and hardener. Stud assemblies shall consist of a stainless steel Type 316 all-thread anchor rod with nut and washer. Provide manufacturer's recommended installation tools for installing anchor components. Install anchors in full compliance with the manufacturer's recommendations. Adhesive anchor system shall be Hilti, HIT-RE 500-SD; Simpson Strong Tie, SET-XP Epoxy-Tie or Acrylic Tie; or approved equal.
- F. Anchors used in masonry construction shall be as indicated in Section 2.03.C above where anchors are installed into solid grouted cells. Additional, Hilti, HIY-HY150 MAX adhesive anchoring system, or approved equal, may also be used in grouted masonry construction. When fastening to hollow concrete block or brick, adhesive anchors shall be a three-part stud, screen, and chemical dispenser anchoring system. Adhesive cartridges shall contain premeasured amounts of resin and hardener which are mixed and deposited in a screen tube by a dispenser. Stud assemblies shall consist of a stainless steel Type 316 all-thread anchor rod with nut and washer. Anchors shall be Hilti, HIT HY-20 System or approved equal.
- G. Automatic end welded headed anchor studs shall be flux ended studs made from cold drawn steel, ASTM A108 Grades C-1010 through C-1020. Headed anchor studs shall be Nelson, H4L Headed Concrete Anchors or equal.
- H. Machine bolts and nuts shall conform to FS FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers, and related appurtenances shall be Type 316 stainless steel.
- I. Connection bolts for wood members shall be ASTM A307, galvanized where specified.
- J. Toggle bolts shall be Hilti, Toggler Bolt, or equal.

## 2.04 METAL GRATING

- A. Grating shall have rectangular, 3/16 inch thick, bearing bars spaced 1-3/16 inches on center with cross bars spaced at 4 inches on center. All grating panels shall be banded with a bar the same size as the bearing bars.

1. Grating shall not exceed the fabricator's maximum recommended span, and meet or exceed the following load and deflection criteria for the maximum span length at the opening being covered by the grating.
    - a. The grating shall produce a deflection of 1/360 of the span or less under a uniform live load of 100 pounds/square foot on the maximum span.
    - b. The grating shall produce a deflection of 1/360 of the span or less under a concentrated live load of 300 pounds applied at the mid-point of the maximum span.
  2. Openings 2 inches or greater in diameter/dimension and grating edges shall be banded with a bar of the same depth and thickness as the bearing bars. Cut bearing bars or cross bars shall be welded to the banding bar.
  3. Provide trench grating with symmetrical cross bar arrangement.
  4. Grating clamps, nuts, bolts, washers, and other fastening devices for grating and grating supports shall be Type 316 stainless steel. All grating shall be anchored to the supporting system using saddle clips.
- B. Aluminum grating material shall be aluminum alloy 6063-T6 with a mill finish. Cross bars shall be attached to the bearing bars with interlocked swaged joints. The grating shall be Type BS by IKG Borden, Houston, TX; Type 19 SG-4 by Ohio Gratings, Inc., Canton, OH; Type 19S4 by Seidelhuber Metal Products, San Carlos, CA; or equal.
- C. Metal frames and supports for grating shall be of the same material as the grating unless otherwise shown on the Drawings. Where aluminum supports are used, they shall be fabricated from aluminum alloy 6061-T6.

## 2.05 RAILINGS

- A. Guardrails and railing systems shall comply with the requirements of OSHA and the FBC and shall be custom pre-engineered, mechanically fastened, or welded pipe aluminum railing systems. Mechanically fastened railing system shall be TUFrail as provided by Thomson Fabrication Company or equal.
- B. Rails and posts shall be 6061-T6, 6063-T6, or 6105-T5. Splice and reinforcing sleeves, brackets, end caps, toeboards, etc, shall be aluminum alloy 6061-T6, 6063-T6, or 6105-T5 alloy. Cast fittings shall be aluminum alloy No. 214. Railing system fastening hardware shall be Type 316 stainless steel. After welding, aluminum shall be anodized. All railing, posts, toeboards, and exposed aluminum shall be anodized with a clear architectural Class I satin finish providing a

minimum coating thickness of 0.7 mils and a minimum coating weight of 32 milligrams per square inch in compliance with AA M10C22A41.

- C. Railings shall be two-rail welded railing systems as shown on the Drawings, fabricated with 1 1/2-inch nominal diameter pipe. Posts shall be Schedule 80 pipe and railing shall be Schedule 40 pipe, minimum. Posts and top rails shall be continuous. The top surface of the top railing at all points, including corners and terminations, shall be smooth and shall not be interrupted by projected fittings or posts. Spacing of posts shall not exceed 5 feet on center and shall be uniformly spaced except as otherwise shown on the Drawings. Posts will be required on each side of structure expansion joints. All railing posts shall be vertical.
- D. Welds shall be circumferential welds ground smooth and even to produce a railing that is neat in appearance and structurally sound. Welding methods shall be in conformity with AWS standards for the materials being joined. All rail to post connections shall be coped and fastened by continuous welds. There shall be no burrs, sharp edges, or protrusions on any weld on any part of the handrail system. After fabrication, the welds and surrounding area shall be cleaned and hand buffed to blend with the adjacent finish. All mechanical fasteners shall be unobtrusively located in countersunk holes with the top flush with the surface of the rail. Bends in the railing shall be as indicated by the Drawings. No distortion of the circular railing shape will be allowed. Bends and terminal sections shall be made without the use of fittings. Corner bends shall be mitered and welded bends.
- E. Railing shall be assembled in sections as long as practical but shall not be greater than 24 feet in length. A field splice shall be used when an assembled section is to be attached to another section. Field splices shall be used in all railing panels that cross over structure expansion joints.
  - 1. Field splices shall use internal splice sleeves located within 8 inches of railing posts. The sleeve shall be welded to the rail on one side and fastened with a set screw to the rail on other side. The field splice shall be detailed to take the differential expansion between the railing system and the supporting structure.
  - 2. When the field splice occurs in a railing panel crossing a structure expansion joint, the sleeve shall be welded to the rail on one side and be free to slide in the rail on other side. The field splice shall be detailed to take the same movement as the structure expansion joint.
- F. The bases or supports for railing posts and handrail shall be the types indicated on the Drawings.
  - 1. Where non-removable railing is set in concrete, the posts shall be placed in 2 1/2-inch-diameter formed concrete openings and firmly caulked with a

nonsulphur compound, hydraulic cement equal to Por-Rok by Minwax Construction Products Division Sterling Drug, Montvale, NJ. Collars shall be placed around the post bases and fastened in place with set screws on the side of the post away from the walkway. Posts shall be placed with the centerline 4 inches from the edge of the concrete except that posts shall be set at the centerline of concrete curbs.

2. Aluminum railing posts, which may collect condensation, shall have a 3/16 inch drain hole drilled immediately above the concrete encased area, the base flange, or supporting socket on the side away from the walking area. The bottom of the rail post between the drain hole and the bottom of the post shall be filled with an inert material such as a compressed closed cell neoprene rod.
- G. Toeboards shall be provided on all railing adjacent to a drop in elevation of 4 feet or more. Toeboards are not required on the inclined portion of stairway railings or where concrete or steel curbs, 4 inches or more in height, are present. Toeboards shall be 4-inch-high channels of the same material as the railing. The channels shall have a minimum thickness of 1/8-inch and have flanges of not less than 3/4-inch nor more than 1-1/2 inches in width. Toeboards shall be positioned with a maximum clearance of 1/4 inch from the floor and fastened to railing posts with 1/4 inch stainless steel U-bolts, with J-bolts at corner posts and with clip angles and two 1/4 inch stainless steel expansion bolts at walls. Toeboards shall not be welded to the posts. Connection to post shall allow expansion and contraction movements.
- H. All railings shall be properly protected by paper, or by an approved coating, or by both against scratching, splashes, or mortar, paint, or other defacements during transportation and erection and until adjacent work by other trades has been completed. After protective materials are removed, the surfaces shall be made clean and free from stains, marks, or defects of any kind.
- I. Aluminum shapes, including mounting brackets, in contact with concrete or a different type of metal shall be separated by a 1/32 inch neoprene gasket or provided with a heavy coating of protective zinc chromate for separation of dissimilar materials.
- J. Safety gates for railing openings shall be fabricated of matching pipe and rail material and configuration. The gates shall be self-closing gates with approved stop, latch, and stainless steel closure spring and hinges.
- K. Barrier chains for railing openings shall be fabricated of stainless steel chains. Chain shall be 1/4 inch stainless steel links with 11 links per foot as manufactured by Eastern Chain Works, Inc., NY; Lawrence Metal Products, Inc.; or equal. Chains shall be fastened to the handrail posts at the elevation of each rail. One end

of each chain shall be connected to one post with a 1/4 inch-diameter stainless steel eye bolt and the other end shall be connected to the other post by means of a heavy chromium plated bronze swivel eye slide harness snap and a similar eye bolt.

## 2.06 ACCESS HATCHES (NOT USED)

## 2.07 MISCELLANEOUS ALUMINUM

- A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.
- B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close-fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Welding shall be on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous aluminum items shall include: beams, angles, closure angles, grates, hatches, floor plates, stop plates, stair nosings, and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.
- D. Angle frames for hatches, beams, grates, etc, shall be complete with welded strap anchors attached.
- E. Aluminum diamond plate and floor plate shall have a minimum thickness of 3/8 inch. Frames and supports shall be of aluminum construction. Fastening devices and hardware shall be Type 304 stainless steel. Plates shall have a mill finish.
- F. Stair treads for aluminum stairs shall have abrasive non-slip nosing as approved.
- G. Aluminum nosing at concrete stairs shall be Wooster Products, Inc.; Alumogrit Treads, Type 116; similar by Barry Pattern and Foundry Co.; Andco; or equal. Furnish with wing type anchors and flat head stainless steel machine screws, 12 inches on center. Nosing shall also be used at concrete ladder openings. Nosing

shall a single piece for each step extending to within 3 inches at each side of stair or full ladder width. Set nosing flush with stair tread finish at concrete stairs. Furnish treads with heavy duty protective tape cover.

- H. Miscellaneous aluminum items shall have a cleaned and degreased mill finish.

## 2.08 MISCELLANEOUS STEEL

- A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture, and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.
- B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous steel items shall include: beams, angles, lintels, metal stairs, support brackets, base plates for other than structural steel or equipment, closure angles, bridge crane rails, monorail hoist beams, holddown straps and lugs, door frames, splice plates, subframing at roof openings, and any other miscellaneous steel called for on the Drawings and not otherwise specified.
- D. Structural steel angle and channel door frames shall be shop coated with primer. Frames shall be fabricated with not less than three anchors on each jamb.
- E. Steel pipe pieces for sleeves, lifting attachments, and other functions shall be Schedule 40 pipe unless otherwise shown on the Drawings. Wall and floor sleeves, of steel pipe shall have welded circumferential steel waterstops at mid-length.
- F. Lintels, relief angles, or other steel supporting masonry or embedded in masonry shall be shop coated with primer.
- G. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust, and foreign matter and shall be given one shop coat of primer compatible with the finish coat after fabrication but before shipment. Paint shall



be omitted within 3 inches of proposed field welds. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces.

- H. Galvanizing, where required, shall be the hot-dip zinc process after fabrication. Coating shall be not less than 2 ounces/square foot of surface.

## 2.09 MISCELLANEOUS STAINLESS STEEL

- A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture, and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.
- B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close-fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. Grind smooth continuous welds that will be exposed. Provide holes for temporary field connections and for attachment of the work of other trades.
- C. Miscellaneous stainless steel items shall include: beams, angles, bar racks, and any other miscellaneous stainless steel called for on the Drawings and not otherwise specified.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Install all items except those to be embedded in concrete or other masonry which shall be installed under Division 3. Items to be attached to concrete or masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted.
- B. Abrasions in the shop primer shall be touched up immediately after erection. Areas left unprimed for welding shall be painted with primer after welding.
- C. Zinc coating which has been burned by welding, abraded, or otherwise damaged shall be cleaned and repaired after installation. The damaged area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or

cracked zinc coating removed before painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint. The paint shall be properly compounded with a suitable vehicle in the ratio of one part zinc oxide to four parts zinc dust by weight.

- D. Specialty products shall be installed in accordance with the manufacturer's recommendations.
- E. Expansion bolts shall be checked for tightness a minimum of 24 hours after initial installation.
- F. Install adhesive capsule anchors using manufacture's recommended drive units and adapters and in compliance with the manufacturer's recommendations.
- G. Headed anchor studs shall be welded in accordance with manufacturer's recommendations.
- H. All railings shall be erected to line and plumb with tightly fitted joints proving smooth transitions. For mechanically fastened systems, provide gaps between connecting members no greater than 1/8 inch unless at designated expansion joints.
- I. All steel surfaces that come into contact with exposed concrete or masonry shall receive a protective coating of an approved heavy bitumastic troweling mastic applied in accordance with the manufacturer's instructions before installation.
- J. Where aluminum contacts a dissimilar metal, apply a heavy brush coat of zinc-chromate primer followed by two coats of aluminum metal and masonry paint to the dissimilar metal.
- K. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.
- L. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.
- M. Between aluminum grating, aluminum stair treads, or aluminum handrail brackets and steel supports, insert 1/4-inch-thick neoprene isolator pads, 85 plus or minus 5 Shore A durometer, sized for full width and length of bracket or support.

END OF SECTION

**DIVISION 9**

**FINISHES**

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SECTION 09900  
PAINTING AND COATING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes materials for and application of painting and coating systems for the following surfaces:
  - 1. Submerged metal.
  - 2. Exposed metal.
  - 3. Buried metal.
  - 4. Concrete and masonry.
  - 5. PVC.
  - 6. Metal in contact with concrete.
  
- B. It does not include coating steel water tanks and reservoirs.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 03300, Cast-In-Place Concrete.
- E. Section 03360, Concrete Finishes.
- F. Section 15075, Process Equipment, Piping, and Valve Identification.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
  
- B. Submit manufacturer's data sheets showing the following information:
  - 1. Percent solids by volume.
  - 2. Minimum and maximum recommended dry-film thickness per coat for prime, intermediate, and finish coats.
  - 3. Recommended surface preparation.
  - 4. Recommended thinners.
  - 5. Statement verifying that the specified prime coat is recommended by the manufacturer for use with the specified intermediate and finish coats.

6. Application instructions including recommended equipment and temperature limitations.
  7. Curing requirements and instructions.
- C. Submit color swatches.
- D. Submit certificate identifying the type and gradation of abrasives used for surface preparation.
- E. Submit material safety data sheets for each coating.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
1. ASTM A780—Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings.
  2. ASTM C501—Standard Test Method for Relative Resistance to Wear of Unglazed Ceramic Tile by the Taber Abraser.
  3. ASTM D520—Standard Specification for Zinc Dust Pigment.
  4. ASTM D522—Standard Test Methods for Mandrel Bend Test of Attached Organic Coatings.
  5. ASTM D1002—Standard Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal-to-Metal).
  6. ASTM D2240—Standard Test Method for Rubber Property—Durometer Hardness.
  7. ASTM D2697—Standard Test Method for Volume Nonvolatile Matter in Clear or Pigmented Coatings.
  8. ASTM D3734—Standard Specification for High-Flash Aromatic Naphthas.
  9. ASTM D4060—Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser.
  10. ASTM D4138—Standard Practices for Measurement of Dry Film Thickness of Protective Coating Systems by Destructive, Cross-Sectioning Means.

11. ASTM D4258—Standard Practice for Surface Cleaning Concrete for Coating.
12. ASTM D4260—Standard Practice for Liquid and Gelled Acid Etching of Concrete.
13. ASTM D4261—Standard Practice for Surface Cleaning Concrete Unit Masonry for Coating.
14. ASTM D4263—Standard Test Method for Indicating Moisture in Concrete by the Plastic Sheet Method.
15. ASTM D4787—Standard Practice for Continuity Verification of Liquid or Sheet Linings Applied to Concrete Substrates.
16. ASTM D6386—Standard Practice for Preparation of Zinc (Hot-Dip Galvanized) Coated Iron and Steel Product and Hardware Surfaces for Painting.
17. ASTM D7091—Standard Practice for Nondestructive Measurement of Dry Film Thickness of Nonmagnetic Coatings Applied to Ferrous Metals and Nonmagnetic, Nonconductive Coatings Applied to Non-Ferrous Metals.
18. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.

B. U.S. Department of Defense (MIL)

1. MIL-P-21035—Paint High Zinc Dust Content, Galvanizing Repair.

C. National Association of Corrosion Engineers International (NACE)

1. NACE SP0188—Discontinuity (Holiday) Testing of New Protective Coatings on Conductive Substrates.

D. Steel Structure Painting Council (SSPC)

1. SSPC PA-1—Shop, Field, and Maintenance Painting of Steel.
2. SSPC PA-2—Measurement of Dry Coating Thickness with Magnetic Gauges.
3. SSPC SP-1—Solvent Cleaning.
4. SSPC SP-2—Hand Tool Cleaning.
5. SSPC SP-3—Power Tool Cleaning.
6. SSPC SP-5—White Metal Blast Cleaning.
7. SSPC SP-6—Commercial Blast Cleaning.
8. SSPC SP-7—Brush-Off Blast Cleaning.
9. SSPC SP-10—Near-White Blast Cleaning.
10. SSPC SP-11—Power Tool Cleaning to Bare Metal.
11. SSPC SP-13—Surface Preparation of Concrete.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MOCK-UP (NOT USED)

1.12 PROJECT REQUIREMENTS (NOT USED)

PART 2 MATERIALS

2.01 PAINTING AND COATING SYSTEMS

The following index lists the various painting and coating systems by service and generic type:

PAINT COATINGS SYSTEM INDEX		
No.	Title	Generic Coating
Submerged Metal Coating Systems		
1.	Submerged Metal, Raw Water (Nonpotable) or Raw Sewage	
6.	Submerged Metal, Raw Sewage or Grit Slurries	Epoxy resin/ceramic
7.	Submerged Metal, Potable or Nonpotable Water	Epoxy
Exposed Metal Coating Systems		
10.	Exposed Metal, Corrosive Environment	High-build epoxy (two-coat system) with polyurethane topcoat
15.	Exposed Metal, Atmospheric Weathering Environment	Acrylic
18.	Exposed Metal, Organic Zinc Primer for Shop Coating and Field Touch-Up	Organic zinc
Buried Metal Coating Systems		
21.	Buried Metal	Epoxy
24.	Buried Metal	Corrosion-resisting grease



PAINT COATINGS SYSTEM INDEX		
No.	Title	Generic Coating
Concrete and Masonry Coating Systems		
31.	Exposed Concrete and Masonry, Corrosive Environment	Epoxy
36.	Exposed Concrete and Masonry, Corrosive Environment	High-build epoxy with polyurethane topcoat
PVC, CPVC, and FRP Coating Systems		
41.	PVC Ultraviolet Exposure or Color Coding	Polyurethane
Coating Systems for Miscellaneous Metals		
51.	Insulate Aluminum (Insulation) from Concrete and Carbon Steel	Bituminous
Coating Systems for Galvanized Steel		
52.	Exposed Metal, Galvanized Steel	Synthetic resin or Epoxy Primer

These systems are specified in detail in the following Paragraphs. For each coating, the required surface preparation, prime coat, intermediate coat (if required), topcoat, and coating thicknesses are described. Mil thicknesses shown are minimum dry-film thicknesses.

A. Submerged Metal Coating Systems

1. System No. 1—Submerged Metal—Raw Water (Nonpotable) or Raw Sewage:
  - a. Type: Tnemec Series 446 Perma-Shield MCU Modified Aromatic Polyurethane at 8.0 to 10.0 mils per coat with a minimum 71% solids by volume (sbv).
  - b. Service Conditions: For use with metal pipes or structures (such as scum troughs, sluice gates, or piping) alternately submerged in raw sewage or raw water (nonpotable) and exposed to a moist saturated hydrogen sulfide atmosphere, as in raw sewage wet wells. Minimum temperature resistance of the coating shall be 140°F for moist heat conditions.
  - c. Surface Preparation: Average blast profile to be 1.5 to 2.5 mils. Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast per SSPC SP-10, Near White Metal Blast Cleaning.
  - d. Prime Coat: ICI Devoe Bar-Rust 233H, 8 mils; Tnemec Series 446 Perma-Shield MCU Modified Aromatic Polyurethane at 8.0 to 10.0 mils per coat; Sherwin Williams Tank Clad HSB62-80 Series/B60V80 Series at 5.0 to 8.0 mils DFT.
  - e. Finish Coat: ICI Devoe Bar-Rust 233H, 8 mils; Tnemec Series 446 Perma-Shield MCU Modified Aromatic Polyurethane at 8.0 to

10.0 mils per coat; Sherwin Williams Tank Clad HS B62-80 Series/B60V80 Series at 5.0 to 8.0 mils DFT.

2. System No. 6—Submerged Metal, Raw Sewage or Grit Slurries:
- a. Type: Two-component epoxy resin/ceramic having 100% volume solids and having the following characteristics:

Tensile shear adhesion (ASTM D1002):	2,500 psi (min)
Shore D hardness (minimum):	85
Abrasion resistance (ASTM D4060):	0.8 mg (max) loss per 1,000 cycles

- b. Service Conditions: For use as a lining for pump volutes, pump impellers, piping, valves, and heat exchanger tubes subject to severe abrasion service.
- c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast per SSPC-SP-10, Near White Metal Blast Cleaning.
- d. Coating System: Apply two coats (each a different color) to a minimum thickness of 10 mils per coat. Minimum total coating shall be 20 mils, DFT. Product: THORTEX Cerami-Tech C.R. as applied by Western Industrial Technology, Inc., Fullerton, California, or Paragon Industries, Horsham, Pennsylvania; Belzona 1341; or equal.
3. System No. 7—Submerged Metal, Potable or Nonpotable Water:
- a. Type: Epoxy: 100% sbv Polyamine Epoxy with near “0” VOC.
- b. Service Conditions: For use with structures, valves, piping, or equipment immersed in potable or nonpotable water.
- c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast per SSPC SP-10, Near Abrasive White Metal Blast Cleaning.
- d. Coating System: Apply the manufacturer’s recommended number of coats to attain the specified minimum coating thickness. Products: Devoe Bar-Rust 233H; Tnemec N140; Sherwin-Williams Tank Clad HS B62-80 Series/B60V80; PPG AQUAPON® LT NSF Low Temperature Epoxy Coatings 95-172; Carboline Super Hi-Gard 891; Ameron 395; International Interline 785HS; Wisconsin Protective Coating Corp. Plasite 9133, Keysite 740, or equal; minimum total coating shall be 20 mils, DFT. Color of topcoat: white. Each coat shall be a different color than the one preceding it. Tnemec Series N140 Pota-Pox Plus Polyamidoamine

epoxy at 6.0 to 8.0 mils/coat. Apply two (2) coats. Total system should not exceed 17 mils.

B. Exposed Metal Coating Systems

1. System No. 10—Exposed Metal, Corrosive Environment:

- a. Type: High-build epoxy intermediate coat having a minimum volume solids of 60%, with an inorganic zinc prime coat and a pigmented polyurethane finish coat having a minimum volume solids of 52%.
- b. Service Conditions: For use with metal structures or pipes subjected to water condensation, chemical fumes such as hydrogen sulfide, salt spray, and chemical contact.
- c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast per SSPC-SP-10, Near White Metal Blast Cleaning.
- d. Prime Coat: Self-curing, two-component inorganic zinc-rich coating recommended by the manufacturer for overcoating with a high-build epoxy finish coat. Minimum zinc content shall be 12 pounds per gallon. Apply to a thickness of 3 mils. Products: Tnemec Series 90-97; Devoe Catha-Coat 304 or 304V; International Interzinc 180HS; Ameron 9HS; Carboline 11 HS; Sherwin-Williams Zinc-Clad II Plus, B69VZ12/B69VZ13/B69D11 at 2.5 to 4.0 mils DFT; PPG METALHIDE® 28 Inorganic Zinc-Rich Primer 97 – 672, or equal.
- e. Intermediate Coat: Tnemec Series 104; ICI Devoe Devran 224 HS; International Interguard 760HS; Ameron 385; Carboline 888 or 890; Sherwin-Williams Macropoxy 646 B58-600/B58V600 at 4.0 to 8.0 mils DFT; PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 Series, or equal; 5 mils. Film thickness 5.0 to 8.0 mils/coat. Minimum solids by volume should be 82%.
- f. Finish Coat: Two-component pigmented acrylic or aliphatic polyurethane, minimum 70% sbv recommended by the manufacturer for overcoating a high-build epoxy coating. Apply to a thickness of at least 2 mils. Products: Tnemec Series 1075; ICI Devoe Devthane 379; International Interline 990HS; Ameron 450 HS; Carboline 134 HG; Sherwin-Williams Hi-Solids Polyurethane B65-300 Series/B60V30 at 2.5 to 4.0 mils DFT; PPG PITTHANE® Ultra-Gloss Urethane Enamel 95-812 Series; or equal.

2. System No. 15—Exposed Metal, Atmospheric Weathering and Water Condensation Environment:
  - a. Type: One-component acrylic enamel having a minimum volume solids content of 35% with an inorganic zinc primer.
  - b. Service Conditions: For use on interior and exterior metal and piping subject to sunlight, weathering, and water condensation.
  - c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast to a minimum Commercial Blast Cleaning per SSPC-SP6. SSPC SP-10, Near White Metal Blast Cleaning is preferred.
  - d. Prime Coat: Sherwin-Williams Zinc Clad II Plus primer B69VZ12/B69VZ13/B69D11 at 2.5-4.0 mils DFT; ICI Devoe Inorganic Zinc 304V; or Carboline 11HS; applied to a minimum dry-film thickness of 3 mils.
  - e. Finish Coats: Two or more coats of Sherwin-Williams Sher-Cryl B66 – 300 Series at 2.5-4.0 mils DFT/coat; ICI Devoe Devflex 659; Carboline 3359 DTM; Tnemec Series 1028 (gloss) or Tnemec Series 1029 (semi-gloss); or equal. Apply sufficient coats to provide a total minimum dry-film thickness of 8 mils. Thickness of any individual coat shall not exceed 4 mils.
  
3. System No. 18—Exposed Metal Organic Zinc Primer for Shop Coating and Field Touch-Up:
  - a. Type: Organic zinc primer having a minimum zinc content of 14 pounds per gallon.
  - b. Service Conditions: For use as a shop-applied primer or field touch-up primer over inorganic zinc prime coatings on exposed metal.
  - c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast per SSPC-SP-10, Near White Metal Blast Cleaning.
  - d. Coating: Coating shall be of the two- or three-component converted epoxy, epoxy phenolic, or urethane type. Products: Tnemec 90-97; International Interzinc 308; Ameron 68HS; ICI Devoe 313; Carboline 859; Sherwin-Williams Zinc-Clad III HS B69A100/B69D11/B69D11 at 3.0 to 5.0 mils DFT; PPG Durethane™ MCZ 97-679; or equal. Applied to a minimum dry-film thickness of 3 mils. Organic zinc primer shall be manufactured by the prime coat manufacturer.

## C. Buried Metal Coating Systems

### 1. System No. 21—Buried Metal:

- a. Type: High solids Cycloaliphatic Amine epoxy or phenolic epoxy having minimum volume solids of 80% (ASTM D2697).
- b. Service Conditions: Buried metal, such as valves, flanges, bolts, nuts, structural steel, and fittings.
- c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Abrasive blast per SSPC-SP-10, Near White Metal Blast Cleaning.
- d. Coating System: Apply three or more coats of Ameron 400; Tnemec 104 HS (6.0 to 8.0 mils per coat); ICI Devoc Bar-Rust 233H; Carboline 890LT; Sherwin-Williams Tank Clad HS B62-80 Series/B60V80 Series at 5.0 to 8.0 mils/coat or equal; 30 mils total. Maximum thickness of an individual coating shall not exceed the manufacturer's recommendation.

### 2. System No. 24—Buried Metal:

- a. Type: Corrosion-resisting grease.
- b. Service Conditions: Buried metal, such as bolts, bolt threads, tie rods, and nuts.
- c. Surface Preparation: Solvent clean per SSPC-SP1 to remove contaminants from the surface. Power Tool Clean per SSPC-SP3 as a minimum. Abrasive blasting per SSPC-SP-6, Commercial Blast Cleaning is preferred.
- d. Coating: NO-OX-ID GG-2 as manufactured by Sanchem, Inc. Apply to a minimum thickness of 1/4 inch.

## D. Concrete and Masonry Coating Systems

### 1. System No. 31—Exposed Concrete and Masonry, Corrosive Environment:

- a. Type: Polyamide-cured epoxy having a minimum volume solids of 53%.
- b. Service Conditions: Concrete and masonry exposed to corrosive atmospheres, such as hydrogen sulfide gas, chlorine gas, or chlorinated effluent sprays in wastewater treatment plants.
- c. Surface Preparation: In accordance with Part 3.04. Clean to an ICRI CSP 5 standard. If using for splash and spillage surface, preparation can be brush off abrasive blasting.
- d. Prime Coat: Epoxy filler compound or epoxy masonry filler having a minimum solids volume of 60%. Apply one coat to fill voids,

pores, and cracks. Products: Tnemec 54-660, International Intercryl 320WB, Amerlock 400 BF, ICI Devoe Devran 265 BHF, Sentry 610, Sherwin-Williams Kem Cati-Coat HS B42W400/B42V401 at 10.0 to 20.0 mils DFT, or equal. For surfacing, use Tnemec Series 218 MortarClad applied to 1/4-inch. For greater depressions use Tnemec Series 63-1500 or Tnemec Series 219 MortarCast.

- e. Intermediate Coat: One coat of Tnemec 104 (6.0 to 8.0 mils per coat); International Interguard 760HS; Amerlock 400; ICI Devoe Bar-Rust 233 H; Carboline 890; Sherwin-Williams Macropoxy 646 B58-600 Series/B58V600 at 5.0 to 8.0 mils DFT; or equal.
- f. Finish Coat: Two coats of Tnemec 104 (use 6.0 to 8.0 mils per coat); International Interguard 760HS; Amerlock 400; ICI Devoe Bar-Rust 233 H; Carboline 890; Sherwin-Williams Macropoxy 646 B58-600 Series/B58V600 at 4.0 to 8.0 mils DFT; or equal.
- g. For floors, provide non-slip additives.

2. System No. 36—Exposed Concrete and Masonry, Corrosive Environment:

- a. Type: High-build epoxy intermediate coat having minimum volume solids of 100% with an epoxy filler prime coat and a pigmented polyurethane finish coat.
- b. Service Conditions: Concrete and masonry block exposed to corrosive atmospheres, such as hydrogen sulfide gas, chlorine gas, or chlorinated effluent sprays in wastewater treatment plants.
- c. Surface Preparation: In accordance with Article 3.04, ICRI 3-5.
- d. Prime Coat: Epoxy filler compound or epoxy masonry filler having a minimum solids volume of 60%. Apply one coat to fill voids, pores, and cracks. Products: Amerlock 400 BF; Tnemec 54-660; International Intercryl 320WB; ICI Devoe Devran 265 BHF; Sentry 610; Sherwin-Williams Kem Cati-Coat HS B42 W400 Series/B42V401 at 10.0 to 20.0 mils DFT; or equal.
- e. Intermediate Coats: Ameron 385; Tnemec Series 434 Perma-Shield H<sub>2</sub>S at 1/8 inch; International Interguard 760HS; ICI Devoe Devran 224 HS; Carboline 890LT; Sherwin-Williams Macropoxy 646 B58-600 Series/B60V80 at 5.0 to 8.0 mils DFT; or equal. Apply multiple coats to a total minimum thickness of 15 mils. Thickness of any single coat shall not exceed 6 mils.
- f. Finish Coat: Two-component pigmented acrylic or aliphatic polyurethane recommended by the manufacturer for overcoating a high-build epoxy coating. Minimum volume of solids shall be 52%. Apply to a thickness of at least 2 mils. Products: Ameron 450 HS; Tnemec Series 435 Perma-Glaze at 15.0-20.0 mils DFT; International Interthane 990HS; ICI Devoe Devran 379;

Carboline 134 HG; Sherwin-Williams Hi-Solids Polyurethane HS B65-300 Series/B60V30 at 3.0-4.0 mils DFT; or equal.

E. PVC Coating System

1. System No. 41—PVC, Ultraviolet Exposure, or Color Coding:
  - a. Type: Epoxy primer with minimum volume solids of 54% and a pigmented polyurethane enamel having a minimum volume solids of 66%.
  - b. Service Conditions: Color coding of PVC exposed to sunlight.
  - c. Surface Preparation: Clean the surface per SSPC SP-1, Solvent Cleaning. Then, lightly abrade the surface with medium-grain sandpaper.
  - d. Prime Coat: One coat of Tnemec Series N69 Epoxoline; International 7510; Ameron 385; ICI Devoe Devran 224 HS; Sherwin-Williams Macropoxy 646 B58 Series/B58V600 at 5.0 to 8.0 mils DFT; Carboline 888 or 890; PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 Series; or equal. Apply to a minimum dry-film thickness of 4 mils.
  - e. Finish Coat: One coat of Tnemec Series 1075; International Interthane 990HS; Ameron 450 HS; ICI Devoe Devran 379; Carboline 134 HG; Sherwin-Williams Hi-Solids Polyurethane B65-300 Series/B60V30 at 3.0 to 4.0 mils DFT; PPG PITTHANE® Ultra-Gloss Urethane Enamel 95-812 Series; or equal. Apply to a minimum dry-film thickness of 3 mils.

F. Coating Systems for Miscellaneous Metals

1. System No. 51—Insulate Aluminum (Insulation) from Concrete and Carbon Steel:
  - a. Type: Bituminous paint having a minimum volume solids of 68% coal-tar pitch based.
  - b. Service Conditions: Coat areas of aluminum grating, stairs, structural members or aluminum fabrications, in contact with concrete or carbon steel with this system.
  - c. Surface Preparation: Solvent or steam clean in accordance with SSPC SP-1; do not use alkali cleaning. Then dust blast.
  - d. Prime Coat: Apply synthetic resin or epoxy primer to metal surface before finish coats. Products: International Intervinux VTA528/529, or equal. No primer required for Carboline or Tnemec.

- e. Finish Coat: Carboline Super Service Black; Tnemec 46-465; International Intertuf 100; or equal. Apply two coats to a minimum dry-film thickness of 8.0 to 12.0 mils/coat.

G. Coating Systems for Galvanized Steel

- 1. System No. 52—Exposed Metal, Galvanized Steel:
  - a. Type: Synthetic resin or epoxy primer.
  - b. Service Conditions: Coat galvanized steel surfaces with this system before applying topcoat.
  - c. Surface Preparation of Galvanized Steel: Surfaces shall be flat with no protrusions. Remove high spots and tears in the galvanizing with hand and power grinders. Comply with ASTM D6386, Paragraph 5.2.1. Do not remove the galvanized coating below the specified thickness. Solvent clean galvanized surfaces in accordance with ASTM D6386, Paragraph 5.3.2. Then sweep blast as in ASTM D6386, Paragraph 5.4.1. Use one of the abrasive materials described in ASTM D6386, Paragraph 5.4.1. Surface preparation for weathered and partially weathered galvanized steel shall be in accordance with ASTM D6386, Paragraphs 6 and 7. Apply prime coating within 1 hour of the surface preparation.
  - d. Prime Coat: Tnemec Series N69 2.5 to 3.5 mils; Ameron 385; ICI Devoe Devran 224 HS; Carboline Rustbond Penetrating Sealer SG; Sherwin-Williams Macropoxy 646 B58-600 Series/B58V600 at 5.0 to 8.0 mils DFT; PPG PITT-GUARD® Direct-to-Rust Epoxy Mastic Coating 97-145 Series; or equal. Apply to a minimum thickness of 4 mils.
  - e. Intermediate and Finish Coats: Epoxy and polyurethane as described in System No. 10. Do not include the inorganic zinc prime coat described in that system.

H. Abrasives for Surface Preparation

- 1. Abrasives used for preparation of ferrous (excluding stainless steel) surfaces shall be one of the following:
  - a. 16- to 30- or 16- to 40-mesh silica sand or mineral grit.
  - b. 20- to 40-mesh garnet.
  - c. Crushed iron slag, 100% retained on No. 80 mesh.
  - d. SAE Grade G-40 or G-50 iron or steel grit.
- 2. Abrasives used for preparation of stainless steel surfaces shall be 20- to 40-mesh silicon carbide or aluminum oxide.



3. Abrasives used for preparation of copper and aluminum surfaces shall be one of the following:
    - a. Crushed slag, 80 to 100 mesh.
    - b. Very fine silica sand, 80 to 100 mesh.
  4. Abrasives used for preparation of concrete and masonry surfaces shall be 16- to 30- or 16- to 40-mesh silica sand.
  5. In the above gradations, 100% of the material shall pass through the first stated sieve size and 100% shall be retained on the second stated sieve size.
- I. Organic Zinc Primer for Field Touch-Up and Shop Coating
1. Where shop-applied inorganic zinc primers cannot be used because of volatile organic compound (VOC) regulations, the organic zinc primer described in System No. 18 may be substituted for the specified inorganic zinc primers.

## PART 3 EXECUTION

### 3.01 WEATHER CONDITIONS

- A. Do not paint in the rain, wind, snow, mist, or fog or when steel or metal surface temperatures are less than 5°F above the dew point.
- B. Do not apply paint when the relative humidity is above 85%.
- C. Do not paint when temperature of metal to be painted is above 120°F.
- D. Do not apply alkyd, inorganic zinc, silicone aluminum, or silicone acrylic paints if air or surface temperature is below 40°F or expected to be below 40°F within 24 hours.
- E. Do not apply epoxy, acrylic latex, and polyurethane paints on an exterior or interior surface if air or surface temperature is below 60°F or expected to drop below 60°F in 24 hours.

### 3.02 SURFACE PREPARATION PROCEDURES

- A. Remove oil and grease from metal surfaces in accordance with SSPC SP-1. Use clean cloths and cleaning solvents and wipe dry with clean cloths. Do not leave a

film or greasy residue on the cleaned surfaces before abrasive blasting. Powerwashing with a biodegradable degreaser is also acceptable.

- B. Remove weld spatter and weld slag from metal surfaces and grind smoothly rough welds, beads, peaked corners, and sharp edges including erection lugs in accordance with SSPC SP-2 and SSPC SP-3. Grind 0.020 inch (minimum) off the weld caps on pipe weld seams. Grind outside sharp corners, such as the outside edges of flanges, to a minimum radius of 1/4 inch.
- C. Do not abrasive blast or prepare more surface area in one day than can be coated in one day; prepare surfaces and apply coatings the same day. Remove sharp edges, burrs, and weld spatter. Prime all areas before rust bloom forms and within the same day.
- D. Do not abrasive blast PVC, CPVC, or FRP piping or equipment. Do not abrasive blast epoxy- or enamel-coated pipe that has already been factory coated, except to repair scratched or damaged coatings.
- E. For carbon steel, do not touch the surface between the time of abrasive blasting and the time the coating is applied. Apply coatings within 2 hours of blasting or before any rust bloom forms.
- F. Surface preparation shall conform to the SSPC specifications as follows:

Solvent Cleaning	SP-1
Hand Tool Cleaning	SP-2
Power Tool Cleaning	SP-3
White Metal Blast Cleaning	SP-5
Commercial Blast Cleaning	SP-6
Brush-Off Blast Cleaning	SP-7
Pickling	SP-8
Near-White Blast Cleaning	SP-10
Power Tool Cleaning to Bare Metal	SP-11
Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultrahigh-Pressure Water Jetting Before Recoating	SP-12
Surface Preparation of Concrete	SP-13

- G. Wherever the words “solvent cleaning,” “hand tool cleaning,” “wire brushing,” or “blast cleaning” or similar words are used in these Specifications or in the paint manufacturer’s specifications, they shall be understood to refer to the applicable

SSPC (Steel Structure Painting Council), surface preparation specifications listed above.

- H. *Dust blasting* is defined as cleaning the surface through the use of very fine abrasives, such as siliceous or mineral abrasives, 80 to 100 mesh. Apply a fine etch to the metal surface to clean the surface of any contamination or oxide and to provide a surface profile for the coating.
- I. *Brush-off blasting* of concrete and masonry surfaces is defined as opening subsurface holes and voids and etching the surface for a coating to bond.
- J. For carbon steel surfaces, after abrasive blast cleaning, the height of the surface profile shall be 2 to 3 mils. Verify the surface profile by measuring with an impresser tape acceptable to the Owner's Representative. Perform a minimum of one test per 100 square feet of surface area. Testing shall be witnessed by the Owner's Representative. The impresser tape used in the test shall be permanently marked with the date, time, and locations where the test was made. Test results shall be promptly presented to the Owner's Representative.
- K. Do not apply any part of a coating system before the Owner's Representative has reviewed the surface preparation. If coating has been applied without this review, if directed by the Owner's Representative, remove the applied coating by abrasive blasting and reapply the coat in accordance with this Specification.

### 3.03 ABRASIVE BLAST CLEANING

- A. Use dry abrasive blast cleaning for metal surfaces. Do not use abrasives in automatic equipment that have become contaminated. When shop or field blast cleaning with handheld nozzles, do not recycle or reuse blast particles.
- B. After abrasive blast cleaning and before coating is applied, dry clean surfaces to be coated by dusting, sweeping, and vacuuming to remove residue from blasting. Apply the specified primer or touch-up coating within an 8-hour working day. Do not apply coating over damp or moist surfaces. Reclean any blast-cleaned surface not coated within the 8-hour period before applying primer or touch-up coating.
- C. Keep the area of the work in a clean condition and do not permit blasting particles to accumulate and constitute a nuisance or hazard.
- D. During abrasive blast cleaning, prevent damage to adjacent coatings. Schedule blast cleaning and coating so that dust, dirt, blast particles, old coatings, rust, mill scale, etc., will not damage or fall upon wet or newly coated surfaces.

### 3.04 PREPARATION OF CONCRETE AND MASONRY SURFACES TO BE COATED

- A. Surface preparation of concrete and masonry surfaces shall be in accordance with SSPC SP-13/NACE 6 and the following.
- B. Do not apply coating until concrete has cured at least 30 days at 75°F and a minimum 50%. Finish concrete surfaces in accordance with Section 03300, Cast-In-Place Concrete, and Section 03360, Concrete Finishes. Do not use curing compound on surfaces that are to be coated.
- C. Concrete and masonry surfaces on which coatings are to be applied shall be of even color, gray or gray-white. The surface shall have no pits, pockets, holes, or sharp changes of surface elevation. Scrubbing with a stiff-bristle fiber brush shall produce no dusting or dislodging of cement or sand. Sprinkling water on the surface shall produce no water beads or standing droplets. Concrete and masonry shall be free of laitance and slick surfaces.
- D. Detergent clean the concrete or masonry surface with Trisodium Phosphate in accordance with ASTM D4258. Then sandblast surfaces (brush-off blast). Floor slabs may be acid etched as specified in ASTM D4260 in lieu of sandblasting. After sandblasting, wash surfaces with water to remove dust and salts in accordance with ASTM D4258 or D4261. The grain of the concrete surface to touch shall not be rougher than that of No. 10 mesh sand. Use International Concrete Repair Institute (ICRI) standards for concrete and masonry surface preparation.
- E. Before coating concrete and masonry with System Nos. 31 and 36, determine the presence of capillary moisture in accordance with ASTM D4263, except as modified below. Tape a 4-foot-by-4-foot sheet of polyethylene plastic to the concrete surface to be coated. Allow the plastic sheet to remain in place at least 24 hours. After the specified time has elapsed, remove the plastic sheet and visually examine both the underside of the plastic sheet and the concrete surface beneath it. There shall be no indication of moisture on either surface. If moisture is indicated, allow additional curing time for the concrete and then retest. Provide one test sheet for every 300 square feet of concrete surface to be coated. For walls, provide one test sheet for each 10 feet (or fraction thereof) of vertical rise in all elevations starting within 12 inches of the floor or base slab.
- F. Acceptance criteria for concrete surfaces shall be in accordance with SSPC SP-13, Table 1, "Severe Service."
- G. Do not apply coatings to concrete when the concrete is outgassing. Apply coatings only when the concrete surface temperature is stable, not rising. Apply concrete coatings when the temperature is falling to reduce the potential of outgassing.

### 3.05 PROCEDURES FOR ITEMS HAVING SHOP-APPLIED PRIME COATS

- A. After applying primer to surfaces, allow coating to cure for a minimum of 2 hours before handling to minimize damage.
- B. When loading for shipment to the project site, use spacers and other protective devices to separate items to prevent damaging the shop-primed surfaces during transit and unloading. If wood spacers are used, remove wood splinters and particles from the shop-primed surfaces after separation. Use padded chains or ribbon binders to secure the loaded items and minimize damage to the shop-primed surfaces.
- C. Cover shop-primed items 100% with protective coverings or tarpaulins to prevent deposition of road salts, fuel residue, and other contaminants in transit.
- D. Handle shop-primed items with care during unloading, installation, and erection operations to minimize damage. Do not place or store shop-primed items on the ground or on top of other work unless the ground or work is covered with a protective covering or tarpaulin. Place shop-primed items above the ground upon platforms, skids, or other supports.

### 3.06 FIELD TOUCH-UP OF SHOP-APPLIED PRIME COATS

- A. Remove oil and grease surface contaminants on metal surfaces in accordance with SSPC SP-1. Use clean rags wetted with a degreasing solution, rinse with clean water, and wipe dry.
- B. Remove dust, dirt, salts, moisture, chalking primers, or other surface contaminants that will affect the adhesion or durability of the coating system. Use a high-pressure water blaster or scrub surfaces with a broom or brush wetted with a solution of Trisodium Phosphate, detergent, and water. Rinse scrubbed surfaces with clean water.
- C. Remove loose or peeling primer and other surface contaminants not easily removed by the previous cleaning methods in accordance with SSPC SP-7. Take care that the remaining primers are not damaged by the blast cleaning operation. The remaining primers shall be firmly bonded to the steel surfaces with blast-cleaned edges feathered.
- D. Remove rust, scaling, or primer damaged by welding or during shipment, storage, and erection in accordance with SSPC SP-10. Take care that the remaining primers are not damaged by the blast cleaning operation. Areas smaller than

1 square inch may be prepared in accordance with SSPC SP-11. The remaining primers shall be firmly bonded to the steel surfaces with cleaned edges feathered.

- E. Use repair procedures on damaged primer that protect adjacent primer. Blast cleaning may require the use of lower air pressure, smaller nozzles and abrasive particle sizes, short blast nozzle distance from surface, shielding, and/or masking.
- F. After abrasive blast cleaning of damaged and defective areas, remove dust, blast particles, and other debris by dusting, sweeping, and vacuuming; then apply the specified touch-up coating.
- G. Surfaces that are shop primed with inorganic zinc primers shall receive a field touch-up of organic zinc primer as specified in System No. 18 to cover scratches or abraded areas.
- H. Other surfaces that are shop primed shall receive a field touch-up of the same primer used in the original prime coat.

### 3.07 PAINTING SYSTEMS

- A. All materials of a specified painting system, including primer, intermediate, and finish coats, shall be produced by the same manufacturer. Thinners, cleaners, driers, and other additives shall be as recommended by the paint manufacturer for the particular coating system.
- B. Deliver paints to the jobsite in the original, unopened containers.
- C. Provide color charts to Engineer for final selection by the Owner.

### 3.08 PAINT STORAGE AND MIXING

- A. Store and mix materials only in areas designated for that purpose by the Owner's Representative. The area shall be well ventilated, with precautionary measures taken to prevent fire hazards. Post "No Smoking" signs. Storage and mixing areas shall be clean and free of rags, waste, and scrapings. Tightly close containers after each use. Store paint at an ambient temperature from 50°F to 100°F.
- B. Prepare multiple-component coatings using all of the contents of the container for each component as packaged by the paint manufacturer. Do not use partial batches. Do not use multiple-component coatings that have been mixed beyond their pot life. Provide small quantity kits for touch-up painting and for painting other small areas. Mix only the components specified and furnished by the paint manufacturer. Do not intermix additional components for reasons of color or otherwise, even within the same generic type of coating.

### 3.09 PROCEDURES FOR THE APPLICATION OF COATINGS

- A. Conform to the requirements of SSPC PA-1. Follow the recommendations of the coating manufacturer, including the selection of spray equipment, brushes, rollers, cleaners, thinners, mixing, drying time, temperature and humidity of application, and safety precautions.
- B. Stir, strain, and keep coating materials at a uniform consistency during application. Power mix components. For multiple component materials, premix each component before combining. Apply each coating evenly, free of brush marks, sags, runs, and other evidence of poor workmanship. Use a different shade or tint on succeeding coating applications to indicate coverage where possible. Finished surfaces shall be free from defects or blemishes.
- C. Do not use thinners unless recommended by the coating manufacturer. If thinning is allowed, do not exceed the maximum allowable amount of thinner per gallon of coating material. Stir coating materials at all times when adding thinner. Do not flood the coating material surface with thinner before mixing. Do not reduce coating materials more than is absolutely necessary to obtain the proper application characteristics and to obtain the specified dry-film thicknesses.
- D. Remove dust, blast particles, and other debris from blast cleaned surfaces by dusting, sweeping, and vacuuming. Allow ventilator fans to clean airborne dust to provide good visibility in working area before applying coating. Remove dust from coated surfaces by dusting, sweeping, and vacuuming before applying succeeding coats.
- E. Apply coating systems to the specified minimum dry-film thicknesses as determined in accordance with SSPC PA-2.
- F. Apply primer immediately after blast cleaning and before any surface rusting occurs, or any dust, dirt, or any foreign matter has accumulated. Before applying coating, re-clean surfaces that have surface colored or become moist by blast cleaning.
- G. Apply a brush coat of primer on welds, sharp edges, nuts, bolts, and irregular surfaces before applying the primer and finish coat. Apply the brush coat before and in conjunction with the spray coat application. Apply the spray coat over the brush coat.
- H. Before applying subsequent coats, allow the primer and intermediate coats to dry for the minimum curing time recommended by the manufacturer. In no case shall the time between coats exceed the manufacturer's recommendation.

- I. Each coat shall cover the surface of the preceding coat completely and there shall be a visually perceptible difference in applied shade or tint of colors.
- J. Applied coating systems shall be cured at 75°F or higher for 48 hours. If temperature is lower than 75°F, curing time shall be in accordance with printed recommendations of the manufacturer, unless otherwise allowed by the Owner's Representative.
- K. Assembled parts shall be disassembled sufficiently before painting or coating to ensure complete coverage by the required coating.

### 3.10 SURFACES NOT TO BE COATED

- A. Do not paint the surfaces listed below unless otherwise noted in the drawings or in other Specification Sections. Protect the following surfaces during the painting of adjacent areas:
  - 1. Concrete walkways.
  - 2. Mortar-coated pipe and fittings.
  - 3. Stainless steel.
  - 4. Metal letters.
  - 5. Glass.
  - 6. Roofing.
  - 7. Fencing.
  - 8. Copper tubing and red brass piping except where such piping occurs in rooms where the walls are painted or required for color coding.
  - 9. Electrical fixtures except for factory coatings.
  - 10. Nameplates.
  - 11. Grease fittings.
  - 12. Brass and copper, submerged.
  - 13. Buried pipe, unless specifically required in the piping Specifications or shown in the Drawings.
  - 14. Fiberglass items, unless specifically required in the FRP Specifications.
  - 15. Aluminum handrail, stairs, and grating.
  - 16. Stainless-steel equipment components and panels, unless specifically required in the equipment Specifications.
  - 17. Factory-painted equipment, unless specifically required in the equipment specifications.
  - 18. Insulated Pipe.



### 3.11 PROTECTION OF SURFACES NOT TO BE PAINTED

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

### 3.12 SURFACES TO BE COATED

- A. The exact coating to be applied in any location is not designated by the descriptive phrases in the coating system titles such as “corrosive environment,” “buried metal,” or “submerged metal.” Coat surfaces with the specific coating systems as described below:
  - 1. Coat mechanical equipment, such as pumps as described in the various mechanical equipment specifications. The color of the finish coat shall match the color of the connecting piping.
  - 2. Coat aboveground and exposed piping or piping in vaults and structures as described as shown in the Piping Schedule in the drawings. The color of the finish coat shall match the color of the connecting piping.
  - 3. Coat submerged piping in wet wells as specified in System No. 1.
  - 4. Coat valves as described in the various valve specifications, the same as the adjacent piping. Aboveground valves, or valves in vaults and structures, shall match the color of the connecting piping.
  - 5. Coat concrete surfaces where shown in the drawings. Apply System No. 31 on exposed exterior concrete, System No. 36 on exposed interior concrete surfaces unless otherwise shown on the Drawings.
  - 6. Coat aluminum surfaces in contact with concrete as specified in System No. 51.
  - 7. Coat buried flanges, nuts and bolts, valves, flexible pipe couplings, exposed rebar in thrust blocks, and valve boxes as specified in System No. 21 as specified in the particular Specifications for the above items. Coat buried bolt threads, tie bolt threads, and nuts as specified in System No. 24.
  - 8. Coat metal canopy building components as specified in System No. 15 unless specified elsewhere or shown on the drawings.

### 3.13 DRY-FILM THICKNESS TESTING

- A. Measure coating thickness specified for carbon steel surfaces with a magnetic-type dry-film thickness gauge in accordance with SSPC PA-2. Measure coating

thickness specified for stainless steel, aluminum, and copper surfaces with an eddy-current type thickness gauge in accordance with ASTM D7091. Provide certification that the gauge has been calibrated by a certified laboratory within the past 6 months. Provide dry-film thickness gauge as manufactured by Mikrotest or Elcometer.

- B. Test the finish coat of metal surfaces (except zinc primer and galvanizing) for holidays and discontinuities with an electrical holiday detector, low-voltage, wet-sponge type. Provide measuring equipment. Provide certification that the gauge has been calibrated by a certified laboratory within the past 6 months. Provide detector as manufactured by Tinker and Razor or K-D Bird Dog.
- C. Measure coating thickness specified for concrete or masonry surfaces in accordance with ASTM D4138. Test the finish coat of concrete and masonry surfaces in accordance with NACE SP0188 or ASTM D4787. Patch coatings at the points of thickness measurement or holiday detection.
- D. Check each coat for the correct dry-film thickness. Do not measure within 8 hours after application of the coating.
- E. For metal surfaces, make five separate spot measurements (average of three readings) spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. Make three readings for each spot measurement of either the substrate or the paint. Move the probe or detector a distance of 1 to 3 inches for each new gauge reading. Discard any unusually high or low reading that cannot be repeated consistently. Take the average (mean) of the three readings as the spot measurement. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80% nor more than 120% of the specified thickness. One of three readings which are averaged to produce each spot measurement may underrun by a greater amount as defined by SSPC PA-2.
- F. For concrete surfaces, make five separate spot measurements spaced evenly over each 100 square feet of area (or fraction thereof) to be measured. The average of five spot measurements for each such 100-square-foot area shall not be less than the specified thickness. No single spot measurement in any 100-square-foot area shall be less than 80% nor more than 120% of the specified thickness.
- G. Perform tests in the presence of the Owner's Representative.

### 3.14 REPAIR OF IMPROPERLY COATED SURFACES

- A. If the item has an improper finish color or insufficient film thickness, clean and topcoat the surface with the specified paint material to obtain the specified color and coverage. Sandblast or power-sand visible areas of chipped, peeled, or abraded paint, feathering the edges. Then prime and finish the coat in accordance with the Specifications. The work shall be free of runs, bridges, shiners, laps, or other imperfections.

### 3.15 CLEANING

- A. During the work, remove discarded materials, rubbish, cans, and rags at the end of each day's work.
- B. Thoroughly clean brushes and other application equipment at the end of each period of use and when changing to another paint or color.
- C. Upon completion of painting work, remove masking tape, tarps, and other protective materials, using care not to damage finished surfaces.

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**DIVISION 11**  
**EQUIPMENT**

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SECTION 11000  
GENERAL EQUIPMENT REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies general work requirements regarding the products and execution services that are specified in the Division 11 Sections incorporated in the Contract Documents. The requirements specified shall apply to all of the Division 11 Sections, unless noted otherwise.

1.02 RELATED WORK

- A. Other Specifications Sections in the Contract Documents contain work that is related to the general work requirements specified in this Section. This related work includes but is not limited to the following Sections:

1. Section 01330, Submittals and Acceptance.
2. Section 01650, Delivery, Storage, and Handling.
3. Section 01780, Warranties and Bonds.
4. Section 01830, Operations and Maintenance Manuals.
5. Section 09900, Painting and Coating.
6. Division 11, Equipment.
7. Division 13, Instrumentation.
8. Section 15125, Piping Appurtenances.
9. Division 16, Electrical.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. The submittal contents for equipment, instrumentation, controls, and appurtenances specified in the Division 11 Sections shall contain the general information listed below. Additional submittal requirements are contained in the Division 11 Sections.
1. A list and description of all deviations from the Contract Documents.
  2. A list of equipment and components on each drawing with each product identified by legend reference. Include product name, manufacturer, and model number.

3. Completely dimensioned plans, elevations, and cross-sections of system equipment and sub-assemblies.
4. Shop and erection drawings showing details, anchor bolt locations, and field connections.
5. Manufacturers' equipment installation instructions.
6. Descriptive literature, technical bulletins, and catalog data sheets for all equipment and purchased sub-components.
7. Installation, operation, maintenance and start-up procedures.
8. Total equipment weight (while operating).
9. Drive mechanism torque rating and bearing life rating.
10. Motor data and catalog information.
11. Submit complete electrical drawings, schematics, and interconnecting wiring diagrams and schedules for the equipment control system, instrumentation, and control panel(s) showing numbered wiring terminals in the control panel conforming to NEMA ICS-1-101. Identify field device terminals, wire number, wire sizes, control and power wire types, and interfaced elements.
12. Control panel construction and panel layout drawings.
13. Complete technical literature for all factory-applied paint systems. Clearly indicate the components to be coated and the corresponding paint system.
14. Manufacturers' descriptive literature, product specifications, and published details.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS (NOT USED)

#### 1.06 QUALITY ASSURANCE

- A. Requirements of Regulatory Agencies: The Contractor shall comply with construction requirements of State, County, and other local political subdivision specifications as may exceed the requirements of the codes, standards, and approving bodies referenced in this Section.
  1. NFPA Standards: The Contractor shall comply with requirements of the National Fire Protection Association (NFPA) Standards referenced in the various Specifications Sections and as directly appropriate to the work and workmanship.
  2. Electrical Requirements: The Contractor shall comply with requirements for both the Underwriters' Laboratories, Inc. (UL) Listings, Labels, and Approvals and the National Electrical Manufacturers' Associations (NEMA) Stamps or Seals as applicable to electrical equipment or apparatus forming parts of the Mechanical Equipment.



- B. Certificates and Permits: Upon completion of work and before final payment, the Contractor shall furnish to the Engineer formal certification of final inspections from authorities having jurisdiction over the work in this project and secure required permits, if any, from such authorities. Additionally, the Contractor shall prepare any detailed diagrams and drawings that are required by those authorities having jurisdiction over the work of this project at no additional cost to the Owner.
- C. Source Quality Control: Products used throughout these Specifications and as indicated on the Drawings shall be from companies having established reputations in the manufacture of the particular materials, equipment, or apparatus specified. Such products may be of their own make or products of others for which they assume full responsibility when used in finished products that are not manufactured completely by them and with replacement parts available.
- D. Products: The equipment specified in the Division 11 Sections was based on the latest models that were available from the specified equipment manufacturers at the time the Contract Documents were developed. If any equipment models specified in the Division 11 Sections have been discontinued or will be discontinued within 1 year after the bid date, the Contractor shall furnish and install the latest and most recent equipment model at no additional cost to the Owner.
- E. For each category of materials and equipment (Products) specified in the Division 11 Sections, the Contractor shall provide Products of the same manufacturer and type.
- F. Equipment Selection: The Contractor may furnish equipment of higher electrical characteristics, physical dimensions, capacities, and ratings provided such proposed equipment is approved by the Engineer in writing. Upon receiving the Engineer's approval to provide such equipment, the Contractor shall furnish the connecting mechanical and electrical services including but not limited to circuit breakers, conduit, increased control panel enclosure size, motors, bases, and any other electrical equipment needed to accommodate the higher electrical characteristics at no additional cost to the Owner.
- G. If minimum energy ratings or efficiencies of equipment are specified in Division 11, Equipment, the Contractor shall furnish and install equipment that meets or exceeds the specified design and commissioning requirements (no exceptions) as determined by the Engineer.
- H. All the equipment specified in the Contract Documents shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable and qualified in the manufacture of the equipment to be

furnished. The equipment shall be designed, constructed, and installed in accordance with the best practice and methods and shall operate satisfactorily when installed.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS

- A. The manufacturer of each piece of equipment described in the Division 11 Sections shall meet the following requirements, unless noted otherwise:
  - 1. Have a record of operation, manufacturing and servicing the items specified in the Division 11 Sections for a minimum of 10 years before the Bid Date.
  - 2. Have a minimum of five installations of equipment similar to that specified in this Section at municipal wastewater treatment facilities in Florida before the bid date.
  - 3. Have been in business for at least the 10 consecutive years before the Bid Date.
- B. If the equipment manufacturer that the Contractor proposes to furnish and install the equipment described in the Division 11 Sections does not meet these qualifications and is not specified in the Contract Documents, the Engineer reserves the right to reject the equipment from this manufacturer for use on this project. Any costs incurred by the Contractor as a result of providing equipment from a manufacturer that does not meet the qualifications described in this Section shall not be incurred by the Owner.
- C. The Contractor shall furnish documentation that the manufacturer meets these qualifications as part of the submittals specified in Section 01330, Submittals and Acceptance.

#### 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 MAINTENANCE

### A. Spare Parts

1. The Contractor shall furnish the spare parts specified in the Division 11 Sections. The Contractor shall also submit a list of recommended spare parts, special tools, and lubricants for each equipment item. The list shall include contact information for local sources for supply of all parts and professional service.

## 1.12 SYSTEM DESCRIPTION (NOT USED)

## 1.13 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

## 1.14 PATENTS AND LICENSES (NOT USED)

## PART 2 PRODUCTS

### 2.01 MOTORS

- A. All motors identified in Division 11 Sections shall be furnished and installed under Division 11, Equipment, and in accordance with Division 16, Electrical.

### 2.02 CONTROLS

#### A. General

1. All control panels specified in the Division 11 Sections shall be furnished and installed under Division 11, Equipment, and in accordance with Divisions 13, Special Construction, and 16, Electrical.
2. The Contractor shall furnish and install controls designed to operate on 120-volt, single-phase, 60-Hertz electric service unless otherwise specified. The Contractor shall furnish and install 120-volt step-down voltage transformers as specified in Division 16, Electrical, in each control panel as required.
3. The Contractor shall furnish and install elapsed time meters in each control panel for each piece of motor-driven equipment being controlled

by that control panel. All elapsed-time meters shall be furnished and installed in accordance with Division 16, Electrical.

4. All control panels shall be furnished with a main circuit breaker to enable/disable electric service to the panelboard.
5. All control panels that will annunciate a local and/or remote alarm shall be furnished with an ALARM ACKNOWLEDGE reset pushbutton switch (momentary contact) wired to each alarm contact.
6. All indicating lamps in each control panel shall be furnished in accordance with the color-coded scheme, unless otherwise specified:
  - a. ON indicating lamps: Green.
  - b. OFF indicating lamps: Red.
  - c. Alarm indicating lamps: Amber.
  - d. POWER ON indicating lamp: White.
7. Unless otherwise specified, provide a heater inside of each control panel enclosure to prevent condensation. Heater size shall be in accordance with the equipment manufacturer's recommendations.
8. The face of each control panel shall be installed so it is facing north whenever possible, or provided with a sunshield when not possible.

#### 2.03 FLOAT SWITCHES (NOT USED)

#### 2.04 EQUIPMENT ANCHORING SYSTEMS

- A. All anchoring systems including, but not limited to, expansion anchors, adhesive anchors, anchor bolts, cinch anchors, and screws that are required to install the equipment and appurtenances specified in the Division 11 Sections shall be AISI Type 316 stainless steel unless noted otherwise. The Contractor shall furnish and install all equipment anchoring systems in accordance with the equipment manufacturers' recommendations and applicable Specifications Sections.

#### 2.05 EQUIPMENT NAMEPLATES

- A. The Contractor shall provide engraved laminated phenolic nameplates with white legend and black field that provides the following information for each piece of equipment described in the Division 11 Sections.
  1. Equipment Description (i.e., Belt Filter Press No. 1, Lift Station Pump No. 1, etc.).

## 2. Equipment Identification Label No.

- B. Letter height on each nameplate shall not be less than 3/4-inch. Nameplates shall be factory drilled for fasteners. Secure nameplates to equipment or nearby wall using AISI Type 304 stainless steel fasteners. The locations of each nameplate shall be coordinated with the Owner and approved by the Owner before their installation.
- C. The Contractor shall obtain the Engineer's approval for the nameplate information for each equipment item described in the Division 11 Sections before ordering these nameplates from the manufacturer.

### 2.06 PRESSURE GAUGE ASSEMBLIES - PUMPING UNITS

- A. General: The Contractor shall provide a pressure gauge assembly as specified in Section 13300, Instrumentation and Control for Process Systems and Section 15125, Piping Appurtenances, on the suction and discharge piping of the pumping units specified in the Division 11 Sections. The Contractor shall mount each pressure gauge as close to the pump suction and discharge connections as possible as shown on the Drawings, but so as not to impede the operation and maintenance of the pressure gauge assembly, pumping unit, and valves installed on the pumping unit suction and discharge piping. Coordinate the location of all pressure gauge assemblies with the Engineer and Owner before installation.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. General: The Contractor shall install the equipment in accordance with the manufacturer's instructions and recommendations and approved submittals at the locations shown on the Drawings. If the equipment locations shown on the Drawings are in conflict with the manufacturer's recommendations or will interfere with the installation or operation of any other item indicated in the Contract Documents, the Contractor shall relocate this equipment and provide the necessary appurtenances to install the equipment in accordance with the manufacturer's recommendations at no additional cost to the Owner. The Contractor shall not install any equipment at locations not in accordance with the Contract Documents or approved submittals.
- B. The Contractor shall install equipment, slabs, walls level and plumb, parallel and perpendicular to other building and components in exposed interior spaces, unless otherwise shown on the Drawings.

- C. The Contractor shall apply an anti-seize compound to threaded fasteners of equipment components that require removal, replacement, or adjustment as part of any maintenance or inspection procedure.
- D. The Contractor shall furnish and install the required oil and grease for initial operation in accordance with the manufacturer's recommendations.
- E. Provide means of oil lubrication for bearings and other metallic parts in sliding contact. Use alemite industrial-type fittings except where otherwise specified. The Contractor shall also perform the following work:
  - 1. Locate lubrication points on equipment readily accessible without the necessity of removing covers, plates, housings or guards, or without creating safety hazards at installed equipment elevations.
  - 2. The Contractor shall exhaust pressure-lubricated units to the atmosphere to prevent excessive greasing.
  - 3. The Contractor shall extend grease fittings to locations that are readily accessible to the Owner. The Contractor shall coordinate the location of these grease fittings with the Owner before their installation.
- F. The Contractor shall furnish and apply touch-up paint to any equipment's factory painting finish that is chipped or damaged during installation. All factory-finish touch-up paint shall be mutually compatible with the factory finish on the equipment and shall be furnished by the manufacturer of the equipment to be touched up in the field.
- G. If equipment mounting heights are not shown on the Drawings, the Contractor shall install that piece of equipment to provide the maximum amount of headroom (defined as the distance from the bottom of the structure to the top of finished floor or grade), as possible. In such an instance, the Contractor shall obtain the Engineer's approval for this mounting location before installing that piece of equipment in the field.
- H. The Contractor shall furnish and install all mechanical equipment to facilitate service, maintenance, and repair or replacement of the equipment components. The Contractor shall connect equipment for ease of disconnecting, with minimum interference to other installations.

### 3.02 FIELD TESTING

- A. General: The Contractor shall provide services of a factory-authorized service representative to perform, approve, and certify the field testing specified in this Section. Field testing shall generally consist of performing the pre-startup and startup tests as specified in the Division 11 Sections and the final mechanical

performance test specified in this Section. The Contract Documents may require the Contractor to perform factory testing on equipment items before the Engineer approves their use for this project. The Contractor shall refer to the Division 11 Sections regarding equipment shop testing requirements.

- B. The Contractor shall adhere to the following requirements regarding the field testing to be provided for this project:
1. The service representative shall be employed by the manufacturer of the equipment specified at the time field testing is being performed. The service representative shall be authorized by the factory to perform the field testing specified in Division 11, Equipment. Upon request by the Engineer, the Contractor shall submit a letter from a company officer of the equipment manufacturer stating that the service representative performing the field testing is authorized by the manufacturer.
  2. Before scheduling each field test with the equipment manufacturer, the Contractor shall coordinate with the Owner and Engineer to obtain a list of dates that both parties would be available to attend the testing. The Contractor shall notify the Owner and Engineer of the field testing dates no less than 14 calendar days before the date of the field test.
  3. If directed by the Engineer, the Contractor shall perform a second pre-startup and/or startup test, in accordance with the procedures specified in the Division 11 Sections, at no additional cost to the Owner if the original pre-startup and/or startup test did not pass because of any work that was deemed by the Engineer to be non-compliant with the Contract Documents and/or manufacturer's recommendations.
  4. The Contractor shall only perform startup testing after the Contractor has reached Substantial Completion for the project as defined in the Agreement and General Conditions.
  5. The Contractor shall furnish, install, and remove any temporary piping, valves, appurtenances, and equipment necessary to perform the pre-startup and startup testing to the Engineer's satisfaction.
  6. All field testing shall be performed Monday through Friday at the project site, unless otherwise approved by the Owner.
  7. The duration that the manufacturer's representative is required to be onsite to perform the pre-startup and startup training is specified in the Division 11 Sections.
- C. Operating Costs
1. Costs for Pre-startup and Startup Testing: The Contractor shall include in the Contract Price the following operating costs for satisfactorily

completing the Initial Mechanical Performance Tests on equipment being tested:

- a. Lubricating grease.
- b. Lubricating oils.
- c. Such other materials or utilities not specifically identified in this Section, but required to conduct the pre-startup and startup testing.
- d. Portable diesel power generation sets and diesel fuel as needed for lighting, portable tools, and furnishing electrical to any temporary pumping units used to transfer reclaimed water to each treatment or storage structure for startup testing.

2. Costs for Final Mechanical Performance Tests: The Owner will pay for the operating costs for the Final Mechanical Performance Test, except for the Contractor's personnel needed to perform and supervise this testing as specified in this Section.

D. The intent of the field testing for each equipment item specified in the Division 11 Sections is provided in this Section. If the individual equipment field testing procedures specified in the Division 11 Sections are not sufficient to obtain a Manufacturer's Certification or to demonstrate compliance with the Contract Documents, the Contractor shall perform these additional field test procedures at no additional cost to the Owner.

1. Pre-startup Testing: Upon the Contractor's completion of the installation and adjustment of the equipment; the Contractor, with his own forces and with the manufacturer's representative(s), shall demonstrate to the Engineer's satisfaction that the equipment has been furnished and installed in accordance with the Contract Documents and the manufacturer's recommendations.
  - a. The Contractor shall repair any equipment items that do not pass the pre-startup test, as identified by the Engineer and/or manufacturer's representative, to the satisfaction of the Engineer before performing the startup testing for that equipment.
2. Startup Testing: Upon successful completion of the pre-startup testing, the Contractor shall demonstrate that the mechanical performance and controls of each equipment item, when operated in accordance with the design intent indicated by the Contract Documents, are satisfactory to the Owner and Engineer.
  - a. Startup testing shall be performed with each equipment item and associated treatment structure simulated under similar operating



conditions as the final mechanical performance testing specified in this Section. For equipment that will operate while being submerged as shown on the Drawings, the Contractor shall fill the respective treatment structure to its maximum water surface with reclaimed water for wastewater systems or potable water for water systems and perform startup testing while that equipment is submerged. The Contractor shall not use wastewater to fill any treatment structures for startup testing.

- b. After the startup testing procedures specified in the Division 11 Sections have been completed to the satisfaction of the Engineer, the Contractor shall operate that equipment for one successful continuous 72-hour period without assistance from the Owner as a condition of startup testing. If the equipment needs to be taken out of service for repair during this 72-hour period because it not operating in accordance with the intent of the Contract Documents, this operating period shall cease. A new operating period will not begin until the equipment has been operating in accordance with the Contract Documents and manufacturer's recommendations for at least 72 consecutive hours. The Contractor shall furnish any additional supervision or provisions necessary to verify that each equipment item was successfully operated during this 72-hour operating period.
- c. Upon completion of the startup test, the Contractor shall dewater each treatment and storage structure in accordance with local and State regulations and in a manner that is satisfactory to the Owner and Engineer.

3. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing of the equipment specified in the Division 11 Sections once the following conditions have been satisfied:

- a. The Contractor has successfully completed the pre-startup and startup testing requirements specified in the Division 11 Sections.
- b. The Contractor has performed the training services specified in this Section.
- c. The Contractor has procured all of the required permits for each building and treatment structure within the project site.
- d. The Engineer has received and approved all of the manufacturer's certifications of compliance, warranties, and operation and maintenance manuals for all required items as specified in the Contract Documents.

- e. The intent of the final mechanical performance test is for the entire facility to be operated by the Owner for a continuous 30-day period while the WRF is receiving and treating raw sewage and the new Dewatering Facility and Onsite Lift Station are operating at their specified operating times determined by the Owner and Engineer. During this 30-day testing period the Contractor shall furnish personnel who shall be on site as needed and available at all times during the operation of the Dewatering Equipment and Onsite Lift Station Equipment during the final mechanical performance test. Personnel shall be competent in the troubleshooting and repair of the equipment and related electrical and mechanical systems specified in the Contract Documents. The Contractor's electricians and mechanical technicians shall be on-site as needed (minimum 8 hours/week) and available 24 hours per day to assist with this testing. If the final mechanical performance testing needs to be stopped and suspended due to equipment not operating in accordance with the design intent of the Contract Documents as determined by the Engineer, the following conditions shall apply:
- (1) The Contractor shall repair and troubleshoot these items immediately at no additional cost to the Owner.
  - (2) The 30-day period for the final mechanical performance testing will start over (i.e., be reset to zero hours).
- f. Upon restarting the final mechanical performance testing, the Contractor shall furnish the appropriate personnel defined above on-site as needed and available (minimum 8 hours/week) for 24 hours per day during the 30-day period at no additional cost to the Owner even though the total duration of the final mechanical performance testing (including restarts), may exceed 30 days.
- g. The final mechanical performance test shall end when the Engineer determines that all of the equipment and related systems are operating in accordance with the design intent of the Contract Documents and all deficiencies that hinder the normal day-to-day operation of the facility have been corrected to the satisfaction of the Engineer. The Engineer shall notify the Contractor in writing when the final mechanical performance testing has been successfully completed.

### 3.03 TRAINING SERVICES

- A. Upon completion of the pre-startup and startup testing and before the final mechanical performance testing, the manufacturer of the equipment specified in the Divisions 11, 13, and 15 Sections shall provide an authorized representative to train the Owner's personnel in the operation and maintenance of the equipment. The representative shall provide additional onsite startup and troubleshooting services during this training upon request by the Engineer or Owner while performing these training services. The duration of the training services for each equipment item are specified in the Division 11 Sections.

### 3.04 MANUFACTURER'S CERTIFICATIONS OF COMPLIANCE

- A. Upon successful completion of the pre-startup testing, startup testing, and training services specified in this Section, the Contractor shall obtain the equipment manufacturer's certification that the equipment specified in the respective Division 11 Sections has been installed, adjusted, and tested in accordance with the manufacturer's recommendations. The Contractor shall furnish the Engineer with Manufacturer's Certificates of Compliance and Equipment Manufacturer's Certificate of Installation Testing and Instruction for each specified equipment item before performing the final mechanical performance testing specified in this Section.

### 3.05 MANUFACTURER'S CERTIFICATIONS OF COMPLIANCE

- A. Upon successful completion of the pre-startup testing, startup testing, and training services specified in this Section, the Contractor shall obtain the equipment manufacturer's certification that the equipment specified in the respective Division 11 Sections has been installed, adjusted, and tested in accordance with the manufacturer's recommendations. The Contractor shall furnish the Engineer with Manufacturer's Certificates of Compliance and Equipment Manufacturer's Certificate of Installation Testing and Instruction for each specified equipment item before performing the final mechanical performance testing specified in this Section.

Table 11000-1 Equipment Testing and Training Requirements					
(Hours below stipulate the duration the manufacturer's representative is required be on site to perform the required pre-startup and starting testing, final mechanical performance and polymer optimization testing, and training services specified in the listed Sections. See Note 1.)					
Section	Equipment Name	Pre-Startup Testing <sup>(3)</sup>	Startup Testing <sup>(3)</sup>	Final Mechanical Performance & Polymer Optimization Testing <sup>(4)</sup>	Training <sup>(4)</sup>
11350	Skid-Mounted Belt Filter Press Dewatering System including all pumps, polymer feed, controls, and other appurtenances.	32 hours	32 hours	24 hours	16 hours
11356	Progressing Cavity Pumps – Dewatered Sludge Conveyance System	24 hours	24 hours	24 hours	16 hours

Notes:

1. If difficulties occur in operating the equipment due to the manufacturer's fabrication or the Contractor's installation, additional service shall be provided at no change in Contract Price or Time.
2. All times listed above exclude travel time to and from the project site.
3. The Pre-Startup and Startup testing may be combined within a single trip if the manufacturer's representative determines that the equipment is properly installed by the Contractor in accordance with the Contract Documents and the manufacturer's recommendations. However, these services shall not be combined with the Final Mechanical Performance and Polymer Optimization Testing and Training; a separate trip(s) shall be conducted to accomplish these services.
4. The Final Mechanical Performance and Polymer Optimization Testing and Training may be combined within a single trip, but shall not be combined with the Pre-Startup and Startup testing. Training shall be conducted in accordance with Section 01820, Training on two separate 8 hour days.

**MANUFACTURER'S CERTIFICATE OF COMPLIANCE**

OWNER \_\_\_\_\_ EQPT SERIAL NO: \_\_\_\_\_

EQPT TAG NO: \_\_\_\_\_ EQPT/SYSTEM: \_\_\_\_\_

PROJECT NO: \_\_\_\_\_ SPEC. SECTION: \_\_\_\_\_

I hereby certify that the above-referenced equipment/system has been:

(Check Applicable)

- \_\_\_\_\_ Installed in accordance with Manufacturer's recommendations.
- \_\_\_\_\_ Inspected, checked, and adjusted.
- \_\_\_\_\_ Serviced with proper initial lubricants.
- \_\_\_\_\_ Electrical and mechanical connection meet quality and safety standards.
- \_\_\_\_\_ All applicable safety equipment has been properly installed.
- \_\_\_\_\_ System has been performance tested, and meets or exceeds specified performance requirements (when complete system of one manufacturer).

Comments: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

I, the undersigned Manufacturer's Representative, hereby certify that I am (i) a duly authorized representative of the manufacturer, (ii) empowered by the manufacturer to inspect, approve, and operate his equipment, and (iii) authorize the make recommendations required to assure that the equipment furnished by the manufacturer is complete and operational, except as may be otherwise indicated herein. I further certify that all information contained herein is true and accurate.

Date: \_\_\_\_\_, 20\_\_\_\_

Manufacturer: \_\_\_\_\_

By Manufacturer's Authorized Representative: \_\_\_\_\_  
(Authorized Signature)

**EQUIPMENT MANUFACTURER'S CERTIFICATE OF  
INSTALLATION TESTING AND INSTRUCTION**

OWNER

PROJECT

CONTRACT NO.

Jones Edmunds No.

EQUIPMENT SPECIFICATION SECTION \_\_\_\_\_

EQUIPMENT DESCRIPTION \_\_\_\_\_

I \_\_\_\_\_, Authorized representative of  
(Print Name)

\_\_\_\_\_  
(Print Manufacturer's Name)

hereby CERTIFY that \_\_\_\_\_  
(Print equipment name and model with serial No.)

Installed for the subject project has have been installed in a satisfactory manner, has have been satisfactorily tested, is/are ready for operation, and that Owner assigned operating personnel have been suitably instructed in the operation, lubrication, and care of the units on Date:

\_\_\_\_\_ Time: \_\_\_\_\_.

CERTIFIED BY: \_\_\_\_\_ DATE: \_\_\_\_\_  
(Signature of Manufacturer's Representative)

OWNER'S ACKNOWLEDGEMENT OF MANUFACTURER'S INSTRUCTION

I/We the undersigned, authorized representatives of the \_\_\_\_\_ and/or Plant Operating Personnel have received classroom and hands on instruction on the operation, lubrication, and maintenance of the subject equipment and am are prepared to assume normal operational responsibility for the equipment:

\_\_\_\_\_ DATE: \_\_\_\_\_

\_\_\_\_\_ DATE: \_\_\_\_\_

\_\_\_\_\_ DATE: \_\_\_\_\_

END OF SECTION

SECTION 11350  
SKID-MOUNTED BELT FILTER PRESS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish a complete skid-mounted belt filter press dewatering system as specified herein and elsewhere in the Project Specifications and as indicated on the Drawings to meet the specified performance requirements. Equipment furnished and installed under this Section shall be fabricated, assembled, erected, and placed in proper operating condition in full conformity with the Drawings, Specifications, engineering data, instructions, and recommendations of the equipment manufacturer, unless noted by the Engineer.
- B. The following shall be provided for the skid-mounted belt filter press (BFP):
1. Two-belt, two-meter, BFP unit, with three zones of dewatering: gravity zone, drum zone, and pressure zone. Pre-assembled unit shall be complete with frame, drainage pans, discharge assembly, dewatering belts, belt drives, and all appurtenances specified.
  2. Sludge feed pump.
  3. Washwater booster pump.
  4. Sludge condition system:
    - a. Complete polymer feed skid, injection ring, and orifice mixer.
  5. BFP control panel as specified herein and Section 13300.
  6. Belt drive variable-speed drives.
  7. Anchorage devices.
  8. Special tools, spare parts and accessories.
  9. All spare parts defined in Section 13300 that are provided for the PLC Control Panel

- C. The Contractor shall coordinate all the details required for a complete dewatering system installation and coordinate final system heights and associated walkway and platform heights and dewatered cake discharge hopper. The Contractor shall provide all work to properly install, adjust, and place in operation a complete working system. The Contractor shall be fully responsible for the equipment upon delivery to site, including off-loading, storage, and installation. The Contractor shall store and install the equipment in accordance with the manufacturer's recommendation. As a minimum, installation includes equipment mounting, providing and installing all interconnected wiring and piping required to feed the dewatering system and convey the filtrate and dewatered cake discharged from the dewatering system and between various system components.
- D. If the process equipment requires additional space, utilities, and/or equipment that are not specified herein or shown on the Drawings, the Contractor shall be responsible for all costs associated with modifications, additions, and construction changes required to place the proposed equipment into service.
- E. The Contractor is solely responsible for coordination with the BFP manufacturer and supplier to furnish and install any materials, equipment, or incidentals required for complete operation of the system. The Engineer's review and approval of shop drawings does not release the Contractor from meeting this responsibility.

## 1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01755, Equipment Testing and Startup.
- D. Section 01780, Warranties and Bonds.
- E. Section 01830, Operations and Maintenance Manuals.
- F. Section 11000, General Equipment Requirements.
- G. Section 11356, Progressing Cavity Pumps-Dewatered Sludge Conveyance System.
- H. Section 13121, Pre-Engineered Metal Building.
- I. Section 13300, Instrumentation and Control for Process Systems.
- J. Division 15, Mechanical.
- K. Division 16, Electrical.

## 1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.



- A. The Contractor shall submit to the Engineer copies of all materials required to establish compliance with this Section. Submittals shall include at least the following:
1. Certified shop and erection drawings showing all important details of construction, dimensions, and anchor bolt locations. Coordination of final BFP skid support height and final height and coordination of metal platforms, walkway, and stairs.
  2. Descriptive literature, bulletins, and/or catalogs of the equipment.
  3. Complete master wiring diagrams, elementary or control schematics including coordination with other electrical control devices, such as the pump control system. Suitable outline drawings shall be furnished for approval before proceeding with manufacture. Provide suitable outline drawings showing such details as are necessary to facilitate interconnections with other equipment. Standard pre-printed sheets or drawings simply marked to indicate applicability to this Contract will not be acceptable. Refer to the Electrical and Instrumentation Drawings for the control wiring diagrams for the pump motors.
  4. A complete bill of materials for all equipment.
  5. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in this Section, with the manufacturer's current price for each recommended spare part item. Include gaskets, packing, etc., on the list. List bearings by the bearing manufacturer's name and corresponding numbers.
  6. Complete motor and drive data.
  7. Spare parts and special tools list.
- B. Test reports to be submitted:
1. Description of test procedures and equipment.
  2. Copies of all test results, as specified in Parts 2 and 3 of this Section.
- C. Complete operating and maintenance instructions in accordance with Section 01830, Operations and Maintenance Manuals, shall be furnished for all equipment specified in this Section.
- D. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with Section 11000, General Equipment Requirements.
- E. If it is not possible to conform to certain requirements of this Specification, include in submittals a complete description of all requirements not complied with.

## 1.04 WORK SEQUENCE

- A. The BFP skid shall be in place as shown on the Drawings before the erection of the metal building specified in Specification Section 13121, Pre-Engineered Metal Building.

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Iron and Steel Institute (AISI)
- B. American National Standards Institute (ANSI)
- C. APHA/AWWA/WEF, Standard Methods for Examination of Water and Wastewater
- D. American Society of Mechanical Engineers (ASME)
- E. American Society for Testing and Materials (ASTM)
  - 1. ASTM A36/A36M—Specification for Carbon Structural Steel.
  - 2. ASTM A123—Standard Specifications for Zinc (Hot-Dip Galvanizing) Coatings on Iron and Steel Products.
  - 3. ASTM A384/A384M—Practice for Safeguarding Against Warpage and Distortion During Hot-Dip Galvanizing of Steel Assemblies.
  - 4. ASTM A385—Practice for Providing High-Quality Zinc Coatings (Hot-Dip).
  - 5. ASTM A500—Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
- F. AWS D1.1/D 1.1M, Structural Welding Code - Steel
- G. National Electrical Manufacturers Association (NEMA)
- H. Society for Protective Coatings (SSPC)
  - 1. SSPC SP10, Near-White Blast Cleaning.

## 1.06 QUALITY ASSURANCE

- A. These Specifications are intended to provide a general description of what is required, but do not cover all details, which may vary in accordance with the exact requirements of the equipment as offered. The Specifications are, however, intended to cover the furnishing, delivery, installation, field testing, and field calibration of all materials and apparatus as required. Any additional equipment necessary for the proper operation of the proposed installation not specifically mentioned in these Specifications or shown on the Drawings shall be furnished and installed at no change in Contract price or time.
- B. To ensure unity of responsibility, the BFP, supporting frames, polymer blending units, washwater booster pump, sludge feed pump, and control systems shall be furnished and coordinated by a single manufacturer. The manufacturer shall also coordinate with the positive displacement pumps, pressure gauge and pressure switch, and air compressor (dewatered cake pumps) supplier to automatically control the discharge of dewatered cake to the trailers for disposal. The Contractor shall assume full responsibility for the satisfactory installation and operation of the entire dewatering system package.
- C. The equipment covered by these Specifications shall be standard units of proven ability as manufactured by a competent organization having proven experience in the production of such equipment.
- D. All equipment furnished under this Specification shall be new and unused and shall be the standard product of manufacturers. The manufacturer shall have a minimum of 10 years of experience of producing substantially similar equipment and shall be able to show evidence of at least three installations in satisfactory operation in Florida at the time of the bid.
- E. Component Supply and Compatibility
  - 1. Obtain all equipment included in this Section regardless of component manufacturer from a single belt filter press manufacturer.
  - 2. Belt filter press manufacturer shall review and approve or to prepare all Shop Drawings and submittals specified in this Section for all components furnished under this Section.
  - 3. All components shall be fully suitable for specified service conditions and shall be integrated into overall assembly by the BFP manufacturer.
- F. The Ashbrook/Alfa Laval, Klampress 2.0-Meter is the Basis of Design. If the Contractor proposes an alternate dewatering system manufacturer, a 5-day pilot test shall be conducted at the Leesburg Turnpike WRF to demonstrate that the alternate equipment meets the performance criteria stipulated in this Specification. The pilot test shall be conducted within 30 days of the bid opening and be

conducted at no cost to the Owner or extension of the construction duration. In addition, the alternate dewatering system manufacturer shall certify that the proposed equipment can meet the performance criteria stipulated in this Specification and fit within the available space in the Dewatering Facility as shown on the Drawings. The Contractor shall provide revised drawings that show any changes to location, alignment, pipe configuration, sizing, and orientation for the Engineer's review and approval.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.
- B. All equipment supplied under this Section shall be warranted for 2 years by the Contractor and the manufacturer. The warranty period shall begin as outlined in Division 1, General Requirements.
- C. The equipment shall be warranted to be free from defects in workmanship, design, and materials. If any part of the equipment should fail during the warranty period, it shall be replaced and the unit(s) restored to service at no expense to the Owner.
- D. The manufacturer's warranty period shall run concurrently with the Contractor's warranty period. No exception to this provision shall be allowed.
- E. See Division 1, General Requirements, for additional warranty requirements.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling and the manufacturer's recommendations for storing and protecting the items specified in this Section.
- B. All entrapped water from testing shall be drained before shipment, and proper care shall be taken to protect parts from water entering them during shipping, storing, and handling.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS

- A. Testing shall be performed as specified in Part 3 of this Section as well as in Table 11000-1 in Section 11000, General Equipment Requirements.

#### 1.11 MAINTENANCE (NOT USED)

## 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

## 1.13 PATENTS AND LICENSES (NOT USED)

## 1.14 SPARE PARTS AND SPECIAL TOOLS

### A. Spare Parts

1. Furnish the following spare parts:
  - a. One complete sets of cloth belts. Provide belts following successful start-up to allow evaluation of performance of installed belts.
  - b. One complete sets of doctor blades.
  - c. One complete sets of bearings and bearing seal rings.
  - d. One complete set of wash water spray nozzles.
  - e. One complete set of edge seals for dewatering zones.
  - f. One complete set of drive unit components for one BFP, including motors, speed reducers, drive belts, chains, sprockets, and related items for each type and size of drive unit provided.
  - g. One quart of epoxy glaze finish paint in selected color, for field touchup after completion of the Work.
2. Furnish supply of all greases and lubricants required for start-up, field testing, and first year of operation. Products shall be as recommended by the manufacturer
3. Furnish maintenance repair kit for belts and repairable wear items as recommended by equipment manufacturer.
4. Furnish and deliver spare parts, consumables, and special tools carefully packed in sturdy containers with clear indelible identification markings.
5. Properly store spare parts, consumables, and special tools until transferred to the Owner. The Contractor shall provide list of additional manufacturer-recommended spare parts for an operating period of 1 year. The list shall describe each part, quantity recommended, and unit price of the part.
6. The Contractor shall furnish the following spare parts for the progressing cavity sludge feed pump in clearly identified containers, labeled for easy

identification without opening the packaging and suitably protected for long-term storage in a humid environment.

- a. One stator assembly with TSE sensor sleeves.
- b. One of each set of mechanical seals.
- c. One rotor.
- d. Two sets of packing.

7. The Contractor shall furnish the following spare parts and special tool for the polymer feed system in clearly identified containers, labeled for easy identification without opening the packaging and suitably protected for long-term storage in a humid environment.

- a. Metering pump spare parts kit.
- b. One set of mechanical seals.
- c. One check valve.
- d. Two pressure gauges.
- e. Flow Meter Rotameter.

8. The Contractor shall provide a list of additional manufacturer-recommended spare parts for an operating period of 1 year of equipment specified in this Section. The list shall describe each part, quantity recommended, and unit price of each part.

B. Special Tools: The Contractor shall furnish two sets of special tools required for normal operation including but not limited to:

- 1. Two specialized grease fittings that can be attached to a standard grease gun.
- 2. Keys.
- 3. Wrenches.

## 1.15 EQUIPMENT LIST

A. Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Tag Number</u>
Belt Filter Press No. 1	BFP-01 (115-BFP-01)
Belt Filter Press Control Panel No. 1	CP-01 (115-CP-01)
Washwater Booster Pump No. 1	WBP-01 (115-WBP-01)
Sludge Feed Pump No. 1	SFP-01 (115-SFP-01)
Polymer Feed Pump No. 1	PF-01 (115-PF-01)

## 1.16 DESIGN REQUIREMENTS

- A. Feed Sludge Conditions: The BFP dewatering system shall be able to dewater raw waste-activated sludge produced by a municipal biological wastewater treatment system (sequencing batch reactors [SBRs]). The waste shall be digested aerobically to meet Class B standards and gravity thickened in two aerobic digesters (one primary and one secondary). The expected characteristics are as follows:

1.	Sludge Type:	Waste-Activated Sludge.
2.	Feed Concentration (% T.S.):	1.5 average (0.5 to 2% range).
3.	Total Volatile Solids (% T.V.S.):	78 average (75 to 80% range).
4.	pH:	6.0 to 9.0 range.
5.	Temperature (°F)	68 to 90 range.

## 1.17 GUARANTEED PERFORMANCE REQUIREMENTS

- A. The BFP dewatering system shall be able to meet or exceed the following Guaranteed Performance Requirements:

1.	Design Sludge Feed Rate (gpm):	160.
2.	Maximum Solids Rate (DS/hr):	1,200 lb/hour.
3.	Minimum Percent Cake Solids (% T.S.):	15 to 17.
4.	Minimum Percent Capture (% T.S.)	95 (when feed solids are >0.75%).
5.	Maximum Polymer Dosage (active lb/dry ton of cake solids):	27 to 32 +/- 10%.

- B. The supplier shall furnish a Performance Bond in the amount equal to the full Material Price for satisfactory performance of the dewatering equipment, as specified in this Specification Section. Such bond shall be on a form furnished by a surety satisfactory to the Buyer, and licensed to do business in the State of Florida. The premium for such bond shall be paid by the supplier. The Bond shall be provided upon execution of the purchase agreement.

## PART 2 PRODUCTS

### 2.01 APPROVED MANUFACTURERS

- A. The equipment specified in this Section shall be Ashbrook/Alfa Laval, Klampress, 2.0-Meter, or Engineer-approved equivalent. All of the equipment described herein shall be supplied by one supplier to ensure unit responsibility.

- B. The structural, mechanical, electrical and instrumentation designs for the BFP dewatering system are specific to the equipment manufactured by Ashbrook/Alfa Laval, as specified herein. If an alternate sludge dewatering system is submitted for consideration, the equipment must fit within the existing building and pilot testing will need to be performed and approved on all alternate equipment prior to acceptance, in accordance with Article 1.06. The dead and live loads of the alternate dewatering equipment proposed must be equal or less than the specified unit or the Contractor will be responsible for additional improvements to building structural components for the additional loads.

## 2.02 BELT FILTER PRESS

### A. Materials of Construction:

1. All materials used in the construction of the sludge dewatering equipment shall be of the best quality and entirely suitable in every respect for the service required. All structural steel shall conform to the ASTM Standard Specification for Structural Steel, Designation A36/A36M. All iron castings shall conform to the ASTM Standard Specifications for Gray Iron Castings, Designation A48, and shall be of a class suitable for the purpose intended. All electrical components shall be U.L. listed where such listing exists and all electrical control panels shall be assembled in U.L.-approved facilities. All structural carbon steel plates and shapes shall have a minimum thickness of 1/4 inch and shall be hot-dip galvanized in accordance with ASTM A123.
2. Unless specified otherwise herein, all metals in contact with polyelectrolyte or sludge, and all other components specified to be stainless steel, shall be AISI Type 316L stainless steel.
3. The following materials and coatings shall be provided for the BFP and related components unless specified otherwise herein.

Bearing Housings	Nylon Coated, Cast Iron
Belt Support Grids	Stainless Steel, fitted with UHMW Polyethylene Wiper Bars
Belt Wash Housing	Stainless Steel, 14 Gauge
Belt Wash Spray Tube and Nozzles	Stainless Steel
Belt Wash Piping	Schedule 80 PVC, 1 1/2 inch
Chicanes	Galvanized Steel Support Rods, Galvanized Cast Iron Holders, and UHMW Polyethylene Blades
Chutes, Feed	Stainless Steel, 10 Gauge



Doctor Blades	UHMW Polyethylene
Drain Trays	Stainless Steel, 14 Gauge
Drain Tray Piping	Schedule 40 PVC
Electrical Junction Box	Stainless Steel or FRP
Electrical Conduit	SO Cord
Electrical Switch Enclosures	NEMA 4, Press Mounted
Frame	A36 Steel, Hot Dip Galvanized, ASTM A123, Coating Grade 100
Hardware Fasteners, Springs, Clips, Etc.	316 Stainless Steel
Hydraulic Cylinders: Body  Rod	FRP Tube with High-Strength Glass-Filled Nylon Head  Solid 316 Stainless Steel with Hard Surface Treatment
Miscellaneous	Carbon Steel Surfaces to be Hot-Dip Galvanized per ASTM A123
Polymer Mixer Housing Counterweight Injection Ring Splitter Manifold	Cast 316SS Cast Iron, Galvanized UHMW Polyethylene UHMW Polyethylene
Rollers (Solid)	Carbon Steel, 1/2-inch Wall, with Forged Roller Shafts. Drive Rollers Coated with Buna N Rubber, 1/4-inch; other Solid Rollers Coated with Thermoplastic Nylon 25 Mils
Rollers (Perforated)	1/4-inch Wall Carbon Steel Hot-Dip Galvanized, or Nylon Coated
Carbon Steel	Nylon Coated
Roller Shafts	Forged Steel
Sludge Containment Barriers	Stainless Steel, 14 Gauge

4. Other types of protective coatings shall not be acceptable. All hot-dip galvanizing shall be applied in accordance with ASTM-A123. Zinc flame spray shall not be considered an acceptable substitute to this Specification.

B. Structural Main Frame:

1. The structural main frame shall be fabricated of steel members conforming to AISC Standard Specifications for Structural Steel, into a rigid structure, adequately braced to withstand intended loads without excessive vibration or deflection.
2. The frame shall have a minimum safety factor of greater than 5 and maximum deflection of 0.025 inch under maximum loading. The moment

of inertia of the structural members shall be adequately chosen to provide the safety factor and deflection rate specified herein.

C. Gravity Drainage Section:

1. Each BFP shall be furnished with a gravity drainage section to accept sludge from the sludge-conditioning system. The gravity drainage section shall be furnished with a sludge feed chute and an inlet distributor to evenly distribute the conditioned sludge over the effective width of the moving filter belt.
2. The conditioned sludge shall be contained on the belt with adjustable containment barriers equipped with replaceable rubber seals to prevent leakage. The rubber seals shall be designed to attach to the containment barriers, with a friction fit, to allow for easy replacement without the use of tools. The gravity drainage section shall have a minimum dewatering area of 93 square feet.
3. The filter belt, while in the gravity drainage section, shall be supported by a steel grid fitted with high-density polyethylene wiper bars. The wiper bars shall be spaced at a maximum of 2-1/2 inches centerline to centerline, and shall have a nominal wear thickness of 1/2 inch, to minimize the frequency of replacement. The wiper bars shall be arranged in a chevron pattern, with the apex toward the sludge inlet, to reduce the possibility of belt creasing. The belt support grid shall be a minimum of 2 inches wider than the belt on each side and so designed to reduce belt wear. Wiper bars constructed of fiberglass, other high friction materials, or table rollers shall not be considered an acceptable substitute to this Specification.
4. The gravity drainage section shall be furnished with chicanes (plows) to adequately furrow the conditioned sludge to facilitate drainage. Each row of chicanes shall be provided with a single lifting handle, designed to remove the entire row of chicanes at least 6 inches from the belt, out of the sludge flow, to facilitate cleaning. Chicanes shall be designed to be individually adjustable laterally and shall pivot to allow them to pass over obstructions on the belt. The minimum of number of chicanes shall be 84, and the minimum number of rows shall be 10.
5. The manufacturer shall be required to demonstrate that each individual chicane shall be capable of allowing a 1-inch vertical obstruction on the belt to pass under them without damage to the equipment.

D. Pressure Section

1. Each BFP shall be furnished with a pressure section following the gravity drainage section. The pressure section shall consist of two stages.
2. The first stage of the pressure section shall be the increasing pressure (wedge) zone, where the upper and lower belts gradually converge,

creating a belt/sludge sandwich. In the wedge zone, the sludge cake is prepared for the shear pressure zone by generating continuously increasing pressure on the sludge as it travels through the zone.

3. For process flexibility, the amount of pressure exerted on the sludge and the rate at which the increasing pressure is applied shall be independently adjustable while the machine is in operation using an adjustable steel wedge plate located between the belts, pressing down on the sludge. These adjustments shall be capable of being performed without causing undue wear on the belts or other components and without causing the belts to be moved from their normal path between rollers. The sludge inlet height at the entrance to the wedge plate shall be adjustable between 1 and 3 inches.
4. The minimum effective dewatering area in the increasing pressure zone shall be 59 square feet, based on the lower belt only. The lower belt in the increasing pressure zone shall be supported in the same manner as supported in the gravity drainage section.
5. The second stage of the pressure section shall be the shear pressure zone consisting of a 12-inch radius curved grid and a minimum of eight pressure rollers arranged to provide an S-shaped pattern of belt travel.
6. The curved grid shall enhance dewatering by causing the pressure on the sludge between the belts to increase and press out free water. The horizontal wiper bars shall create a wiping action to the bottom of the belt in the wedge zone that will quickly remove water from the belt allowing faster drainage. The belt support grid in the wedge zone shall be horizontal for the first several feet and blend into a gradual downward curve that shall be tangent to the perforated pressure roller that follows.
7. The first roller in the increasing pressure zone shall be a 16-inch perforated roller. Rollers shall be constructed as specified under Part 2.02, E, "Rollers." The rollers shall be supported by bearings mounted on the end shafts as specified under Part 2.02, F, "Bearings."
8. The minimum effective dewatering area in the shear pressure zone shall be 121 square feet. The effective dewatering area in the shear pressure zone shall be defined as the area of the roller in contact with the belts.

E. Rollers:

1. Construction:

- a. All solid rollers shall be constructed using one-piece forge shafts and end plates. The forged stub shaft unit shall eliminate all welding of the roller shafts in the region of highest stress where the shafts join with the end plates. Welded up constructions of round bar and flat plates that create built-in stresses and stress concentrations will not be acceptable. The forged stub shaft unit shall be welded to the roller shell with a machine-applied weld

using the submerged arc process. The weld depth shall be equal to the wall thickness of the roller shell. The roller shall be machined so that the total indicated runout of the shell relative to the journals is 0.010 inch maximum. Total surface machining is required to provide a smooth surface for the coating of thermoplastic nylon or to prepare the roller for cladding.

- b. The perforated roller, which is the first roller in the pressure section, is designed to allow water to escape out both ends. It shall be constructed with a solid through shaft and at least five radial vanes to support the perforated shell.

2. Materials:

- a. The forged stub shaft unit shall be made of AISI Type 304L or 316L stainless steel. The roller shells and perforated roller shall also be AISI Type 304L or 316L stainless steel.
- b. Solid rollers shall be clad with 304 or 316 stainless steel. The cladding will be welded to the fully machined roller entirely covering the roller up to the point of insertion into the bearings. Welded stainless steel shafts in lieu of the forging are not acceptable for this application due to the lower strength and higher stress.

3. Dimensions:

- a. All solid roller shells shall have a mill spec minimum wall thickness of 1/2 inch. Heavier walls shall be used where required to meet the maximum stress and deflection limits. The roller bearing journals shall be turned to 75 mm to accept direct-mounted 75-mm bore bearings. The minimum thickness of the forged flange that forms the end plates shall be 1 inch.
- b. The perforated roller shall have punched holes of 1-1/4-inch diameter minimum to prevent bridging of solid material. The punched shell shall be rolled with the smooth side out. The shell shall be a minimum 1/4-inch thick.

4. Stress and Deflection: The rollers shall be analyzed using finite element stress analyses. Certified calculations, showing the maximum stress to be less than 1/5 the yield strength of the material and the maximum deflection at mid span to be less than 0.050 inch shall be submitted as set forth in the Contract Documents. The standard load case for the pressure rollers shall be a distributed load in the belt contact area equivalent to 50-pli belt tension, weight loading and drive torque. The standard load case for the

other rollers shall be a distributed load in the belt contact area equivalent to 50-pli belt tension and weight loading.

F. Bearings:

1. All rollers shall be supported by greaseable type, high-capacity-design roller bearings, in sealed, splash-proof, horizontal split-case pillow block housings. The bearings shall be direct mounted on the shaft with a shrink fit backed by a retaining snap.
2. Bearings supporting the steering rollers shall be non self-aligning cylindrical roller bearings in pivot-mounted pillow block housings.
3. All rollers except steering rollers shall be supported by self-aligning Type "E" spherical roller bearings with metallic cages (plastic cages in spherical roller bearings are not acceptable), mounted in fixed-pillow block housings.
4. All bearings shall have a minimum L10 bearing life of 200,000 hours, calculated by using the latest ANSI/AFBMA standard. The L10 life shall be based on the summation of forces applied to the bearings from roller mass forces and belt tension on the rollers. The belt tension forces exerted on the pressure zone rollers shall include a minimum load 50 pli, the applied (motors are oversized >2x) drive motor torque and friction forces.
5. Bearing housings shall be cast iron with two mounting bolts and four cap bolts. The outer side of the housing shall be solid, without end caps or filler plugs. The housings shall be designed with an integrally cast water trough which, when shrouded by a shaft-mounted water flinger, shall divert water from the bearing seal area. The housings shall be cleaned, iron phosphated, and coated with nylon to a thickness of 8 to 12 mil.
6. The bearing seal in the pillow block housing shall be of nonmetallic construction with a carrier/flinger that rotates with the roller shaft. A static sealing arrangement between the carrier/flinger and the shaft shall be a triple rubber seal, constructed in a manner that prevents relative rotation between the seal and the shaft. A dynamic sealing arrangement between the carrier/flinger and the bearing housing shall consist of a primary dynamic contact seal of ozone-resistant rubber that shall seal by rotational contact with a machined housing surface. A secondary dynamic seal shall be a labyrinth seal between the carrier/flinger and the bearing housing which utilizes a nonmetallic retaining ring to hold the seal assembly in position within the housing.
7. Bearing lubrication shall be performed through a stainless steel grease fitting mounted on the bearing housing. All bearings shall be outboard (externally mounted) and shall be greaseable while the unit is in operation. Lubrication shall not be required more often than once every 6 months.

## G. Belt Wash System

1. The BFP shall be equipped with individual belt wash stations for both the upper and lower belts. Each station shall consist of a spray pipe, fitted with spray nozzles, contained within a fabricated housing that encapsulates a section of each belt. The housing and nozzle assembly shall be readily removable.
2. Nozzle spacing and spray pattern shall be such that the sprays from adjacent nozzles overlap one another at the belt surface. Individual spray nozzles shall be replaceable.
3. The housing shall be sealed against the belt with rubber seals. The spacing between the upper and lower housing shall be adjustable to ensure continuous contact between the seals and belt. The seals shall be replaceable without disassembly of the wash station.
4. The belt wash station shall be furnished with a drain valve having an external handwheel to which is mounted a stainless steel cleaning brush located inside the spray pipe. One full turn of the handwheel shall cause the brush bristles to enter each spray nozzle and dislodge any solid particles that have accumulated, open the valve, and allow the solids particles to be flushed into the drainage system.
5. The belt wash station shall be positioned such that the washing is performed after the cake has been discharged from the belt. The belt wash station shall extend over the full width of the filter belt by a minimum of 2 inches. The belt shall be cleaned by the belt wash with no blinding.

## H. Belt Alignment and Tensioning System

1. Each belt shall be provided with an automatic hydraulic belt alignment system to ensure proper alignment of both belts at all times. Belt alignment shall be accomplished using a self-contained system that does not require an external power source, except for electrical power.
2. The belt alignment system shall be provided with sensing devices designed with a counter-weighted arm fitted with a ceramic plate that rides on the edge of the belts to detect their position. The arm shall operate a pilot valve that in turn affects the position of a hydraulic actuator connected to a pivoted belt alignment roller. The pivoting action of the belt alignment roller shall cause this roller to skew from its transverse position to guide the belts centrally along their path.
3. The alignment systems shall function as a continuous automatic belt guidance system and shall be an integral part of the press. The alignment system shall operate with smooth and slow motions resulting in a minimum of belt travel from side to side. The use of electrical servos or systems that utilize devices that maintain alignment by a large snap-action-type alternating movement of the alignment roller shall not be

considered acceptable to this Specification. Backup limit switches for the belt alignment system shall be provided on the machine with sufficient contacts to de-energize all drives and sound an alarm in case of belt over travel.

4. Each belt shall be provided with a belt-tensioning system. The belt-tensioning system shall be hydraulically actuated. The design of the tensioning system shall be such that adjustments in tension shall result in immediate changes in dewatering pressure.
5. The belt tensioning system shall be furnished with a control station located on the press so that shutoff of belt tension is possible. Actual belt tension shall be maintained automatically despite process changes or belt stretching and not require additional adjustment by the operator to maintain the setpoint.
6. The tensioning system shall have two hydraulic cylinders for each belt, directly connected to a rigid tensioning yoke, to provide absolute parallel tension across the entire width of the belt. The tension force shall be constant over the full range of the cylinder.
7. Manual tensioning systems or pneumatic bellows systems, which do not automatically maintain a pre-set pressure on the sludge despite process changes, are not acceptable.
8. Sensing devices shall be furnished for each belt with sufficient electrical contacts to de-energize all drives and sound an alarm in the event of failure of the belt or the tensioning system.

#### I. Hydraulic Power Unit

1. Each BFP system shall be provided with a dedicated hydraulic power system to provide pressurized oil for the steering and tensioning. The unit shall consist of a 1-gallon reservoir, a variable-displacement pressure compensated hydraulic oil pump and drive motor, hydraulic oil filter (reusable), pressure gauges, piping, valves, and cylinders to make a complete operational system.
2. The pump, motor, reservoir, oil filter, and valves shall be mounted directly to the belt press frame to minimize excess piping runs, fittings, and hoses. All hydraulic lines shall be properly sized for the pressure and flow of the unit. Pressurized hydraulic lines shall be AISI Type 316 stainless steel tubing and shall be rigidly supported on the structural frame of the press. Flexible lines to cylinders, low-pressure connections to the reservoir, etc., shall be hose of the material and construction appropriate to the application. The hydraulic reservoir shall be made of high-density polyethylene (HDPE) and shall be translucent to allow visual inspection of the oil level.

3. The pump motor shall be 1 HP and shall not exceed a noise level of 70 dBa. The motor shall be a cast-iron TEFC 1,200 rpm, NEMA B design with a “C” face mounting for the hydraulic pump adapter.
4. Hydraulic system controls shall be grouped for easy access and ease of operation. There shall be means provided to retract the belt tension cylinders for service. The valves, fittings, manifold, and associated parts shall be of non-corroding materials such as FRP, glass-filled Nylon, and stainless steel.
5. The oil-pressure gauge shall indicate oil pressure in PSI and the belt tension in PLI. Normal operating limits shall be indicated on the face of each gauge. A low-pressure switch shall be provided to sense the absence of belt tension pressure.
6. Hydraulic cylinders shall have a non-corroding body and AISI Type 316 stainless steel hardware and cylinder rod. The cylinder rod shall be solid stainless with a hardened polished seal contact surface. No plated rods shall be allowed. Plating can fail and damage the seal.

J. Belt Drive

1. The BFP belt speed shall be controlled through a mechanical friction disk drive, located at the drive motor and gearbox assembly. The drive roller speed reduction is obtained through a helical gear reducer.

Drive Motor Data:

Quantity per Machine	1
Maximum Horsepower	3 HP
Power Requirements	230/460 vac, 3 Phase, 60 Cycle
Rated Speed	1740 rpm.
NEMA Design	B
Insulation Class	F
Enclosure	TEFC
Service Factor	1.15
Special Features	Sever Duty Rating

2. The variable input power shall be transmitted through a helical gear-reducer mounted on the drive roller shaft extension. The drive roller shall be constructed as specified under "Rollers" and shall be surfaced with a Buna-N rubber coating to permit slip free transmission of driving torque to the belt.

K. Dewatering Belts

1. Each BFP shall incorporate the use of two dewatering belts. Belts shall be fabricated of monofilament polyester and shall have 316 stainless steel



seams. The mesh design shall be selected for optimum dewatering of the sludge to be processed and provide for maximum belt life when operated in accordance with the manufacturer's instructions.

2. Belt selection shall be based on the manufacturer's experience obtained from testing the sludge during start-up of the BFP and at other installations dewatering similar sludges with similar polyelectrolyte conditioning chemicals.
3. Each belt and connecting seam shall be designed for a minimum tensile strength equal to five times the normal maximum dynamic tension to which the belt shall be subjected. The seam shall be designed to fail before the belt. Belts shall be designed for ease of replacement with a minimum of belt filter down time. Belt replacement shall be such that disassembly of the equipment is not required.

#### L. Drainage Pans

1. Drainage pans shall be provided as necessary to contain filtrate from all dewatering areas within the BFP without splashing and to prevent rewetting of downstream cake. All drainage piping shall be furnished, adequately sized for the intended service, and rigidly attached to the press frame. Drainage piping shall terminate inside the structural frame at the bottom of the press. Drain connection shall be self-venting to prevent overflow. Drainage pans shall be located so that the moving belts do not come into contact with the pans under any condition.

### 2.03 WASHWATER BOOSTER PUMP

- A. The dewatering system shall use a washwater booster pump to provide water to clean the belts of the BFP. The booster pump shall be a centrifugal pump with cast-iron suction/discharge chamber, with a 15.0-HP motor.
- B. The pump shall be capable of delivering 80 gallons per minute water from 15 psi to 100 psi. The motor starter for the washwater booster pump will be included into the main control panel.
- C. A 2-inch quick-disconnect fitting is required for water connection. Minimum supply pressure and flow shall be 80 gpm at 15 psig.

### 2.04 SLUDGE FEED PUMP

- A. The dewatering system shall be provided with a progressive cavity feed pump to deliver the sludge through an inline sludge/polymer mixer to the BFP.

- B. The feed pump shall be part of the BFP skid and supplied a Seepex (or approved equal) progressing cavity sludge feed pump with a 15-HP drive motor. The sludge flow is controlled via a mechanical handwheel located on the motor and gearbox assembly.
- C. The pump shall be designed to handle flows up to 40 to 200 gallons per minute. Minimum supply pressure shall be at 15 psig.

## 2.05 DEWATERED CAKE HOPPER AND PUMP

- A. The dewatered cake hopper shall be constructed of 10-gauge AISI Type 316L stainless steel. The Contractor shall field verify hopper dimensions and coordinate with the BFP and progressing cavity cake pump manufacturers before fabrication and installation.
- B. The dewatered cake pump shall be a progressing cavity pump in accordance with Specification Section 11356, Progressing Cavity Pumps – Dewatered Sludge Conveyance System.

## 2.06 SLUDGE CONDITIONING SYSTEM

- A. Polymer Dilution System
  - 1. The liquid polymer dilution system is designed to dilute and feed liquid solution polymers to the proper solution concentrations by varying water flow and neat polymer flow. Equipment includes, mixing system, metering pump, check valve, rotameter, pressure gauges all mounted on AISI Type 304 stainless steel frame which will be bolted to the equipment skid system. A suction wand to connect to a polymer storage tank shall be included.
- B. Inline Variable Orifice Mixer and Polymer Injection Ring
  - 1. The inline mixer and injection ring shall be mounted after the sludge feed pump and before the BFP inlet. The assembly shall consist of a flow-splitting manifold; a four-port vortex polymer injection ring; an in line, non-clog, variable-orifice mixer; and all the necessary piping to complete the system. Polymer addition systems that utilize tanks with mixers or inject polymer directly into the sludge line are not an acceptable equal to the system specified due to the excess amounts of polymer required by these inefficient systems.
  - 2. The sludge-conditioning system shall be capable of providing the following performance:

- a. The polymer and sludge must be instantly mixed (less than 1.0 second at 60 gpm).
  - b. Mixing energy must be independently adjustable during operation.
3. The sludge-conditioning system shall meet the following mechanical specifications:
- a. The in line mixer shall have a flanged cast housing, an adjustable orifice plate with shaft and O-ring seal connected to an externally mounted lever and counterweight, and a removable side plate for inspection and cleaning.
  - b. The inlet to the flow-splitting manifold shall be fitted with a 3/4-inch male hose fitting connection. The four manifold outlets and polymer injection-ring inlets shall be fitted with 1/2-inch male hose fittings that provide for the interconnection of clear flexible tubing.
  - c. The open throat area of the mixer shall be fully adjustable downward and shall open automatically to prevent clogging.
  - d. The position of the counterweight on the externally mounted orifice plate lever shall be fully adjustable, within a 360-degree circle, to allow for adjustment of the mixing energy, regardless of the mounting angle, while the unit is in operation.
4. The polymer mixer shall be designed specifically for its intended use. The use of modified check valves, static mixers, or mixers requiring a tank and motor-driven propeller shall not be acceptable to this Specification

## 2.07 CONTROL PANEL

- A. Each BFP shall be provided with a manual control panel that will contain the necessary control devices and equipment for controlling the dewatering process as described herein.
- B. The control panel shall accept a 460 VAC, 60 hertz, 3-phase, 80-amp power input. A main disconnect and operator mechanism shall be included. When the disconnect is in the open position, all power shall be removed from the control system. IEC-rated motor circuit protection starters will be provided for the washwater pump, hydraulic pump, belt drive, sludge pump, and belt conveyor. A control power transformer shall be included that will provide 120 VAC control power to the polymer system.
- C. Located on the front of the control panel shall be a CONTROL POWER ON/OFF switch. When in the ON position, the CONTROL POWER ON pilot light will be

illuminated and control power shall be distributed to the control system. When in the OFF position, the control system shall be held de-energized. Also located on the control panel shall be an EMERGENCY STOP pushbutton. It shall be a mushroom head-style push-pull operator that when depressed shall immediately de-energize all moving equipment in the system.

- D. As a minimum, the following operator devices shall be located on the front of the control panel:
1. CONTROL POWER off/on selector.
  2. CONTROL POWER indicator.
  3. EMERGENCY STOP pushbutton.
  4. ALARM SILENCE pushbutton.
  5. RESET pushbutton.
  6. CAKE PUMP START pushbutton.
  7. CAKE PUMP STOP pushbutton.
  8. CAKE PUMP RUNNING indicator.
  9. WASHWATER PUMP START pushbutton.
  10. WASHWATER PUMP STOP pushbutton.
  11. WASHWATER PUMP RUNNING indicator.
  12. HYDRAULIC PUMP START pushbutton.
  13. HYDRAULIC PUMP STOP pushbutton.
  14. HYDRAULIC PUMP RUNNING indicator.
  15. BELT DRIVE START pushbutton.
  16. BELT DRIVE STOP pushbutton.
  17. BELT DRIVE RUNNING pushbutton.
  18. SLUDGE PUMP START pushbutton.
  19. SLUDGE PUMP STOP pushbutton.
  20. SLUDGE PUMP RUNNING indicator.
  21. POLYMER PUMP START pushbutton.
  22. POLYMER PUMP STOP pushbutton.
  23. POLYMER PUMP RUNNING indicator.
- E. To operate the BFP, the operator will start the belt conveyor by pushing the CAKE PUMP START pushbutton, start the washwater pump by pressing the WASHWATER PUMP START pushbutton, and then start the hydraulic pump by pressing the HYDRAULIC PUMP START pushbutton. An interlock with a preset time is included in the panel to prevent the operator from starting the belt drive before the belts are tight. The operator will press the BELT DRIVE START button to energize the belt drive. No interlock is provided to prevent the operator from starting the sludge pump and polymer pump before the belts have been pre-wet. Pressing the SLUDGE PUMP START pushbutton and the POLYMER PUMP pushbutton will energize the process feed pumps.

- F. Enclosures: The control panel enclosures shall be fabricated of AISI Type 316 stainless steel, and shall be suitable for NEMA 4X service. The control panel shall be located as shown on the Drawings off of the skid and on the elevated walkway.
- G. Wiring: All power and control wiring shall be 600 volt, type THHN/THWN insulation stranded copper and shall be sized for the required load, 12 AWG for power, 14 AWG for control, and 18 AWG for instrumentation.
- H. Motor Starter: Motor starters shall be full voltage, non-reversing, IEC LB1 style across-the-line units. Coils shall be 120 VAC.
- I. Controller as defined in Section 13300.
- J. Selector Switches: All selector switches shall be heavy-duty, oiltight/watertight, corrosion-resistant units rated for NEMA 4X service. Contact blocks shall be rated for 10-ampere continuous service. Selector switches shall be Square D, Type SK, or equal.
- K. Pushbuttons: All pushbuttons shall be heavy-duty, oiltight/watertight, corrosion-resistant units rated for NEMA 4X service. Contact blocks shall be rated for 10-ampere continuous service. Pushbuttons shall be Square D, Type SK, or equal.
- L. Pilot Lights: Pilot lights shall be heavy-duty, oiltight/watertight, corrosion-resistant units rated for NEMA 4X service. Units shall be 120 VAC transformer-type press to test. Pilot lights shall be Square D, Type SK or equal.
- M. Terminal Blocks: Terminal blocks shall be high-density, solderless box lug style, with 600-volt rating. Terminal blocks shall be Square D, Class 9080, Type M, or equal.

## 2.08 SKID SYSTEM

- A. The entire sludge dewatering system, including BFP, washwater pump, feed pump, and polymer system shall be mounted on a carbon-steel hot-dipped galvanized skid. The skid shall not exceed the following dimensions: 309 inches long, 165 inches wide, 120 inches high, and 48,000 pounds.
- B. The skid shall contain a sump under the entire area that will capture filtrate, washwater, and any hose down or excess water used during clean up. The water captured by the sump shall discharge out of both sides of the skid through 6-inch NPT outlets located approximately mid-length of the skid. Fiberglass grating shall be provided over the entire area of the skid, except where equipment is present.

- C. The skid system and all components listed herein shall be prepiped and wired. Connections required by the Owner/Contractor shall consist of one electrical supply landing, one sludge feed pipe landing, water connections to the washwater pump, and water connections to the polymer system. Connections to the polymer system from the neat polymer solution shall include a drum stick for insertion into a 55-gallon drum or 250-gallon or larger storage tote.

## 2.09 PAINTING

- A. Painting shall be in accordance with Section 09900, Painting and Coating.

## 2.10 SAFETY ITEMS

- A. All equipment furnished shall be manufactured to comply with the most recent safety standards of the Federal Occupational Safety Health Act (OSHA) and all other applicable safety codes.
- B. The emergency stop cord shall be wired so that it is 3-1/2 feet above the deck of the elevated walkway or just above waist high of an average height of a male from where it is normally installed. Other areas where the emergency stop cord is wired shall be at the normal elevation it is provided on the skid.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. The equipment shall be manufactured and tested in accordance with the best applicable trade practices and in compliance with state, OSHA, and other governing code requirements.
- B. The equipment shall be installed to provide a complete working system.

### 3.02 DELIVERY, STORAGE AND HANDLING

- A. All equipment shall be factory-assembled, skid-mounted, crated, and delivered to protect against damage during shipment as practical to suit shipment and installation requirements.
- B. All exposed flanges shall be covered and sealed with shrink-wrap to prevent the entrance of moisture. Finished iron or steel surfaces not painted shall be properly protected with factory-applied corrosion-inhibiting coating, CRC SP-400, or approved equal.

- C. All equipment delivered to the site shall be stored as specified in accordance with the manufacturer's instructions.

### 3.03 INSTALLATION

- A. Equipment shall be installed as shown on the Drawings and in strict accordance with manufacturer's recommendations.

### 3.04 MANUFACTURER'S REPRESENTATIVE

- A. In addition to the performance testing requirements (Article 3.06), the manufacturer shall include the services of a factory-trained field engineer for the purposes of installation inspection, making field adjustments necessary to ensure proper system operation, equipment start-up, polymer selection, and training of plant personnel regarding proper operation and maintenance of the equipment.
- B. The Owner and Engineer shall be notified 2 weeks in advance of the manufacturer's representative's scheduled visits on site. Cost of these services shall be included in the lump sum price.

### 3.05 SHOP TESTING

- A. All major system components shall be factory tested for proper function and integrity.

### 3.06 FIELD TESTING

- A. The Contractor shall provide the services of a factory-authorized service representative to perform, approve, and certify the pre-startup and startup testing and final mechanical performance testing specified in this Section and in Section 11000, General Equipment Requirements. The service representative shall be certified and employed by the manufacturer of the equipment specified in this Section. All field start-up and testing shall be provided in accordance with Section 11000, General Equipment Requirements. The specified time for these services shall be as shown in Section 11000, Table 11000-1, Equipment Testing and Training Requirements. If additional service is required due to the equipment not being fully operational at the time of service requested by the Contractor, the additional service days will be at the Contractor's expense.
- B. Field tests shall not be conducted until the entire installation is complete and ready for testing.
- C. Pre-Startup Testing: The pre-startup testing services specified in this Section shall be performed by the factory-authorized service representative.

1. Field Electric Control System Tests:
  - a. Check all drives for correct clearances, alignment, and lubrication before start up in accordance with the respective manufacturer's instructions.
  - b. Check all low-voltage power and control signals from adjustable-speed drives and analogue and discrete control signals to confirm proper communication of each unit treatment process and eliminate "Communication Failures" before Performance Testing begins.
  
2. Field Motor Tests:
  - a. Megger each motor winding before energizing the motor, and if insulation resistance is found to be low, notify the Engineer. Do not energize the motor.
  - b. Check all motors for correct clearances and alignment and for correct lubrication in accordance with the manufacturer's instructions. Check the direction of rotation of all motors and reverse connections if necessary.
  - c. Perform all testing requirements as specified in Section 13300, Instrumentation and Control for Process Systems, and Division 16, Electrical.
  
3. BFP and Polymer Blending Systems:
  - a. After installation, the Contractor shall demonstrate to the Owner and Engineer that the installed equipment can perform satisfactorily under actual field conditions. The equipment shall be field tested to verify mechanical integrity and soundness of construction, installation, and operation of all equipment and controls.
  - b. After the equipment has been operated long enough to make all desirable corrections and adjustments, each unit and all associated equipment shall be field tested to determine that operation is satisfactory; free from excessive vibration, leaks, and noise; and in compliance with the requirements of these Specifications.
  - c. All BFP, polymer blending system, and cake pump operating settings, alarms, controls, flow meters, and monitoring and shutdown devices shall be calibrated and tested during the field tests to make corrections and confirm all systems are ready for full-scale Performance Testing.



4. Field Alarm System Testing: Check each alarm and detection device for proper operation for the complete belt filter press dewatering feed system and related equipment, instrumentation, and controls.
- D. Startup Testing: The startup test shall include the initial sludge feeding and polymer mixing and feeding and dewatering (complete dewatering system) performance testing with waste activated sludge generated from the facility. The startup test shall verify all dewatering system functions and initial performance and provide troubleshooting as necessary.
- E. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing for this equipment in accordance with Section 11000, General Equipment Requirements.
1. Performance testing shall occur at such time as the installation work and pre-startup testing are complete, corrections made to the satisfaction of the Owner and Engineer.
  2. Proposed test procedures shall be developed and submitted by the equipment manufacturer and approved by the Engineer. A qualified representative of the equipment manufacturer shall supervise equipment operation during the test.
  3. Final testing shall include polymer optimization testing and final performance testing.
    - a. Polymer Optimization Testing: The optimization testing shall use polymers recommended by the BFP manufacturer. Results of the Polymer Optimization Testing shall be submitted in a report that shall include recommended polymer supplier, dose, usage rate, cost per gallon, and annual cost. The recommended polymer to use for the Final Performance Test shall be provided. The report shall be developed by the BFP manufacturer and Contractor for review and approval by the Engineer and Owner. The Engineer and/or Owner have the right to reject the polymer type and/or supplier.
    - b. Final Performance Testing: Shall include continuous testing to achieve the minimum Guaranteed Performance Requirements in Article 1.17 with the Owner's polymer product(s) or other as recommended, and be conducted for the periods specified in Section 11000, General Equipment Requirements.
  4. The Contractor shall supply all labor and materials to perform performance testing. The Owner will provide the water and electricity for

performance testing and will provide the polymer if the Owner's current polymer is shown to provide the optimized performance and cost benefit.

5. In the case of non-acceptable performance, the manufacturer shall have 30 days in which to perform, at the manufacturer's sole expense, all equipment modifications to meet the Guaranteed Performance Requirements and request a retest performance testing. If the modified equipment does not meet the Guaranteed Performance Requirements, the manufacturer shall have 30 days in which to perform, at the manufacturer's sole expense, all equipment modifications to meet the Guaranteed Performance Requirements. This process shall continue until retest performance testing shows compliance with the Guaranteed Performance Requirements.
6. If the polymer feed rates and BFP performance do not meet these Specifications, corrective measures shall be taken or the polymer unit or BFPs shall be removed and replaced with equipment that satisfy the conditions specified and retested.
7. The Contractor shall provide certified laboratory services as required to demonstrate final compliance with performance requirements.

### 3.07 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

- A. The Contractor shall furnish a Manufacturer's Certification of Compliance for the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements.

END OF SECTION

SECTION 11356  
PROGRESSING CAVITY PUMPS –  
DEWATERED SLUDGE CONVEYANCE SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, and incidentals required to provide one self-priming, positive-displacement progressing-cavity pumping units and dewatered sludge (also referred to as cake) conveyance appurtenances specified in this Section, the Project Specifications, and as shown on the Drawings, including a progressing cavity pump, a hopper, an air compressor, valves, a pressure gauge and switch with isolator ring, and associated control panels. Each pumping unit shall be specifically designed to transfer municipal dewatered sludge cake from the BFP to trucks for off-site disposal. All equipment shall be installed, adjusted, tested, and placed in operation in strict accordance with this Section and the manufacturer's recommendations.
  
- B. Each pumping unit shall be designed and constructed to operate satisfactorily with minimum noise, vibration, and cavitation, and reasonable long service life when operated continuously or intermittently for dewatered sludge cake at 15% to 18% total solids.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01755, Equipment Testing and Startup.
- D. Section 01780, Warranties and Bonds.
- E. Section 01820, Training.
- F. Section 01830, Operations and Maintenance Manuals.
- G. Section 03600, Grout.
- H. Section 09900, Painting and Coating.
- I. Section 11000, General Equipment Requirements.
- J. Division 13, Special Construction, except as otherwise specified in this Section.
- K. Section 15110, Manual, Check, and Process Valves.
- L. Section 15125, Piping Appurtenances.
- M. Division 16, Electrical, except as otherwise specified in this Section.
- N. Section 16775, Variable Frequency Drives.

### 1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Certified shop and erection drawings showing all important details of construction, dimensions, and anchor bolt locations.
- B. Descriptive literature, bulletins, and/or catalogs of the equipment.
- C. Complete master wiring diagrams and elementary or control schematics drawings, including coordination with other electrical control devices such as the pump control system, shall be furnished for approval before proceeding with manufacturing. Drawings should show such details that are necessary to facilitate interconnections with other equipment. Standard pre-printed sheets or drawings simply marked to indicate applicability to this Contract will not be acceptable. Refer to the Electrical and Instrumentation Drawings for the control wiring diagrams for the pump motors.
- D. A complete bill of materials of all equipment.
- E. A list of the manufacturer's recommended spare parts to be supplied in addition to those specified in this Section, with the manufacturer's current price for each recommended space part item. Include gaskets, packing, etc. on the list. List bearings by the bearing manufacturer's name and corresponding numbers.
- F. Complete motor and variable-frequency drive data.
- G. Test reports to be submitted: Tests shall be conducted at a minimum of five points along the pump performance curve on the actual pumping units to be furnished. All equipment tested by the pump manufacturer shall certify to its compliance with the project requirements. Curves and other information shall be submitted on 8-1/2-inch-by-11-inch sheets at as large a scale as is practical. Curves shall be plotted from zero flow at shut-off head to pump capacity at minimum specified head:
  - 1. Certified factory test results of each pumping unit in accordance with the standards of the Hydraulic Institute.
  - 2. Factory-tested, certified, and guaranteed pump performance curves showing the specified requirements for head/capacity, brake horsepower, pump efficiency, speed of rotation, and NPSHR for each pumping unit. Characteristics of pumps furnished may have a tolerance of 1% percent below or 5% above the head and capacity of the specified requirements.

- H. The Contractor shall submit the Manufacturer's Certificate of Installation, Testing, and Instruction as specified in Section 11000, General Equipment Requirements.
- I. If it is not possible to comply with certain requirements of this Specification, include in submittals a complete description of all requirements not complied with.
- J. The Contractor shall submit a signed letter from an authorized representative of the pump manufacturer certifying that each pumping unit will not clog or bind on the solids typically found in the application specified in this Section.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Gear Manufacturers' Association (AGMA)
- B. Anti-Friction Bearing Manufacturers Association (AFBMA)
- C. American Iron and Steel Institute (AISI)
- D. American National Standards Institute (ANSI)
  - 1. ANSI B16.1—Cast Iron Pipe Flanges and Flanged Fittings.
  - 2. ANSI B16.5—Pipe Flanges and Flanged Fittings.
- E. American Society for Testing and Materials (ASTM)
  - 1. ASTM A48—Standard Specification for Gray Iron Castings.
- F. American Welding Society (AWS)
- G. Institute of Electrical and Electronics Engineers (IEEE)
  - 1. IEEE 112—Standard Test Procedure for Polyphase Induction Motors and Generators.
  - 2. IEEE 117—Standard Test Procedure for Evaluation of Systems of Insulating Materials for Random-Wound AC Electric Machinery.

- H. National Electrical Manufacturer's Association (NEMA)
  - 1. NEMA MG 1—Motors and Generators Standards.
  - 2. NEMA MG 1-12.58.1—Standardized Method for Testing.

#### 1.06 QUALITY ASSURANCE

- A. The Contractor shall provide quality assurance measures for the items specified in this Section in accordance with this Section and Section 11000, General Equipment Requirements.
- B. Modifications to the manufacturer's standard design may be required to meet these Specifications. Equipment not complying with the mechanical, electrical, and material integrity established by these Specifications will not be acceptable as determined by the Engineer.
- C. All of the equipment, accessories, and controls specified in this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished.
- D. The Seepex Progressing Cavity Pump is the basis of design. If the Contractor proposes an alternative pump manufacturer, the manufacturer will have to certify that the proposed equipment can meet the performance criteria stipulated in this Specification and fit within the available space in the Dewatering Facility as shown on the Drawings.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, and in this Section for storing and protecting the equipment specified in this Section.
- B. The pumps shall be shipped to the jobsite complete with the motor, local wiring, control, equipment base, and anchor bolts and other appurtenances as specified pre-installed. Spare parts shall be shipped loose and ready for installation at the location shown on the Contract Drawings.

## 1.09 QUALIFICATIONS

- A. The manufacturer(s) of the equipment specified in this Section shall meet the qualifications specified in Section 11000, General Equipment Requirements. Additionally, the pump manufacturer shall meet the following qualifications that supersede the requirements specified in Section 11000, General Equipment Requirements:
1. The manufacturer shall have a minimum of five installations in Florida that are similar to the pumping equipment specified in this Section. The Engineer shall reserve the right to determine if previous installations by the manufacturer are similar to the pumping equipment specified in this Section.
  2. The Contractor shall submit a list of no fewer than 10 reference installations of pumps in identical service applications to those specified in this Section. At least three of the reference installations provided shall be of the exact model pump specified in this Section. References shall be pumps that have been in continuous service for at least 3 years from the Bid Date.
- B. The Seepex Progressing Cavity Pump is the basis of design. If the Contractor proposes an alternative pump manufacturer, the manufacturer will have to certify that the proposed equipment can meet the performance criteria stipulated in this specification and fit within the available space in the Dewatering Facility as shown on the Drawings.

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 SPARE PARTS AND SPECIAL TOOLS

- A. The Contractor shall furnish the following spare parts for each pump in clearly identified containers, labeled for easy identification without opening the packaging and suitably protected for long-term storage in a humid environment:
1. One stator assembly with TSE sensor sleeves.
  2. One of each set of mechanical seals.
  3. One rotor.
  4. Two sets of packing.
- B. The Contractor shall provide a list of additional manufacturer recommended spare parts for operating period of one year of equipment specified in this Section. List shall describe each part, quantity recommended and unit price of each part.

- C. Special Tools: The Contractor shall furnish two sets of special tools required for normal operation and maintenance.

1.12 SYSTEM DESCRIPTION

- A. The pumping equipment specified in this Section shall be designed to pump dewatered sludge cake from one BFP to a truck-loading bay that discharges into a sludge trailer for disposal as shown on the Drawings. The BFP will discharge dewatered sludge cake into a hopper that feeds the progressing-cavity pump operated by a variable-speed drive. A compressed-air system shall provide compressed air to assist in pumping the sludge cake, purge the dewatered sludge cake discharge piping, and operate existing pneumatic solenoid valves at the digester aeration piping as shown on the Drawings. The pumping equipment and compressed-air system shall be coordinated and furnished by a single supplier.
- B. Equipment furnished under this Section shall be designed for a municipal wastewater treatment plant environment in which the equipment is exposed to the atmosphere. The equipment shall be designed for humid atmospheric conditions in Central Florida.

1.13 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

1.14 PATENTS AND LICENSES (NOT USED)

1.15 SPECIAL CONSIDERATIONS (NOT USED)

1.16 EQUIPMENT LIST

- A. Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Tag Number</u>
Dewatered Cake Pump No. 1	DCP-01 (Loop 115-DCP-01)
DCP Variable Frequency Drive No. 1	VFD-01 (Loop 115-VFD-01)
Pressure Indicator Gauge No. 1	PI-01 (Loop 115-PI-01)
Pressure Switch No. 1	PS-01 (Loop 115-PS-01)
Air Compressor	AC-01 (Loop 115-AC-01)



## PART 2 PRODUCTS

### 2.01 PERFORMANCE AND DESIGN REQUIREMENTS

#### A. General Design Requirements

1. Number of Pumps: One.
2. Minimum Rated Capacity: 8 gpm at 250 psi (35 rpm).
3. Maximum Rated Capacity: 20 gpm at 250 psi (89 rpm).
4. NPSHR: 6.87 feet.
5. Suction Dimension: AISI 10-gauge Type 316L stainless steel hopper per the Drawings.
6. Discharge Diameter: 4 inches ANSI Class 150.

#### B. Pump Mounting

1. Base Mount (on a common fabricated-steel base-plate).

#### C. Service Conditions

1. Material Pumped: Dewatered Sludge Cake.
2. Percent Solids: 13% to 18%.
3. pH: 5 to 9.
4. Product Temperature: 32°F to 113°F.
5. Design Pumping Temperature: 68°F.
6. Installation: Horizontal.

#### D. Acceptable Manufacturers:

1. Seepex, Inc., Model BTHE 17-24.
2. Engineer-approved equal.

### 2.02 EQUIPMENT

#### A. The pumping equipment specified in this Section shall in general consist of the following components:

1. Pump Case.
2. Helix ribbon auger at the pump inlet.
3. Rotor.
4. Stator.

5. Drive Train:
    - a. Universal Joint.
    - b. Drive Shafts.
    - c. Bearings.
  6. Motor.
- B. Pump Casing: A 150-pound (ANSI B16.5) flanged connection shall be provided at the discharge port. The discharge casings shall each be provided with a 3/8-inch (or larger) tap to permit installation of pressure instruments. The suction casing shall be fabricated from corrosion resistant steel plate and designed with a rectangular opening, which is 2 meters by 0.4 meter. The suction casing shall incorporate a conical "extension tube" between the hopper opening and the rotor and stator. A single helix ribbon auger shall run the entire length of the suction casing. The ribbon auger shall turn concentrically in the hopper. The auger shall be driven by the main pump drive gear motor. The ribbon auger and extension tube work in concert to apply additional shearing forces against the thixotropic sludge to reduce the apparent viscosity of the material, minimize air entrainment and improve the volumetric efficiency of the pumping elements. The walls of the hopper shall be vertical to minimize bridging.
- C. Rotor and Stator: Each pump shall be a minimum two-stage design employing a convoluted rotor operating in a similarly convoluted stator. The convolutions shall be configured to form a cavity between the rotor and stator, which shall progress from the pump's inlet to the discharge port with the operation of the rotor. The fit between the rotor and stator at the point of contact shall compress the stator material sufficiently to form a seal and to prevent leakage from the discharge back to the inlet end of the pumping chamber. The stator shall be molded with a seal integral to the stator elastomer, preventing the metal stator tube and the bonding agent from the elastomer from contacting the pumped liquid. Gaskets or "O" rings may not be used to form this seal. Stators for sludge pumps shall have Buna-N elastomer. The sludge pump rotors shall be constructed of tool steel. Additionally, the sludge pump rotors shall have a chromium nitride coating (Duktil) with a hardness of 1,250 Vickers and a minimum thickness of 250  $\mu\text{m}$  (.0108 inch). Hard chrome plating or ceramic coatings are not acceptable due to the potential for cracking and the lack of diffusion into the rotor base metal.
- D. Drive Train: Each pump rotor shall be driven through a positively sealed and lubricated pin joint. The pin joint shall have replaceable bushings, constructed of air-hardened tool steel of 57-60 HRC, in the rotor head and coupling rod. The pin shall be constructed of high-speed steel, air hardened to 60-65 HRC. The joint shall be grease lubricated with a high temperature (450°F), PTFE-filled synthetic

grease, covered with a Buna-N sleeve, and positively sealed with hose clamps constructed of AISI Type 304 stainless steel. A stainless steel shell shall cover the rotor-side universal joint assembly to protect the elastomer sleeve from being damaged by tramp metals or glass. The universal joints shall carry a separate warranty of 10,000 operating hours. This warranty shall be unconditional regarding damage or wear.

E. Shaft Seals and Bearings: Each pump shall be provided with oil-lubricated thrust and radial bearings, located in the gear motor, designed for all loads imposed by the specified service. The shaft shall be sealed with minimum five rings of packing. The packing gland shall have ports for flushing when required.

F. Motor

1. Unless otherwise noted in this Section, motors shall be in accordance with Section 16480, Motors.
2. Gear motors or gear reducers shall be designed in accordance with AGMA 6019-E (Class II). Unless otherwise noted, motors shall be energy-efficient, TEFC motors in accordance with Section 16480, Motors.
3. Variable Frequency Drives (VFDs) shall be constant-torque type as specified in Section 16775, Variable Frequency Drives. For VFD-driven units, the pump supplier shall be responsible for the provision of the fixed reduction between the motor and pump. The reduction ratio shall be that required to operate the pump at its maximum operating speed when the motor is operating at its nominal rated full speed in accordance with this Specification. VFD-driven units may be operated at up to 80 Hz at the maximum speed.
4. The motors shall meet the following:

a.	Motor Duty	Adjustable Speed (Constant Torque)
b.	Horsepower	20 Hp
c.	Voltage	230/460V
d.	Phase	3
e.	Hertz	60 Hz
f.	Nominal Motor Speed	1,740 rpm
g.	Motor enclosure	TEFC
h.	NEMA Design Letter	B
i.	Insulation Class	H
j.	Service Factor	1.00 (inverter duty rated)
k.	Bearing Life	100,000 hours (AFBMA B10)

5. Acceptable manufacturers:
  - a. WEG Motors.
  - b. US Motors.
  - c. Engineer-approved equal.

G. Accessories:

1. Run-Dry Protection: The stator shall be fitted with a sensor sleeve and thermistor sensor. A controller shall also be provided and shall be installed by the Contractor in the motor control center. The controller shall monitor the stator temperature and activate a shutdown and alarm sequence if the stator temperature reaches the adjustable limit on the controller. The controller shall include a manual local and remote reset function. Input to the controller shall be 1x115VAC/60 Hz.
2. Over-Pressure Protection: Each pump unit shall be supplied with a silicone-filled isolation ring with a dual-mounted gauge and single-point pressure switch. The pressure ranges for the switch and gauge shall be selected specifically for each specified service. The isolation ring shall be mounted between ANSI flanges, be sized according to the discharge pipe as shown on the plans, and be constructed with a carbon steel body and fittings with a Buna sleeve. The switch shall be SPDT, NEMA 4. The isolator ring, pressure gauge, and switch shall be in accordance with Section 15125, Piping Appurtenances, and Section 13300, Instrumentation and Control for Process Systems.
3. Hopper Extension with Laser Mounting Brackets: Each pump shall be supplied with a hopper extension that is pre-installed and flange mounted to the pump. The hopper extension shall include the following as a minimum:
  - a. An open hopper flange for the integration of the pump with a customer-supplied AISI 10-gauge Type 316L stainless steel transition hopper that will extend from the dewatering equipment to the extension flange.
  - b. The integral flanged hopper extension shall integrate a window on the drive end of the hopper extension. This window will be used for level measurement and presence/absence detection of cake.
  - c. The integral hopper extension shall include a metal fabricated sloped canopy internal to the hopper extension and covering the window. This canopy will eliminate any cake from falling out of the hopper and obstructing the level measurement and presence/absence detectors.

- d. The hopper extension shall incorporate a flexible polycarbonate shield that will divert falling cake away from the level measurement equipment signal. This shield will be clear polycarbonate and will be between 1/8- and 1/4-inch thick depending on the application. It will be flexible in order to prevent cake build up and eliminate possibility of bridging.
  - e. The hopper extension shall include all adjustable brackets to mount all of the presence/absence and level control transmitters and receivers.
4. Laser Level Transmitters: The dewatered sludge cake pump will be supplied/installed with three pre-programmed laser measurement devices that incorporate the following characteristics:
- a. Each laser shall be self-contained and have an IP67 rating for being capable of being fully submersed.
  - b. Must be able to measure distances ranging from 8 to 390 inches with an overall accuracy of not more 3/4-inch where extraneous light is less than 40klx.
  - c. The laser level transmitter shall project a dot no larger than 5/8-inch diameter at the maximum measuring length.
  - d. The laser measurement system shall be able to operate in environmental temperatures ranging from 15 to 140°F
  - e. Each laser transmitter shall utilize sealed M12 connections to prevent any contamination, but easy period maintenance or removal and replacement.
  - f. Each laser transmitter shall incorporate a discrete output to represent the laser line being broke by falling cake. Additionally, the laser transmitter shall include an analog process signal indicating the proximity of cake from the sensor.
  - g. Each of the three laser transmitters shall be programmed identically to permit them to measure level or indicate presence of dewatered sludge cake. The operator shall be able to switch the function of each transmitter only by swapping the M12 quick connector.
5. Level Controller: The system shall include a level controller to analyze all of the level signals and provide on-the-fly filtering to determine proper operation and speed of the pump to keep the process operating in a continuous manner. The controller shall be as manufactured by the pump manufacturer and include the following features:
- a. Minimum of 5 previous installations that incorporate the controller and hardened control algorithms.

- b. The controller shall be housed in a non-metallic enclosure that carries a minimum rating of NEMA 4X.
- c. The controller shall feature a 5.7-inch color touch screen, capable of producing a 64,000 color gamut, which will permit operators of selecting or changing parameters of operation. The display shall incorporate a resistive touch display that will permit operation with gloved hands.
- d. The control system shall permit the control of boundary layer injection pumps to reduce frictional piping losses pressure in application that may convey for longer distances.
- e. The controller shall be capable of accepting/transmitting a minimum of the following control signals:
  - (1) Analog process inputs: 4.
  - (2) Analog process outputs: 4.
  - (3) Discrete inputs that are 24 VDC tolerant: 16.
  - (4) Dry-contact relay outputs that are each rated for 10 amps resistive: 15.
- f. The level controller shall be the Seepex Touch controller as manufactured by Seepex, Inc., or approved equal.

#### H. Compressed-Air System

- 1. The compressed-air system shall generally consist of the following components as shown on the Drawings:
  - a. One Air compressor.
  - b. One Receiver tank.
  - c. Piping.
  - d. Valves.
- 2. Air Compressor:
  - a. Each air compressor shall be a two-stage splash-lubricated reciprocating compressor capable of producing a minimum of 16.6 CFM at 175 psi.
  - b. The compressor shall be equipped with an air-cooled after-cooler, thermal overload protection, and a pressure switch.

- c. Provide anchor bolts, vibration pads, and flexible connection.
  - d. Motor:
    - (1) Tank mounted.
    - (2) Power feed: 480 V, 3 Phase, 60 Hz.
    - (3) Motor shall be sized such that brake horsepower required by the driven equipment under all conditions will not exceed the nameplate rating on the motor.
    - (4) Motor shall have a 1.15 service factor.
    - (5) NEMA 4 starter.
3. Receiver Tank:
- a. Each receiver tank shall be welded steel vertical configuration with an 80-gallon capacity.
  - b. Tank shall be constructed in accordance with ASME requirements.
  - c. Tank shall have an automatic condensate drain valve, pressure gauge, and safety valve.
  - d. Outlet connection size shall be 3/4-inch NPT.
  - e. As shown on the drawings there shall be a 1/2-inch stainless steel ball valve and quick isolator coupling for use of air tools by the Owner.
4. Air Compressor and Receiver Tank Manufacturers:
- a. Granger Speedaire, Model 35WC42.
  - b. Ingersol-Rand.
  - c. Equal approved by the Engineer.
5. Piping: Air piping shall be as shown in the Pipe Schedule and on the Drawings.
6. Valves: Valves for the compressed air system shall be as shown on the Drawings and as specified in Section 15110, Manual, Check, and Process Valves.
7. Anchor bolts, nuts, and fasteners for mounting the compressor shall be AISI Type 316 Stainless Steel. Anchoring shall be done in accordance with the manufacturer's recommendation unless directed otherwise by the Engineer in the Project Specifications or shown on the Drawings.

- I. Additional functional descriptions for the complete cake pump system and sludge dewatering system are in Section 01100, Summary of Work, and Section 11350, Skid-Mounted Belt Filter Press.

## 2.03 PAINTING

- A. Equipment shall be provided with the manufacturer's recommended shop and field coating systems for severe-duty services rated for outdoor exposure in Florida.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. The Contractor shall install the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements and per manufacturer's recommendations.
- B. Install the equipment in the locations as shown on the Contract Drawings and in accordance with the manufacturer's published instructions and recommendations and the approved shop drawings. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.
- C. All anchor bolts and fasteners shall be AISI Type 316 stainless steel and shall be furnished by the pump manufacturer.
- D. Adjust pump assemblies so that the motors are properly aligned, plumb, and level with the pumps and all interconnecting shafts and couplings.
- E. Provide non-shrink grout for pump installation in accordance with Section 03600, Grout.
- F. All strain from the attached piping shall be eliminated from the pumps, and any evidence of pump or motor misalignment, noisy operation, or other signs of improper setting shall be corrected by the Contractor using the means specified in this Section at no additional cost to the Owner. Care during storage, installation, and lubrication shall be in strict accordance with the manufacturer's recommendations.

### 3.02 FIELD TESTING

- A. Field testing shall be coordinated with the testing for the Skid Mounted Belt Filter Press in accordance with Sections 11350, Skid-Mounted Belt Filter Press,



and 13300, Instrumentation and Control for Process Systems. The Contractor shall provide the services of a factory-authorized service representative to perform, approve, and certify the pre-startup and startup testing and final mechanical performance testing specified in this Section and in Section 11000, General Equipment Requirements. The service representative shall be certified and employed by the manufacturer of the equipment specified in this Section. All field startup and testing shall be provided in accordance with Section 11000, General Equipment Requirements. The specified time for these services shall be as shown in Section 11000, General Equipment Requirements, Table 11000-1, Equipment Testing and Training Requirements. If additional service is required due to the equipment not being fully operational, at the time of service requested by the Contractor, the additional service days will be at the Contractor's expense.

1. Pre-Startup Testing: The factory-authorized service representative shall perform the pre-startup testing specified in this Section in accordance with Section 11000, General Equipment Requirements
2. Startup Testing: The factory-authorized service representative shall perform the startup testing specified in this Section in accordance with Section 11000, General Equipment Requirements.
3. Final Mechanical Performance Testing: The Contractor shall perform final mechanical performance testing for this equipment in accordance with Section 11000, General Equipment Requirements.
4. Noise and vibration tests shall be conducted in conformance with the Hydraulics Institute Test Codes and OSHA Standards of Occupational Noise Exposure. Maximum allowable noise level, corrected for background sound, shall not exceed 85 dBA when measured at a horizontal distance of 3 meters from the equipment being tested, at a height of 3 meters above floor level. The actual natural frequency of the installed pumping units will be verified using industry-accepted procedures.
5. All pumps operating settings, alarms, controls, and shutdown devices shall be calibrated and tested during the field tests.
6. The Contractor shall supply all labor, test instruments, supplies, and materials to perform testing. The Owner will provide the water and electricity for testing.

### 3.03 TRAINING SERVICES

- A. The factory-authorized service representative shall be on site to perform training services in accordance with Section 01820, Training, and Section 11000, General Equipment Requirements. Duration of training services shall be as specified in Section 11000, General Equipment Requirements, Table 11000-1, Equipment Testing and Training Requirements.

- B. Training shall be shall be coordinated with the training for the Skid-Mounded Belt Filter Press in accordance with Sections 11350, Skid-Mounted Belt Filter Press, and 13300, Instrumentation and Control for Process Systems.

#### 3.04 MANUFACTURER'S CERTIFICATION OF COMPLIANCE

- A. The Contractor shall furnish a Manufacturer's Certification of Compliance for the equipment specified in this Section in accordance with Section 11000, General Equipment Requirements.

END OF SECTION

SECTION 11535  
SUBMERSIBLE NON-CLOG CENTRIFUGAL PUMPS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, new materials, equipment, and incidentals necessary for the complete installation of the submersible non-clog centrifugal pumps, including but not limited to pumps, pump bases, guide rails and lifting system, and electrical and/or controls as specified in this Section and as shown on the Drawings.
- B. The pumps, pump bases, motors, and guide rails shall be furnished by a single supplier. The pump supplier shall be responsible for overall supply and quality of these items and shall be responsible for testing, start-up, troubleshooting, and personnel training for the submersible non-clog centrifugal pumps and lift station.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01600, Materials and Equipment.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manual.
- E. Section 05500, Miscellaneous Metal.
- F. Section 09900, Painting and Coating.
- G. Section 13300, Instrumentation and Control for Process Systems.
- H. Section 15155, Ductile Iron Pipe and Fittings.
- I. Division 16, Electrical.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. The Contractor shall submit written certification from the pump supplier that the wet well size and layout are acceptable for the pump installation.
- B. Shop Drawings: The Contractor shall submit integrated shop drawings for the pumping system illustrating the mechanical and electrical equipment and components specified in this Section and including the following:

1. **Product Data:** For each mechanical, structural, and electrical component include the manufacturer's descriptive literature, product specifications, published details, technical bulletins, performance, and capacity-rating curves with primary and secondary design conditions clearly noted, charts, and schedules, catalog data sheets, and other submittal materials as required to verify that the proposed products conform to the quality and function of the specified products.
  - a. **Identification:** Clearly indicate by an arrow on submissions covering more than one product type or style exactly which product is being submitted for approval.
  - b. **Equipment Characteristics:** Provide bearing ratings, complete motor data, service factors, shaft diameters, coupling type, and weights of principal parts and assembled equipment.
  - c. **Manufacturer:** Include the catalog name, company name, address, and telephone number for the manufacturer of each product submitted.
2. **Equipment Drawings:** Submit completely dimensioned plan, elevations, and cross-sections of system equipment and sub-assemblies.
3. **Layout Drawings:** Submit completely dimensioned drawing of pump, pump base, anchor bolt size and patterns, complete guide rails system, installation notes, recommended grout configuration of wetwell bottom, discharge elbow mounting instructions, and other pertinent setting details.
4. **Product List:** Provide a list of equipment and components on each drawing with each product identified by legend reference. Include product name, manufacturer, and model number.
5. **Wiring Diagrams:** Submit complete interconnecting wiring diagrams and schedules for electrical apparatus showing numbered wiring terminals in the pump control panel conforming to NEMA ICS-1-101. Identify field device terminals, wire number, wire sizes, control and power wire types, and interfaced elements.
6. **Control Panel Drawing:** Submit a dimensioned drawing of the revised control panel indicating the updated primary electrical components and panel face with control devices, lights, indicators, and other panel-face-mounted apparatus located and identified. Provide an internal face view of the equipment arrangement with equipment identified.

7. Additional Requirements: See Division 13, Special Construction, for additional submittal requirements for the control panel furnished under this Section and specified below.
- C. Pump Test Report: Submit certified copies of factory-run pump performance test curves. Factory-certified performance test curves shall indicate the following:
1. Flow in gallons per minute.
  2. Total head in feet of water.
  3. Horsepower.
  4. Pump efficiency in percent of input shaft horsepower.
  5. Pump data:
    - a. Model number.
    - b. Serial number.
    - c. Impeller diameter and type.
    - d. Impeller speed.
  6. Test condition data:
    - a. Date of test.
    - b. Mean water temperature.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Concrete Institute (ACI)
  1. ACI 318/318R Building Code Requirements for Reinforced Concrete.
- B. American Iron and Steel Institute (AISI)

- C. American National Standards Institute (ANSI)
  - 1. ANSI B16.1—Cast Iron Pipe Flanges and Flanged Fittings.
- D. American National Standards Institute/Hydraulic Institute (ANSI/HI)
  - 1. ANSI/HI 1.1-1.2—Centrifugal Nomenclature.
  - 2. ANSI/HI 1.4—Centrifugal Operations.
- E. American Society of Mechanical Engineers (ASME)
  - 1. ASME B16.1—Cast Iron Pipe Flanges and Flanged Fittings.
- F. American Society for Testing and Materials (ASTM)
  - 1. ASTM A36/A36M—Standard Specification for Carbon Structural Steel.
  - 2. ASTM A48—Standard Specification for Gray Iron Castings.
  - 3. ASTM A105/A105M—Standard Specification for Carbon Steel Forgings for Piping Applications.
  - 4. ASTM A123—Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
  - 5. ASTM C478—Standard Specification for Precast Reinforced Concrete Manhole Sections.
- G. American Waterworks Association (AWWA)
  - 1. AWWA C207—Standard for Steel Pipe Flanges for Waterworks Service-Sizes 4 In. through 144 In.
- H. International Standards Organization (ISO)
  - 1. ISO 2858—End Suction Centrifugal Pump (Rating 16 Bar) Designation, Nominal Duty Point and Dimensions.
  - 2. ISO 5199—Technical Specifications for Centrifugal Pumps, Class II.
  - 3. ISO 7005-2—Metallic Flanges Part 2: Cast Iron Flanges.
- I. National Electrical Manufacturer's Association (NEMA)
  - 1. NEMA 250—Enclosures for Electric Equipment (1000 Volts Maximum).
  - 2. NEMA 3R—Rain-Proof and Sleet- (Ice-) Resistant-Outdoor Enclosures.
  - 3. NEMA Design B—Electrical Induction Motors.
  - 4. NEMA ICS-1—Industrial Control and Systems: General Requirements.

- J. National Fire Protection Association (NFPA)
  - 1. NFPA 70 – National Electrical Code (NEC).
- K. Underwriters Laboratory (UL)
  - 1. UL 508—Industrial Control Equipment.

#### 1.06 QUALITY ASSURANCE

- A. The pumps shall be shipped to the jobsite complete with the motor, local wiring, control, equipment base, and anchor bolts and other appurtenances as specified pre-installed. Spare parts shall be shipped loose and ready for installation at the location shown on the Drawings.
- B. Modifications to the manufacturer's standard design may be required to meet these Specifications. Equipment not complying with the mechanical, electrical, and material integrity established by these Specifications shall be identified by the Contractor and submitted to the Engineer for review.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplemental Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS

- A. The manufacturer(s) of the equipment specified shall meet the following requirements:
  - 1. Shall have been in business for at least the 10 years before the Bid Date.
  - 2. Shall have a record of operating, manufacturing, and servicing the types of items specified for a minimum of 10 years before the Bid Date.
  - 3. Shall have a minimum of five installations of equipment similar to and meeting the requirements specified in this Section at municipal wastewater treatment facilities in Florida before the bid date.

#### 1.10 TESTING REQUIREMENTS (NOT USED)

### 1.11 MAINTENANCE (NOT USED)

### 1.12 SYSTEM DESCRIPTION

- A. The pump station shall have submersible centrifugal non-clog pumps as specified in this Section with controls capable of operating the pumps either individually, alternately, and/or simultaneously, depending on the load condition.
- B. The pump station shall be complete units with necessary appurtenances installed within the pump intake basin.

### 1.13 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals, and shall include the following:
  - 1. Installation instructions.
  - 2. Functional description of the pumping control system for each mode of operation of equipment.
  - 3. Automatic and manual operation.
  - 4. Alarms and fail-safe features.
  - 5. Interlocked and/or interfaced equipment operation and control.
  - 6. Exploded view drawings and illustrations with descriptions for assembly and disassembly of equipment.
  - 7. Comprehensive parts and materials maintenance and repair list for each equipment element indicating the manufacturer and the manufacturer's identification number. Include the name, address, and telephone number of local sales and service office for major equipment items.
  - 8. Schedules of recommended spare parts to be stocked, including part number, inventory quantity, and ordering information.
  - 9. Performance rating and nameplate data for each major system component.
  - 10. Procedures for starting, operating, adjusting, calibrating, testing, and shutting down system equipment.
  - 11. Emergency operating instructions and trouble-shooting guide.
  - 12. Schedule of routine maintenance requirements and procedures and preventative maintenance instructions required to ensure satisfactory performance and equipment longevity.
  - 13. Maintenance instructions for extended out-of-service periods.
  - 14. Schedule of lubrication requirements, including lubricant type, service interval, and lubrication points.
  - 15. Field-verified power and control wiring schematics. Submit the approved schematics in each manual. After initial start-up and operation, correct



these schematics to reflect any required field changes and submit the required copies for inclusion in the manuals.

- B. The Contractor shall not be compensated for the pumping equipment until the O&M manuals are received for Engineer's review.
- C. Installation Certificate: Submit a certificate from the manufacturer or from the manufacturer's qualified, factory-authorized representative for each pump furnished and installed and specified in this Section stating that the equipment has been installed, inspected, and adjusted as required in accordance with the manufacturer's written installation procedures and operating instructions and is ready for acceptance by the Owner.

#### 1.14 PATENTS AND LICENSES (NOT USED)

#### 1.15 EQUIPMENT LIST

- A. Equipment numbers are as follows:

<u>Item</u>	<u>Equipment Tag Number</u>
Lift Station Pump No. 1	P-01 (Loop 120-P-01)
Lift Station Pump No. 2	P-02 (Loop 120-P-02)
Lift Station Control Panel No. 1	CP-01 (Loop 120-CP-01)

#### 1.16 SPECIAL CONSIDERATIONS

- A. All of the equipment, accessories, and controls specified in this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the equipment to be furnished.

### PART 2 PRODUCTS

Materials and equipment shall conform to the referenced publications or as specified and indicated and shall be the products of manufacturers regularly engaged in the manufacture of such products.

#### 2.01 SUBMERSIBLE CENTRIFUGAL NON-CLOG PUMPS

- A. Major pump components shall be of grey cast iron, Oil-Filled Pumps: ASTM A48 Class 30, with smooth well-rounded water passages and smooth interior surfaces free from cracks, porosity, blowholes, or other irregularities. All exposed nuts or bolts shall be AISI Type 300 series stainless steel. The discharge nozzle shall be

flanged and sufficiently rigid to support the guiderail-mounted pumping unit under all operating conditions.

B. Impeller:

1. The impeller shall be as recommended by the pump manufacturer for the intended use.
2. The impeller shall be dynamically balanced and securely locked to the shaft by a key and self-locking bolt or nut.

C. Coatings: All metal surfaces in contact with the pumped media, other than stainless steel, shall be coated in the factory with a zinc primer and polyester resin or high-solids epoxy finish.

D. Wearing Rings (For Enclosed Impellers Only): Renewable Type 316 stainless steel wearing rings shall be provided in the casing and on the impeller. The rings shall be positively locked in place.

E. Oil Chamber Housing: The oil chamber shall contain a drain plug and a vent plug.

F. Seals:

1. Oil-Filled Pumps: Each pump shall be provided with two mechanical rotating shaft seals arranged in tandem and with an oil chamber between the seals. John Crane Type 21 seals shall be used with the rotating face of the seal shall be carbon and the stationary seal faces shall be ceramic. The pump shall be equipped with AISI Type 300 Series stainless steel hardware and an AISI Type 300 Series stainless steel shaft sleeve for under the lower seal. A seal leak detection sensor shall be provided between the seals.

G. Sealing of Mating Surfaces: All mating surfaces of major components shall be machined and fitted with O-rings where watertight sealing is required. Sealing shall be accomplished by O-ring contact on four surfaces and O-ring compression in two planes, without reliance on a specific fastener torque or tension to obtain a watertight joint. The use of elliptical O-rings, gaskets, or seals requiring a specific fastener torque value to obtain and maintain compression and watertightness will not be acceptable. The use of secondary sealing compounds, gasket cement, grease, or other devices to obtain watertight joints will not be acceptable.

H. Discharge Base:

1. The manufacturer shall furnish a discharge base and discharge elbow for each pumping unit. The base shall be sufficiently rigid to firmly support

the guiderails, discharge piping, and pumping unit under all operating conditions. The base shall be provided with one or more integral support legs or pads suitable for bolting to the floor of the pump intake basin. The face of the discharge elbow inlet flange shall be perpendicular to the floor and shall make contact with the face of the pump discharge nozzle flange. The diameter and drilling of the elbow outlet flange shall conform to ANSI B16.1, Class 125.

2. The pump and motor assembly shall be automatically connected to and supported by the discharge base and guiderails so that the unit can be removed from the wet well and replaced without the need for operating personnel to enter the pump intake basin.

I. Pump Characteristics:

Unit designation	Onsite Pump Station
Number of Units	2
Total Head at Primary Design Condition (feet)	51.0
Capacity at Primary Design Condition (gpm)	1,200
Minimum Efficiency at Primary Design Condition	67.0%
Total Head at Secondary Design Condition (feet)	46.50
Capacity at Secondary Design Condition (gpm)	1,300
Minimum Efficiency at Secondary Design Condition	66.5%
Shut-off Head (feet)	93.0
Rated Pump Speed (rpm)	1750
Motor Power (hp)	25 max
Discharge Elbow Outlet Diameter (inches)	6
Minimum Hydrostatic Test Pressure	1.5 times shutoff head plus suction pressure

1. Pump performance shall be stable and free from cavitation and noise through the specified operating head range at minimum suction submergences.
2. Each pumping unit shall be designed so that reverse rotation at rated head will not cause damage to any component.

J. Acceptable Pump Manufacturer/Model:

1. Sample Pump Station:
  - a. Pentair Ltd., Hydromatic Model S6L/S6LX.
  - b. Approved equal.

## 2.02 ELECTRIC MOTORS

Electric motors shall be in accordance with Division 16 unless noted otherwise in this Section:

- A. Each pump shall be driven by a dielectric oil-filled, totally submersible electric motor manufactured by the pump manufacturer. Each motor shall be rated 460 volts, 60 Hz, three phase and shall have a service factor of 1.15. The motor nameplate rating shall exceed the maximum horsepower required by the pump in the operating head of the entire pump curve. The motor shall operate over the entire range of the pump curve without overloading the motor or operating in the service factor of the motor. The stator housing shall be an oil-filled, watertight casing. Motor insulation shall be moisture resistant, Class F, 155°C. Each motor shall be NEMA Design B for continuous duty at 40°C ambient temperature and designed for at least 10 starts per hour.
- B. The motor bearings shall be antifriction, permanently lubricated type. The lower bearing shall be fixed to carry the pump thrust and the upper bearing free to move axially. The bearing shall have a calculated AFBMA L<sub>10</sub> Life Rating of 40,000 hours when operating at maximum operating head.
- C. Each motor shall be capable of continuous operation in air (unsubmerged) for at least 24 hours under pump full load conditions without exceeding the temperature rise limits for the motor insulation system.
- D. Each pump shall be equipped with one or more multiconductor cable assemblies for power and control. Each multiconductor assembly containing power cables shall be provided with a separate grounding conductor. Each cable assembly shall bear a permanently embossed code or legend indicating that the cable is suitable for submerged use. Cable sizing shall conform to NEC and ICEA requirements. All cables shall be of sufficient length to terminate at the control panel or as otherwise indicated in the Drawings, with 10 feet of slack which will be coiled in the pump intake basin. Each cable shall be supported by AISI Type Series 300 corrosion-resistant stainless-steel Kellems or woven grips to prevent damage to the cable insulation. Mounting of cable supports in the basin shall be coordinated by the supplier to prevent damage to the cable. No splicing of cables shall be allowed.
- E. The cable entry water seal shall be water tight and include a strain relief.
- F. The motor and its integral protective controls shall be explosion proof and rated and labeled for use in a Class I, Division 1, Group D area under submerged and unsubmerged conditions.

## 2.03 PIPES, FITTINGS, AND VALVES

- A. A flanged ductile iron reducer shall be furnished and installed on the discharge of the base elbow to replace the existing reducer. Ductile iron pipe shall be in accordance with Section 15155, Ductile Iron Pipe and Fittings.
- B. Flange bolts and nuts shall be AISI Type 304 stainless steel.

## 2.04 GUIDE RAIL AND LIFTING SYSTEM

- A. Sliding Bracket: Each pumping unit shall be provided with an integral non-sparking, self-aligning guiderail sliding bracket. The bracket shall be designed to obtain a wedging action between flange faces as final alignment of the pump occurs in the connected position. The entire weight of the pump unit shall be wedged tightly against the inlet flange, making metal-to-metal contact with the pump discharge forming a seal without the use of bolts, gaskets, or o-rings. The bracket shall maintain proper contact and a suitably sealed connection between flange faces under all operating conditions.
- B. Guide Rails: Each pumping unit shall be equipped with two AISI Type 316 stainless-steel guide rails. Guide rails shall be sized by the pump manufacturer to fit the discharge base and the sliding bracket and shall extend upwards from the discharge base to the access open at the top of the pump basin. An upper guide rail bracket of AISI Type 316 stainless steel shall be provided.
- C. Lifting Chain: The pump manufacturer shall select and provide a stainless-steel lifting chain suitable for removing and installing each pump. The lifting chain shall be connected to an AISI Type 316 stainless-steel lifting bail that is an integral part of the pump. A suitable AISI Type 316 stainless-steel chain hook shall be provided at the top of the basin.

## 2.05 MISCELLANEOUS

- A. All metal fabrications, hangers, and hardware in the lift station shall be AISI Type 316 stainless steel.

## 2.06 ANCHOR BOLTS

- A. Discharge connection anchor bolts shall be AISI Type 316 stainless-steel epoxy anchors, not less than 3/4-inch diameter, designed for embedment in the concrete wet well floor. The anchor bolts and positioning templates shall be furnished by the pump manufacturer. All other anchor bolts shall be AISI Type 316 stainless-steel epoxy anchors.

## PART 3 EXECUTION

### 3.01 GENERAL

- A. Pumps, guide rails, and appurtenances shall be installed as indicated, in accordance with the Drawings and the manufacturer's instructions. The Contractor shall provide services required to install the pumps, piping, and accessories and perform wiring to connect pumps, level sensors, etc., with the control panel and the existing control panel with power as required to place the pumping system in service in accordance with requirements of the Contract Documents, all local codes, and NFPA 70.
- B. Each discharge base shall be leveled, plumbed, aligned, and wedged into position to fit connecting piping. Installation procedures shall be as recommended by the pump manufacturer and Hydraulic Institute Standards.

### 3.02 PAINTING

- A. All painting and associated work shall be performed in accordance with the paint manufacturer's recommendations for the particular application.

### 3.03 TESTS

Commercial testing shall be required and include the following:

- A. The pump shall be visually inspected to confirm that it is built in accordance with the specification as to HP, voltage, phase, and hertz.
- B. The motor and seal housing chambers shall be hi-potted to test for moisture content and/or insulation defects.
- C. The pump shall be allowed to run dry to check for proper rotation.
- D. Discharge piping shall be attached, the pump submerged in water, and amp readings shall be taken in each leg to check for an imbalanced stator winding. If there is a significant difference in readings, the stator windings shall be checked with a bridge to determine if an unbalanced resistance exists. If so, the stator will be replaced.

### 3.04 FIELD REPRESENTATIVE

- A. A representative of the submersible centrifugal non-clog pump manufacturer hired by the Contractor shall inspect the pump installation and direct the startup of the station and shall instruct representatives of the Owner in startup and operation

procedures. The Contractor shall procure the services of a representative of the submersible centrifugal non-clog pump manufacturer for the following:

1. A minimum of 1 full day on site to inspect, adjust, and test the pump station installations and provide certification as specified and to train representatives of the Owner in the operation, maintenance, and repair of the pumps, control panel, and related appurtenances.
  2. A minimum of 1 full day on site to place the pump station in operation to demonstrate compliance with requirements of the Contract Documents.
- B. The manufacturer's services specified represent an absolute minimum acceptable level of service and are not intended to limit the responsibilities of the Contractor to comply with all requirements of the Contract Documents. The Contractor shall procure, at no additional cost to the Owner, all services required, including additional or extended trips to the job site by the manufacturer's representative to comply with these requirements.

END OF SECTION

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**DIVISION 13**  
**SPECIAL CONSTRUCTION**

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SECTION 13121  
PRE-ENGINEERED METAL BUILDING

PART 1 GENERAL

1.01 DESCRIPTION

- A. Contractor shall furnish all labor, and materials for the installation of a manufacturer designed of prefabricated metal buildings as specified herein and as shown on the Drawings.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 09900, Painting and Coating.

1.03 SUBMITTALS

- A. Submit shop drawings in accordance with the General Conditions, Section 01330, Submittals and Acceptance, and the following:
  - 1. Submit letter of certification identifying the metal building manufacturer is IAS (AC472) certified fabricator and that all building components will be designed in accordance with the current edition of the IBC Building Code.
  - 2. Submit certification that the metal building manufacturer has been in business for at least 10 years and has designed and supplied at least five buildings similar to the specified project building. Include names of owners and locations for the referenced buildings.
  - 3. Submit manufacturer's catalog data describing the building construction and components. Submit project-specific design and erection drawings, shop painting and finishing specifications, instruction manuals, and other data to describe the design, materials, sizes, layouts, construction details, fasteners, and erection.
  - 4. Submit engineering design calculations for structural members and covering components, bracing, equipment supports, and anchor bolts. Submit the stress values utilized in the analysis stating the design criteria and procedures used. Design calculations shall be signed by a civil engineer registered in the state of Florida.
  - 5. Submit certificate that the design meets the specified building codes.
  - 6. Submit erection drawings and diagrams for each building. Submit calculations verifying the base anchor/foundation assemblies indicated in the drawings are adequate to accommodate the project-specific metal building reactions. Show column base anchor details and anchor bolt sizes. Show roof and wall bracing.

7. Submit color charts of the colors available for wall and roof panels, however, contract to include the cost to custom color match owners' preferred color for exterior wall panels.

#### 1.04 WORK SEQUENCE (NOT USED)

- A. Contractor shall not erect the building until the Skid Mounted Belt Filter Press is in-place.

#### 1.05 QUALITY ASSURANCE

- A. Modifications to the manufacturer's standard design may be required to meet these Specifications. Equipment not complying with the material integrity established by these Specifications will not be acceptable as determined by the Engineer.
- B. All of the building materials, equipment, and accessories specified in this Section shall be furnished by a single manufacturer and shall be standard units of proven ability as manufactured by a competent organization that is fully experienced, reputable, and qualified in the manufacture of the building to be furnished.

#### 1.06 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.
- B. Buildings shall be guaranteed against water leaks arising out of or caused by ordinary wear and tear by the elements for a period of 5 years. Such guarantee is in addition to the guarantee required in the General Conditions and shall start upon final acceptance of the work by the Owner.
- C. Performance Warranty: Metal roof system and flashing shall be warrantied for weathertightness for a period of 20 years. Warranty shall include coverage for faulty workmanship, defective materials including sealants and fasteners, and water infiltration.
- D. Special Warranty on Metal Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period, ABC Standard.
- E. Finish Warranty Period: 20 years from date of Substantial Completion.

## 1.07 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, and in this Section for storing and protecting the equipment specified in this Section.

## 1.08 QUALIFICATIONS

- A. The manufacturer shall have a minimum of five installations in Florida that are similar to the application as specified in this Section. The Engineer shall reserve the right to determine if previous installations by the manufacturer are similar to the application specified in this Section.
- B. The Contractor shall furnish documentation that the manufacturer meets these qualifications as part of the submittals specified in Section 01330, Submittals and Acceptance.

## 1.09 SPARE PARTS

- A. Provide a minimum of 5% excess over the required amount of nuts, bolts, screws, washers, and other required fasteners with each building. Provide separate boxes for the parts for each building. Label each box with the name of the building to which it pertains; the building manufacturer's name; and the local representative's name, address, and telephone number. Provide individual boxes for each item (nuts, bolts, washers, etc.).

## PART 2 MATERIALS

### 2.01 MANUFACTURERS

- A. Prefabricated metal buildings shall be manufactured by:
  - 1. American Buildings.
  - 2. Butler.
  - 3. Varco-Pruden.
  - 4. Approved equal.

### 2.02 DESIGN CRITERIA

- A. Buildings shall be of the size and shape shown, complete with all accessories.
- B. The design of the building and components shall be in accordance with Metal Building Manufacturer's Association's "Metal Building Systems Manual," latest edition, and the IBC Building Code.
- C. Design building for the dead load, specified live load, and the combinations of these loads as specified below. Reduction of loads due to tributary loaded area is

permitted only for the rigid frames. Include the following loads in addition to the dead load:

1. Roof Live load: 20 psf
  2. A uniform collateral load of 3 psf in addition to the dead load of the building.
  3. Weights of mechanical equipment and process piping supported by the structure if greater than 3 psf.
  4. Wind load: See Design Drawings.
- D. Rigid frame shall consist of welded up plate section columns and beams complete with necessary splice plates for bolted field assembly.
- E. End rigid frames shall be the same as interior rigid frames and shall be designed and detailed to be expandable for future construction.
- F. Design structural steel members in accordance with AISC publication, "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings." Design structural cold-formed steel framing members in accordance with AISI publication, "Specification for the Design of Cold-Formed Steel Structural Members."
- G. Purlins and Girts shall be 8 in. minimum deep "Z" sections, precision roll formed.
- H. Eve struts shall be 8in. minimum deep "C" sections.
- I. All columns shall be designed as "Pin" connected. Moment transfer to footings will not be allowed.
- J. The building foundation plan is a preliminary design, the foundation design will be reviewed by the engineer once the Prefabricated Metal Building submittal is approved.
- K. Design framed openings to replace structurally the covering and framing displaced.
- L. Welding of steel shall be in accordance with AWS D1.1.
- M. Except as modified hereinafter, design steel covering in accordance with AISI publication "Specification for the Design of Cold-Formed Steel Structural Members."
- N. Maximum wind load deflection for Primary Framing shall not exceed 1/60 of the eave height of the building.
- O. Maximum wind load deflection for wall sheets shall not exceed 1/180 of the span between supports, and maximum live load deflection for roof sheets shall not

exceed 1/180 of the span between supports. Maximum deflections shall be based on sheets continuous across two or more supports with sheets unfastened and fully free to deflect.

## 2.03 BRACING

- A. Provide roof bracing. Design bracing for controlling wind or seismic load combinations. Brace compression flanges of structural members as required by the code.

## 2.04 ASSEMBLY AND DISASSEMBLY

- A. The size of the prefabricated components and the field connections required for erection shall permit easy assembly and disassembly by means of the building manufacturer's standard fasteners and construction tools. The maximum size of any shop-assembled component of the building shall permit transportation from factory to site by commercial carrier.
- B. Clearly and legibly mark each and every piece and part of the assembly to correspond with previously prepared erection drawings, diagrams, and/or instruction manuals.

## 2.05 EXTERIOR COVERING COMPONENTS—STEEL

- A. Roof Covering shall be standing seam with minimum 26-gauge Galvalume steel sheeting conforming to ASTM A792, factory color finished. Panels shall have two major corrugations, 2 inches high, not exceeding 24 inches.
- B. Wall Covering shall be rib panel with minimum 26-gauge Galvalume steel conforming to ASTM A792, Galvalume, factory color finished.

## 2.06 ACCESSORIES

- A. Flashing, trim, metal closure strips, caps, and similar metal accessories shall be not less than the minimum thicknesses specified for covering. Molded closure strips shall be bituminous-saturated fiber, closed-cell or solid-cell synthetic rubber or neoprene, or PVC premolded to match configuration of the covering.
- B. Gutters, downspouts, and trim pieces are to be the manufacturer's standard products installed in accordance with manufacturer's instructions and as shown on the erection drawings.

## 2.07 DISSIMILAR METAL ISOLATION

- A. Coat steel in contact with aluminum or aluminum-coated steel covering or provide rubber or nylon gaskets between steel and aluminum surfaces.

## 2.08 FASTENERS

- A. All structural framing shall utilize high-strength (H-S) bolts. H-S bolts, nuts, and washers shall conform to ASTM A325, Type 1 galvanized, ASTM A563, and ASTM F436, respectively. All hardware shall be galvanized.
- B. Provide gasketed washers of a material compatible with the covering and with a minimum diameter of 3/8 inch for structural connections to waterproof the fastener penetration on the exterior side. Gasketed portion of washers shall be neoprene or other equally durable elastomeric material approximately 1/8 inch thick. Exposed wall fasteners shall be factory color finished or provided with plastic color caps to match the covering.

## 2.09 PAINTING OF ROOF PANELS

- A. Color finish roof covering at the factory on exterior side. Interior side shall receive a siliconized polyester finish. Prepare surfaces for coating by thoroughly cleaning, pretreating, and priming (if required by the finish coat) to provide a film that is compatible with the metal surface and the color finish. Treat galvanized steel surfaces per DOD-P-15328D. Clean surfaces of oil, grease, loose scale, and other foreign substances. Prime coat shall be in accordance with the manufacturer's standard system.
- B. Color finish shall consist of a Kynar 500/Hylar 5000 fluoropolymer coating.
- C. Dry-film coating thickness of the color coat shall be not less than 1.0 mil for exterior and interior surface finish. The exterior and interior finishing systems shall meet the quality standards specified in The Aluminum Association publication, "Aluminum Standards and Data," except that for salt spray resistance, exposure shall be 450 hours, and maximum undercutting from the scored line shall not exceed 1/8 inch. Colors shall be as selected by the Owner from manufacturer's standard colors.

## 2.10 FINISH OF GIRTS, PURLINS, BEAMS, COLUMNS, BRACING, AND EAVE STRUT

- A. Rigid frames and rod bracing shall be finished with System No. 15 as specified in Section 09900, Painting and Coating.
- B. Secondary framing (Girts, Purlins, eave strut, etc.) shall receive a G90 galvanized coating per ASTM A653.

## 2.11 INSULATION (NOT USED)

## 2.12 SEALANT

- A. Provide sealant of the type recommended by the building manufacturer at each joint.



## PART 3 EXECUTION

### 3.01 STORAGE AND PROTECTION

- A. Deliver, store, handle, and erect prefabricated components, sheets, panels, and other manufactured items such that they will not be damaged or deformed. Stock materials stored on the site before erection on platforms or pallets and cover with tarpaulins or other weathertight covering. Store metal sheets or panels so that water will drain off. Upon arrival on the jobsite, remove moisture on sheets and panels, restack, and protect until used.
- B. Do not store the sheets or panels in contact with materials that might cause staining. Remove stained, discolored, or damaged sheets from the site.

### 3.02 ERECTION

- A. Determine anchor bolt layouts before pouring concrete footings, walls, or slabs to support the buildings.
- B. Erect in accordance with the manufacturer's erection instructions and drawings and the requirements herein. Plug improper or mislocated drill holes with an oversize screw fastener and gasketed washers. Do not use sheets with an excess of such holes or with such holes in critical locations. Keep exposed surfaces clean and free from sealant, metal cuttings, and other foreign materials.
- C. Accurately set anchor bolts by template while the concrete is in a plastic state. Provide uniform bearing under baseplates and sill members using nonshrink grout. Accurately space members to assure proper fitting of covering. As erection progresses, securely fasten the work and brace to resist vertical loads and horizontal wind or earthquake loads.
- D. Apply wall covering with the longitudinal configurations in the vertical position. Apply roof covering with the longitudinal configurations in the direction of the roof slope.
- E. Except for self-framing buildings, make end laps over framing members with fasteners into framing members approximately 2 inches from the end of the overlapping sheet. Side lap distances, end lap distances, joint sealing, and spacing of fasteners shall be in accordance with the manufacturer's standard practice insofar as the maximum fastener spacing specified is not exceeded and provided such standard practice will result in a structure that will be free from water leaks and meet design requirements.
- F. Spacing of fasteners shall present an orderly appearance and shall not exceed 8 inches on center at end laps of covering, 12 inches on center at connection of covering to intermediate supports, 12 inches on center at side laps of roof coverings, and 18 inches on center at side laps of wall covering. Install fasteners in straight lines within a tolerance of 1/2 inch in the length of a bay.

- G. Seal side laps and end laps of roof and wall covering and joints at accessories. Drive fasteners normal to the surface and to a uniform depth to properly seat the gasketed washers. Fasten accessories into framing members.
- H. Insulate incompatible dissimilar materials that are in contact by means of gaskets or insulating compounds.

### 3.03 FIELD PAINTING

- A. Touch up galvanized coated or painted surfaces as needed in the field to eliminate any rust and provide a finished surface as intended per Section 09900, Painting and Coating

END OF SECTION

## SECTION 13300

### INSTRUMENTATION AND CONTROL FOR PROCESS SYSTEMS

#### PART 1 – GENERAL

##### 1.01 DESCRIPTION

###### A. Scope:

1. CONTRACTOR shall provide all labor, materials, equipment, and incidentals as shown, specified, and required to furnish, install, calibrate, test, start-up, and place in satisfactory operation a complete and operating instrumentation and control system.
2. The Work includes, but is not limited to, the following:
  - a. Panels and panel mounted instruments.
  - b. Field mounted instruments.
  - c. Programmable logic controllers (PLC) and software.
  - d. Uninterruptible power supply.
  - e. Network communication hardware and software required for interfacing various systems to provide one fully integrated system.

###### B. Coordination:

1. Instrumentation and Controls:
  - a. The Work involves multiple participants who will provide related materials, equipment, or services to place the Dewatering Facility Control and Monitoring System (DFCMS) into satisfactory operation. Programming of control logic and configuration of operator interface terminal (OIT) is part of the Work. The DFCMS supplier will provide and program the new Belt Filter Press Control panel. The DFCMS supplier will program the new OIT provided by the city. The Instrumentation System Supplier (ISS) will provide the instrumentation, existing control panel modifications and communications interconnections between control panels. Functional description of process system and associated equipment is included in Article 2.7 of this Section.
  - b. Some panels and equipment are furnished under other Specification Sections under this Contract. Coordinate with Suppliers of these panels and equipment to provide fully functional system in accordance with the Contract Documents and that interfaces with the main PLC provided with the Dewatering Facility equipment, located in 115-CP- 1.
  - c. Integration into existing SCADA system is not included in the Work. OWNER will integrate new I/O and modify existing SCADA screens at a later time TBD.
  - d. Computer system input/output list identifies inputs and outputs required

and is part of this Section. Input/output list is for coordinating signals between equipment provided by other Suppliers and DFCMS

Supplier, and identifying signals to be integrated into SCADA by OWNER at a later time TBD. Include Work for CONTRACTOR-furnished control options not on the input/output list at no additional cost to OWNER.

2. To centralize responsibility, materials and equipment provided under this Section shall be furnished by a single Supplier.
3. With CONTRACTOR, Supplier shall assume the responsibility for adequacy and performance of materials and equipment provided under this Section.
4. To the greatest extent possible, provide materials and equipment from a single manufacturer.
5. Supplier's Responsibilities:
  - a. Preparing all instrumentation and control equipment submittals in accordance with the Contract Documents.
  - b. Proper interfacing of instrumentation and control equipment with field equipment, instruments, devices, and panels, including required interfacing with packaged control systems furnished by other equipment Suppliers, and required interfacing with the Site's electrical system.
  - c. Review and coordination with manufacturers, Suppliers, and other contracts of Shop Drawings and other CONTRACTOR submittals for equipment, valves, piping, and appurtenances for ensuring proper interfacing of hardware, and locations and installation requirements of inline devices and instrument taps.
  - d. Direct, detailed oversight of installation of instruments, panels, consoles, cabinets, wiring and other components, and related wiring and piping connections.
  - e. Calibrating, source quality control, field quality control, and start-up of the system.
  - f. Responsibility for correction period obligations for instrumentation and control system.
  - g. Training of operations and maintenance personnel in operation and maintenance (including calibration and troubleshooting) of the instrumentation and control system.

C. Related Sections:

1. Section 11350, Belt Filter Press.
2. Section xxxx, Identification for Electrical Systems.
3. Section xxxx, Low-Voltage Variable Frequency Drives
4. Section xxxx, Low-Voltage Combination Magnetic Motor Starters

## 1.02 REFERENCES

A. Standards referenced in this Section are:

1. ANSI/ASQ Z1.4, Sampling Procedures and Tables For Inspection By Attributes.
2. ASTM A269, Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.
3. ASTM A312, Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
4. ASTM A403, Specification for Wrought Austenitic Stainless Steel Piping Fittings.
5. ASTM B88, Specification for Seamless Copper Water Tube.
6. IEEE 802.1 LAN/MAN Bridging & Management
7. IEEE 802.1X, Port Based Network Access Control.
8. IEEE 802.3, Standards Defining Physical Layer and Data Link Layer Media Access Control (MAC) Sublayer of Wired Ethernet
9. ISA 5.1, Instrumentation Symbols and Identification.
10. ISA 5.4, Instrument Loop Diagrams.
11. ISA 20, Specification Forms for Process Measurement & Control Instruments, Primary Elements & Control Valves.
12. ISO 8802-3, Information Technology - Telecommunications and Information Exchange Between Systems - Local and Metropolitan Area Networks - Specific Requirements - Part 3: Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications.
13. NEMA 250, Enclosures for Electrical Equipment (1000 Volts Maximum).
14. NFPA 70 (NEC), Article 770, Optical Fiber Cables and Raceways.
15. NFPA 79, Electrical Standard for Industrial Machinery.
16. UL 50, Safety Enclosures for Electrical Equipment, Non-Environmental Considerations.
17. UL 508A, Industrial Control Panels.

### 1.3 QUALITY ASSURANCE

A. Qualifications:

1. Supplier:

- a. Shall be financially sound with at least five years continuous experience in designing, implementing, supplying, and supporting instrumentation and control systems for municipal wastewater treatment facilities comparable to the instrumentation and control systems required for the Project, relative to hardware, software, cost, and complexity.
- b. Shall have record of successful instrumentation and control system equipment installations. Upon OWNER's request, submit record of experience listing for each project: project name, owner name and

- contact information, name and contact information for contractor, name and contact information for engineer or architect, approximate contract value of instrumentation and controls Work for which Supplier was responsible,
- c. Shall have at time of Bid experienced engineering and technical staff capable of designing, supplying, implementing, and supporting the instrument and control system and complying with submittal and training requirements of the Contract Documents.
  - d. Shall be capable of training operations and maintenance personnel in instrumentation and control applications, and in operating, programming, and maintaining the control system and equipment.
  - e. Shall have UL-approved panel shop.
2. Manufacturer: Manufacturers of instrumentation and control equipment furnished under this Section shall be experienced producing similar equipment and shall have the following qualifications:
- a. Shall manufacture instrumentation and control system components that are fully-developed, field-proven, and of standardized designs.
  - b. Shall have system of traceability of manufactured unit through production and testing in accordance with ANSI/ASQ Z1.4.
  - c. Shall have guaranteed availability clause (99.99 percent, minimum for one year) for microprocessor-based components and appurtenances.
  - d. Shall have documented product safety policy relevant to products proposed for the Work.

#### 1.04 SUBMITTALS

##### A. Action Submittals: Submit the following:

- 1. Shop Drawings:
  - a. Field Instruments:
    - 1) Manufacturer's product name and complete model number of devices proposed for use, including manufacturer's name and address.
    - 2) Instrument tag number in accordance with the Contract Documents.
    - 3) Data sheets and manufacturer's catalog literature. Provide data sheets in accordance with ISA 20 and annotated for features proposed for use. For instruments not included in ISA 20, submit data sheets using a format similar to ISA 20.
    - 4) Description of construction features.
    - 5) Performance and operation data.
    - 6) Installation, mounting, and calibration details; instructions and recommendations.
    - 7) Service requirements.
    - 8) Dimensions of instruments and details of mating flanges and locations of closed tanks, pipe sizes for insertion instruments, and upstream/downstream straight run pipe lengths required.

- 9) Range of each device and calibration information
- 10) Descriptions of materials of construction and listing of NEMA ratings for equipment
- b. Panels, Consoles, and Cabinets:
  - 1) Layout drawings that include:
    - a) Front, rear, and internal panel views to scale.
    - b) Tag number and functional name of components mounted in and on panel, console, or cabinet, as applicable.
    - c) Product information on panel components.
    - d) Nameplate location and legend including text, letter size and colors to be used.
    - e) Location of anchorage connections.
    - f) Location of external wiring and piping connections.
    - g) Mounting and installation details, coordinated with actual application.
    - h) Proposed layouts and sizes of operator interface graphic display panels and alarm annunciator panels.
    - i) Calculations for heating and cooling of panels
    - j) Subpanel layouts and mounting details for items located inside control panels.
  - 2) Product information on panel components including:
    - a) Manufacturer's product name and complete model number of devices being provided, including manufacturer's name and address.
    - b) Instrument tag number in accordance with the Contract Documents.
    - c) Data sheets and catalog literature. Submit data sheets as shown in ISA 20 and annotated for features proposed for use. For instruments not included in ISA 20, submit data sheets with format similar to ISA 20.
    - d) Description of construction features.
    - e) Performance and operation data.
    - f) Installation, mounting, and calibration details; instructions and recommendations.
    - g) Service requirements
  - 3) Wiring and piping diagrams, including the following:
    - a) Name of each panel, console, or cabinet.
    - b) Wire sizes and types.
    - c) Pipe sizes and types.
    - d) Terminal strip and terminal numbers.
    - e) Wire color coding.
    - f) Functional name and manufacturer's designation for components to which wiring and piping are connected.
    - g) Lightning and surge protection grounding.

- 4) Electrical control schematics in accordance with NFPA 79. Drawings shall be in accordance with convention indicated in Annex D of the NFPA 79. Typical wiring diagrams that do not accurately reflect actual wiring to be furnished are unacceptable. Tables or charts for describing wire numbers are unacceptable.
  - 5) Stock list or bill of materials for each panel including tag number, functional name, manufacturer's name, model number and quantity for components mounted in or on the panel or enclosure.
  - 6) Detail showing anchorage plan of wire bundles between subpanels and front panel mounted devices.
- c. Field wiring and piping diagrams, include the following:
- 1) Wire and pipe sizes and types.
  - 2) Terminal numbers at field devices and in panels.
  - 3) Fiber optic termination designations in the field and in panels.
  - 4) Color coding.
  - 5) Conduit numbers in which wiring will be located.
  - 6) Locations, functional names, and manufacturer's designations of items to which wiring or piping are connected.
- d. DFCM System:
- 1) Submit the following general information:
    - a) Detailed block diagram showing system hardware configuration and identifying model numbers of system components.
    - b) Software listings for operating system, applications, and HMI.
    - c) Software language and organization.
  - 2) Hardware:
    - a) Layout drawings showing front, rear, end and plan views to scale of equipment, I/O components, power supplies, and peripheral devices.
    - b) Equipment ventilation requirements.
    - c) Interconnection diagrams, including termination details, cable identification list, and cable length.
    - d) Drawings showing equipment layout.
    - e) Installation requirements, instructions, and recommendations.
  - 3) Software:
    - a) Licensing agreement with name of licensee, renewal requirements, release and versions, expiration dates (if any) and upcoming releases scheduled before Project completion. When upcoming releases are expected, provide descriptions, when available, of features that differ from the proposed release.
    - b) Standard technical and instructional documentation covering software for utility, system support, system documentation, display, communications, data logging and storage and diagnostic functions. Submit this information on electronic media.
    - c) Standard technical documentation covering all aspects of the computer system software functions and capabilities, including



instruction set description and programming procedures related to monitoring, display, logging, reporting and alarming functions.

- 4) Documentation describing memory type, size and structure and listing size of system memory, I/O and Data Table memory and size of memory available for control programs.
- 5) System I/O Loop Wiring Diagrams: (a) Prepare Shop Drawings on module-by-module basis and include the following information:
  - a) Rack numbers, module type and slot number, and module terminal point numbers. Include location and identification of intermediate panel and field terminal blocks and terminal numbers to which I/O wiring and power supply wiring is connected. Identify power supply circuits with designation numbers and ratings.
  - b) Wiring types, wire numbers, and color coding.
  - c) Designation of conduits in which field I/O wiring will be installed.
  - d) Location, functional name, tag numbers and manufacturer's module numbers of panel and field devices and instruments to which I/O wiring will be connected.
  - e) Prepare loop wiring diagrams in accordance with ISA 5.4.
- e. Complete point-to-point interconnection wiring diagrams of field wiring associated with the system. Diagrams shall include the following:
  - 1) Field wiring between each equipment item, panel, instruments, and other devices, and wiring to control stations, panelboards, and motor starters. Some of this equipment may be specified in other Divisions, CONTRACTOR is responsible for providing complete point-to-point interconnection wiring diagrams for control and monitoring of that equipment.
  - 2) Numbered terminal block and terminal identification for each wire termination.
  - 3) Identification of assigned wire numbers for interconnections. Assign each wire a unique number.
  - 4) Schedule showing the wiring numbers and the conduit number in which the numbered wire is installed.
  - 5) Junction and pull boxes through which wiring will be routed.
  - 6) Identification of equipment in accordance with the Contract Documents.
2. Product Data:
  - a. Product data for field instruments in accordance with requirements for Shop Drawings in this Section.
  - b. Product data for panels, consoles, and cabinets in accordance with requirements for Shop Drawings in this Section.

- c. Product data for field wiring and piping provided for instrumentation and control service and not included under other Sections or contracts.
  - 3. Factory Acceptance Test Procedure: Submit factory testing procedures that will be performed to fulfill requirements of the Contract Documents. Test procedure shall include the following:
    - a. Visual inspection of components and assembly.
    - b. Description of hardware operational testing.
    - c. Description of software demonstration.
    - d. Description of testing equipment to be used.
    - e. Sign-off sheets to be used at time of testing.
- B. Informational Submittals: Submit the following:
- 1. Documents to be submitted prior to pre-construction conference, in accordance with Section 01 31 19.13, Pre-Construction Conference.
  - 2. System Software Documentation: Submit preliminary software documentation not later than four weeks prior to scheduled start of factory testing. Software documentation shall include the following:
    - a. Complete printed copies of all programming.
    - b. Complete listing of external and internal I/O address assignments, register assignments and preset constant values with function point descriptions. List unused/undefined I/O and data table registers available.
    - c. Copies of all proposed OIT screens.
  - 3. Manufacturer's Instructions:
    - a. Shipping, handling, storage, installation, and start-up instructions.
  - 4. Source Quality Control Submittals:
    - a. Factory test reports and results.
  - 5. Special Procedure Submittals:
    - a. Submit notification to OWNER and ENGINEER at least 14 days before readiness to begin system checkout. Schedule system checkout on dates agreed to by OWNER and ENGINEER.
    - b. Submit written procedure for system checkout to OWNER three months prior to starting system checkout. Three months prior to starting system checkout submit written procedure for start-up to OWNER.
  - 6. Field Quality Control Submittals:
    - a. Submit the following prior to commencing system checkout and start-up.
      - 1) Completed calibration sheets for each installed instrument showing five-point calibration (0, 25, 50, 75, 100 percent of span), signed by factory-authorized serviceman.
    - b. Field calibration reports
    - c. Field testing reports.
  - 7. Supplier's Reports:
    - a. Installation inspection and check-out report.

- b. Submit written report of results of each visit to Site by Supplier's service technician, including purpose and time of visit, tasks performed, and results obtained. Submit within two days of completion of visit to the Site.
  - 8. Qualifications Statements:
    - a. Supplier.
    - b. Manufacturer, when required by OWNER.
- C. Closeout Submittals: Submit the following:
- 1. Operations and Maintenance Data:
    - a. Submit in accordance with Section 01 78 23, Operation and Maintenance Data.
    - b. Include complete up-to-date system software documentation. Provide hardcopy and electronic copies.
    - c. Include acceptable test reports, maintenance data and schedules, description of operation, wiring diagrams, and list of spare parts recommended for one year of operation with current price list.
  - 2. Record Documentation:
    - a. Prepare and submit record documents in accordance with Section 01 78 39, Project Record Documents.
    - b. Revise all system Shop Drawing submittals to reflect as-built conditions in accordance with the following.
      - 1) Two copies of each revised Shop Drawings and documentation to replace out-dated drawings and documentation contained in operation and maintenance manuals. Submit half-size black line drawings for each drawing larger than 11 inches by 17 inches. Include specific instructions for out-dated drawing removal and replacement with record documents submittal.
      - 2) Half-size black line prints of wiring diagrams applicable to each control panel shall be placed in clear plastic envelopes and stored in a suitable print pocket or container inside each control panel.
      - 3) Submit CADD drawings of the point-to-point interconnection wiring diagrams updated to reflect final as-built equipment information and as-installed field installation information.
- D. Maintenance Materials Submittals: Submit the following:
- 1. Spare Parts and Test Equipment
    - a. General
      - 1) Furnish the spare parts and test equipment as indicated below, identical to and interchangeable with similar equipment provided under this Section.
      - 2) Provide source quality control for spare parts as part of factory testing prior to shipment of instrumentation and control equipment.
      - 3) For process sensors and other analog instruments, Supplier shall submit a separate quotation for recommended list of spare parts and

test equipment. Separately list and price each item recommended. Spare parts quotation shall include a statement that prices quoted are valid for a period of one year from date of equipment installation and that Supplier understands that OWNER reserves the right to purchase none, any, or all parts quoted. Upon request, Supplier shall submit documentation that stock of spare parts and test equipment is obtainable within 48 hours of receipt of OWNER's order.

- b. Furnish the following spare parts:
    - 1) Five of each type of input/output relay for each quantity of forty or fraction thereof provided under the Contract.
    - 2) One of each type of PLC input/output module or card used.
    - 3) One replacement power supply for each type and size provided under the Contract.
    - 4) One-year supply of all expendable or consumable materials.
    - 5) One per quantity of five or fraction thereof of gauges, indicators, and switches provided, complete with diaphragm seals, filled and ready to use.
    - 6) One per quantity of ten or fraction thereof provided, per range of field instruments including insertion type instruments. No spares are required for inline instruments such as magnetic flow meters and flumes or venturis that include flow tubes through which flow is conveyed.
    - 7) Twelve of each type and size of fuse used in instruments.
  - c. Furnish the following test equipment:
    - 1) One thermocouple calibrator, including case.
2. Software:
- a. Submit copies of programming and configuration files developed specifically for the Project in accordance with Section 01 78 23, Operations and Maintenance Data.

## 1.05 STORAGE AND HANDLING

- A. Prior to packaging, each manufacturer or Supplier shall securely attach tag number and instructions for proper field handling and installation to each instrument.
- B. Comply with Section 01 65 00, Product Delivery Requirements, and Section 01 66 00, Product Storage and Handling Requirements.

## PART 2 – PRODUCTS

### 2.01 SYSTEM REQUIREMENTS

- A. General:
  - 1. Furnish 480-volt, 3-phase, 60 Hertz power feeder to belt filter press control panel. Include main disconnect switch, transformer(s), and circuit breaker load center for all 120-volt panel power requirements.
  - 2. Separate all 120-volt devices from 480-volt devices.
  - 3. Install SCR controllers, if provided, within belt filter press control panel and provide with individual circuit breaker or fused-type disconnect switches and contactors. Provide suitably sized transformers to provide proper power and control voltage for SCR controllers.
  - 4. Provide mechanical, variable speed, AC drives, if furnished, with circuit breaker combination-type starters for each drive, including control power transformers of suitable size with all necessary relays and timers provided within main control panel, 115-CP-1. Provide all “start/stop” pushbuttons, indicating lights, speed indicating motors, control logic relays, and other controls in belt filter press control panel.
  - 5. Panel devices shall conform to this Section.
- B. Controls, Instruments, and Devices:
  - 1. Arrange belt filter press control panel to allow either manual or automatic control of belt filter press equipment. When “MANUAL” operation is selected, all equipment associated with belt filter press shall be controlled by “START/STOP” pushbuttons. When “AUTOMATIC” operation is selected, control of equipment shall be “AUTOMATIC/START” and “AUTOMATIC/STOP” pushbuttons, and programmable controller:
    - a. Belt filter press control panel shall include the following:
      - 1) One control mode selector switch marked “AUTOMATIC/MANUAL.” When “MANUAL” operation is selected, all equipment associated with belt filter press shall be controlled by “START/STOP” pushbuttons. Provide one “START” and one “STOP” pushbutton for each of the following:
        - a) Belt filter press drive.

- b) Hydraulic power supply (provide with hydraulic belt tensioning system only).
  - c) Wash water pumps.
  - d) Sludge cake conveyor.
  - e) Sludge feed pumps.
  - f) Polymer feed pumps.
- 2) One speed potentiometer for manual adjustment of belt speed.
  - 3) “INCREASE” and “DECREASE” momentary pushbuttons for sludge feed pump speed and polymer feed pump speed adjustment.
  - 4) Digital indicators for sludge feed flow rate and polymer solution feed flow rate. Indicators shall accept 4 to 20 mADC field input and shall be calibrated in gpm and gph, respectively.
  - 5) One “MANUAL/OFF” selector switch for wash water solenoid valve operation.
  - 6) Green indicating lights for “RUNNING” status for each unit operated from panel, including wash water solenoid valve energized indication.
  - 7) Red indicating lights for “OFF” status for each unit operated from panel, including wash water solenoid valve de-energized indication.
  - 8) One each “AUTOMATIC/START” and one “AUTOMATIC/STOP” momentary pushbuttons, for automatically starting and stopping each belt filter press system. Sludge cake conveyor shall be manually controlled when belt filter press control mode selector switch is in either the “AUTOMATIC” or “MANUAL” position.
  - 9) One “EMERGENCY STOP” red mushroom.
  - 10) One “ENABLE/DISABLE” selector switch for overriding cake thickness monitoring switch.
  - 11) One programmable logic controller with I/O rack power supply, I/O cards, and cabling for controlling belt filter press and associated equipment.
  - 12) Control for hydraulic pump motor (provide with hydraulic belt tensioning system only).
    - a) One “MANUAL/OFF” selector switch.
    - b) One red indicating light for “OFF” status.
    - c) One green indicating light for “RUNNING” status.
    - d) One amber indicating light for “LOW HYDRAULIC FLUID” pressure alarm.

C. Power Supplies:

1. Electrically powered equipment and devices shall be suitable for operation on 115-volt plus-or-minus 10 percent, single-phase, 60 Hertz plus-or-minus two Hertz, power supply. If different voltage or closer regulation is required, provide suitable regulator or transformer at no additional cost to OWNER.

2. Provide appropriate power supplies for field instruments requiring power source less than 115 volts. Power supplies shall be mounted in control panels or enclosures installed near associated instrument or in field panels.
  3. Power supplies shall be capable of minimum of 130 percent of maximum simultaneous current draw.
  4. Provide power on-off switch or air circuit breaker for each item provided under this Section that requires electric power.
- D. Signal Requirements:
1. Control system shall use four to 20 mA DC analog signals, unless otherwise shown or indicated.
  2. Provide signal converters and repeaters where required. Adequately size power supplies for signal converters and repeater loads.
  3. Isolate signals from ground.
  4. Signals transient DC voltage shall not exceed 300 volts over one millisecond, and shall not have a DC component over 300 volts.
  5. Discrete signals shall use 120 vac.
- E. Surge Protection Requirements:
1. Provide surge protection to protect electronic instrumentation and control systems from surges propagating along signal and power supply cabling. Protection systems shall be such that the protection level shall not interfere with normal operation, but shall be lower than instrument surge withstand level, and be maintenance-free and self-restoring.
  2. Provide instruments in suitable metallic cases, properly grounded. Ground wires for surge protectors shall be connected to good earth ground and, where practical, run each ground wire individually and insulated from other wires. Mount protectors within instrument enclosure or in separate junction box compatible with the area designation coupled to the enclosure.
- F. Miscellaneous:
1. General:
    - a. Instrumentation components shall be heavy-duty types, constructed for continuous service.
    - b. System shall consist of equipment models currently in production.
    - c. Materials and equipment, including cabling and interconnections, shall be in accordance with Division 26, Electrical, and manufacturer's recommendations, unless indicated otherwise in the Contract Documents.
    - d. Materials and equipment shall, where applicable, be in accordance with UL standards and be so marked and labeled.
  2. Logic and control loops shall be fail-safe. Instrumentation components shall return automatically to accurate measurement within 15 seconds upon restoration of power after power failure and when transferred to standby power supply.

3. Provide surge protection for instruments and other control system components that could be damaged by electrical surges. Provide lightning arresters on both ends of communication lines, except for fiber optic cabling, external to buildings or structures, including leased telephone lines and similar communication lines.
4. Field-mounted instruments and system components shall be constructed for use in humid and corrosive service conditions. Field-mounted instrument enclosures, junction boxes and appurtenances shall have NEMA rating appropriate for hazardous rating requirements shown or indicated on electrical Drawings, instrument data sheets, and elsewhere in the Contract Documents.
5. Miscellaneous hardware such as fittings, fasteners, and screws, be Type 316 stainless steel or other appropriate material to prevent galvanic reactions, and shall be suitable for service intended. Piping stands shall be provided for fastening instruments as required. Provide threaded pipe stands with flange bolted to slab. Use carbon steel piping and flanges painted in accordance with Section 09 91 00, Painting.
6. Data processing equipment and relays with interconnections to field devices shall be wired through field wiring terminal blocks in the panel. Terminals as part of relay base are unacceptable.
7. Arrange panel-mounted instruments, switches, and other devices ergonomically for functional use and ease of maintenance. Similar types of panel-mounted devices shall be by one same manufacturer and of the same model line.
8. Equipment furnished shall be of modular construction and be capable of field expansion through installation of plug-in circuit cards and additional cabinets as necessary.
9. Field- and panel-mounted instruments shall be tagged with equipment number and nomenclature indicated in the Contract Documents; if not so indicated, tag in accordance with approved Shop Drawings.
10. Coordinate ranges and scales specified in the Contract Documents with manufacturer of the equipment actually furnished for operability over the intended range. Complete the coordination prior to submitting Shop Drawings to OWNER.
11. Treat field-mounted devices with anti-fungus spray.
12. Protect field-mounted devices from exposure to high and freezing temperatures to provide complete operability under the environmental conditions indicated in the Contract Documents.

G. Environmental Conditions:

1. Provide control system suitable for continuous operation under the following conditions:
  - a. Outdoor Instruments
    - 1) Ambient Temperature: -15 degrees F to 120 degrees F.
    - 2) Relative Humidity: 100 percent, maximum.



2. Protect outdoor-mounted field instruments from direct sunlight by providing sunshade for instruments. Construct sunshade out of non-corrosive material. Sunshade shall withstand wind velocity of 140 miles per hour.

## 2.02 PROCESS TAPS, SENSING LINES, AND ACCESSORIES

### A. Water Pressure Sensing Lines and Accessories for Flow and Pressure Transmitters:

1. Material: Copper water tubing, ASTM B88, Type L, drawn temper or annealed.
2. Pressure Rating: Same as connecting pipe..
3. Size: 1/2-inch O.D. for water.
4. Connections: Brass compression type.
5. Shut-off Valves:
  - a. Type: Ball.
  - b. Pressure Rating: Same as connecting pipe .
  - c. Body, Ball, and Stem: Brass.
  - d. Packing: High-density Teflon.
  - e. Handle: Nylon with metal travel stops.
  - f. Support Rings: TFE coated brass.
  - g. End Connections: Removable.
6. Manifolds:
  - a. Type: Five-valve and three-valve meter manifolds.
  - b. Materials: Type 316 stainless steel body, bonnets, and stems; delrin seats; Teflon packing.
  - c. Manufacturers: Provide products of one of the following:
    - 1) Anderson-Greenwood.
    - 2) Swagelok by Crawford.
    - 3) Or equal.

### B. Air Pressure Sensing Lines and Accessories for Air Flow/Pressure Transmitters:

1. Material: Type 316 stainless steel tubing, ASTM A269, medium wall thickness.
2. Pressure Rating: Same as connecting pipe .
3. Size: 3/8-inch OD for air.
4. Connections: Type 316 stainless steel compression type.
5. Shut-off Valves:
  - a. Type: Ball.
  - b. Pressure Rating: Same as connecting pipe .
  - c. Body, Ball and Stem: Type 316 stainless steel.
  - d. Packing: High density Teflon.
  - e. Handle: Nylon with metal travel stops.
  - f. Support Rings: Teflon coated Type 316 stainless steel.
  - g. End Connections: Removable.
  - h. Products and Manufacturers: Provide one of the following:

- 1) Whitey Valves.
  - 2) Anderson Greenwood.
  - 3) Or equal.
6. Manifolds:
- a. Type: Five-valve and three-valve meter manifolds.
  - b. Materials: Type 316 stainless steel body, bonnets and stems; delrin seats; Teflon packing.
  - c. Products and Manufacturers: Provide products of one of the following:
    - 1) Anderson-Greenwood.
    - 2) Swagelok.
    - 3) Or equal.
- C. Pressure Tap Sensing Lines and Accessories for Pressure Gauges and Pressure Switches:
1. For Process Sensing Taps in Ductile Iron, Steel and Stainless Steel Piping Systems:
    - a. Material and Fittings: Type 304 stainless steel pipe, ASTM A312; and threaded fittings and adapters, ASTM A403.
    - b. Sizes: 1/2-inch diameter minimum for main sensing piping and 1/4-inch diameter gauge and switch connections.
    - c. Pressure Rating: Equal to or greater than the applicable system test pressure as specified in the Contract Documents.
    - d. Accessories:
      - 1) For applications not requiring diaphragm seals, provide separate 1/2-inch diameter Type 316 stainless steel threaded ball valve for each gauge and switch.
      - 2) For applications requiring diaphragm seals, provide separate 1/2-inch diameter threaded Type 316 stainless steel ball valve for seal process side shutoff.
  2. For Process Sensing Taps in Copper and Thermoplastic Piping Systems:
    - a. Pipe Material and Fittings: Use same type of pipe material and fittings as that used in the process piping system. Provide PVC and CPVC piping in accordance with Section 40 05 31, Thermoplastic Process Pipe.
    - b. Sizes: 1/2-inch diameter minimum for main process sensing piping and 1/4-inch diameter for gauge and switch connections.
    - c. Pressure Rating: Equal to or greater than the applicable system test pressure as specified in the Contract Documents.
    - d. Accessories:
      - 1) For copper piping system taps with or without seals, provide separate 1/2-inch diameter minimum threaded brass or bronze ball valve for each gauge and switch.
      - 2) For PVC and CPVC piping systems with or without diaphragm seals, provide separate 1/2-inch diameter threaded ball valve for process sensing line shutoff.

## 2.03 PANELS

### A. General Provisions:

1. Provide electrical components and devices, support hardware, fasteners, and interconnecting wiring and piping required to provide control panels complete and operational.
2. Locate and provide hardware so that connections can be easily made and there is ample room for servicing each item.
3. Prevent movement by adequately supporting and restraining devices and components mounted on or within panel.
4. Provide panels with sub-panels for installation of all internally mounted hardware.
5. Provide numbered terminal strips for terminating field wiring and wiring from other panels, unless otherwise shown or indicated.
6. Provide copper grounding studs for hardware requiring grounding.
7. Provide the following convenience accessories inside each panel:
  - a. One 120 vac, 20-amp duplex, grounding type receptacle.
  - b. One 120 vac fluorescent service light fixture with 20-watt lamp and protective plastic shield or appropriate wattage incandescent bulb for panels two feet by two feet and smaller.
  - c. One 120 vac snap switch, to turn on service light, mounted in outlet box with cover and located so that switch is easily accessible from access door.
  - d. Service light with switch and duplex receptacle shall have a dedicated circuit breaker.
8. Control of Environment (Except NEMA 7 Panels):
  - a. Provide 120 vac thermostatically-controlled fan-driven heater units to maintain stable temperature within enclosure to protect equipment from harmful effects of condensation, corrosion, and low temperatures inside panels.
  - b. Provide automatically controlled closed-loop heat exchangers or closed-loop air conditioners to maintain temperature inside each enclosure at optimum operating temperature rating of components inside the enclosure.
  - c. Each heat exchanger or air conditioner shall have a dedicated, properly-sized and -rated circuit breaker.
  - d. Submit supporting calculations as part of panel Shop Drawing submittal if panel equipment to comply with specified environmental requirements is proposed to be deleted as unnecessary.
9. Panels to be located in non-hazardous (non-classified) environments shall comply with UL 50 and UL 508A.
10. Panels to be located in hazardous (classified) environments shall comply with UL 698A and UL 2062.
11. Provide panels under this Section with 20 percent additional space requirements for future use. Install nothing in space reserved for future use.

12. CONTRACTOR is responsible for detailed layout and design of panels, in accordance with the Contract Documents. Base cutouts and design on instrument manufacturers' requirements.
13. Lower 12 inches of free standing panels shall be free of devices, including pendants and terminal strips, for ease of installation and maintenance.
14. For front-opening panels, install no device less than three feet above operating floor level, unless otherwise shown or indicated. For rear-opening panels, install no devices on the door.
15. Wire bundles between subpanels and front panel-mounted devices shall be anchored and protected from damage by opening and closing of panel door.
16. Do not locate front panel-mounted devices requiring manipulation by operating personnel, such as pushbuttons, hand switches, controllers, and similar devices, higher than 5.5 feet above finished floor.
17. Pendants located on either side of terminal strips shall have minimum clearance of 1.5 inches between pendant and terminal strip.
18. Provide three-inch high channel base assembly, drilled to mate panel to floor pad.
19. Provide easily-accessible pocket built into panel door to enclose "as built" panel wiring diagrams.
20. Panels shall be UL-listed.

B. Identification:

1. Provide laminated plastic nameplate for identification of panels. Use self-tapping stainless steel screws for fastening nameplates to panels. When self-tapping screws may degrade panel's NEMA rating, retain NEMA rating intact by using gaskets on each side of panel surface and use retaining plate on the panel back that is same size as nameplate. When gaskets and retaining plate are used, use full-penetration screws with nuts.
2. Panel identification nameplates shall have 1/2-inch high engraved letters.
3. Identify front panel-mounted devices with nameplates engraved with functional description of the device. Nameplate engraving shall be in accordance with the identification provided in the Drawings. .
4. Tag electric components and devices mounted within panels with high adhesive labels.
5. Identify terminal strips with nameplate engraved as "TB-XX" where "XX" is the numerical identification of terminal strip.
6. Identify terminals within each terminal strip with sequential numbers and wire numbers.
7. Internal panel wiring shall be color-coded and numerically identified with unique wire numbers affixed at each end of each wire. Color coding shall be in accordance with panel wiring color code table, below:

**Panel Wiring Color Code Table**

<b>Description</b>	<b>Color</b>
110 vac panel power before fuses or breakers	Black
Controlled 110 vac power (e.g., after relay contacts, selector switch contacts, and similar equipment.)	Red
110 vac power source from devices external to panel	Yellow
110 vac neutral	White
24 vdc positive power from power supplies	Brown
24 vdc negative power from power supplies	
Controlled 24 vdc power (e.g., after PLC output contacts, relay contacts, and similar)	Blue
24 vdc positive power from devices external to panel	Orange
24 vdc negative power from devices external to panel	
24 vdc four to 20 mA DC signal cable	Grey with red positive, clear negative
Grounding wire	Green

C. Panel Construction Features:

1. Control panels located in non-environmentally controlled areas and outdoor areas shall be rated NEMA 4X and with the following features:
  - a. Panels shall be Type 316L stainless steel construction with minimum thickness of 12-gage for all surfaces, except areas requiring reinforcing, with a smooth-brushed finish.
  - b. Stainless steel screw clamp assemblies on three sides of each door.
  - c. Rolled lip around three sides of door and along top of enclosure opening.
  - d. Hasp and staple for padlocking.
  - e. Provide clear-plastic, gasketed lockable hinged door to encompass non-NEMA 4X front-of-panel devices.
2. Wall/Stanchion-Mounted Panels:
  - a. General: Wall-mounted panels shall comply with applicable features and standards specified in this Section for the associated NEMA-rated panel.
  - b. Unless otherwise indicated or approved by OWNER, depth of wall-mounted panels shall not exceed 18 inches.
  - c. Panels may be all stainless steel, fiberglass, polycarbonate, or acrylonitrile butadiene and styrene (ABS).
  - c. Provide appropriate size and number of external mounting feet.
  - d. Drilled holes or knockouts in back of wall-mounted panels are not allowed.
  - e. Provide corrosion-resistant polyester quick release latches (for non-stainless steel panels) or stainless steel screw clamp assemblies (for stainless steel panels).

D. Programmable Logic Controller (PLC)

1. The PLC system configuration indicated is diagrammatic. The final system configuration shall utilize the System Manufacturer's standard hardware and software to meet the functional requirements of these Specifications.
2. All equipment furnished under this Contract shall be provided to meet the functional requirements of these Specifications plus a 20 percent growth in project requirements, (e.g., additional field instrumentation and equipment, database, graphics, reports, alarms, trend functions). This equipment includes processor memory, I/O card allocations, and mass/bulk memory storage devices. All equipment shall be provided under this Contract, such that the entire 20 percent project growth can be implemented into the PLC system, without any additional hardware cost to the Owner.
3. The Controller Series shall be an Allen Bradley MicroLogix 1400 1766-L32AWAA or SLC 5/05. No equal will be accepted.
  - a. The processor shall be programmed using ladder logic with Logix-500
  - b. Controller shall communicate via 10/100 Mbps Ethernet and RS-232.
  - c. The process controller, in conjunction with I/O modules, performs all system level operations, system and data table monitoring and maintenance, alarm detection, PID control, user program executions, network request and response handling.
  - d. The controller shall be able to operate within the following environmental parameters: Processor and I/O modules shall be capable of withstanding temperatures of 32°F to 122°F at a relative humidity of 5 to 95 percent (non-condensing) in system manufacturer's standard enclosures.
  - e. Input/Output Modules:
    - 1) The system shall be configured to support the quantity of input/output signals required from the input/output list plus an additional 20 percent spare input and output signals. This includes 20 percent spare of each type of input and output module. For PLC system(s) where a particular type of I/O module is not required from the input/output list, provide a minimum of one I/O module of that type in the rack. The additional 20 percent shall be distributed between the different I/O cards and shall be installed in the rack and wired. The additional 20 percent spare I/O is in addition to the spare parts to be furnished in accordance with Article 1.5, above.
    - 2) The I/O structure shall be field expandable to the maximum spare requirements without modification to the control processor.

E. Electrical Systems:

1. Power Source and Internal Power Distribution:

- a. Provide in the panel, near where incoming power is terminated, nameplate with panel power supply source, type, voltage, and circuit number.
- b. Protect incoming 480V, 3-phase, 60 Hz power feed to power the panel by providing lightning and surge arrestors, properly connected to grounds.
- c. Provide panel with internal step down transformer with 120 vac power distribution system with properly-sized and -rated circuit breakers to distribute power. Power not more than six devices from a single breaker. When power supplies are included in the panel, not more than two power supplies shall be powered from a single breaker. Convenience receptacles and interior panel lights shall have their own breakers. When one or more field instruments require 120 vac power from the panel for instrument power, power not more than three instruments from a given breaker.
- d. Provide space for a minimum of two spare breakers in each panel.

2. Electrical Systems:

- a. Internal wiring shall be Type MTW and THW stranded copper wire with thermoplastic insulation rated for 600 volts at 85 degrees C for single conductors, color-coded and labeled with wire identification.
- b. For DC signal wiring, use shielded cable with 18-gage conductors. DC field signal wiring terminal strips shall be capable of handling wires up and including No. 12 size.
- c. For AC power wiring, use No. 12 minimum AWG. For AC signal and control wiring, use No. 16 minimum AWG. For wiring carrying more than 15 amps, use sizes required by the NEC (NFPA 70) .
- d. Inside of panels, route DC signal wiring separately from power wiring with minimum separation distance of six inches.
- e. Use covered panduits to route internal panel cables and wiring. Panduits in each section of panel shall be appropriately sized to accommodate the quantity of wires to be routed with a spare capacity of 40 percent.
- f. Install wire troughs inside panels along horizontal or vertical routes to present a neat appearance. Angled runs are unacceptable.
- g. Wiring that is routed without panduits shall be adequately supported and restrained to prevent sagging or other movement. Use of adhesive anchors to support or restrain wiring is unacceptable.
- h. Terminate internal panel wiring using forked, insulated, crimp-on connectors; soldered connectors are unacceptable. Provide panels with 600-volt rated barrier type terminal strips mounted on Din rails. Identify terminal strips as indicated in this Section. Identification devices shall be self-stick, plastic tape strips with permanent, machine- printed numbers.

- i. Wiring in panels shall be installed such that, if wires are removed from any one device, power will not be disrupted to other devices. Provide spare terminals equal in number to 20 percent of terminals used for each type of wiring (e.g., DC signal and AC power).
- j. Provide ground terminals to terminate the shield wire of shielded cables. Termination of more than two shielded wires on a single ground terminal is unacceptable.
- k. Provide a single copper bus bar with 5/16-inch diameter copper grounding stud to connect the panel to external ground. Panel's internal grounds shall be terminated to the bus bar.
- l. Where wires pass through panel walls, provide suitable bushings to prevent cutting or abrading of insulation.
- m. When DC power or low voltage AC power is required, furnish and install in the panel required power supplies and transformers.
- n. Provide complete wiring diagram of "as-built" circuitry enclosed in transparent plastic.

#### 2.04 DATA SHEETS – PANEL INSTRUMENTS AND PRIMARY SENSORS AND FIELD INSTRUMENTS

##### A. General:

- 1. Panel-mounted devices and instruments and primary sensors and field instruments shall be in accordance with the "data sheets" included in Part 3 of this specification.
- 2. Do not fabricate, ship, or assemble instruments and devices in panels until required Shop Drawings and other submittals required for fabrication are approved or accepted as required.

#### 2.05 IDENTIFICATION

##### A. Instrument Tagging

- 1. Headings on the instrument index in the Contract Documents have the following meaning:
  - a. "TAG" is divided into two sections. The first seven to nine alphanumeric characters represent the OWNER's equipment number and the remaining characters comply with ISA Standard S5.1.
  - b. "DESCRIPTION/LOCATION" is an explanation of instrument function and location.
  - c. "RANGE/SET POINT" is the limit for the specified units of the instrument and set point is the precise value within the instrument's range.
  - d. "SPEC REF" is the paragraph reference in the Specifications where the instrument's requirements are specified.
  - e. "DRAWING NO." indicates the Drawing where the device is shown or indicated.



f. "REMARKS" contains specific notes relative to the instrument.

#### B. Input/Output List Identification

1. I/O point list contains information required to configure PLC I/O interface hardware, and to indicate range conversion or signal functions.
2. "POINT NUMBER" is an alphanumeric character string. For example, for the point "MP-FI-806-0123" the following apply:
  - a. The first two characters (MP) refer to the specific plant area (MP = Main Pump, for example).
  - b. The third character is the functional identifier and conforms with ANSI/ISA S5.1. In the example, "F" represents flow.
  - c. The fourth (and sometimes fourth and fifth) alphabetical character (I) is the function identifier. In the example, the "I" represent indication input.
  - d. The first three-digit number (806) identifies the P&ID number.
  - e. The next four-digit number (0123) identifies the loop or field device.
  - f. Suffix, where required, is used for distinguishing between similar variables.
3. "DESCRIPTION" is an alphanumeric character string up to 40 characters in length. Points described as "SPARE" indicate pre-wired I/O.
4. "SIGNAL TYPE" is one of the following:
  - a. AI indicates analog input.
  - b. DI indicates discrete input.
  - c. PI indicates pulse input.
  - d. AO indicates analog output.
  - e. DO indicates momentary, maintained or latched discrete output.

#### C. ISA Identification

1. A = Analytical.
2. B = Burner, Combustion.
3. C = Cooling (Cooling Condenser).
4. D = Dissolved.
5. E = Voltage.
6. F = Flow.
7. G = Intrusion.
8. H = Hand.
9. I = Current.
10. J = Power.
11. K = Time.
12. L = Level.
13. M = Manual.
14. N = UNDEFINED.
15. O = Overload.
16. P = Pressure.
17. Q = Communication.
18. R = Reverse.
19. S = Speed, Frequency.

20. T = Temperature.
21. U = Universal (Common).
22. V = Vibration.
23. W = Torque (Weight or Force).
24. X = Critical (Emergency).
25. Y = Event, State or Presence.
26. Z = Position, Dimension.

D. Function Identifier:

1. A = Alarm
2. B = UNDEFINED.
3. C = Control.
4. D = Differential.
5. E = Element.
6. F = Failure.
7. G = UNDEFINED.
8. H = High.
9. I = Indication.
10. J = UNDEFINED.
11. K = Factor.
12. L = Low.
13. M = Mode.
14. N = Normal.
15. O = Oxygen.
16. P = UNDEFINED.
17. Q = Quantity.
18. R = Rotation.
19. S = Switch.
20. T = Timer
21. U = UNDEFINED.
22. V = Slow (output)
23. W = Slow (input)
24. X = Selector Switch (input)

## 2.06 PROCESS CONTROL DESCRIPTIONS

A. General:

1. Program the PLC for automatic control of belt filter press, system sequencing, and interlock functions as specified.
2. Configuration and programming of PLC system shall be responsibility of belt filter press manufacturer. System documentation including memory loading, I/O configuration and programming shall be provided per Section 01 78 23, Operations and Maintenance Data.
3. Provide and install auxiliary relays and wiring for equipment and devices specified in this Section required for implementing functional requirements

specified.

- B. "AUTOMATIC Start/AUTOMATIC Stop" Cycle (typical for all belt filter presses):
1. Automatic start cycle request to PLC shall be initiated by "AUTOMATIC/START" pushbutton.
  2. Control logic for an "AUTOMATIC/START" cycle shall start belt filter press in the following order after "AUTOMATIC/START" command has been initiated and interlocks are complete.
    - a. Hydraulic unit, if applicable. Hydraulic fluid pressure interlock must be satisfied before sequence continues.
    - b. Wash water pump.
    - c. Belt filter press drive(s).
    - d. Energize wash water solenoid.
    - e. Sludge feed pump.
    - f. Polymer feed pump.
  3. Do not start each drive until previous drive has is running and necessary time delay has elapsed. Belt filter press manufacturer shall determine where time delays are required and shall program settings to provide smooth start-up of equipment.
  4. Once all drives are confirmed running by motor run contacts from their respective starters, PLC shall cause the run indicating light to illuminate. Loss of run status contact for a drive once cycle logic is complete shall shut down belt filter press and associated equipment.
  5. Upon "AUTOMATIC /STOP" command, system shall shut down in order that is reverse of specified start-up order with necessary time delays.
  6. As part of start-up sequence, operations personnel will be responsible for disabling cake thickness monitoring switch by placing selector switch at belt filter press panel in "DISABLE" position. After "AUTOMATIC/START" cycle is complete and cake thickness and feed rates have been verified, operations personnel will enable cake thickness monitoring switch via the belt filter press control panel selector switch. Once enabled, PLC shall shut down belt filter press and associated equipment system upon loss of cake detected by cake thickness monitoring switch.
- C. Interlocks: The following interlocks shall be satisfied when control mode selector switch is in either "Automatic" or "Manual" position. Failure of any one signal during start cycle or after cycle is complete shall shut down all associated belt filter press equipment.
1. Sludge cake conveyor servicing the belt filter press shall be operating and confirmed by conveyor zero speed switches.
  2. Hydraulic/pneumatic system pressure shall be confirmed by pressure switch. Hydraulic unit, if applicable, for each belt filter press shall started at beginning of cycle with subsequent check of fluid pressure by PLC.
  3. Wash water pump must be on and running.
  4. Belts on the belt filter press must be properly aligned as detected by limit

switches.

5. Control mode selector switch shall be in “AUTOMATIC” position.
6. Belt filter press safety pull cord switch shall be reset and in operating position.
7. “Emergency Stop” pushbutton shall be in operating position. “Emergency Stop” pushbutton shall be hardwired directly to starters of all motor drives of the associated belt filter press system and to PLC for interlocking.

D. Annunciation and Alarms:

1. Provide devices in belt filter press control panel conforming to requirements of Section 40 60 05, Panel-Mounted Instruments and Devices, for alarming of the following:
  - 1) Belt misalignment.
  - 2) Low air/hydraulic fluid pressure.
  - 3) Loss of sludge cake only when enabled by hand switch.
  - 4) Local emergency stop initiated at either belt filter press control panel or pull cord switch.
  - 5) High discharge pressure at polymer feed pump.
  - 6) Sludge cake conveyor malfunction.
  - 7) Low wash water pressure.
  - 8) Air compressor malfunction (if air compressor is provided).
2. Provide at least 20 percent spare windows.
3. Wire all alarms to PLC system for relaying to remote location.

## 2.07 SOURCE QUALITY CONTROL

A. General:

1. Factory Test:
  - a. Neither OWNER or ENGINEER will witness factory test at the testing facility during operational test of equipment. Registered professional engineer retained by CONTRACTOR or Supplier shall witness factory test to verify that approved test procedures are followed. When factory tests have been successfully completed, submit to OWNER factory test report signed and sealed by professional engineer.
2. Factory test results will be acceptable when all components within tested control panel or system being tested successfully operate and meet its intended function, and are so certified by the testing entity.
3. Do not ship the equipment until obtaining OWNER’s acceptance of factory test results.

B. Factory Inspection:

1. Inspect each panel, console, device, and cabinet before testing and before shipping. Inspection shall include, but not be limited to the following:
  - a. Verify all “Approved as Corrected” comments on Shop Drawings were

implemented.

- b. Verify presence of and accuracy of nameplates and tags.
- c. Verify that wire sizes and color-coding comply with the Contract Documents.
- d. Verify presence of terminal blocks, terminal block numbers, and required quantity of spares.
- e. Verify annunciator window engravings and quantity of spare windows comply with the Contract Documents.
- f. Verify proper wiring practices and grounding.
- g. Verify enclosure flatness, finish, and color.
- h. Verify anchoring of wire bundles between subpanels and front panel-mounted devices.
- i. Verify presence of applicable items specified in this Section.

C. Panel Operational Testing:

1. Test all input/output components to verify that internal panel wiring is properly terminated at correct locations. Verify initial ranges and settings.
2. Test all system hardware and software to verify proper operation as stand-alone units. Test shall include, but not be limited to, the following:
  - a. Power distribution and breaker ratings to match approved Shop Drawings.
  - b. Power fail/restart tests.
  - c. Diagnostics checks.
  - d. Demonstrate that all specified equipment functional capabilities are working properly.
3. Test components and devices requiring data transmission to verify that communication between such components is working properly. Verify communication by using the same media required for the completed system at the Site as indicated in the Contract Documents.
4. Perform integrated system test with all system equipment and simulated inputs/outputs connected to verify that equipment is performing properly as an integrated system.
5. Simulation devices shall be of suitable quality to not mask control panel defects.

## PART 3 – EXECUTION

### 3.01 INSPECTION

- A. Examine conditions under which the Work will be installed and notify OWNER in writing of conditions detrimental to proper and timely completion of the Work. Do not proceed with the Work until unsatisfactory conditions are corrected.

### 3.02 INSTALLATION

- A. Environmental Requirements:
  - 1. Do not install instruments in areas where construction may cause instrument to be damaged, without providing adequate protection for said instrument.
- B. Installation of Instrumentation:
  - 1. Secure field-mounted instruments to stands or brackets in accordance with manufacturer's recommendations, approved or accepted (as applicable) submittals, and the Contract Documents.
  - 2. Locate sensors where shown on the Drawings. Confirm exact locations in the field with OWNER.
  - 3. Install all devices so that devices are readily accessible for service and do not cause potential hazards.
- C. Services and Operator Instructions:
  - 1. Provide repairs or replacement of defective materials, equipment or workmanship, including with respect to equipment, the services of factory-trained servicemen.
  - 2. In addition to the calibration required for check-out, provide two additional calibrations on all instruments. The first re-calibration shall be approximately six months after acceptance of the system, and the second shall be approximately eleven months after acceptance. As part of each calibration, provide two copies of the calibration sheets, a detailed list of deficiencies (should any be found), and a statement that the entire system is in proper operation and condition (except for the deficiencies noted) and shall be turned over to the OWNER.

### 3.03 FIELD QUALITY CONTROL

- A. Tests and Inspections: Field-verify calibration and performance of each instrument prior to start-up of the associated equipment, and document on a separate sheet for each.
  - 1. For each calibration certification sheet, include the following information:
    - a. Project name.
    - b. Tag number and description.
    - c. Manufacturer.
    - d. Model and serial number.
    - e. Date, time and person who performed calibration.
    - f. Calibration data to include.
      - 1) Input, output, and error at 0, 25, 75, and 100 percent of span for analog instruments.
      - 2) Switch setting, contact action and deadband, if applicable, for discrete elements.
    - g. Space for comments.

- h. Signature and date.
- 2. System Check-Out and Start-Up Responsibilities:
  - a. CONTRACTOR shall retain the services of the System Supplier to supervise and/or perform check-out and start-up of all system components. As part of these services, the System Supplier shall include for those equipment items not manufactured by him the services of an authorized manufacturer's representative to check the equipment installation and place the equipment in operation. The manufacturer's representative shall be thoroughly knowledgeable about the installation, operation and maintenance of the equipment.
  - b. Check and approve the installation of all instrumentation and control system components and all cable and wiring connections between the various system components prior to placing the various processes and equipment into operation.
  - c. Conduct a complete system checkout and adjustment, including calibration of all instruments, tuning of control loops, checking operation functions, and testing of final control actions. When there are future operational functions included in the Work, they should be included in the system checkout. All problems encountered shall be promptly corrected to prevent any delays in start-up of the various unit processes.
  - d. CONTRACTOR shall provide all test equipment necessary to perform the testing during system checkout and start-up.
  - e. CONTRACTOR and System Supplier shall be responsible for initial operation of monitoring and control system and shall make any required changes, adjustments or replacements for operation, monitoring and control of the various processes and equipment necessary to perform the functions intended at no additional cost to the OWNER. These changes or adjustments shall be documented by the CONTRACTOR and submitted to the OWNER as part of the Installation Inspection Report described in Paragraph g. below.
  - f. CONTRACTOR shall furnish to the OWNER certified calibration reports for field instruments and panel mounted devices specified in this Section as soon as calibration is completed.
  - g. CONTRACTOR shall furnish OWNER an Installation Inspection Report certifying that all equipment has been installed correctly and is operating properly. The report shall be signed by authorized representatives of both CONTRACTOR and the System Supplier.
  - h. Instrumentation and Control System Field Test:
    - 1) Following the instrumentation and control system checkout and initial operation, CONTRACTOR, under the supervision of the System Supplier, shall perform a complete system test to verify that all equipment and programmed software is operating properly as a fully integrated system, and that the intended instrumentation and control functions are fully implemented and operational. Any

- defects or problems found during the test shall be corrected by CONTRACTOR and then retested to demonstrate proper operation.
- 2) Following demonstration of all system functions, the instrumentation and control system, including field sensors/transducers and instruments, and telemetry system shall be running and fully operational for a continuous 48 hour period.

### 3.04 MANUFACTURER'S SERVICES

#### A. General:

1. CONTRACTOR shall retain the services of the System Supplier to provide operation and maintenance training for all instrumentation and control system equipment as specified herein.
2. For equipment items not manufactured by the System Supplier, he shall provide for on-Site training by an authorized representative of the equipment manufacturer as part of his services. The manufacturer's representative shall be fully knowledgeable in the operation and maintenance of the equipment.
3. CONTRACTOR shall be responsible for all costs associated with training and shall provide all required materials, texts and required supplies.
4. Training shall conform to the requirements of Section 01 79 23, Instruction of Operations and Maintenance Personnel.

#### B. On-Site Training:

##### 1. General:

- a. Provide on-Site operation and maintenance training by System Supplier and the equipment manufacturer representatives prior to placing the equipment in continuous operation.
- b. Training courses shall include time for students to develop and demonstrate understanding of training concepts. Testing shall include hands on training with equipment.
- c. At the conclusion of each course students shall be tested on course material. Testing shall include exercises where students must demonstrate proper response to normal operational needs, emergencies and maintenance tasks. Every student shall be tested individually.
- d. Training shall accomplish the following:
  - 1) Provide instruction covering use and operation of the equipment to perform the intended functions.
  - 2) Provide instruction covering procedures for routine, preventive and troubleshooting maintenance, including equipment calibration.
  - 3) Explain procedures for placing the equipment in and out of operation and explain necessary actions and precautions to be taken regarding the overall plant monitoring and control system.
  - 4) Provide classes and field training as to how to change process control and alarm set points in all microprocessor based controllers



- and transmitters. Maintenance personnel shall be trained to enter passwords, programming or configuration data, etc.
2. Primary Sensors/Transducers and Field Instruments:
    - a. The services of equipment manufacturer's representatives shall be provided for a minimum of two (2) hours for each type of instrument.
    - b. Training shall include:
      - 1) Basic repair and maintenance capabilities of installed equipment.
      - 2) Procedures for placing the equipment in and out of operation.
      - 3) Use of any special repair equipment or software packages that are used for repair or maintenance.
      - 4) Procedures for testing any repair before placing equipment back in service.
  3. PLC and OIT Training
    - a. Training shall include
      - 1) Hardware and software configuration of PLC and OIT programs.
      - 2) Perform a walk through with students identifying system components. Instructor shall test each student's knowledge of system components during walk through.
      - 3) Identify key operating and alarm features of the project specific PLC and HMI programs.
      - 4) Test students' knowledge of proper response to alarms, capabilities to replace hardware components, switch hardware and software between online and offline, add new components, know when to call for assistance, demonstrate understanding of hardware and safety requirements, understand impact of changes made to rest of the control system.
      - 5) Provide instruction covering basic editing of PLC programs and OIT screens. Instruction shall include testing students programming capabilities by having students make minor changes to programs and test changes online.

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**DIVISION 15**  
**MECHANICAL**

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SECTION 15055  
PIPING SYSTEMS—GENERAL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Specification describes responsibilities and requirements for Piping Systems including the following:
  - 1. Labor, materials, tools, equipment, and services to be furnished in accordance with the provisions of the Contract Documents. The materials to be used for the piping systems shown in the Drawings are listed by service in the Piping Schedule, included in the Contract Drawings.
  - 2. Coordination of work with other trades.
  - 3. Furnishing and installing all supplementary or miscellaneous items, appurtenances, and devices incidental to or necessary for a sound, secure, and complete installation, although such work is not specifically indicated.
  - 4. Furnishing Record Drawings and documents for piping systems.

1.02 RELATED WORK

- A. Section 01300, Contract Administration.
- B. Section 01330, Submittals and Acceptance.
- C. Section 01650, Delivery, Storage, and Handling.
- D. Section 01780, Warranties and Bonds.
- E. Section 01785, Record Documents.
- F. Section 01830, Operations and Maintenance Manuals.
- G. Section 02305, Earthwork for Utilities.
- H. Section 09900, Painting and Coating.
- I. Section 15144, Pressure Testing of Piping.
- J. Section 15155, Ductile Iron Pipe and Fittings.
- K. Section 15250, Small-Diameter Piping and Fittings.
- L. Section 15290, Polyvinyl Chloride (PVC) Pipe, 3 Inches and Smaller.
- M. Section 15291, Polyvinyl Chloride (PVC) Pressure Pipe and Fittings.

### 1.03 SUBMITTALS

The Contractor shall submit the following in accordance with Section 01330, Submittals and Acceptance:

- A. If the Contractor deviates from the piping layout as shown on the Contract Drawings, the Contractor shall submit scaled piping drawings showing locations and dimensions to and from fittings, valves, tanks, equipment, structures, and related appurtenances. Provide scaled drawings to a minimum scale of 1 inch equals 10 feet. Provide details to minimum scale of 1/8 inch equals 1 foot. Elevations shall correspond to reference vertical elevation datum shown or provided for this project.
- B. Copies of any manufacturer's written directions regarding material handling, delivery, storage, and installation.
- C. Record piping drawings shall meet the requirements of Section 01300, Contract Administration, or Section 01785, Record Documents. During the work, the Contractor shall maintain accurate, up-to-date Record Drawings of piping systems installed in the project, including pre-existing piping discovered, relocated, or at locations other than as originally shown on the Drawings. When the work is completed and accepted by the Owner and the Engineer, the Contractor shall submit Record Drawings in accordance with Section 01785, Record Documents. The Contractor shall identify complete location, elevations, and description of piping systems. Piping systems and fittings are to be identified from three points on structures and/or stationary appurtenances.
- D. Submit copies of forms documenting required field pressure testing work and results.
- E. Submit welding certificate copies.
- F. Submit certified copies of mill test reports for bolts and nuts, including coatings if specified. Provide recertification by an independent domestic testing laboratory for materials originating outside of the United States.
- G. Submit manufacturer's data sheet for gaskets supplied showing dimensions and bolting recommendations.
- H. Support Systems:
  - 1. Drawings of each piping system locating each support, guide, and anchor.
  - 2. Identify support, guide, and anchor type by catalog number and shop/contract drawing detail number

## 1.04 WORK SEQUENCE (NOT USED)

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standards Institute (ANSI)
  - 1. ANSI A21.11—Rubber Gasket Joints for Cast Iron and Ductile Pressure Pipe and Fittings.
  - 2. ANSI B1.1—Unified Inch Screw Threads.
  - 3. ANSI B2.1—Pipe Threads.
  - 4. ANSI B16.21—Nonmetallic Gaskets for Pipe Flanges.
  - 5. ANSI B18.2.1—Square and Hex Bolts and Screws, Including Askew Head Bolts, Hex Cap Screws, and Lag Screws.
  - 6. ANSI B18.2.2—Square and Hex Nuts.
  - 7. ANSI B31.3—Process Piping.
  
- B. American Society of Mechanical Engineers (ASME)
  - 1. ASME B31.1—Power Piping (Pressure Piping).
  - 2. ASME Boiler and Pressure Vessel Code.
  
- C. American Society for Testing and Materials (ASTM)
  - 1. ASTM A183—Specification for Carbon Steel Track Bolts and Nuts.
  - 2. ASTM A193—Standard Specification for Alloy-Steel; and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and Other Special-Purpose Applications.
  - 3. ASTM A194—Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.
  - 4. ASTM A307—Specification for Carbon Steel Externally Threaded Standard Fasteners.
  - 5. ASTM D1330—Standard Specification for Rubber Sheet Gaskets.
  - 6. ASTM F467—Standard Specification for Nonferrous Nuts for General Use.

- D. American Water Works Association (AWWA)
  - 1. AWWA C207—Steel Pipe Flanges for Waterworks Service-Sizes 4 Inches Through 144 Inches (100 mm Through 3,600 mm).
- E. Manufacturers Standardization Society of the Valve and Fittings Industry (MSS)
  - 1. MSS SP 58—Pipe Hangars and Supports – Material, Design, and Manufacture.
- F. NSF International (NSF)
  - 1. NSF 61—Drinking Water System Components – Health Effects.

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. The Contractor shall protect the pipe from kinks, cuts, end damage, and other defects when transporting all piping. Binding and tie-down methods shall not damage or deflect the pipes in any way. Pipe damaged during shipment shall be rejected.
- C. Pipe shall be stored on level ground, preferably turf or sand, free of sharp objects that could damage the pipe. Stacking of any pipe shall be limited to a height that will not cause excessive deformation of the lower layers of pipe under anticipated temperature conditions. When necessary due to ground conditions, the pipe shall be stored on wooden sleepers, spaced suitably and of such widths to not allow deformation of the pipe at the point of contact with the sleeper or between supports. Pipe shall not be removed from storage until bedding or sub-grade work is complete and ready to receive the pipe.
- D. The joined pipe shall be handled in such a manner that the pipe is not damaged by dragging it over sharp and cutting objects. Ropes, fabric, or rubber-protected slings and straps shall be used when handling pipe. 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. Slings for handling joined pipe shall not be positioned at socket-welded joints. Sections of the pipes with cuts and gouges shall be removed and the ends of the pipe rejoined. In accordance with the pipe manufacturer's written instructions, the Contractor shall repair all pipe with damaged linings and pipe exterior coatings that have been damaged before the pipe is installed.

- E. The Contractor shall cover all pipe stored on the site with canvas or other opaque material to protect it from sunlight. Provide air circulation under the covering.
- F. The Contractor shall inspect all pipe, fittings, and other accessories upon delivery and during the work. Any defective or damaged materials found during field inspection or during tests shall be removed from the site and replaced by, and at the expense of, the Contractor.
- G. The interior of all pipe, fittings, and other accessories shall be kept free from dirt and foreign matter at all times. Fittings shall be drained and stored in a manner that will protect them from damage by freezing.
- H. 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-delivered-to-site and first-to-be-installed rotation basis. Mechanical-joint glands, bolts, and washers shall be handled and stored in a manner that will ensure proper use with respect to types and sizes.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 MAINTENANCE (NOT USED)

#### 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

#### 1.13 DEFINITIONS OF BURIED, EXPOSED, AND SUBMERGED PIPING

- A. Buried piping is piping buried in soil, beneath a structure and/or encased in concrete. Where an exterior pipe coating is specified to be factory- or field-applied, the Contractor shall provide the coating up to the penetration of a

structure. Piping encased in concrete does not require an exterior coating other than what is factory furnished.

B. Exposed piping is piping in any of the following conditions or locations:

1. Above ground.
2. Inside buildings, vaults, or other structures.
3. In underground concrete trenches or galleries.

C. Submerged piping is considered to be all piping within a liquid holding tank.

## 1.14 SYSTEM DESIGN REQUIREMENTS

A. General

1. The Specifications and Drawings are not all inclusive of explicit piping details; provide piping for intended use in compliance with laws and regulations, including ASME B31.1 Code (Power Piping).
2. Pressure ratings and materials specified represent minimum acceptable standards for piping systems.
3. Piping Systems: Suitable for the services specified and intended.
4. Piping shall be color coded in accordance with the Florida Department of Environmental Protection (FDEP) requirements.

B. Support Systems

1. The absence of pipe supports and details on the Drawings shall not relieve the Contractor of responsibility for sizing and providing supports for this project.
2. Select and design within the specified spans and component requirements.
3. Comply with requirements of MSS SP 58, Pipe Hangers and Supports – Materials, Design, and Manufacture.
4. Criteria for structural design and selection of pipe support system components:
  - a. Dead loads imposed by the weight of the pipes filled with water, within specified spans and component requirements, plus any insulation.
  - b. Safety factor: Minimum of 5.

5. Design, size, and space support anchoring devices, including anchor bolts, inserts, and other devices used to anchor the support, to withstand the shear and pullout loads imposed by loading and spacing on each particular support.
  - a. Piping smaller than 30 inches: Supports are shown only where specific types and locations are required; additional pipe supports may be required and are to be provided and installed by the Contractor at no additional cost to the Owner.

C. Adapters

1. No attempt has been made to show all adapters, spool pieces, reducers, bushings, or other fittings required to accommodate the connection of pipes, fittings, and valves of various joint design and sizes throughout the project. The Contractor is completely responsible for providing, at his expense, all adapters, reducers, sleeves, spool pieces, and other fittings and appurtenances necessary for connection of pipe (for the same pipe material of or a transition of pipe materials), valves, fittings, and appurtenances throughout the project, which shall be constructed of appropriate materials, coated and lined to match the materials, coatings, and linings specified for the connected components. All adapters, reducers, sleeves, spool pieces, and other fittings shall be coated and lined in accordance with the specifications for each individual pipe system.

D. Unions

1. No attempt has been made to show all unions required for the project. The Contractor shall provide unions at all connections of threaded pipe to installed equipment unless deleted by the Engineer, in writing, at certain locations. The unions shall meet or exceed the quality of materials, pressure rating, service, and painting requirements of connected piping.

## PART 2 PRODUCTS

### 2.01 PIPING SYSTEM GENERAL REQUIREMENTS SCHEDULE

- A. Unless noted otherwise in the Drawings, piping system materials, fittings, and appurtenances are subject to requirements of the individual Specifications for the piping systems.

## 2.02 PIPING SCHEDULE

- A. A piping schedule (flow stream identification) listing the piping identification abbreviations, piping materials, operating pressures, field test pressures, lining systems, and color coding associated with the flow streams is provided on the Contract Drawings. In project locations where the piping system material referenced on the piping schedule is not appropriate, the required piping material is indicated on the Contract Drawings. Materials called out in the Contract Drawings shall govern over materials stated in the piping schedule.

## 2.03 THREAD FORMING FOR STAINLESS STEEL BOLTS

- A. Form threads for stainless steel bolts by rolling, not by cutting or grinding.

## 2.04 BOLTS AND NUTS FOR FLANGES FOR DUCTILE IRON PIPE FLANGES

- A. Bolts, washers, and nuts for pipe installed indoors, outdoors above and below ground, and in vaults and structures shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.
- B. Bolts, washers, and nuts for submerged Class 150 flanges shall be Type 304 stainless steel conforming to ASTM A193 (Grade B8) for bolts and ASTM A194 (Grade 8) for nuts. Fit shall be Class 2A conforming to ANSI B1.1 when connecting to cast-iron valves having body bolt holes.

## 2.05 BOLTS AND NUTS FOR TYPE 304 STAINLESS STEEL PIPE FLANGES

- A. Bolts, washers, and nuts for flanges shall be Type 304 stainless steel conforming to ASTM A193, Grade B8, for bolts and ASTM A194, Grade 8, for nuts.

## 2.06 BOLTS AND NUTS FOR TYPE 316 STAINLESS-STEEL PIPE FLANGES

- A. Bolts, washers, and nuts for flanges shall be Type 316 stainless steel conforming to ASTM A193, Grade B8, for bolts and ASTM A194, Grade 8, for nuts.

## 2.07 BOLTS AND NUTS FOR PVC PIPE FLANGES

- A. Bolts for piping in sodium hypochlorite service shall be made of titanium, in accordance with ASTM F467, Grade Ti1, Ti2, or Ti7. Nuts and washers shall conform to ASTM F467 and shall be made of titanium.
- B. Bolts, washers, and nuts in chemical service other than sodium hypochlorite shall be Type 304 stainless steel conforming to ASTM A193, Grade B8, for bolts and ASTM A194, Grade 8, for nuts.

- C. Bolts, washers, and nuts for buried and submerged flanges and flanges located outdoors above ground or in vaults and structures shall be Type 304 stainless steel conforming to ASTM A193, Grade B8, for bolts and ASTM A194, Grade 8, for nuts.
- D. The Contractor shall provide a washer under each nut and under each bolthead. Washers shall be of the same material as the nuts.

## 2.08 BOLTS AND NUTS FOR STEEL PIPE FLANGES

- A. Bolts, washers, and nuts for Class 150 flanges (including AWWA C207, Class D) located indoors, outdoors above ground, in vaults, and in structures shall be carbon steel, ASTM A307, Grade B. Bolts, washers, and nuts for buried service shall also be hot-dipped galvanized.
- B. Bolts, washers, and nuts for submerged Class 150 flanges shall be Type 304 stainless steel conforming to ASTM A193 (Grade B8) for bolts and ASTM A194 (Grade 8) for nuts. Fit shall be Class 2A in accordance with ANSI B1.1 when connecting to cast-iron valves having body bolt holes.

## 2.09 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

- A. Anti-seize thread lubricant shall be applied to the thread portion of all (above grade and below grade) stainless steel bolts (stainless steel tie rods, etc.) during assembly. Anti-seize lubricant shall be chloride free and shall be nongalling NSF approved. Anti-seize thread lubricant shall be Jet-Lube “Nikal,” John Crane “Thred Gard Nickel,” Never-Seez “Pure Nickel Special,” or Permatex “Nickel Anti-Seize.”

## 2.10 FLANGE GASKETS FOR STEEL, DUCTILE IRON, AND STAINLESS STEEL PIPE

- A. Flange gaskets shall be in accordance with AWWA C207, except as modified in this Section. Gaskets shall be ring type. All gasket material shall be suitable for the fluid being conveyed and shall be resistant to free chlorine concentrations up to 10 mg/L. All gasket material shall be rated to the surge pressures listed in the pipe schedule. Gaskets shall be EPDM, Viton, or an approved equal.

## 2.11 FLANGE GASKETS FOR DUCTILE-IRON PIPE AND FITTINGS IN RAW SEWAGE

- A. Gaskets shall be full face, 1/8 inch thick, Buna-N having a Brinell Hardness of 55 to 65 durometer. Gaskets shall be suitable for a water pressure of 200 psi at a temperature of 250°F. Gaskets shall have "nominal" pipe size inside diameters, not the inside diameters indicated in ANSI B16.21. Provide Garlock Style 9122 or

equal. The Contractor shall verify that the gaskets are compatible with all chemicals being used.

## 2.12 FLANGE GASKETS FOR PVC PIPE

- A. Gaskets for flanged joints shall be full faced, 1/8 inch thick, having a Brinell Hardness of 50 to 70 durometer A. Gasket material shall be EPR unless noted or specified otherwise. Gasket material for sodium hypochlorite service shall be Viton ETP unless noted or specified otherwise. Gaskets shall be compatible with the fluids conveyed.

## 2.13 POTABLE WATER PIPING SYSTEMS

- A. All potable water piping systems including pipe, valves, fittings, weld-solvents, linings, gaskets, lubricants, grout disinfection agents, and surfaces in contact with potable water shall meet all local and State of Florida regulations and requirements including NSF 61. The Contractor shall coordinate the color of the potable water system piping color with the Owner's color standard and shall provide color as approved by the Owner.

## 2.14 LOCATOR WIRE

- A. All 2-inch and larger buried piping shall be laid with two insulated, 12-gauge minimum AWG, THWN strand copper wires taped with adhesive-backed tape or tied to the nonmetallic pipe at 5 feet on center for location purposes.

# PART 3 EXECUTION

## 3.01 PREPARATION

- A. Field Alignment:
  - 1. The piping shown on the Contract Drawings is generally indicative of the work, with symbols and notations provided for clarity. However, the Contract Drawings are not an exact representation of all conditions involved; therefore, install piping to suit actual field conditions and measurements as approved by the Engineer. No extra compensation will be made for work due to differences between indicated and actual dimensions.
  - 2. The Contractor shall install all adapters, fittings, flanged connections, closures, restrained joints, etc. not specified but necessary for a complete installation acceptable to the Engineer.
  - 3. The Contract Drawings do not indicate all adapters, fittings, spool pieces, bushings, unions, supports, hangers, and other items required to

accommodate the installing and connecting of pipe, fittings, valves, and equipment of various joint designs and sizes. Provide such required items of appropriate designs, materials, coatings, and linings.

4. Underground piping, duct, conduit, direct-buried conductors, and related structures of various sizes, materials, alignments, age, and function may exist within the project site. Conclusive information concerning these facilities is not available. Consequently, the design of new piping indicated on the Contract Drawings is approximate. Adjust alignment, fitting, valve, and joint locations as required and as approved by the Engineer to accommodate and protect existing facilities and provide the intended functionality of new piping.

### 3.02 FIELD LAYOUT AND MODIFICATIONS

- A. Unless directed otherwise, the Contractor shall be responsible for setting construction layout stakes and/or offsets required to complete the designated work. The Contractor shall ensure that those stakes and/or offsets are protected and any re-staking required for any reason including work stoppage shall be included in the bid price and no additional compensation to the Contractor will be made.
- B. The Engineer has the right to make any modifications the Engineer deems necessary due to field conditions, conflicts with other utilities, or to protect other properties.

### 3.03 PIPE PRODUCTS INSPECTION

- A. The Contractor shall obtain from the pipe manufacturer a certificate of inspection to the effect that the pipe, fittings, gaskets, glands, bolts, and nuts 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 before installing the pipe materials. The Contractor shall visually inspect all pipe and fittings at delivery and before they are lowered into the trench to be installed. Pipe or fittings that do not conform to these Specifications or have been damaged in any manner will be rejected and the Contractor must remove them immediately. The entire product of any plant may be rejected when, in the opinion of the Engineer, the methods or quality assurance and uniformity of manufacturer fail to secure acceptable and uniform pipe products or where the materials used produce inferior pipe products.

### 3.04 REMOVAL OF EXISTING PIPE AND FITTINGS

- A. Pipe specifically identified on the Drawings to be removed or replaced from service shall be physically taken out. The limits of pipe to be removed shall be

specifically called for in the plans or shall be approved in writing by the Engineer. Any other removal not specifically called for shall be approved in writing and shall be considered incidental to construction of other items in the contract and the Contractor will not receive compensation for such work.

- B. When removing buried pipe the Contractor shall excavate a trench wide enough to dislodge the pipe from the surrounding soil and long enough to be able to handle the pipe without causing any damage to nearby utilities, structures, or adjacent property.
- C. The removed pipe, fitting, and appurtenances will become the Contractor's property and the Contractor shall be responsible for proper disposal and any required permits for disposal.

### 3.05 BURIED PIPING AND PIPE FITTINGS

- A. Trenching and backfilling for all pipe and fittings shall also be in accordance with Section 02305, Earthwork for Utilities.
- B. Installation
  - 1. Inspect all piping for defects and remove all lumps or excess coatings before installation. The inside of the mechanical joint and outside of plain-end pipe shall be cleaned before joining pipe. Caution shall be taken to prevent damage to the pipe during lowering into the trench. Remove all foreign matter that has entered the pipe during storage and installation. The Contractor shall cover the pipe ends during installation to prevent debris from entering the pipe. No debris, tools, clothing, or other material shall be placed in the pipe.
  - 2. After being placed in the trench, the pipe shall be brought to the proper line and grade by compacting the approved backfill material under it, except at the bell end. Joint deflection shall not exceed 75% of the manufacturer's limit.
  - 3. The Contractor shall install temporary water-tight plugs on the pipe ends during the time that the pipe is in the trench but no work is in progress. If there is water in the trench upon beginning work, this plug shall remain in place until the trench has been pumped dry, unless otherwise approved by the Engineer, the Engineer's Representative, or the Owner's Representative.
  - 4. Buried carbon steel bolts and nuts shall be coated in accordance with Section 09900, Painting and Coating, System No. 21.
  - 5. Coat threaded portions of stainless steel bolts and nuts with lubricant before assembly.



### 3.06 FLANGED JOINTS FOR EXPOSED PIPE AND FITTINGS

- A. When bolting flanged joints, the Contractor shall avoid restraint on the opposite end of the pipe or fitting, which would prevent uniform gasket compression or which would cause unnecessary stress in the flanges. One flange shall be free to move in any direction while the flange bolts are being tightened. Bolts shall be tightened gradually and at a uniform rate to ensure uniform compression of the gasket, in accordance with pipe and fitting manufacturer's recommendations.
- B. Coat threaded portions of stainless steel bolts and nuts with lubricant before assembly.

### 3.07 PIPING CONNECTIONS TO PUMPS AND OTHER EQUIPMENT

- A. When connecting to pumps and equipment, the Contractor shall ensure that piping stresses are not transmitted to the pump and equipment. All connecting pipe shall be permanently supported and aligned so that accurate matching of bolt holes and uniform contact over the entire surface of pump flanges are obtained before any bolts are installed in the flanges or pipe is threaded into pump and equipment. In addition, pump connection piping shall be free to move parallel to its longitudinal center line while the bolts are being tightened.
  - 1. Pumps and equipment shall be leveled, aligned, and wedged into a position that will fit the connecting pipe, but shall not be grouted until the initial fitting and alignment of the pump and equipment may be shifted on its foundation if necessary to properly install the connecting pipe. Each pump and piece of equipment shall, however, be grouted before final bolting of the connecting piping.
  - 2. After final alignment and bolting, the pump and equipment connections shall be tested for applied piping stresses by loosening the flange bolts which, if the piping is properly installed, should result in no movement of the piping relative to the pump or opening of the pump connection joints. If any movement is observed, the piping shall be loosened and re-aligned as required and then the flanges bolted back together. The flange bolts then shall be loosened and the process repeated until no movement is observed.
  - 3. All carbon steel bolts and nuts shall be coated with the same exterior coating applied to the piping system.

### 3.08 ANCHORING AND RESTRAINING

- A. Thrust blocks shall be used in new lines and shall be limited to areas in which a new fitting has been installed in an existing line and field restraining joints are not feasible or when directed by the Engineer.

### 3.09 FLUSHING, CLEANING, TESTING AND INSPECTION OF PIPING

- A. See Section 15144, Pressure Testing of Piping, for the requirements of pipe flushing, cleaning, pressure testing, and inspection requirements.

### 3.10 DISINFECTION

- A. See Section 15141, Disinfection of Piping, for the disinfection requirements.

### 3.11 PIPE COLOR CODING

- A. The pipe color shall be as identified on the Drawings. The Contractor shall coordinate with the Engineer and the Owner to generate a list of acceptable pipe colors for exposed piping systems. Where color-coding is achieved by painting exterior surfaces of the piping systems, painting shall be provided in accordance with Section 09900, Painting and Coating. On applicable pipes, color shall be in accordance with FDEP color-coding requirements.

END OF SECTION

SECTION 15060  
PIPE HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes requirements for materials and installation of pipe hangers and supports, including accessory items such as anchor bolts and screws, pipe spiders, neoprene isolation pads, cable trays for hoses, and drip guards.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 05500, Miscellaneous Metal.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Provide line drawings of each piping system to the scale shown on the Drawings, locating each support or hanger. Identify each type of hanger or support by the manufacturer's catalog number or figure.
- B. Provide installation drawings and manufacturer's catalog information on each type of hanger and support used. Clearly indicate the actual pipe outside diameter (not just nominal pipe size) that is used for the hangers and supports.
- C. Submit layout drawings for the drip guards, showing dimensions and thicknesses. Show design of seam or joint where field connections will be made between sections and pieces of drip guards.
- D. Submit a certificate listing the type of resin to be used, describing the manufacturer's brand name or designation, composition, and characteristics.

1.04 WORK SEQUENCE (NOT USED)

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standards Institute (ANSI)
  - 1. ANSI B31.1.0—Power Piping.
  
- B. American Society for Testing and Materials (ASTM)
  - 1. ASTM A36—Standard Specification for Carbon Structural Steel.
  - 2. ASTM A47—Standard Specification for Ferritic Malleable Iron Castings.
  - 3. ASTM A48—Standard Specification for Gray Iron Castings.
  - 4. ASTM A153—Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
  - 5. ASTM A194—Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
  - 6. ASTM A276—Standard Specification for Stainless Steel Bars and Shapes.
  - 7. ASTM A307—Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
  - 8. ASTM A575—Standard Specification for Steel Bars, Carbon, Merchant Quality, M-Grades.
  - 9. ASTM A576—Standard Specification for Steel Bars, Carbon, Hot-Wrought, Special Quality.
  - 10. ASTM A635—Standard Specification for Steel, Sheet and Strip, Heavy-Thickness Coils, Hot-Rolled, Alloy, Carbon, Structural, High-Strength Low-Alloy, and High-Strength Low-Alloy with Improved Formability, General Requirements for.
  - 11. ASTM A1011—Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
  - 12. ASTM D256—Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics.
  - 13. ASTM E84—Standard Test Method for Surface Burning Characteristics of Building Materials.
  - 14. ASTM F593—Standard Specification for Stainless Steel Bolts, Hex Cap Screws, and Studs.
  - 15. ASTM F594—Standard Specification for Stainless Steel Nuts.

C. Manufacturer's Standardization Society

1. MSS SP-58—Pipe Hangers and Supports – Materials, Design, Manufacture, Selection, Application, and Installation.
2. MSS SP-69—Pipe Hangers and Supports – Selection and Application.

1.06 QUALITY ASSURANCE

- A. All hangers, supports, and appurtenances shall conform to the latest applicable requirements of ANSI B31.1.0, except as supplemented or modified by the requirements of this Section.
- B. All hangers, supports, and appurtenances shall be of approved standard design where possible and shall be adequate to maintain the supported load in proper position under all operating conditions. The minimum working factor of safety for all supporting equipment, with the exception of springs, shall be five times the ultimate tensile strength of the material, assuming 10 feet of water-filled pipe being supported.
- C. All pipe and appurtenances connected to equipment shall be supported so as to prevent any strain being imposed on the equipment. When manufacturers have indicated requirements that piping loads shall not be transmitted to their equipment, the Contractor shall submit certification stating that such requirements have been complied with.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. All supports and hangers shall be crated, delivered, and uncrated to protect against any damage.
- C. All parts shall be properly protected so that no damage or deterioration shall occur during a prolonged delay from the time of shipment until installation is completed.

- D. Finished iron or steel surfaces not galvanized or painted shall be properly protected to prevent rust and corrosion.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 MAINTENANCE (NOT USED)

#### 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

### PART 2 PRODUCTS

#### 2.01 GENERAL

- A. Not all pipe supports or hangers required are shown on the Drawings. The Contractor shall provide pipe supports for every piping system installed. Support piping by pipe support where it connects to pumps or other mechanical equipment.
- B. The Contractor shall ensure that pipe support and hanger components shall withstand the dead loads imposed by the weight of the pipes, fittings, and valves (all filled with water) plus valve actuators and any insulation and shall have a minimum safety factor of 5 based on the material's ultimate strength.
- C. All of the equipment specified in this Section is intended to support the various types of pipe and piping systems. The details shown on the Drawings are intended to indicate the generally desired methods of support under normal conditions. The Contractor shall develop final details and any details associated with special conditions not already covered to meet the system conditions specified in the respective Division 15, Mechanical, pipe sections.
- D. All pipe and tubing shall be supported as required to prevent significant stresses in the pipe or tubing material, valves, fittings, and other pipe appurtenances and to support and secure the pipe in the intended position and alignment. All supports shall be designed to adequately secure the pipe against excessive dislocation due to thermal expansion and contraction, internal flow forces, and all probable external forces such as equipment, pipe, and personnel contact. Any structural steel members required to brace any piping from excessive dislocation shall

conform to the applicable requirements of Section 05500, Miscellaneous Metal, and shall be furnished and installed under this Section.

- E. Hangers and supports shall be spaced in accordance with ANSI B31.1.0 except that the maximum unsupported span shall not exceed 10 feet unless otherwise specified in this Section.
- F. Where flexible couplings are required at equipment, tanks, etc., the end opposite to the piece of equipment, tank, etc. shall be rigidly supported.
- G. All pipe and appurtenances connected to the equipment shall be supported so as to prevent any strain from being imposed on the equipment or piping system.
- H. All rods, clamps, hangers, inserts, anchor bolts, brackets, and components within the dewatering facility building shall be of AISI Type 316 stainless steel. Interior clamps on plastic pipe shall be plastic coated.
- I. Supports shall be sufficiently close together so that the sag of the pipe is within limits that will permit drainage and avoid excessive bending stresses from concentrated loads between supports.
- J. All un-insulated non-metallic piping such as PVC, etc., shall be protected from local stress concentrations at each support point. Protection shall be provided by galvanized steel protection shields or other method as approved by the Engineer. Where pipes are bottom supported 180°, arc shields shall be furnished. Where 360° arc support is required, such as U bolts, protection shields shall be provided for the entire pipe circumference. Protection shields shall have an 18-gauge minimum thickness, not be less than 12 inches in length, and be securely fastened to pipe with stainless steel or galvanized metal straps not less than ½-inch wide.
- K. All insulated pipe shall be furnished with a rigid foam insulating saddle at each pipe support location as specified under respective pipe insulation. Provide galvanized protection shields as specified in Paragraph 2.01J above at each location.
- L. Where pipe hangers and supports come in contact with copper piping, provide protection from galvanic corrosion by wrapping pipe with 1/16-inch-thick neoprene sheet material and galvanized protection shield or copper-plated or PVC-coated hangers and supports.

- M. Pipe supports shall be provided as follows unless specified elsewhere in the Project Specifications or shown on the Drawings:
1. Cast-iron and ductile-iron piping shall be supported at a maximum support spacing of 8 feet with a minimum of one support per pipe section at the joints.
  2. Steel and stainless steel piping 2-1/2 inches or larger diameter shall be supported at a maximum support spacing of 10 feet with a minimum of one support per pipe section at the joints.
  3. Support spacing for steel and stainless steel piping 2 inches and smaller diameter and copper tubing shall not exceed 5 feet.
  4. Supports for multiple PVC plastic piping shall be continuous wherever possible. Individually supported PVC pipes shall be supported as recommended by the manufacturer except that support-spacing shall not exceed 3 feet. Multiple, suspended, horizontal plastic PVC pipe runs shall, where possible, be supported by ladder-type cable trays such as the Electray Ladder by Husky-Burndy; Cable Tray by Enduro Composite Systems; the Globetray by the Metal Products Division of United States Gypsum or equal. Ladder shall be of FRP construction. Rung spacing shall be 12 inches. Tray width shall be approximately 6 inches for single runs and 12 inches for double runs. Ladder-type cable trays shall be furnished complete with all hanger rods, rod couplings, concrete inserts, hanger clips, etc., required for a complete support system. Individual plastic pipes shall be secured to the rungs of the cable tray by strap clamps, or fasteners similar to Globe, Model M-CAC; Husky-Burndy, Model SCR; or equal. Spacing between clamps shall not exceed 9 feet. The cable trays shall provide continuous support along the length of the pipe. Individual clamps, hangers, and supports in contact with plastic PVC pipe shall provide firm support but not so firm as to prevent longitudinal movement due to thermal expansion and contraction.
  5. All vertical pipes shall be supported at each floor and at intervals of not more than 8 feet by approved pipe collars, clamps, brackets, or wall rests and at all points necessary to ensure rigid construction.
  6. Pipe supports shall not induce point loadings, but shall distribute pipe loads evenly along the pipe circumference.
  7. Supports shall be provided at changes in direction and elsewhere as shown on the Drawings or as specified in this Section. No piping shall be supported from other piping or from metal stairs, ladders, and walkways, unless specifically directed or authorized by the Engineer.
  8. Pipe supports shall be provided to minimize lateral forces through valves, both sides of split-type couplings, and sleeve-type couplings and to minimize all pipe forces on pump housings. Pump housings shall not be used to support connecting pipes.



9. Effects of thermal expansion and contraction of the pipe shall be accounted for in the pipe support selection and installation.

N. Any required pipe support for which the supports specified in this Section are not applicable shall be fabricated or constructed from standard structural steel shapes and concrete and anchor hardware similar to items previously specified in this Section and shall be subject to the approval of the Engineer.

## 2.02 HANGER AND SUPPORT SYSTEMS

A. Pipe hangers and supports shall be as manufactured by Anvil, Unistrut, Cooper B-Line, Aikinstrut, Superstrut, or equal.

B. Pipe hangers and supports shall comply with MSS SP-58 for the standard types referenced on the Drawings. The Contractor shall construct special hangers and supports if detailed in the Drawings. Type numbers for standard hangers and supports shall be in accordance with MSS SP-58 as listed below:

Type Number	Description	Manufacturer and Model (or Equal)
1	Adjustable steel clevis	Anvil Fig. 590 or 260, B-Line B3100 or B3102
3	Steel double-bolt pipe clamp	Anvil Fig. 295A or 295H, B-Line B3144 or B3144A
4	Steel pipe clamp (pipes smaller than 3 inches)	Anvil Fig. 212, B-Line B3140
4	Steel pipe clamp (pipes 3 inches and larger)	Anvil Fig. 216, B-Line 3142
5	Pipe hanger	B-Line B6690
6	Adjustable swivel pipe ring	Anvil Superstrut 714, Anvil Fig. 104
7	Adjustable steel band hanger	B-Line B3172
8	Extension pipe or riser clamp	Anvil Fig. 261, B-Line B5573
9	Adjustable band hanger	Anvil Fig. 97
10	Adjustable swivel ring band hanger	Anvil Fig. 70, B-Line B3170 NF
11	Split pipe ring with adjustable turnbuckle	Anvil Fig. 108, B-Line B3173
13	Steel turnbuckle	Anvil Fig. 230, B-Line B3202
14	Steel clevis	Anvil Fig. 299, B-Line B3201
15	Swivel turnbuckle	Anvil Fig. 114, B-Line B3224
16	Malleable iron socket	Anvil Fig. 110R, B-Line B3222
17	Steel weldless eye nut	B-Line B3200
18	Steel or malleable iron concrete insert	Anvil Fig. 281, Superstrut 452
19	Top beam C-clamp	Anvil Fig. 92, B-Line B3033
20	Side I-beam or channel clamp	Anvil Fig. 14 or 217
21	Center I-beam clamp	Anvil Figure 134
22	Welded attachment type	Anvil Fig. 66 B-Line B3083
23	C-clamp	Anvil Fig. 86, B-Line B3036L
24	U-bolt	Anvil Fig. 137, B-Line B3188

Type Number	Description	Manufacturer and Model (or Equal)
26	Clip	Anvil Fig. 262, B-Line B3180
28	Steel I-beam clamp with eye nut	Anvil Fig. 228
29	Steel wide flange	Anvil Fig. 228 clamp with eye nut
30	Malleable iron beam clamp with extension piece	Superstrut CM-754, B-Line B3054
31	Light welded steel bracket	Anvil Fig. 194, B-Line B3063
32	Medium welded steel bracket	Anvil Fig. 195, B-Line B3066
33	Heavy welded steel bracket	Anvil Fig. 199, B-Line B3067
34	Side beam bracket	Anvil Fig. 202, B-Line B3062
36	Pipe saddle support	Anvil Fig. 258, B-Line B3095
37	Pipe stanchion saddle	Anvil Fig. 259, B-Line B3090
38	Adjustable pipe saddle support	Anvil Fig. 264, B-Line B3093/B3089
39	Steel pipe covering	Anvil Fig. 160, 161, 162, 163, 164, or 165; Superstrut A 789; B-Line B3160/B3165
40	Insulation protection shield	Anvil Fig. 167, B-Line B3151
41	Single pipe roll	Anvil Fig. 171, B-Line B3114
43	Adjustable roller hanger with swivel	Anvil Fig. 181, B-Line B3110
44	Pipe roll, complete	Anvil Fig. 271, B-Line B3117SL

- C. Pipe hangers and supports shall be AISI Type 316 stainless steel.

## 2.03 MISCELLANEOUS PIPE SUPPORTS AND HANGERS

- A. Pipe Anchor Chair: Anvil Figure 198 or equal.  
 B. One Hole Clamp: Anvil Figure 126 or equal.  
 C. Roller Chair: Anvil Figure 175 or equal.

## 2.04 STEEL CHANNEL FRAMING SYSTEM

- A. Steel channel frames shall be 1-5/8 inches wide by 1-5/8 or 3-1/4 inches high by 12-gauge metal thickness, unless otherwise shown on the Drawings. Material shall conform to ASTM A36, A1011 (Grade 33 minimum), or A653 unless stainless steel is indicated on the Drawings. Stainless steel shall be Type 304. One side of the channel shall have a continuous open slot with inturned clamping ridges. Maximum allowable stress under any combination of applied uniformly distributed loads and concentrated loads shall not exceed those recommended in the AISC or AISI. Deflection shall not exceed 1/240 of span. The Contractor shall use multiple back-to-back channels to achieve these criteria if single channels are not sufficient. Products: Unistrut P1000 or P5000 Series, B-Line B11 or B22 Series, or equal.
- B. Nuts shall be machined and case hardened. The Contractor shall provide rectangular nuts with the ends shaped to permit a quarter turn crosswise in the

framing channel. Provide two serrated grooves in the nut to engage the inturned edges of the channel.

- C. Pipe clamps (including attachment screws and nuts) shall be Unistrut P1100 or P2000 Series, B-Line B2000 Series, or equal. Material shall be Type 316 stainless steel.
- D. Hanger rods for trapezes shall be carbon steel (ASTM A36, A575, or A576) unless stainless steel is indicated on the Drawings. Stainless-steel hanger rod material shall comply with ASTM A276, Type 316.
- E. Accessory fittings and brackets shall be the same material as the channel or trapeze. Provide coating on carbon steel fittings and brackets as specified for the channels and frames.
  - 1. Flat Plate Fittings: Unistrut P1065, P1066, P1925; Superstrut AB-206, AB-207; or equal.
  - 2. Post Bases: Unistrut P2072A, Superstrut AP-232, or equal.
  - 3. 90° Brackets: Unistrut P1326, P1346; Superstrut AB-203; or equal.
  - 4. Rounded-End Flat Plate Fittings: Unistrut P2325, Superstrut X-240, or equal.
- F. Parallel pipe clamps shall be Unistrut P1563 through P1573, Superstrut AB-719, or equal. Material shall be Type 316 stainless steel.

## 2.05 FIBERGLASS-REINFORCED PLASTIC (FRP) CHANNEL FRAMING SYSTEM

- A. FRP pipe hangers and supports shall be Aickinstrut, Inc. or equal.
- B. Material properties shall be as follows:

Longitudinal Direction	
Ultimate Tensile (psi)	37,500 minimum
Ultimate Compressive (psi)	35,000 minimum
Ultimate Flexural (psi)	37,500 minimum
Tensile Modulus (psi) x 10**6	3.00 minimum
Flexural Modulus (psi) x 10**6	2.00 minimum
Ultimate Shear Strength (psi)	6,000 minimum
Ultimate Bearing Stress (psi)	35,000 minimum
Izod Impact (ASTM D256) ft-lb/inch notch	30 minimum
Transverse Direction	
Ultimate Tensile (psi)	10,000 minimum
Ultimate Compressive (psi)	20,000 minimum
Ultimate Flexural (psi)	14,000 minimum
Tensile Modulus (psi) x 10**6	1.0 minimum
Compressive Modulus (psi) x 10**6	1.4 minimum

Flexural Modulus (psi) x 10**6	1.0 minimum
Ultimate Shear Strength (psi)	5,500 minimum
Ultimate Bearing Stress (psi)	35,000 minimum
Izod Impact, ft-lb notch	5 minimum
Hardness	
Barcol Test	50 minimum

- C. Glass-fiber-reinforced composites and plastic products shall have a flame spread rating of 25 or less when tested in accordance with ASTM E84.
- D. Channel framing shall be 1-5/8 inches deep by 1-5/8 inches wide and shall be made using vinylester resin equal to Ashland Derakane 411, Ashland Hetron 922, or Reichhold Dion 9800. It shall have a nexus polyester surfacing veil over 100% of the surface which, along with a filler system, will protect against degradation from ultraviolet light. Channel shall be supplied with integral notches 1 inch on center. Notches shall be located on the interior flange to prevent slippage of pipe clamps and fittings after installation. In place of notched channel, unnotched channel may be used if the vertical channel sections supporting the horizontal piping are provided with stop lock hardware at each pipe clamp to prevent slippage. Channel framing shall be Aickinstrut G.R.P. Type V 2000 series or equal.
- E. Channel framing connections shall be made with vinylester glass fiber composite nuts, bolts, all threaded rods, channel fittings, bases, and hanger assemblies. Nut, bolts, and rods shall be Aickinstrut 4200 series, Strut Tech PVCG, or equal. Channel fittings shall be Aickinstrut 2800 style or equal.
- F. Load-bearing pipe clamps and nonload-bearing pipe straps shall be nonmetallic and nonconductive and shall be made by the injection-molding process using polyurethane-base resin. Pipe clamps and straps shall be Aickinstrut 3100 series or equal.
- G. Clevis hangers shall be made with vinylester glass fiber and be Aickinstrut 1500 series or equal.
- H. Hanger rods for trapezes shall be carbon steel (ASTM A36, A575, or A576) unless stainless steel or FRP is indicated on the Drawings. Stainless steel hanger rod material shall comply with ASTM A276, Type 304. FRP hanger rod shall be by Aickinstrut, StrutTech, or equal.

## 2.06 PIPE SPIDERS

- A. Cooper B-Line B3281 to 3286, Superstrut S-794 or equal.

2.07 WAFFLE ISOLATION PADS

- A. Mason Type "W;" Machinery Installation Systems "Unisorb" Type S, SB, F, or FB; or equal. Provide minimum 1/4-inch thickness.

2.08 NEOPRENE ISOLATING SLEEVES FOR METAL PIPE 6 INCHES AND SMALLER

- A. Unistrut P2600, B-Line "Vibrocoussion," or equal.

2.09 ANCHOR BOLTS AND SCREWS

- A. Anchor bolts and screws for attaching pipe supports and hangers to walls, floors, ceilings, and roof beams shall be Type 316 stainless steel, ASTM A276 or F593. Nuts shall be Type 316 stainless steel, ASTM A194, Grade 8M, or ASTM F594, Type 316 stainless steel.

PART 3 EXECUTION

3.01 PIPE HANGER AND WALL SUPPORT SPACING

- A. The Contractor shall install pipe hangers and wall supports on horizontal and vertical runs at the spacing shown or detailed on the Drawings. Provide hanger rods (for horizontal runs) and wall supports of the sizes shown or detailed on the Drawings. If no spacing or rod sizes are given on the Drawings or in the Specifications for a particular piping system, use the following:

- 1. Pipe Hanger and Wall Support Spacing for Steel and Ductile-Iron Pipe:

Pipe Size (inches)	Maximum Support or Hanger Spacing (feet)	Minimum Rod Size (inches)
1/2 through 1	6	3/8
1-1/4 through 2	8	3/8
2-1/2 and 3	10	1/2
3-1/2 and 4	10	5/8
6	10	3/4
8	10	7/8
10 and 12	12	7/8

B. Pipe Hanger or Wall Support Spacing for PVC Pipe:

Pipe Size (inches)	Maximum Support or Hanger Spacing (feet)	Minimum Rod Size (inches)
1	4	3/8
1-1/2	5	3/8
2	5	3/8
2-1/2	5	1/2
3	6	1/2

C. For piping services not described, the Contractor shall provide hangers and supports according to MSS SP-58 and SP-69.

D. The Contractor shall provide bracing for piping 8 inches and smaller that is installed on hangers or trapezes according to MSS SP-127, except provide lateral bracing at maximum 10-foot center-to-center spacings. Provide sway bracing for hangers for piping larger than 8 inches as detailed on the Drawings.

3.02 PIPE SUPPORT SPACING FOR SUPPORTS ON TOP OF SLABS OR GRADE

A. The Contractor shall install pipe supports on horizontal runs at the spacing shown or detailed on the Drawings. Provide supports of the type shown or detailed on the Drawings. If no spacings are given on the Drawings or in the Specifications for a particular piping system, use the following:

1. Pipe Support Spacing for Steel and Ductile-Iron Pipe:

Pipe Size (inches)	Maximum Support Spacing (feet)
1/2 through 1	6
1-1/4 through 2	8
2-1/2 and 3	10
3-1/2 and 4	10
6	10
8	10
10 and 12	12

B. Pipe support spacing for other pipe materials shall be the same as described in Article 3.01 "Pipe Hanger and Wall Support Spacing" above.

3.03 INSTALLING PIPE HANGERS AND SUPPORTS

The Contractor shall do the following:

A. Provide separate hangers or supports at each valve. Provide one hanger or support around each end of the valve body or on the adjacent connecting pipe within one

pipe diameter of the valve end. Provide additional hangers or supports to relieve eccentric loadings imposed by offset valve actuators.

- B. Provide separate hangers or supports at each pipe elbow, tee, or fitting. Provide separate hangers or supports on both sides of each nonrigid joint or flexible pipe coupling.
- C. Adjust pipe hangers according to MSS SP-89, Paragraph 10.6.
- D. Install leveling bolts beneath support baseplates. Provide 3/4-inch-thick grout pad beneath each base.
- E. Install piping without springing, forcing, or stressing the pipe or any connecting valves, pumps, and other equipment to which the pipe is connected.

### 3.04 INSTALLING STEEL AND FRP CHANNEL FRAMES

- A. The Contractor shall use 1-5/8-inch-high channel frames, unless 3-1/4-inch is needed, to provide clearance from walls. Use multiple back-to-back channels if additional clearance is needed.

### 3.05 INSTALLING NEOPRENE ISOLATING SLEEVES

- A. The Contractor shall install a sleeve around each metal pipe 8 inches and smaller at the point of bearing or contact with the pipe hanger or support.

### 3.06 PAINTING AND COATING

The Contractor shall do the following regarding painting and coating:

- A. Grind the welds of fabricated steel pipe supports smooth, prepare surface by sandblasting, and apply coating system.
- B. Except for stainless steel, paint exposed metallic pipe hangers and supports to match the color of the adjacent wall using System No. 52 in accordance with Section 09900, Painting and Coating. If the adjacent wall is not painted, paint the hangers and supports to match color code of the largest pipe on the support.

END OF SECTION

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SECTION 15075  
PROCESS EQUIPMENT, PIPING, AND VALVE IDENTIFICATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes requirements for materials and installation of markers, labels, and signs for pipes, valves, mechanical equipment, and for miscellaneous plant services.

1.02 RELATED WORK (NOT USED)

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. The Contractor shall submit manufacturer's catalog data and descriptive literature describing materials, colors, letter size, and size of labels.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS (NOT USED)

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 LABELS FOR PIPING

- A. Labels for piping shall bear the full piping system name as shown in the Piping Schedule on the Drawings. The Contractor shall provide separate flow directional arrows next to each label. Color, size, and labeling shall conform to ANSI A13.1 and Z535.1. Labels for piping inside buildings shall be vinyl cloth: W. H. Brady Co. B-500 vinyl cloth, Seton Name Plate Corporation Pipe Markers, or equal. Labels for piping located outdoors shall be weather- and UV-resistant acrylic plastic and shall be W. H. Brady Co. B-946, Seton Name Plate Corporation Pipe Markers, or equal.
- B. Alternatively, the Contractor shall provide preprinted, semirigid, snap-on, color-coded pipe markers. Color, size, and labeling shall conform to ANSI A13.1 and Z535.1. Label shall cover 360° (minimum). Labels shall be fabricated of weather- and UV-resistant acrylic plastic. Labels shall be Seton Nameplate Corporation SetMark pipe marks or equal.

2.02 LABELS FOR VALVES

- A. The Contractor shall provide each valve listed on the Tag Number list with an identification tag. The tag shall be 2-inch-square or circular aluminum W. H. Brady B-60, Seton Name Plate Corp., or equal. Aluminum tags shall have black-filled letters. The Contractor shall provide fiberglass tags for chemical system valves. Valve tag shall include valve size, flow stream, valve type, and direction and number of turns to open. Contractor shall submit the valve tag label schedule for review by the Engineer in accordance with Paragraph 1.03.B of this Specification.

2.03 HOSE BIBB SIGNS—UNSAFE WATER

- A. The Contractor shall provide a rigid sign labeled "DANGER—DO UNSAFE WATER" for each hose bibb. Size and lettering shall conform to OSHA requirements. Signs shall be Seton Nameplate Company 20-gauge baked enamel, minimum size 7 inches by 3 inches; Brady B-120 Fiber-Shield fiberglass, minimum size 7 inches by 3 inches, 1/8 inch thick; or equal.

2.04 LABELS FOR MECHANICAL EQUIPMENT

- A. The Contractor shall provide a label for each pump, blower, compressor, tank, feeder, flocculator, flash mixer, clarifier mechanism, or other piece of mechanical equipment. The label shall show the equipment name and tag number as shown on the Tag Number list or on the Drawings. Labels shall be 1-1/2 inches (minimum) by 4 inches (minimum) brass, aluminum, or 1/8-inch-thick fiberglass tags. Provide fiberglass tags for chemical system equipment: Brady B-120 Fiber-Shield, Seton Style 2065, or equal.

2.05 LABELS FOR TANKS

- A. Signs shall be weather- and UV-resistant. Labels shall be Brady B-946, Seton Name Plate Corporation PSPL, or equal. Minimum size shall be 7 inches by 10 inches. Provide a sign on each quadrant of the tank bearing the tank tag number and the name of the liquid stored.

2.06 UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

- A. The Contractor shall provide permanent, bright-colored, continuous-printed plastic tape intended for direct burial service, not less than 6 inches wide by 3.5 mils thick. Provide tape with printing that most accurately indicates the type of service of buried pipe. Provide the following colored tape for the various piping services:

Service	Color
Electric and Conduit	Red
Water	Blue
Sewer	Green
Sludge	Brown
Chemical	Yellow
Reclaimed Water	Pantone Purple

2.07 UNDERGROUND DETECTABLE METALLIC PIPE WARNING TAPE

- A. The Contractor shall provide permanent, bright-colored, continuous-printed tape consisting of an aluminum or steel foil sheathed in a plastic laminate, not less than

2 inches wide by 3 mils thick. Provide tape with printing that most accurately indicates the type of buried service. Provide the following colored tape for the various piping services:

Service	Color
Electric and Conduit	Red
Water	Blue
Sewer	Green
Sludge	Brown
Chemical	Yellow
Reclaimed Water	Pantone Purple

### PART 3 EXECUTION

#### 3.01 INSTALLING PIPE LABELS

- A. The Contractor shall provide a label and flow arrow at each connection to pumps or other mechanical equipment, at wall boundaries, at tees and crosses, and at 20-foot centers on straight runs of piping.
- B. On piping having external diameters less than 6 inches (including insulation, if any), the Contractor shall provide full-band pipe markers, extending 360° around pipe at each location.
- C. On piping having external diameters of 6 inches and larger (including insulation, if any), provide either full-band or strip-type pipe markers but not narrower than three times letter height (and of required length), fastened by one of the following methods:
  - 1. Laminated or bonded application of pipe marker to pipe or insulation.
  - 2. Strapped-to-pipe or insulation application of semirigid type with Type 304 or 305 stainless steel bands.

#### 3.02 INSTALLING VALVE AND EQUIPMENT LABELS

- A. The Contractor shall attach labels to the valve or piece of equipment with Type 304 or 316 stainless steel chains unless otherwise noted. For sodium hypochlorite and hydrofluosilicic acid use thermoplastic chains to attach labels.
- B. The Contractor shall attach valve labels to the valve handwheels. If the valve has no handwheel, attach the label to the valve by tying the tag wire or chain around the operating shaft or nut.

### 3.03 INSTALLING MISCELLANEOUS SIGNS

- A. The Contractor shall attach miscellaneous signs according to the sign manufacturer's recommendations and in accordance with OSHA requirements.

### 3.04 INSTALLING UNDERGROUND PLASTIC WARNING TAPE FOR METAL PIPE

- A. During backfilling of each exterior underground piping system, the Contractor shall install continuous underground-type plastic line marker directly over buried line at 6 to 8 inches above the top of the pipe. Where multiple small lines are buried in common trench and do not exceed overall width of 16 inches, install a single line marker.

END OF SECTION

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SECTION 15110  
MANUAL, CHECK, AND PROCESS VALVES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all valves as shown in the Drawings and as specified in this Section. All valves shall be complete with all necessary manual actuators, valve boxes, extension stems, and floor stands, which are required for proper valve operation and completion of the work.
  - 1. All valves shall be of the sizes shown in the Drawings. All equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.
  - 2. The valves shall include but not be limited to the following:
    - a. Ball Valves
    - b. Gate Valves
    - c. Globe and Angle Valves

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 09900, Painting and Coating.
- F. Section 15055, Piping Systems—General.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product technical submittal data shall contain the following information and data:
  - 1. Acknowledgment that products submitted meet requirements of standards referenced.
  - 2. Manufacturer's installation instructions.

3. Manufacturer's operation and maintenance manuals.
  4. Data of valves, actuators, and accessories:
    - a. Pressure and temperature rating.
    - b. Materials of construction, with ASTM reference and grade.
    - c. Linings and coatings.
    - d. Dimensions and weight.
    - e. Flow coefficient.
    - f. Actuators and accessories details.
    - g. Manufacturer's product brochure, cut-sheets, and parts diagrams.
- B. Dimensions and orientation of valve actuators as installed on the valves. Show location of internal stops for gear actuators. State differential pressure and fluid velocity used to size actuators. For worm-gear actuators, state the radius of the gear sector in contact with the worm and state the handwheel diameter.
- C. The following test reports: Performance Tests; Leakage Tests; Hydrostatic Tests; and Proof-of-Design Tests as applicable or required.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standard Institute (ANSI)
1. ANSI A21.11—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
  2. ANSI B1.20.1—Pipe Threads, General Purpose (Inch).
  3. ANSI B1.20.7—Hose Coupling Screw Threads (Inch).
  4. ANSI B16.1—Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250.
  5. ANSI B16.5—Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard.
  6. ANSI B16.10—Face to Face and End-to-End Dimensions of Valves.
  7. ANSI B16.18—Cast Copper Alloy Solder Joint Pressure Fittings.
  8. ANSI B16.34—Valves Flanged, Threaded and Welding End.



9. ANSI B16.42—Ductile-Iron Pipe Flanges and Flanged Fittings, Classes 150 and 300.
10. ANSI B16.47—Large Diameter Steel Flanges: NPS 26 through NPS 60.
11. ANSI B16.104—Control Valve Seat Leakage.
12. ANSI B36.10—Welded and Seamless Wrought Steel Pipe.
13. ANSI B93.10—Static Pressure Rating Methods of Square Head Fluid Power Cylinders Part 1: Pressure Containing Components.
14. ANSI B93.15—Mounting Dimensions for Square Head Industrial Fluid Power Cylinders.
15. ANSI/NSF 61—Drinking Water System Components – Health Effects.

B. American Petroleum Institute (API)

1. API 6D—Pipeline Valves (Steel Gate, Plug, Ball, and Check Valves).
2. API 6FA—Specification for Fire Test for Valves.
3. API 594—Check Valves: Flanged, Lug, Wafer and Butt-Welding.
4. API 607—Testing of Valves – Fire Type-Testing Requirements.

C. American Society for Testing of Materials (ASTM)

1. ASTM A36—Standard Specification for Carbon Structural Steel.
2. ASTM A47—Standard Specification for Ferritic Malleable Iron Castings.
3. ASTM A48—Standard Specification for Gray Iron Castings.
4. ASTM A105—Standard Specification for Carbon-Steel Forgings for Piping Applications.
5. ASTM A108—Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
6. ASTM A126—Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.
7. ASTM A148—Standard Specification for Steel Castings, High Strength, for Structural Purposes.
8. ASTM A181—Standard Specification for Carbon-Steel Forgings, for General-Purpose Piping.
9. ASTM A182—Standard Specification for Forged or Rolled Alloy and Stainless-Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
10. ASTM A193—Standard Specification for Alloy-Steel and Stainless-Steel Bolting Materials for High-Temperature or High Pressure Service and Other Special Purpose Applications.
11. ASTM A194—Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High-Temperature Service, or Both.
12. ASTM A216—Standard Specification for Steel Castings, Carbon, Suitable for Fusion-Welding, for High-Temperature Service.

13. ASTM A240—Standard Specification for Chromium and Chromium-Nickel Stainless-Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
14. ASTM A269—Standard Specification for Seamless and Welded Austenitic Stainless-Steel Tubing for General Purpose.
15. ASTM A276—Standard Specification for Stainless-Steel Bars and Shapes.
16. ASTM A313—Standard Specification for Stainless-Steel Spring Wire.
17. ASTM A322—Standard Specification for Steel Bars, Alloy, Standard Grades.
18. ASTM A351—Standard Specification for Castings, Austenitic, for Pressure-Containing Parts.
19. ASTM A395—Standard Specification for Ferritic Ductile-Iron Pressure-Retaining Castings for Use at Elevated Temperatures.
20. ASTM A436—Standard Specification for Austenitic Gray Iron Castings.
21. ASTM A439—Standard Specification for Austenitic Ductile-Iron Castings.
22. ASTM A449—Standard Specification for Hex Cap Screws, Bolts and Studs, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
23. ASTM A276—Standard Specification for Stainless-Steel Bars and Shapes.
24. ASTM A479—Standard Specification for Stainless-Steel Bars and Shapes for Use in Boilers and Other Pressure Vessels.
25. ASTM A494—Standard Specification for Castings, Nickel and Nickel Alloy.
26. ASTM A516—Standard Specification for Pressure Vessel Plates, Carbon-Steel, for Moderate- and Lower-Temperature Services.
27. ASTM A536—Standard Specification for Ductile-Iron Castings.
28. ASTM A564—Standard Specification for Hot-Rolled and Cold-Finished Age-Hardening Stainless-Steel Bars and Shapes.
29. ASTM A582—Standard Specification for Free-Machining Stainless-Steel Bars.
30. ASTM A666—Standard Specification for Annealed or Cold-Worked Austenitic Stainless-Steel Sheet, Strip, Plate, and Flat Bar.
31. ASTM A743—Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application.
32. ASTM A744—Standard Specification for Castings, Iron-Chromium-Nickel, Corrosion Resistant, for Severe Service.
33. ASTM A890—Standard Specification for Castings, Iron-Chromium-Nickel-Molybdenum Corrosion-Resistant, Duplex (Austenitic/Ferritic) for General Application.
34. ASTM B16—Standard Specification for Free-Cutting Brass Rod, Bar and Shapes for Use in Screw Machines.
35. ASTM B21—Standard Specification for Naval Brass Rod, Bar, and Shapes.

36. ASTM B61—Standard Specification for Steam or Valve Bronze Fittings.
37. ASTM B62—Standard Specification for Composition Bronze or Ounce Metal Castings.
38. ASTM B98—Standard Specification for Copper-Silicon Alloy Rod, Bar and Shapes.
39. ASTM B99—Standard Specification for Copper-Silicon Alloy Wire for General Applications.
40. ASTM B127—Standard Specification for Nickel-Copper Alloy (UNS N04400) Plate, Sheet, and Strip.
41. ASTM B148—Standard Specification for Aluminum-Bronze Sand Castings.
42. ASTM B150—Standard Specification for Aluminum Bronze Rod, Bar, and Shapes.
43. ASTM B164—Standard Specification for Nickel-Copper Alloy Rod, Bar, and Wire.
44. ASTM A169—Standard Specification for Aluminum Bronze Sheet, Strip, and Rolled Bar.
45. ASTM B193—Standard Test Method for Resistivity of Electrical Conductor Materials.
46. ASTM B371—Standard Specification for Copper-Zinc-Silicon Alloy Rod.
47. ASTM B427—Standard Specification for Gear Bronze Alloy Castings.
48. ASTM B446—Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625), Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219), and Nickel-Chromium-Molybdenum-Tungsten Alloy (UNS N06650) Rod and Bar.
49. ASTM B443—Standard Specification for Nickel-Chromium-Molybdenum-Columbium Alloy (UNS N06625) and Nickel-Chromium-Molybdenum-Silicon Alloy (UNS N06219) Plate, Sheet, and Strip.
50. ASTM B462—Specification for Forged or Rolled UNS N06030, N06022, N06035, N06200, N06059, N06686, N06020, N06024, N06026, N08367, N10276, N10665, N10675, N10629, N08031, N06045, N06025, & R20033 Alloy Pipe Flanges, Forged Fittings, & Valves & Parts for Corrosive High-Temperature Service.
51. ASTM B463—Standard Specification for UNS N08020, UNS N08026, and UNS N08024 Alloy Plate, Sheet, and Strip.
52. ASTM B472—Standard Specification for Nickel Alloy Billets and Bars for Reforging.
53. ASTM B584—Standard Specification for Copper Alloy Sand Castings for General Applications.
54. ASTM B763—Standard Specification for Copper Alloy Sand Castings for Valve Applications.
55. ASTM D1248—Standard Specification for Polyethylene Plastics Extrusion Materials for Wire and Cable.

56. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
57. ASTM D1785—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
58. ASTM D2000—Standard Classification System for Rubber Products in Automotive Applications.
59. ASTM D3222—Standard Specification for Unmodified Poly (Vinylidene Fluoride) (PVDF) Molding Extrusion and Coating Materials.
60. ASTM D4101—Standard Specification for Polypropylene Injection and Extrusion Materials.
61. ASTM F441—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
62. ASTM F467—Standard Specification for Non-Ferrous Nuts for General Use.
63. ASTM F468—Standard Specification for Non-Ferrous Bolts, Hex Cap Screws, and Studs for General Use.

D. American Society of Mechanical Engineers (ASME)

1. ASME 16.5—Pipe Flanges and Flanged Fittings NPS 1/2 through NPS 24 Metric/Inch Standard.
2. ASME B16.11—Standards of Pipes and Fittings.
3. ASME B16.24—Cast Copper Alloy Pipe Flanges and Flanged Fittings Classes 150, 300, 400, 600, 900, 1500, and 2500.

E. American Society of Safety Engineers (ASSE)

1. ASSE 1011—Performance Requirements for Hose Connection Vacuum Breakers.

F. American Water Works Association (AWWA)

1. AWWA C110—Ductile-Iron and Gray-Iron Fittings for Water.
2. AWWA C111—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
3. AWWA C115—Standard for Flanged Ductile-Iron Pipe with Threaded Flanges.
4. AWWA C207—Steel Pipe Flanges for Waterworks Service, Sizes 4-Inch through 144-Inch (100 mm through 3,600 mm).
5. AWWA C500—Metal-Seated Gate Valves for Water Supply Service.
6. AWWA C504—Rubber-Sealed Butterfly Valves.
7. AWWA C507—Ball Valves 6-Inch through 48-Inch (150 mm through 1200 mm).

8. AWWA C508—Swing-Check Valves for Waterworks Service, 2-Inch (50 mm) through 24-Inch (600 mm).
9. AWWA C509—Resilient-Seated Gate Valves for Water-Supply Service.
10. AWWA C512—Air Release, Air/Vacuum, and Combination Air Valves for Waterworks Service.
11. AWWA C515—Reduced-Wall, Resilient-Seated Gate Valves for Water Supply Service.
12. AWWA C550—Protective Epoxy Interior Coatings for Valves and Hydrants.
13. AWWA C606—Grooved and Shouldered Joints.
14. AWWA C800—Underground Service Line Valves and Fittings.

G. Fluid Controls Institute (FCI)

1. FCI 70-2—Control Valve Seat Leakage.

H. Manufacturers Standardization Society (MSS)

1. MSS SP-61—Pressure Testing of Steel Valves.
2. MSS SP-67—Butterfly Valves.
3. MSS SP-68—High Pressure Butterfly Valves with Offset Design.
4. MSS SP-81—Stainless-Steel, Bonnetless, Flanged Knife Gate Valves.
5. MSS SP-83—Class 3000 Steel Pipe Unions Socket Welding and Threaded.
6. MSS SP-108—Resilient-Seated Cast-Iron-Eccentric Plug Valves.

I. NACE International (NACE)

1. NACE MR-01—Materials Resistant to Sulfide Stress Cracking in Corrosive Petroleum Refining Environments.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

- B. All valves, unless otherwise directed, shall be loaded and unloaded by lifting, and under no circumstances shall valves be dropped, skidded, or rolled. Valves shall not be stacked or placed under pipe, fittings, or other valves in such a manner that damage could result.
- C. Slings, hooks, or tongs used for lifting shall be padded in such a manner as to prevent damage to exterior surface or interior linings and valve components. If any part of the coating, lining, or components is damaged, the repairs or replacement shall be made by the Contractor at his expense and in a manner satisfactory to the Engineer before attempting to install such valves.
- D. Only new valves will be allowed for installation and shall be stored in a manner to prevent damage and be kept free of dirt, mud, or other debris.

#### 1.09 QUALIFICATIONS

- A. All of the valves shall be products of well-established firms which are fully experienced, reputable, have been selling this product for a minimum of 10 years, and are qualified in the manufacture of the particular product furnished. The valves shall be designed, constructed, and installed in accordance with the requirements and procedures of applicable AWWA standards and shall comply with these Specifications as applicable.

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 MAINTENANCE (NOT USED)

#### 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

#### 1.13 VALVE TYPE CLASSIFICATIONS

- A. Ball Valves (Type 200 series):
  - 1. Type 210: Double-Union PVC Ball Valves, 3 Inches and Smaller, for Water and Light Chemical Service.
  - 2. Type 221: Full-Port Threaded Stainless-Steel Ball Valves, 2 Inches and Smaller, for Water Service.
  - 3. Type 227: Threaded Stainless-Steel Ball Valves, 1/4 Inch through 2 Inches.

B. Gate Valves (Type 600 series):

1. Type 680: Cast-Iron Resilient Wedge Gate Valves, 3 Inches through 20 Inches, for Exposed Service (AWWA C509).
2. Type 682: Cast-Iron Resilient Wedge Gate Valves, 3 Inches through 20 Inches, for Buried Service (AWWA C509).
3. Type 695: Stainless-Steel Knife Gate Valves, 2 Inches through 24 Inches.

C. Globe and Angle Valves (Type 700 series):

1. Type 720: Bronze Hose Bibbs, 1/2 Inch through 1 Inch.
2. Type 722: Bronze Hose Bibbs 3/4 Inch and 1 Inch with Quick-Connect Coupling Adapters (for Non-Potable Water Service).

D. Plug Valves (Type 900 series):

1. Type 920: Cast-Iron Non-Lubricated Eccentric Plug Valves, 4 Inches and Larger.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. Valves are identified in the Drawings by size and type number. For example, a callout of 36V300 refers to a 36-inch-diameter Type 300 valve. A Type 300 valve is a flanged, rubber-seated butterfly valve that is 4 inches through 72 inches for exposed service.
- B. All valves shall be complete with all necessary geared actuators, chainwheels and chains, handwheels, levers, valve bonnets, valve boxes, extension stems, operating nuts, and T-handle wrenches, which are required for proper valve operating and completing of the work included under this Section. Renewable parts including discs, packing, and seats shall be of types specified in this Section and acceptable by valve manufacturer for the intended service. All units shall have the name of the manufacturer and the size of the valve cast on the body or bonnet or shown on a permanently attached stainless-steel plate in raised embossed letters. All isolation valves shall be suitable for the intended service with bubble-tight shutoff to flow in either direction.

- C. Bronze or brass components in contact with water shall comply with the following requirements:

Constituent	Content
Zinc	7% maximum
Aluminum	2% maximum
Lead	8% maximum
Copper + Nickel + Silicon	83% minimum

- D. Valves and valve operators shall be factory prepared and primed and field finish coated in accordance with Section 09900, Painting and Coating.

## 2.02 VALVE ACTUATORS

- A. The valve actuator shall be an integral part of a valve. The valve actuator shall be provided, installed, and adjusted by the valve manufacturer. Actuator mounting arrangements shall facilitate operation and maintenance and shall be determined by the valve manufacturer unless indicated otherwise on the Drawings or directed by the Engineer.
- B. All valves shall open counter clockwise as viewed from the top. Unless otherwise required by the Owner, the direction of rotation of the wheel or wrench nut to open each valve shall be to the left (counterclockwise). Each valve body or actuator shall have the word "Open" cast on it and an arrow indicating the direction to open.
- C. Actuators shall clearly indicate valve position and an adjustable stop shall be provided to set closing torque. All exposed nuts, bolts, and washers shall be AISI Type 304 stainless steel. Unless noted otherwise, valves shall be equipped with the following manual actuators:
1. Exposed Valves 6 Inches and Smaller: Removable lever or handwheel actuators.
  2. Exposed Valves 8 Inches and Larger: Geared actuators with handwheels.
  3. Buried or Submerged Valves 6 Inches and Smaller: 2-inch-square operating nuts (with valve bonnets, valve boxes, and extension stems as required) and T-handle wrench.
  4. Buried or Submerged Valves 8 Inches and Larger: Geared actuators with 2-inch-square operating nuts (with valve bonnets, valve boxes, and extension stems as required) and wrench.
- D. Levers or handwheels shall be provided to actuate the valves where the valves are within 6 feet and 7 inches from finished grade or the operating floor. Handwheels shall be constructed of ductile-iron. Levers and handwheels shall be coated in



accordance with Section 09900, Painting and Coating. Handwheel diameters for traveling nut actuators shall not exceed 8 inches for valves 12 inches and smaller and shall not exceed 12 inches for valves 20 inches and smaller.

- E. Chainwheel and guide actuators shall be provided for all exposed valves installed with their centerlines more than 6 feet above finished grade. Chainwheels shall be cast-iron with stainless-steel stem, clip, and pins. The actuating chain shall be AISI Type 304 stainless steel. Stainless-steel chain baskets shall also be provided with these units. Chainwheels shall be coated in accordance with Section 09900, Painting and Coating.

Chainwheels and guides shall be Clow Figure F-5680, DeZurik Series W or LWG, Stockham, or equal.

- F. Gear actuators for valves 8 inches through 20 inches shall be of the worm-and-gear or of the traveling-nut type. Gear actuators for valves 24 inches and larger shall be of the worm-and-gear type. Gear actuators for motorized valves shall be of the worm-and-gear type, regardless of size.
  - 1. Gear actuators should be designed assuming that the differential pressure across the valves is equal to the test pressure of the connecting piping and assuming a line fluid temperature range of 33°F to 125°F, unless otherwise required in the detailed valve specifications.
  - 2. Gear actuators shall be enclosed and oil lubricated with seals provided on shafts to prevent entry of dirt and water into the actuator. Gear actuators for valves aboveground or in vaults and structures shall have handwheels. The actuators for valves in exposed service shall contain a dial indicating the position of the valve disc or plug.
  - 3. Traveling nut and worm-and-gear actuators shall be of the totally enclosed design and proportioned to permit operation of the valve under full differential pressure rating of the valve with a maximum pull of 80 pounds on the handwheel or crank. Stop-limiting devices shall be provided in the actuators in the open and closed positions. Actuators shall be of the self-locking type to prevent the disc or plug from creeping. Design actuator components between the input and the stop-limiting devices to withstand without damage a pull of 200 pounds for handwheel or chainwheel actuators and an input torque of 300 foot-pounds for operating nuts when operating against the stops.
  - 4. The self-locking worm gear shall be a one-piece design of gear bronze material (ASTM B427; or ASTM B584, Alloy C86200) that is accurately machine cut. Actuators for eccentric and lubricated plug valves may use ductile-iron gears provided the gearing is totally enclosed with spring-loaded rubber lip seals on the shafts. The worm shall be hardened alloy steel (ASTM A322, Grade G41500 or G41400; or ASTM A148,

Grade 105-85) with thread ground and polished. Support worm-gear shafts at each end by ball or tapered roller bearings. The reduction gearing shall run in a proper lubricant. The handwheel diameter shall be no more than twice the radius of the gear sector in contact with the worm. Worm-gear actuators shall be Limitorque Model HBC, EIM Series W, or equal.

- G. For buried or submerged service, provide watertight shaft seals and watertight valve and actuator cover gaskets. Provide totally enclosed actuators designed for buried or submerged service.
- H. All buried valves shall have non-rising stems. All buried valves 3 feet below grade or deeper as measured at the valve centerline shall be furnished with an operator stem extension to extend the operating nut within 6 inches from the top of the valve box cover.

### 2.03 VALVE END CONNECTIONS

- A. Provide valve end connections conforming to connected piping and as shown in the Drawings. Generally, all buried valves shall be mechanical joint type end connectors. Exposed valves shall be screwed-end, socket-weld end, or flanged to conform to adjacent exposed connected piping system.
- B. Comply with the following standards:
  - 1. Threaded: ANSI B1.20.1.
  - 2. Flanged: ANSI B16.1 Class 125 unless other noted or AWWA C207.
  - 3. Mechanical (gland) Type: AWWA C111.
  - 4. Soldered: ANSI B16.18.
- C. Nuts, Bolts, and Washers: Wetted or internal to be bronze or stainless-steel. Exposed to be zinc or cadmium-plated.
- D. Epoxy Interior Coating: Provide epoxy coating for all interiors of ferrous valve body surfaces in accordance with AWWA C550. Coatings shall be NSF-approved for valves in all potable water piping services. Coatings shall not be required for stainless-steel valve interiors.

### 2.04 VALVE BOXES

- A. All buried valves 2-inch size and larger shall be equipped with a standard cast-iron roadway valve box. Valve boxes shall be of the slip or sliding type with a round lid marked "Water" for potable water valves or "Sewer" for wastewater and a square lid marked "Reclaimed Water" for reclaimed water valves. The box shall be designed to prevent transfer of the surface loads directly to the valve or piping.

Valve boxes must have a minimum adjustable range of 12 inches and a minimum inner diameter of 6 inches. All valve boxes and lids shall be produced from grey cast-iron conforming to the latest revision of specification for grey iron castings, ASTM designation A48, Class 20A-25A. All castings shall be true and free of holes and shall be cleaned according to good foundry practice, chipped and ground as needed to remove fins and rough places on castings. Valve boxes have to be rated to sustain FDOT H-20 loadings and have a minimum depth of 8 inches. The valve box lid shall fit flush in the top of the box without forcing and shall not rock, tip, or rattle.

- B. Provide debris cap as required in the Drawings.
- C. Coat buried cast-iron pieces as specified in Section 09900, Painting and Coating, System No. 21 or with fusion-bonded epoxy.
- D. Valve boxes shall be as manufactured by Tyler Pipe, Geneco, Star Pipe Products, or equal.

## 2.05 EXTENSION STEMS

- A. Where the depth of the valve is such that its centerline is more than 4 feet below grade, provide operating extension stems to bring the operating nut to a point 6 inches below the surface of the ground and/or box cover. Where the valve is submerged, provide operating extension stems to bring the operating nut to 6 inches above the water surface. Extension stems shall be Type 316 stainless steel, solid core, and shall be complete with 2-inch-square operating nut. The connections of the extension stems to the operating nuts and to the valves shall withstand without damage a pull of 300 foot-pounds.
- B. Extension stem diameters shall be as tabulated below:

Valve Size (inches)	Minimum Extension Stem Diameter (inches)
2	3/4
3, 4	7/8
6	1
8	1-1/8
10, 12	1-1/4
14	1-3/8
16, 18	1-1/2
20, 24, 30, 36	1-3/4
42, 48, 54	2

- C. Provide buried valves or valves located inside manholes or vaults with valve boxes cast in the manhole or vault roof with a valve position indicator designed to fit standard 5-1/4-inch valve boxes. The indicators shall show valve position and the direction and number of turns required to fully open (or close). All internal gearing shall be sealed. Ship each unit ready for field installation complete with valve box cast-iron adapter, capscrews, guide bushing, position indicator, flexible washer, centering plate, and 2-inch AWWA nut. Valve box and indicator shall be provided by the valve manufacturer. Indicators shall be Westran Position Indicator, Pratt Diviner, or equal.

## 2.06 FLOOR STANDS

- A. When required by the installations, provide floor stands for the operation of valves. Floor stands shall be of the nonrising stem, indicating type, complete with steel extension stems, couplings, handwheels, stem guide brackets, and special yoke attachments as required by the valves and recommended and supplied by the stand manufacturer. Floor stands shall be cast-iron base type: Clow, Figure F-5515; Bingham and Taylor; Stockham; or equal. Handwheels shall turn counterclockwise to open the valves.
- B. Provide Type 316 stainless-steel anchor bolts.
- C. Provide Type 316 stainless-steel extension stems for valves in exposed service. Provide Type 316 stainless-steel stems for valves in submerged service.
- D. Provide adjustable stem guide brackets for extension stems. The bracket shall allow valve stems to be set over a range of 2 to 36 inches from walls. Provide bushings drilled to accept up to 2-inch-diameter stems. Base, arm, and clamp shall be Type 316 stainless-steel. Bushing shall be bronze (ASTM B584, Alloy C86400 or C83600). Bolts, nuts, screws, and washers (including wall anchor bolts) shall be Type 316 stainless steel. Provide slots in the bracket to accept 3/4-inch bolts for mounting the bracket to the wall. Products: Trumbull Industries, Inc., Adjustable Stem Guide or equal.

## 2.07 BOLTS, NUTS, AND GASKETS FOR FLANGED VALVES

- A. Bolts, nuts, and gaskets for flanged valves shall be as described in Section 15055, Piping Systems—General.

## 2.08 PAINTING AND COATING

- A. Coat metal valves located aboveground or in vaults and structures the same as the adjacent piping. If the adjacent piping is not coated, coat valves as specified in Section 09900, Painting and Coating, System No. 10. Apply the specified prime and finish coat at the place of manufacture. The finish coat shall match the color of the adjacent piping. Coat handwheels the same as the valves.
- B. Coat buried metal valves at the place of manufacture as specified in Section 09900, Painting and Coating, System No. 21.
- C. Line the interior metal parts of metal valves 4 inches and larger, excluding seating areas and bronze and stainless-steel pieces, as specified in Section 09900, Painting and Coating, System No. 6. Apply lining at the place of manufacture.
- D. Coat floor stands as specified in Section 09900, Painting and Coating, System No. 10.
- E. Test the valve interior linings and exterior coatings at the factory with a low-voltage (22.5 to 80 volts, with approximately 80,000-ohm resistance) holiday detector, using a sponge saturated with a 0.5% sodium chloride solution. The lining shall be holiday free.
- F. Measure the thickness of the valve interior linings as specified in Section 09900, Painting and Coating. Repair areas having insufficient film thickness as specified in Section 09900, Painting and Coating.

## 2.09 BALL VALVES (TYPE 200 SERIES)

- A. Type 210—Double-Union PVC Ball Valves, 3 Inches and Smaller, for Water and Light Chemical Service:
  - 1. Unless noted otherwise, ball valves installed in PVC piping systems 3 inches and smaller shall be constructed from polyvinyl chloride (PVC) ASTM D1784, rated to 150 psi minimum from 30° to 120°F, double-union design with two-way blocking capability, socket end connection except where threaded or flanged-end valves are specifically shown in the Drawings, double EPDM O-ring seals and EPDM backing cushions, PTFE seals, ABS handle, NSF-61 certified. Valves shall be as manufactured by Asahi/America Inc., Quarter-Bloc Ball Valve Series, or approved equal. Note: Asahi Quarter-Bloc Ball Valves double O ring seals are made from EPDM. Quarter-Bloc Ball Valves are designed for water and light chemical applications only, sized from ½-inch to 2 inches. Please refer to Asahi's chemical resistance guide for more information.

B. Type 221—Full-Port Threaded Stainless-Steel Ball Valves, 2 Inches and Smaller, for Water Service:

1. Stainless-steel ball valves 2 inches and smaller for water service shall be rated at a minimum pressure of 1,000 psi WOG at a temperature of 100°F. Provide full-port ball and body design. Valve body, ball, and stem shall be Type 316 stainless-steel, ASTM A276 or A351. Seat and seals shall be reinforced PTFE. Valves shall have lever actuators, plastic coated. Valves shall have screwed ends (ANSI B1.20.1) and nonblowout stems. Clean valves for oxygen service according to CGA Standards G-4.1-1996. Parts shall be free of burrs, chips, or other foreign materials. Wash, rinse, and then dry with oil-free filtered air. Assemble valves using only lubricants that are compatible with oxygen. Test valves on equipment using only tools that have been cleaned in the same manner as the valve components. Seal valves in clear plastic bags and tag to identify as having been processed for oxygen service. Valves shall be Worcester Series 59, Apollo 86A-100 Series, or approved equal.

C. Type 227—Threaded Stainless-Steel Ball Valves, 1/4 Inch through 2 Inches:

1. Stainless-steel ball valves 1/4 inch through 2 inches air service shall be rated at a minimum pressure of 1,500 psi WOG at a temperature of 100°F. Bodies shall be Type 316 stainless-steel (ASTM A351, Type CF8M). Ball, stem, and compression ring shall be Type 316 stainless-steel. Seats shall be filled TFE and seals shall be TFE. Valves shall be Jamesbury Type 3000 MT or approved equal.

## 2.10 GATE VALVES (TYPE 600 SERIES)

A. Type 680—Cast-Iron Resilient Wedge Gate Valves, 3 Inches through 20 Inches for Exposed Service (AWWA C509):

1. Valves 3 inches and larger for exposed service operation shall be of cast-iron or ductile-iron body construction and conform to AWWA C509 for resilient seated gate valves. The valve design shall incorporate non-rising stems and "O" ring stem seals. Valves shall open counterclockwise. Valves shall be designed for bubbletight shutoff to flow in either direction. Before shipment, the valve manufacturer shall test each valve to 200 psi pressure differential in both directions and provide a certificate to the Engineer stating that each valve provided bubbletight shutoff during testing. The valve interior shall be epoxy coated on the entire ferrous surface of the waterway. The valve exterior shall be coated in accordance with Section 09900, Painting and Coating.

2. Exposed valves 3 inches and larger shall be flanged.
3. Gate valves shall be manufactured by Mueller, American Flow Control, Kennedy, or approved equal.

B. Type 682—Cast-Iron Resilient Wedge Gate Valves, 3 Inches through 20 Inches, for Buried Service (AWWA C509):

1. Valves 2 inches and larger for buried service operation shall be of cast-iron or ductile-iron body construction and conform to AWWA C509 for resilient seated gate valves. The valve design shall incorporate non-rising stems and "O" ring stem seals. Valves shall open counterclockwise. Valves shall be designed for bubbletight shutoff to flow in either direction. Before shipment, the valve manufacturer shall test each valve to 200 psi pressure differential in both directions and provide a certificate to the Engineer stating that each valve provided bubbletight shutoff during testing. The valve interior shall be epoxy coated on the entire ferrous surface of the waterway. The valve exterior shall be coated in accordance with Section 09900, Painting and Coating as specified in this Section for ductile-iron pipe and fittings. Buried valves shall be equipped with standard 2-inch-square operating nuts.
2. Buried valves 2 inches and larger shall have mechanical joint ends, conforming to AWWA C111. Valves shall be furnished complete with bolts, nuts, and gaskets.
3. Gate valves shall be manufactured by Mueller, American Flow Control, Kennedy, or approved equal.

C. Type 695—Stainless-Steel Knife Gate Valves, 2 Inches through 24 Inches:

1. Knife gate valves shall be of the solid one-piece cast body design. Minimum working pressure shall be 150 psi. Provide bevel gear actuators for valves 14 inches and larger. Materials of construction shall be as follows:

Component	Material	Specification
Body	Stainless-steel	ASTM A743, Grade CF8M
Yoke, superstructure, fasteners, and packing gland	Stainless-steel	AISI Type 304 or 316 stainless-steel
Gate	Stainless-steel	ASTM A240, Type 316
Stem	Stainless-steel	ASTM A582, Grade S20300

Component	Material	Specification
Handwheel	Cast-iron	ASTM A126, Class B
Packing	Flax or acrylic PTFE	--

2. Valves shall be bonnetless wafer type with through bolting flange, for installation between two adjacent flanges. Flange holes in the body shall be Class 125, ANSI B16.1. Valve leakage shall be in accordance with MSS SP-81. Valves shall have a resilient seat (neoprene or nitrile) for drip-tight shutoff. Valves shall be manufactured by DeZurik, ITT Fabri-Valve Model C67S, or approved equal.

## 2.11 GLOBE AND ANGLE VALVES (TYPE 700 SERIES)

### A. Type 720—Bronze Hose Bibbs 1/2-Inch through 1 Inch:

1. Hose bibbs 1/2 inch, 3/4 inch, and 1 inch shall be all bronze (ASTM B62 or ASTM B584, Alloy C83600) with rising or non-rising stem, composition disc, bronze or malleable iron handwheel, and bronze stem (ASTM B99, Alloy C65100; ASTM B371, Alloy C69400; or ASTM B584, Alloy C87600). Packing shall be PTFE or graphite. Valves shall have a pressure rating of at least 125 psi for cold-water service. Threads on valve outlets shall be American National Standard fire hose coupling screw thread (ANSI B1.20.7). Provide atmospheric vacuum breaker conforming to ASSE 1011 and IAPMO code. Valves shall be manufactured by Nibco or approved equal.

### B. Type 722—Bronze Hose Bibbs, 1 inch, with Quick-Connect Coupling Adapters (for Non-Potable Water Service):

1. Hose bibbs 1 inch shall be all bronze (ASTM B62 or ASTM B584, Alloy C83600) with rising or non-rising stem, composition disc, bronze or malleable iron hand wheel, and bronze stem (ASTM B99, Alloy C65100; ASTM B371, Alloy C69400; or ASTM B584, Alloy C87600). Packing shall be Teflon or graphite. Valves shall have a pressure rating of at least 125 psi for cold-water service. Threads on valve outlets shall be American National Standard fire hose coupling screw thread (ANSI B1.20.7). Provide atmospheric vacuum breaker conforming to ASSE 1011 and IAPMO code and approved by the City of Leesburg health department. Provide with quick-connect female coupling to fit the quick-connect male adapter on the rubber water hose. Valves shall be manufactured by Nibco or approved equal.



## 2.12 PLUG (TYPE 900 SERIES)

- A. Plug and Seating Design for Eccentric Plug Valves (Types 900, 910, 915, 920, and 925): Eccentric plug valves shall comply with MSS SP-108 and the following. Provide a rectangular plug design, with an associated rectangular seat. Provide bidirectional seating design. The valve shall seat with the rated pressure upstream and downstream of the closed plug. Provide geared actuators sized for bidirectional operation.
- B. For Types 900, 910, 915, 920, and 925 eccentric plug valves, the metallic portion of the plug shall be one-piece design and shall be without external reinforcing ribs which result in a space between the rib and the main body of the plug through which water can pass. Valves shall be repackable without any disassembly of valve or actuator. The valve shall be capable of being repacked while under the design pressure in the open position. Nowhere in the valve or actuators shall the valve shaft be exposed to iron-on-iron contact. Sleeve bearings shall be stainless-steel in valve sizes 20 inches and smaller and bronze or stainless-steel in valve sizes 24 inches and larger. Provide enclosed worm-gear actuators for valves 6 inches and larger.
- C. Rubber compounds shall have less than 2% volume increase when tested in accordance with ASTM D471 after being immersed in distilled water at a temperature of  $73.4^{\circ}\text{F} \pm 2^{\circ}\text{F}$  for 70 hours.
- D. Type 920—Cast-Iron Non-Lubricated Eccentric Plug Valves, 4 Inches and Larger:
  - 1. Plug valves 4 inches and larger shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with flanges or mechanical-joint end connections to match connecting piping and as shown in the Drawings. Flanged valves shall be 125-lb flanges and faced and drilled to the ANSI B16.1, 125-lb standard. Mechanical joint ends shall conform to AWWA C111. Valve bodies shall be of ASTM A126 Class B cast-iron. Valves shall be furnished with a welded overlay seat of not less than 90% pure nickel. Seat area shall be raised, with raised surface completely covered with weld to ensure that the plug face contacts only nickel. Screwed-in seats shall not be acceptable. The plug shall have a cylindrical seating surface eccentrically offset from the center of the plug shaft. The interference between the plug face and body seat, with the plug in the closed position, shall be externally adjustable in the field with the valve in the line under pressure. Plugs shall be resilient faced with Hycar (Acrylonitrile-Butadiene) or Buna N, formulated and constructed to be suitable for use with wastewater. Minimum port areas shall be 100% of full pipe flow area. Valves shall have sleeve-type metal bearings and shall

be of sintered, oil-impregnated, permanently lubricated Type 316 ASTM. Nonmetallic bearings shall not be acceptable. Valve shaft seals shall be of the multiple V-ring type or U-cup type and shall be externally adjustable and replaceable without removing the bonnet or actuator from the valve under pressure. Valves using O-ring seals or non-adjustable packing shall not be acceptable. All exposed nuts, bolts, springs, washers, and other fasteners shall be 300-series stainless-steel. Valve working pressure ratings shall be a minimum of 150 psi. Each valve shall be given a hydrostatic and seat test with certified copies of proof-of-design test reports as outlined in AWWA C504, Section 5.5. Plug valves shall be DeZurik PEF Series, Henry Pratt Company “Ballcentric” Series, or approved equal.

## PART 3 EXECUTION

### 3.01 JOINTS

- A. Bolt holes of flanged valves shall straddle the horizontal and vertical centerlines of the pipe run to which the valves are attached. Clean flanges by wire brushing before installing flanged valves. Clean flange bolts and nuts by wire brushing, lubricate threads with oil and graphite, and tighten nuts uniformly and progressively. If flanges leak under pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts, and retest the joints. Joints shall be watertight.
- B. Clean threaded joints by wire brushing or swabbing. Apply Teflon joint compound or Teflon tape to pipe threads before installing threaded valves. Joints shall be watertight.
- C. Install lug-type valves with separate hex head machine bolts at each bolt hole and each flange (two bolts per valve bolt hole).
- D. Install grooved-end couplings for valves in accordance with Section 15055, Piping Systems—General.

### 3.02 INSTALLING EXPOSED VALVES

- A. Unless otherwise indicated in the Drawings, install valves in horizontal runs of pipe having centerline elevations 4 feet 6 inches or less above the floor with their operating stems vertical. Install valves in horizontal runs of pipe having centerline elevations between 4 feet 6 inches and 6 feet 9 inches above the floor with their operating stems horizontal.

- B. Install valves on vertical runs of pipe that are next to walls with their stems horizontal, away from the wall. Valves on vertical runs of pipe that are not located next to walls shall be installed with their stems horizontal, oriented to facilitate valve operation.

### 3.03 INSTALLING BURIED VALVES

- A. Connect the valve, coat the flanges, apply tape wrapping or polyethylene encasement as required on the Drawings, and place and compact the backfill to the height of the valve stem.
- B. Place block pads under the extension pipe to maintain the valve box vertical during backfilling and repaving and to prevent the extension pipe from contacting the valve bonnet.
- C. Mount the upper slip pipe of the extension in midposition and secure with backfill around the extension pipe. Pour the concrete ring allowing a depression so the valve box cap will be flush with the pavement surface.
- D. In streets without concrete curbs and in open areas, install the valve box as for a paved area with concrete curb but include a marker post. Cut the marker post from 4-inch-by-4-inch dense structural grade Douglas fir No. 2 or Southern Pine No. 2 surfaced on four sides to a length of 5 feet. Chamfer the top. Set the post in concrete, 2 feet into the ground, away from traffic, and to the side of the pipeline. Coat with a seal and finish coat of white alkyd exterior paint. On the side facing the valve, letter in black the word “VALVE” and the distance in feet from the marker post to the valve box cap.
- E. Install debris cap as close as possible under the cast-iron cover without interfering with the cover operation. Trim flexible skirt to provide a smooth contact with the interior or the extension pipe.

### 3.04 INSTALLING EXTENSION STEM GUIDE BRACKETS

- A. Install extension stem guide brackets at 6- to 8-foot centers. Provide at least two support brackets for stems longer than 10 feet, with one support near the bottom of the stem and one near the top.

### 3.05 FIELD COATING BURIED VALVES

- A. Coat flanges of buried valves and the flanges of the adjacent piping and the bolts and nuts of flanges and mechanical joints, as specified in Section 09900, Painting and Coating, System No. 24.

- B. Wrap buried metal valves 6 inches and larger with polyethylene sheet as specified in Section 15155, Ductile-Iron Pipe and Fittings.

### 3.06 VALVE LEAKAGE AND FIELD TESTING

- A. Test valves for leakage at the same time that the connecting pipelines are tested. See Section 15144, Pressure Testing of Piping, for pressure testing requirements. Protect or isolate any parts of valves, actuators, or control and instrumentation systems whose pressure rating is less than the pressure test. Valves shall show zero leakage. Repair or replace any leaking valves and retest.
- B. Operate manual valves through three full cycles of opening and closing. Valves shall operate from full open to full close without sticking or binding. Do not backfill buried valves until after verifying that valves operate from full open to full closed. If valves stick or bind or do not operate from full open to full closed, repair or replace the valve and repeat the tests.
- C. Test gear actuators through three full cycles from full-open to full-close without binding or sticking. The pull required to operate handwheel- or chainwheel-operated valves shall not exceed 80 pounds. The torque required to operate valves having 2-inch AWWA nuts shall not exceed 150 foot-pounds. If actuators stick or bind or if pulling forces and torques exceed the values stated previously, repair or replace the actuators and repeat the tests. Operators shall be lubricated in accordance with the manufacturer's recommendations before operating.

# ISOLATION VALVE CARD

Date of Installation \_\_\_\_\_

Contract Drawing Number \_\_\_\_\_

Closest Street Address to Valve or Location of Valve

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Size of Valve (inches) \_\_\_\_\_

Circle Type of Valve:    Gate        Butterfly

GPS Coordinate @ Valve \_\_\_\_\_

Installation Foreman \_\_\_\_\_

Confirm Photos are attached \_\_\_\_\_

## **Isolation Valve Layout**

Provide a brief sketch of the installed configuration. Show depths of the water line and show three ties to the isolation valve:

Depth @ Main (feet) \_\_\_\_\_

\_\_\_\_\_  
Contractor Signature

\_\_\_\_\_  
Resident Observer Signature

(Rev 2 – 15 Oct 2006)

END OF SECTION

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SECTION 15122  
FLEXIBLE PIPE COUPLINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, and incidental required to install flexible pipe couplings as shown on the Drawings and specified herein.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 09900, Painting and Coating.
- F. Section 15144, Pressure Testing of Piping.
- G. Section 15155, Ductile Iron Pipe and Fittings.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. The manufacturer's catalog data on flexible pipe couplings and expansion joints. Show the manufacturer's model or figure number for each type of coupling or joint for each type of pipe material for which couplings and joints are used. Show coatings.
- B. The manufacturer's recommended torques to which the coupling bolts shall be tightened for the flexible sleeve-type pipe couplings.
- C. Materials of construction by ASTM reference and grade. Show dimensions.
- D. The number, size, and material of construction of tie rods and lugs for each thrust harness on the project.

1.04 WORK SEQUENCE (NOT USED)

## 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society for Testing and Materials (ASTM)
  - 1. ASTM A240—Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications.
  - 2. ASTM D2000—Standard Classification System for Rubber Products in Automotive Applications.
- B. American National Standards Institute (ANSI)
  - 1. ANSI/NSF Standard 61—Drinking Water Systems Components – Health Effects.
  - 2. ANSI/AWWA C606—Standard for Grooved and Shouldered Type Joints.
- C. American Water Works Association (AWWA)
- D. Expansion Joint Manufacturer’s Association (EJMA)
- E. CSA Group
  - 1. CSA 242—Groove- and Shoulder-Type Mechanical Pipe Couplings

## 1.06 QUALITY ASSURANCE (NOT USED)

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.



1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

PART 2 PRODUCTS

2.01 GENERAL

- A. Each flexible couplings shall be designed for the type, size, and pressure rating of the connecting piping.
- B. All wetted materials shall be suitable for use with the fluid being conveyed.
- C. Wetted materials for flexible coupling used to convey drinking water shall be resistant to free chlorine and chloramine concentrations up to 10 mg/L.
- D. All flexible couplings used in association with drinking water service shall be certified as suitable for contact with drinking water by an accredited certification organization in accordance with ANSI/NSF Standard 61, Drinking Water Systems Components – Health Effects.

2.02 BOLTED-SLEEVE-TYPE COUPLINGS (TYPE C105)

- A. Bolted-sleeve-type couplings shall be designed and manufactured conforming to AWWA C219.
- B. Type C105: Flanged Coupling Adapter:
  - 1. Adapters for ductile-iron pipe 12 inches and smaller shall be ductile iron: Dresser Style 127, Smith-Blair Series 912, or equal.
  - 2. Adapters for ductile-iron pipe larger than 12 inches and steel pipe shall be steel: Dresser Style 128, Smith-Blair Type 913, or equal.
  - 3. Flange ends shall match the flange of the connecting pipe.

## 2.03 BOLTED GOOVED COUPLING

- A. Coupling shall be configured to join two grooved end ductile iron pipe ANSI/AWWA C151/A21.51, Class 53 as a fully restrained pipe joint to match the maximum allowable working pressure of the pipe.
- B. Coupling housing shall be ductile iron conforming to ASTM A536, Grade 64-45-12.
- C. Gasket shall be designed to seal ductile iron surfaces and provide a triple-seal to assure leak-free service. Gasket shall be Nitrile (or other material acceptable to the Engineer).
- D. Grooved end ductile iron pipe joints shall conform to ANSI/AWWA C-606 and CSA 242 M1980. Ductile iron pipe shall be of the same manufacture of the other ductile iron pipe used for this project in accordance with Specification Section 15155, Ductile Iron Pipe and Fittings.
- E. Grooved coupling shall be Victaulic Style 31.

## 2.06 BOLTING FOR FLEXIBLE PIPE COUPLINGS

- A. Bolts and nuts for flexible pipe couplings shall be as specified for the adjacent piping.

## PART 3 EXECUTION

### 3.01 INSTALLING FLEXIBLE PIPE COUPLINGS

- A. Clean oil, scale, rust, and dirt from pipe ends. Clean gaskets in flexible pipe couplings before installation.
- B. Lubricate bolt threads with graphite and oil before installation.
- C. Install threaded nut and bolt thread protection caps after completing the bolt, nut, and gasket installation.

### 3.02 PAINTING AND COATING

- A. Exterior Coating of Buried Flexible Pipe Couplings: Coat buried flexible pipe couplings (including joint harness assemblies) as specified in Section 09900, Painting and Coating, System No. 21. Coat buried bolt threads, tie bolt threads, and nuts according to Section 09900, Painting and Coating, System No. 24.

- B. Exterior Coating of Exposed Flexible Pipe Coupling (Non-Submerged): Coat flexible pipe couplings (including joint harness assemblies) located indoors, in vaults and structures, and above ground with the same coating system as specified for the adjacent pipe. If the adjacent pipe is not coated, coat couplings according to Section 09900, Painting and Coating, System No. 10. Apply prime coat at the factory.
- C. Exterior Coating of Exposed Flexible Pipe Coupling (Submerged): Coat flexible pipe couplings (including joint harness assemblies) that will be submerged according to Section 09900, Painting and Coating, System No. 7. Apply prime coat at the factory.
- D. Line carbon steel and iron-flexible pipe couplings according to Section 09900, Painting and Coating, System No. 7.

### 3.03 HYDROSTATIC TESTING

- A. Hydrostatically test flexible pipe couplings in place with the pipe being tested. Test in accordance with Section 15144, Pressure Testing of Piping.

### 3.04 DISINFECTION

- A. Disinfect flexible coupling in place with the adjacent piping according to Section 15141, Disinfection of Piping.

END OF SECTION

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SECTION 15125  
PIPING APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment, and incidentals required and install complete and ready for operation all piping appurtenances as shown on the Drawings and as specified in this Section.
- B. All piping appurtenances shall be of the size shown on the Drawings. All equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.
- C. All piping appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon the body.
- D. The piping appurtenances shall include, but not be limited to, the following:
  - 1. Tapping Saddles.
  - 2. Tapping Sleeves.
  - 3. Isolator Ring for Pressure Gauge Assembly.
  - 4. Backflow Preventers.
  - 5. Corporation Stop.
  - 6. Curb Stop.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 09900, Painting and Coating.
- F. Section 13300, Instrumentation and Control for Process Systems.
- G. Section 15055, Piping Systems—General.
- H. Section 15110, Manual, Check, and Process Valves.

### 1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Product technical submittal data shall contain the following information and data:
  - 1. Acknowledgment that products submitted meet requirements of standards referenced.
  - 2. Manufacturer's installation instructions.
  - 3. Expansion joints, flexible joints, couplings, adaptors, tapping sleeves, and other appurtenances:
    - a. Pressure and temperature rating.
    - b. Materials of construction.
    - c. Linings.
    - d. Dimensions and weight.
    - e. Accessories.
    - f. Manufacturer's product brochures, cut-sheets, and parts diagrams.

### 1.04 WORK SEQUENCE (NOT USED)

### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Iron and Steel Institute (AISI)
  - 1. AISI Type 304L—Stainless Steel.
  - 2. AISI Type 316—Stainless Steel.
- B. American Society for Testing and Materials (ASTM)
  - 1. ASTM A536—Standard Specification for Ductile Iron Castings.
  - 2. ASTM C285—Standard Test Methods for Sieve Analysis of Wet-Milled and Dry-Milled Porcelain Enamel.

C. American Water Works Association (AWWA)

1. AWWA/ANSI C105/A21.5— Polyethylene Encasement for Ductile-Iron Pipe Systems.
2. AWWA/ANSI C153/A21.53—Standard for Ductile-Iron Compact Fittings for Water Service.
3. AWWA C207—Standard for Steel Pipe Flanges for Waterworks Service.
4. AWWA C210—Standard for Liquid-Epoxy Coating Systems for the Interior and Exterior of Steel Water Pipelines.
5. AWWA/ANSI C213—Fusion-Bonded Epoxy Coating for the Interior and Exterior of Steel Water Pipelines.
6. AWWA C500—Standard for Metal-Seated Gate Valves for Water Supply Service.
7. AWWA C502—Standard for Dry-Barrel Fire Hydrants.
8. AWWA C700—Standard for Cold-Water Meters—Displacement Type, Bronze Main Case.
9. AWWA C800—Transit-Time Flowmeters in Full Closed Conduits.

D. American National Standards Institute (ANSI)

1. ANSI B16.5—Pipe Flanges and Flanged Fittings.

E. National Sanitation Foundation (NSF)

1. NSF 61—Drinking Water System Components - Health Effects.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, HANDLING, AND STORAGE

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.
- B. All piping appurtenances, unless otherwise directed, shall be loaded and unloaded by lifting, and under no circumstances shall any piping appurtenances be dropped, skidded, or rolled.

- C. Slings, hooks, or tongs used for lifting shall be padded to prevent damage to exterior surface or interior linings of piping appurtenances. If any part of the coating, lining, or components is damaged, the Contractor shall make repairs or replacement at his expense and in a manner satisfactory to the Engineer before attempting to install such piping appurtenances.
- D. Only new piping appurtenances will be allowed for installation and shall be stored to prevent damage and be kept free of dirt, mud, or other debris.

## 1.09 QUALIFICATIONS

- A. All of the piping appurtenances shall be products of well-established firms that are fully experienced, reputable, have been selling this product for a minimum of 10 years, and qualified in the manufacture of the particular product furnished. The piping appurtenances shall be designed, constructed, and installed in accordance with the requirements and procedures of applicable AWWA standards and shall comply with these Specifications as applicable.

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 MAINTENANCE (NOT USED)

## 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 TAPPING SADDLE

- A. Saddle body shall be made of malleable iron, ductile iron, or bronze. Malleable iron and ductile iron shall be epoxy or nylon coated. Saddles shall be of the single- or multiple-strap design (multiple straps are required for sizes 10 inches and above). The straps shall be made from Type 304 stainless steel or bronze. The straps shall have a nominal width of 2 inches. Strap studs shall be made from AISI Type 304L stainless steel.
- B. Nuts and washers shall be made from Type 304 stainless steel and shall be treated to prevent galling. The straps shall have a curvature accurately formed to meet the diameter of the pipe on which the service saddle is to be installed. A Neoprene gasket shall be securely glued to or imbedded in the body of the clamp to ensure positive sealing against the pipe. Outlet sizes of 3/4 inch and 1 inch shall have



female C.C. thread and the outlet for 1-1/2 inches and 2 inches shall be female I.P. thread.

- C. Tapping saddles shall not be used on HDPE due to expansion and contraction problems unless specifically approved in writing by the Engineer on a case-by-case basis.

## 2.02 TAPPING SLEEVES

- A. Tapping sleeves shall be designed for a minimum water working pressure of 150 psi. The design shall allow for the insertion of bolts from either side and the internal seal is to be the "O-ring" type. The tapping sleeve shall be furnished complete with AISI Type 304 stainless steel bolts, nuts, and gaskets.
- B. Tapping sleeves for 4-inch- through 24-inch-diameter pipe shall be epoxy-coated fabricated-steel construction and manufactured to meet material specification ASTM C285 Grade C for the body.
- C. Tapping sleeves shall be of the flange outlet type for connection to a restrained flange adapter that connects to the outlet pipe. Tapping sleeves shall JCM Industries No. 412 or approved equal. The restrained flange adapter shall be EBAA Iron, Inc. 2100 Megaflange®.

## 2.03 ISOLATOR RING FOR PRESSURE GAUGE ASSEMBLY

- A. Isolator ring for pressure gauge assemblies shall be provided at locations listed in this Section or as shown on the Drawings. The isolator ring shall consist of AISI Type 316 stainless steel end plates and fittings and a Viton elastomer with silicon fill fluid and is capable of withstanding from vacuum to 1,000 psi of pressure.
- B. The isolator ring shall be compatible with flange pipe with full face thru bolt holes to match the bolt holes of the mating flanges.
- C. The inside diameter of the isolator ring shall match the pipe diameter for a smooth, unobstructed flow.
- D. The isolator ring shall be equipped with a AISI Type 316 stainless steel integral block valve and modular seal with a 1/2-inch-thick rubber membrane and a stainless steel "stinger fitting" at the top of the mounting post to provide a hermetic seal for the isolator ring. The block valve and modular seal shall allow pressure gauges and instruments to be replaced or calibrated with minimum downtime, without vacuum filling, and keeping instrument oil and air out.

- E. The pressure gauge assembly for the isolator ring is provided in Section 13300, Instrumentation and Control for Process Systems.
- F. The Contractor shall furnish and install isolator ring for pressure gauge assemblies with pressure gauge ranges as follows and/or shown on the Drawings:

<u>Location</u>	<u>Number of Assemblies</u>	<u>Pressure Gauge Range (psi)</u>
Dewatered Cake Pump Discharge	1	300

## 2.04 BACKFLOW PREVENTERS

### A. Reduced-Pressure Backflow Preventers

1. Manufacturers:
  - a. FEBCO 825-Y-BV for sizes 3/4- thru 2-inch and FEBCO 825-YD for sizes 2 1/2- thru 10-inch.
  - b. Watts Series 909 for sizes 3/4- thru 10-inch.
2. All services are to be protected by a backflow prevention device suited to the highest degree of hazard encountered at the connection.
3. Standard: USC Cross Connection Control Laboratory and ASSE 1013.
4. Operation: Continuous-pressure applications.
5. Size: As indicated on the Drawings.
6. Configuration: Designed for horizontal, straight-through flow.
7. End Connections: NTP threaded for NPS 2-inch and smaller; flanged for NPS 2-1/2-inch and larger.
8. Reduced pressure zone valve assembly from 3/4 inch to 2 inches shall be provided with ball valves; assemblies that are 2-1/2 inches and larger shall be furnished with OS&Y gate valve shut-offs.
9. Manufacturer-recommended flow range of each unit shall be provided in the shop drawing submittal. The reduced-pressure backflow preventer shall be installed where its discharge will not be objectionable or will not cause a safety hazard and where it can be positively drained away from the unit when installed within a structure. When the preventer is installed in a structure, the Contractor shall provide a 12-inch air gap accessory and a

drain pipe in the floor slab, connected to the RPBP air gap accessory, to drain the RPBP discharge to the closest floor drain.

## 2.05 CORPORATION STOPS

- A. Corporation stops (through 2 inches in diameter) shall be manufactured from cast bronze with machined fitting surfaces and in accordance with AWWA C800. Corporation stops shall withstand a minimum working pressure of 200 psi and be constructed for direct buried service. The inlet and outlet connections shall be coordinated to connect to the adjoining equipment, tubing, piping, couplings, unions, adapters, reducers, etc. by the Contractor. The inlet and outlet size shall be the same. The corporation stop outlet shall have the required all-bronze adapters, unions, reducers, bushings, or couplings to properly secure to the adjacent items and appurtenances. Corporation stops shall be Model FB series as manufactured by Ford Meter Box Company, Inc., or approved equal. Each corporation stop shall be furnished with a solid bronze square-head plug for plugging the corporation stop outlet. Ford stainless-steel insert stiffeners shall be used as required for connection to tubing, PVC pipe, HDPE pipe, or as required.

## 2.06 CURB STOPS

- A. Curb stops shall be manufactured from cast bronze with machined fitting surfaces. Curb stops shall withstand a minimum working pressure of 150 psi. For curb stops (through 2 inches in diameter), the inlet and outlet connections shall be threaded or have 2-hole flanges to connect to the adjoining equipment, tubing, piping, couplings, unions, adapters, reducers, etc. as coordinated by the Contractor. The nuts and bolts for the flanges shall be cadmium-coated or zinc-plated. The inlet and outlet size shall be the same diameter, unless otherwise approved by the Engineer. The curb stop inlet and outlet shall have the required all-bronze adapters, unions, bushings, or couplings to properly secure it to the adjacent items and appurtenances. Curb stops shall have padlock wings and be lockable with standard size padlocks. Curb stops shall be as manufactured by Ford Meter Box Company, Inc., or approved equal. Each curb stop shall be furnished with a solid bronze square-head plug for plugging the curb stop outlet. Ford stainless steel, insert stiffeners shall be used as required for connection to tubing, PVC pipe, HDPE pipe, or as required.
- B. Buried curb stops shall be equipped with a standard cast-iron roadway valve box. The valve box is specified in Section 15110, Manual, Check, and Process Valves.

## 2.07 TOOLS

- A. If required for normal operation and maintenance, special tools shall be supplied with the equipment. Two T-handle wrenches to operate standard 2-inch nuts on buried valves and buried valve actuators shall be provided as part of the work.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. The Contractor shall install all piping appurtenances as shown on the Drawings.
- B. All piping appurtenances shall be installed in the location shown, unless approved otherwise, true to alignment and rigidly supported. Any damage to the above items shall be repaired to the satisfaction of the Owner and the Engineer.
- C. 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 direct bearing on their location and shall be responsible for the proper location of these piping appurtenances during the construction of the structures.

### 3.02 SHOP PAINTING

- A. Exterior surfaces of ferrous valves and piping appurtenances shall be painted in accordance with Section 09900, Painting and Coating, unless noted or specified otherwise.

### 3.03 INSPECTION AND TESTING

- A. Completed valves and piping appurtenances shall be subjected to hydrostatic pressure test as described in Section 15055, Piping Systems—General, and the detail pipe sections of these Specifications. All leaks in valves and piping appurtenances shall be repaired and lines retested as approved by the Engineer. Before testing, the valves and pipelines shall be supported and thrust restrained for forces in excess of the test pressure to prevent movement during tests.

END OF SECTION

SECTION 15141  
DISINFECTION OF PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section describes requirements for materials and procedures for disinfecting water mains by the continuous feed method and the slug method. The Contractor shall disinfect piping in accordance with Rule 62-555.340, FAC, and AWWA C651, except as modified below.
- B. Use potable water for chlorination.
- C. Submit request for use of water from waterlines of the Owner at least 48 hours in advance.
- D. If water for disinfection and/or flushing is supplied from a temporary connection to the existing distribution system, appropriate backflow prevention methods shall be used.
- E. Proper disposal of the chlorinated disinfection water and the flushing water is the Contractor's responsibility. Disinfected water shall be neutralized in accordance with AWWA C651.
- F. Before permit review and coordination with the Owner and appropriate regulatory authorities (i.e., FDEP and Lake County Department of Health), the Contractor shall provide a schedule for the rate of flow and locations of discharges for the disinfection of piping. The neutralized discharge water shall be disposed of by discharging to the nearest sanitary sewer (check with Owner) to the local stormwater system through onsite swales or by other approved means. Discharge to the local stormwater system shall be routed to avoid swale overflow and/or erosion. The Contractor shall be responsible for any damage that occurs related to the discharging process. The Contractor shall repair or replace any damage caused by discharging to the Owner's satisfaction at no additional expense to the Owner.
- G. It is the responsibility of the Contractor to implement and enforce strict adherence to safety guidelines that are addressed in AWWA C651 as well as safety and handling instructions from the manufacturer. The Contractor shall comply with all applicable national, state, and local safety regulations and requirements, including OSHA.

1.02 RELATED WORK (NOT USED)

1.03 SUBMITTALS (NOT USED)

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

A. American Water Works Association (AWWA)

1. ANSI/AWWA B300—Hypochlorites.
2. ANSI/AWWA B301—Liquid Chlorine.
3. AWWA C651—Disinfecting Water Mains.

B. Florida Administrative Code (FAC)

1. FAC 62-555.340—Disinfection and Bacteriological Evaluation of Public Water System Components.

1.06 QUALITY ASSURANCE (NOT USED)

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

## 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 LIQUID CHLORINE

- A. Liquid chlorine shall conform to ANSI/AWWA B301 and shall be applied in strict accordance with AWWA C651.

### 2.02 CALCIUM HYPOCHLORITE (DRY)

- A. Calcium hypochlorite shall conform to ANSI/AWWA B300 and shall be applied in strict accordance with AWWA C651. Calcium hypochlorite intended for swimming pool chlorination shall not be used under any circumstances.

### 2.03 SODIUM HYPOCHLORITE (SOLUTION)

- A. Sodium hypochlorite shall conform to ANSI/AWWA B300 and shall be applied in strict accordance with AWWA C651.

### 2.04 CHLORINE RESIDUAL TEST KIT

- A. For measuring chlorine concentration, the Contractor shall supply and use a medium-range, drop count, DPD drop dilution method kit in accordance with AWWA C651. Maintain kits in good working order available for immediate test of residuals at point of sampling.

## PART 3 EXECUTION

### 3.01 GENERAL DISINFECTION PROCEDURE

- A. Before disinfection, the Contractor shall inspect materials for quality. The Contractor shall use materials and equipment that are appropriate for the disinfection methods selected. The Contractor shall observe the precautionary guidelines given in AWWA C651.
- B. During construction, the Contractor shall take preventative measures in accordance with AWWA C651 to protect materials from contamination.
- C. Hydrostatic testing shall be successfully performed before disinfection.

- D. Before disinfection, the Contractor shall clear water mains of foreign debris:
  - 1. Pipelines that are less than 24 inches in diameter shall be flushed, while pipelines which are greater than 24 inches in diameter may be cleared via broom-sweeping in accordance with AWWA C651 and as specified in Section 15144, Pressure Testing of Piping. Sweepings shall be removed from pipeline before the disinfection process begins.
- E. In accordance with AWWA C651 procedures, the Contractor shall disinfect all newly constructed materials and existing materials that may have been contaminated during construction. The Contractor shall provide adequate documentation that the required disinfection level (i.e., required chlorine residual and contact time) was successfully achieved.
- F. In accordance with Rule 62-555.340, FAC, following disinfection the total chlorine residual in the water mains shall be reduced to 4 milligrams per liter (mg/L). The chlorine residual may be reduced via flushing with potable water or by a neutralizing agent that conforms to AWWA C651.
- G. After the total chlorine residual has been reduced to 4 mg/L, the Contractor shall conduct bacteriological testing for water mains. Bacteriological sampling and testing shall be performed in accordance with Rule 62-555.340, FAC.
- H. The Contractor shall dispose of residue from cleaning and other construction operations as well as water from dewatering operations in a manner satisfactory to FDEP and the Lake County Department of Health.

### 3.02 CONTINUOUS-FEED METHOD FOR PIPELINES

- A. Continuous-feed disinfection shall be performed in accordance with AWWA C651. The Contractor shall introduce potable water into the pipeline at a constant measured rate. Feed the chlorine solution into the same water at a measured rate. Proportion the two rates so that the free chlorine concentration in the pipeline is maintained at a minimum concentration of 25 mg/L. Inject chlorine into the main at a point no greater than 3 feet downstream of the start of the new water main. Using the appropriate test kits specified by AWWA C651, the Contractor shall check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added. The water main shall be completely filled with chlorinated water. The chlorine contact time shall be at least 24 hours. The water shall be chlorinated so that after 24 hours the concentration of free chlorine residual in the water main shall be not less than 10 mg/L.



### 3.03 SLUG METHOD FOR PIPELINES

- A. The Contractor shall perform slug method disinfection in accordance with AWWA C651. Introduce the water in the pipeline at a constant measured rate. At a point no greater than 3 feet downstream of the start of the new water main, feed the chlorine solution into the pipeline at a measured rate so that the free chlorine concentration created in the pipeline is 100 mg/L. Using the appropriate test kits specified by AWWA C651, the Contractor shall check the concentration at points downstream during the filling to ascertain that sufficient chlorine is being added. Feed the chlorine for a sufficient period to develop a solid column or "slug" of chlorinated water that will, as it passes through the line, expose all interior surfaces to a concentration of at least 100 mg/L for at least 3 hours.

### 3.04 DISINFECTION OF VALVES, BLIND FLANGES, AND APPURTENANCES

- A. During the period that the chlorine solution is in the pipeline or as the slug comes into contact with hydrants and valves, open and close valves at least three times to obtain a chlorine residual at hydrants and other pipeline appurtenances. Swab exposed faces of valves and blind flanges prior to bolting flanges in place with a 1% sodium hypochlorite solution.

### 3.05 DISINFECTION OF CONNECTIONS TO EXISTING PIPELINES

- A. The Contractor shall disinfect isolation valves, pipe, and appurtenances in accordance with AWWA C651, Section 4.7. Flush with potable water until discolored water, mud, and debris are eliminated. Swab interior of pipe and fittings with a 1% sodium hypochlorite solution. After disinfection, flush with potable water again until water is free of chlorine odor.

### 3.06 CONFIRMATION OF RESIDUAL

- A. After the chlorine solution applied by the continuous feed method has been retained in the pipeline for 24 hours, the Contractor shall confirm that a free chlorine residual of 10 mg/L minimum exists along the pipeline by sampling at air valves and other points of access, such as tapping valves.
- B. With the slug method, confirm by sampling as the slug passes each access point and as it leaves the pipeline that the free chlorine concentration in the slug is at least 50 mg/L. If the free chlorine residual is less than 50 mg/L, the flow shall be stopped and the slug residual concentration shall be increased to 100 mg/L before disinfection may resume.

### 3.07 PIPELINE FLUSHING

- A. After confirming the free chlorine residual and sufficient contact time, the Contractor shall flush the excess chlorine solution from the pipeline until the free chlorine concentration in the water leaving the pipe is no higher than 4 mg/L.

### 3.08 BACTERIOLOGICAL SAMPLING AND TESTING

- A. For piping and facilities that will contain potable water, in accordance with Rule 62-555.340, FAC, the Contractor shall collect and deliver required samples to a certified laboratory and obtain a bacteriologic quality test to demonstrate the absence of coliform organisms in each separate section of the pipeline and in each structure after chlorination and refilling. Samples shall be delivered to a certified laboratory within 6 hours of sampling:
  - 1. For water mains, collect at least one set of samples from every 1,200 feet of the new water main, plus one set from the end of the line, and at least one set from each branch. At each connection to an existing pipeline, take two additional samples.
- B. The Contractor shall take chlorine residual samples at the time bacteriological samples are taken. If the chlorine residual is greater than 4 mg/L, the bacteriological test shall be considered invalid and the residual shall be reduced to 4 mg/L and the bacteriological testing shall be performed until the required criteria are satisfied.

### 3.09 REPETITION OF PROCEDURE

- A. If the initial chlorination fails to produce required residuals and bacteriologic tests, the Contractor shall repeat the chlorination and testing until satisfactory results are obtained.
- B. If the water main is installed before satisfactory bacteriological results are achieved, a precautionary boil water notice must be issued if recommended by the water supplier or if recommended by the Department of Health's "Guidelines for the Issuance of Precautionary Boil Water Notices" in accordance with Rule 62-555.340, FAC.

### 3.10 TEST FACILITY REMOVAL

- A. After satisfactory disinfection, the Contractor shall disinfect and replace air valves, restore the pipe coating, and complete the pipeline where temporary disinfection or test facilities were installed.

### 3.11 PIPING TO BE DISINFECTED

- A. Disinfect all piping as indicated on the Piping Schedule on the Drawings.

END OF SECTION

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SECTION 15144  
PRESSURE TESTING OF PIPING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies the hydrostatic, pneumatic, and leakage testing of pressure piping for pumping stations, wastewater treatment plants, water treatment plants, and other facilities; water distribution and transmission mains; and raw sewage force mains and lift stations.

1.02 RELATED WORK

- A. Section 01500, Temporary Facilities and Controls.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. Test bulkhead locations and design calculations, pipe attachment details, and methods to prevent excessive pipe wall stresses.
- B. Six copies of the test records to the Engineer upon completion of the testing.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Water Works Association (AWWA)
  - 1. AWWA C600—Standard for Installation of Ductile Iron Water Mains.
  - 2. AWWA C605—Standard for Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.

1.06 QUALITY ASSURANCE (NOT USED)

## 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TEST PRESSURES

- A. Test pressures for the various services and types of piping are shown in the Piping Schedule in the Drawings. At a minimum the Contractor shall perform pressure and leakage test at 1.5 times the maximum system pressure or 100 psi, whichever is greater (based on the elevation or the lowest point of the section under test and corrected for gage location).

## 1.11 TESTING RECORDS

- A. The Contractor shall provide records of each piping installation during the testing. These records shall include the following information:
  - 1. Date and times of test.
  - 2. Identification of process, pipeline, or pipeline section tested or retested.
  - 3. Identification of pipeline material.
  - 4. Identification of pipe specification.
  - 5. Test fluid.
  - 6. Test duration.
- B. Test pressure at low point in process, pipeline, or pipeline section.
- C. Remarks: Leaks identified (type and location), types of repairs, or corrections made.
- D. Certification by Contractor that the leakage rate measured conformed to the Specifications.

## 1.12 MAINTENANCE (NOT USED)

## 1.13 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 VENTS AND DRAINS FOR ABOVEGROUND PIPING

- A. The Contractor shall install vents on the high points of aboveground piping, whether shown in the Drawings or not. Install drains on low points of aboveground piping, whether shown in the Drawings or not. Provide a valve at each vent or drain point. Valves shall be 3/4 inch for piping 3 inches and larger and 1/2 inch for piping smaller than 3 inches. Valves shall be ball or gate valves unless otherwise shown on the Drawings. Valves shall be rated for the pressure of the adjacent piping and shall be suitable for use with the adjacent pipe material.

### 2.02 MANUAL AIR-RELEASE VALVES FOR BURIED PIPING

- A. The Contractor shall provide temporary manual air-release valves at test bulkheads for pipeline test. Construct the pipe outlet in the same manner as for a permanent air valve and, after use, seal with a blind flange, pipe cap, or plug and coat the same as the adjacent pipe.

### 2.03 TEST BULKHEADS

- A. The Contractor shall design and fabricate test bulkheads in accordance with Section VIII of the ASME Boiler and Pressure Vessel Code. Materials shall comply with Part UCS of the code. Design pressure shall be at least 2.0 times the specified test pressure for the section of pipe containing the bulkhead. Limit stresses to 70% of yield strength of the bulkhead material at the bulkhead design pressure. Include air-release and water drainage connections.

### 2.04 TESTING FLUID

- A. The Owner will provide a source of supply from the existing treated water distribution system for the Contractor's use in filling the lines. An air break shall be maintained at all times between the Owner's distribution system and the Contractor's equipment to prevent cross-connection. The line shall be slowly filled with water and the specified test pressure shall be maintained in the pipe for the entire test period by means of a pump furnished by the Contractor. Provide

accurate means for measuring the quantity of water required to maintain this pressure. The amount of water required is a measure of the leakage.

- B. Testing fluid shall be potable water unless a pneumatic test is indicated on the Piping Schedule.
- C. For fuel oil piping, use potable water for hydrostatic testing and flushing.
- D. For potable water pipelines, obtain and use only potable water for hydrostatic testing.
- E. Submit request for use of water from waterlines of Owner 48 hours in advance.
- F. The Contractor shall provide back flow prevention control for temporary connections to existing water mains.

## 2.05 TESTING EQUIPMENT

- A. The Contractor shall provide calibrated pressure gauges, pipes, bulkheads, pumps, compressors, chart recorder, and meters to perform the hydrostatic testing. The Contractor shall provide any necessary assistance required for testing.

## PART 3 EXECUTION

### 3.01 TESTING PREPARATION

- A. Pipes shall be in place, backfilled, and anchored before beginning pressure testing.
- B. The Contractor shall conduct pressure tests on exposed and aboveground piping after the piping has been installed and attached to the pipe supports, hangers, anchors, expansion joints, valves, and meters.
- C. For buried piping, the pipe may be partially backfilled and the joints left exposed for inspection during an initial leakage test. However, perform the final pressure test after completely backfilling and compacting the trench.
- D. Provide any temporary piping needed to carry the test fluid to the piping that is to be tested. After the test has been completed and demonstrated to comply with the Specifications, disconnect and remove temporary piping. Do not remove exposed vent and drain valves at the high and low points in the tested piping; remove any temporary buried valves and cap the associated outlets. Plug taps or connections to the existing piping from which the test fluid was obtained.



- E. Provide temporary drain lines needed to carry testing fluid away from the pipe being tested. Remove such temporary drain lines after completing the pressure testing.
- F. Before starting the test, the Contractor shall notify the Engineer and the Owner's Representative.

### 3.02 CLEANING

- A. Before conducting hydrostatic tests, the Contractor shall flush pipes with water to remove dirt and debris. For pneumatic tests, blow air through the pipes. Maintain a flushing velocity of at least 3 fps for water testing and at least 2,000 fpm for pneumatic testing. Flush pipes for the period given by the formula:

$$T = \frac{2L}{3}$$

in which:

T = flushing time (seconds)

L = pipe length (feet).

- B. For pipelines 24 inches or larger in diameter, acceptable alternatives to flushing are use of high-pressure water jet, sweeping, or scrubbing. Water, sediment, dirt, and foreign material accumulated during this cleaning operation shall be discharged, vacuumed, or otherwise removed from the pipe.

### 3.03 LENGTH OF TEST SECTION FOR BURIED PIPING

- A. The maximum length of test section for buried pipe of 12 inches or smaller in diameter is 3,500 feet; for buried pipe larger than 12 inches, 1 mile. Provide intermediate test bulkheads where the pipeline length exceeds these limits.

### 3.04 INITIAL PIPELINE FILLING FOR HYDROSTATIC TESTING

- A. The maximum rate of filling shall not cause the water velocity in the pipeline to exceed 1 fps. Filling may be facilitated by removing automatic air valves and releasing air manually.

### 3.05 TESTING NEW PIPE WHICH CONNECTS TO EXISTING PIPE

- A. Before testing new pipelines that are to be connected to existing pipelines, the Contractor shall isolate the new line from the existing line by test bulkheads, spectacle flanges, or blind flanges. After the new line has been successfully tested, remove test bulkheads or flanges and connect to the existing piping.

### 3.06 HYDROSTATIC TESTING OF ABOVEGROUND OR EXPOSED PIPING

- A. Open vents at high points of the piping system to purge air while the pipe is being filled with water. Venting during system filling may also be provided by temporarily loosening flanges.
- B. Subject the piping system to the test pressure indicated on the Piping Schedule in the Drawings. Maintain the test pressure for a minimum of 2 hours. Examine joints, fittings, valves, and connections for leaks. The piping system shall show zero leakage or weeping. Correct leaks and retest until zero leakage is obtained.

### 3.07 HYDROSTATIC TESTING OF BURIED PIPING

- A. Where any section of the piping contains concrete thrust blocks or encasement, the Contractor shall not make the pressure test until at least 10 days after the concrete has been placed. When testing mortar-lined or PVC piping, fill the pipe to be tested with water and allow it to soak for at least 24 hours to absorb water before conducting the pressure test.
- B. Apply and maintain the test pressure by a positive displacement hydraulic force pump.
- C. Maintain the test pressure for the 2 hours by restoring the pressure whenever it falls 5 psi.
- D. After the test pressure is reached, use a meter to measure the additional water added to maintain the pressure. This amount of water is the loss due to leakage in the piping system. The allowable leakage volume is defined by the formulas:

PVC Pipe:

$$L = \frac{ND(P)^{1/2}}{C}$$

in which:

- L = allowable leakage (gallons)
- N = number of rubber-gasketed joints in the pipe tested
- D = diameter of the pipe (inches)
- P = specified test pressure (psig)
- C = 7,400

Ductile Iron Pipe:

$$L = \frac{SD(P)^{1/2}}{C}$$

in which:

- L = allowable leakage (gallons)
- S = length of pipe tested (feet)
- D = diameter of the pipe (inches)
- P = specified test pressure (psig)
- C = 133,200

- E. The leakage test shall be a separate test following the pressure test and shall not be less than 2 hours long. All leaks evident at the surface shall be repaired and leakage eliminated regardless of the total leakage as shown by test. Lines that 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.
- F. The allowable leakage for buried piping having threaded, brazed, or welded (including solvent welded) joints shall be zero.
- G. Submit plan for testing to the Engineer for review at least 10 days before starting the test.
- H. Peening shall not be used to repair pinhole leaks in welded pipes. Any leakage in welded pipes shall be repaired by appropriate welding techniques.
- I. Repair and retest any pipes showing leakage rates greater than that allowed in the criteria above.

### 3.08 REPETITION OF TEST

- A. If the actual leakage exceeds the allowable leakage, locate and correct the faulty work and repeat the test. Restore the work and all damage resulting from the leak and its repair. Eliminate visible leakage.

### 3.09 BULKHEAD AND TEST FACILITY REMOVAL

- A. After a satisfactory test, the Contractor shall remove the testing fluid, remove test bulkheads and other test facilities, and restore the pipe coatings/linings.

END OF SECTION

SECTION 15155  
DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide all materials and incidentals, including piping, fittings, flanged joints, mechanical joints, retainer glands, polyethylene bagging for buried ductile iron piping, fittings, valves, and appurtenances for the ductile iron piping systems required for the work shown on the Drawings, in the Drawing—Piping Schedule, and described in Section 15060, Pipe Hangers and Supports.
- B. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 02240, Dewatering.
- D. Section 02300, Earthwork for Structures.
- E. Section 02305, Earthwork for Utilities.
- F. Section 09900, Painting and Coating.
- G. Section 15055, Piping Systems—General.
- H. Section 15060, Pipe Hangers and Supports.
- I. Section 15144, Pressure Testing of Piping.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. All ductile iron pipe and fittings to be installed under this Contract shall be inspected and tested at the foundry where the material for this project is manufactured. The Contractor shall submit sworn certificates of such tests and their results.
- B. Shop Drawings, including layout drawings, shall be submitted as specified in Section 15055, Piping Systems—General.

- C. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

##### A. American National Standard Institute (ANSI)

1. ANSI A21.11—Rubber Gasket Joints Cast & Ductile Iron Pressure Pipe.
2. ANSI A21.53—Ductile-Iron Compact Fittings, 3-Inch through 24-Inch (76mm through 610mm) and 54-Inch through 64-Inch (1,400mm through 1,600mm), for Water Service.
3. ANSI B1.1—Unified Inch Screw Threads (UN & UNR Thread Form).
4. ANSI B16.1—Cast Iron Pipe Flanges and Pipe Fittings.
5. ANSI B16.21—Nonmetallic Flat Gaskets for Pipe Flanges

##### B. American Society for Testing and Materials (ASTM)

1. ASTM A193—Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High-Temperature Service.
2. ASTM A194—Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service, or Both.
3. ASTM A307—Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
4. ASTM A536—Standard Specification for Ductile Iron Castings.
5. ASTM A563—Standard Specification for Carbons and Alloy Steel Nuts.
6. ASTM B117—Standard Practice for Operating Salt Spray (Fog) Apparatus.
7. ASTM C150—Standard Specification for Portland Cement.
8. ASTM C283—Standard Test Methods for Resistance of Porcelain Enameled Utensils to Boiling Acid.
9. ASTM D714—Standard Test Method for Evaluating Degree of Blistering of Paints.
10. ASTM D792—Standard Test Methods for Density and Specific Gravity (Relative Density) of Plastics by Displacement.
11. ASTM D1238—Standard Test Method for Melt Flow Rates of Thermoplastics by Extrusion Plastometer.

12. ASTM E96—Standard Test Methods for Water Vapor Transmission of Materials.
13. ASTM G95—Standard Test Method for Cathodic Disbondment Test of Pipeline Coatings (Attached Cell Method).

C. American Water Works Association (AWWA)

1. AWWA C104—Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
2. AWWA C110—Ductile-Iron and Gray-Iron Fittings, 3-Inch through 48-Inch (75mm through 1200mm) for Water and Other Liquids.
3. AWWA C111—Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
4. AWWA C115—Flanged Ductile-Iron Pipe with Ductile-Iron or Gray-Iron Threaded Flanges.
5. AWWA C150—Thickness Design of Ductile-Iron Pipe.
6. AWWA C151—Ductile-Iron Pipe, Centrifugally Cast, for Water or Other Liquids.
7. AWWA C153—Ductile-Iron Compact Fittings, 3-Inch through 16-Inch (76mm through 610mm), for Water and Other Liquids.
8. AWWA C207—Steel Pipe Flanges for Waterworks Service Sizes 4-Inch through 144-Inch (100mm through 3,600mm).
9. AWWA C600—Installation of Ductile-Iron Water Mains and their Appurtenances.
10. AWWA C651—Disinfecting Water Mains.

D. International Organization for Standardization (ISO)

1. ISO-9001—Quality Systems – Model for Quality Assurance in Production, Installation, and Servicing.

E. NSF International (NSF)

1. NSF 61—Drinking Water System Components – Health Effects.

## 1.06 QUALITY ASSURANCE

A. Source Quality Control:

1. The ductile iron pipe manufacturer shall submit certification that the pipe and fitting products meet all tests required by AWWA C151.
2. All materials shall be new and have a manufacturer's certificate verifying compliance to all tests and inspections as required in this Section. The

weight, class, and casting period shall be shown on each piece of pipe. The manufacturer's "mark," the year produced, and the word "Ductile" or the letters "DI" shall be cast or stamped on all pipe.

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS

- A. See Section 15144, Pressure Testing of Piping, for testing requirements.

#### 1.11 MAINTENANCE (NOT USED)

#### 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

### PART 2 PRODUCTS

#### 2.01 GENERAL

- A. All ductile iron piping shall be designed and manufactured in accordance with AWWA C150 and AWWA C151 for the following minimum operating conditions:
  - 1. The external loads design criteria shall be for the minimum cover indicated on the Drawings at 120 lb per cubic feet soil weight and live load based on one AASHTO H-20 truck load. The thickness design of ductile iron pipe shall be in accordance with AWWA C150.



2. The horizontal deflection of cement-mortar-lined ductile iron pipe resulting from external load conditions shall not exceed 3% of the pipe diameter based on the trench design shown on the Drawings.
3. Pressure Class: All ductile iron piping shall meet the following minimum working pressure classes:
  - a. 4 inches through 12 inches: 350 psi
  - b. Pipe greater than 12 inches: 250 psi

## 2.02 JOINTS

- A. Ductile iron fittings shall be furnished with mechanical joints and flanged joint ends as shown on the Drawings and specified in this Section:
  1. Mechanical Joints: All buried ductile iron fittings shall be furnished with mechanical joint ends unless noted otherwise. Mechanical joints shall conform to ANSI A21.11/AWWA C111. Glands shall be constructed of ductile iron.
  2. Flanged Joints: Pipe for threaded flange fabrication shall be Special Thickness Class 53 in accordance with AWWA C110, AWWA C111, and AWWA C115. Bolt circle and bolt holes shall match those of ANSI B16.1 Class 125 flanges. The flanges shall be rated for a maximum working pressure of 250 psi. Threaded flanges shall be individually fitted and machine tightened on the pipe ends. Flange facing shall be smooth or with shallow serrations in accordance with AWWA C115.

## 2.03 FITTINGS

- A. General: Ductile iron pipe fittings shall be the compact type meeting the requirements of ANSI/AWWA C110 and C153 where applicable. Ductile iron shall be ceramic epoxy lined unless indicated otherwise in the Pipe Schedule in the Drawings. Lining of fitting shall conform to lining specified for piping and service as specified on the Drawing—Flow Stream Identification. Fittings shall be manufactured in accordance with ANSI/AWWA C110. Where taps are shown on fittings, tapping bosses shall be provided. At a minimum, fittings shall have the same pressure rating as the connecting pipe.
  1. Flanged Joint: ANSI/AWWA C110/21.10 and ANSI B16.1, faced and drilled 125-pound ANSI standard.
  2. Mechanical Joint: ANSI/AWWA C110/A21.10

- a. Provide mechanical joint fittings for all buried fittings as shown in the Drawings, unless noted otherwise.
- b. Provide specified gaskets.

2.04 LINING AND COATING

- A. The Contractor shall provide lined ductile iron piping and fittings in accordance with the Drawing—Pipe Schedule. The Contractor shall perform all field measurements confirming the accuracy of the piping sizes and lengths shown on the Drawings. The Contractor shall notify the Engineer immediately before deviating from or altering the lining of ductile iron piping shown on the approved layout schedule.
- B. Ceramic Epoxy Lined Pipe and Fittings: The Contractor shall notify the Engineer immediately before cutting epoxy-lined ductile iron pipe in the field. The Contractor shall repair the cut end in accordance with the pipe manufacturer's written procedures.
  - 1. General: The lining shall be an amine-cured novalac epoxy containing at least 20% by volume of ceramic quartz pigment. The lining material shall be Protecto 401 Ceramic Epoxy as manufactured by Induron Protective Coatings, Inc. The lining shall be applied by a competent pipe lining specialty firm with a successful history of applying linings to the interior of ductile iron pipe and fittings.
  - 2. Lining Materials: Lining material shall meet the following requirements and properties:
    - a. A permeability rating of 0.00 when tested according to Method A of ASTM E96, Procedure A with a test duration of 30 days.
    - b. The following test shall be run on coupons from lined ductile pipe:

Test Parameter	ASTM Test Method	Typical Value
Salt Spray	B117	0.0 undercutting after 2 years
Cathodic disbondment 1.5 volts @ 77° F	G95	No more than 0.5 mm undercutting after 30 days
Immersion	D714	No effect after 2 years for 20% sulfuric acid, 140°F 25% sodium hydroxide, 160°F distilled water
Immersion	D714	0.0 undercutting after 2 years for 120°F tap water

3. Application: The lining applicator shall apply lining according to the requirements of the Protecto 401 Specification and application methods and procedures.
- C. Cement-Lined Ductile Iron Pipe and Fittings: Interior surfaces of all cement-lined ductile iron pipe, fittings, and specials shall be cleaned and lined in the shop with a standard thickness cement-mortar lining applied in conformity with AWWA C104, Portland cement mortar. Every precaution shall be taken to prevent damage to the lining. If lining is damaged or found faulty at delivery site, the Contractor shall repair or replace damaged or unsatisfactory portions with lining conforming to these Specifications at no additional cost to the Owner. Pipe linings for potable water lines shall be NSF 61 approved.
1. All ductile iron pipe and fittings cement-mortar linings shall be surface sealed with an asphaltic seal coating, 1 mil, in accordance with AWWA C104.

## 2.05 MANUFACTURERS

- A. Acceptable ductile iron pipe manufacturers include US Pipe, American Ductile Pipe, or Griffin Pipe.

## 2.06 BOLTS

- A. General: The Contractor shall provide carbon steel, ASTM A307, Grade A hex head bolts and ASTM A563, Grade A hex head nuts. Threads shall be as specified in ANSI B1.1 coarse thread series, Class 2A external and Class 2B internal. Nuts, bolts, and gaskets for flanged fittings and blind flanges shall be designed to withstand the design and test pressure ratings for the pipe.

## 2.07 GASKETS

- A. Gaskets for mechanical joints shall be compatible with sewage pipe service. See Section 15055, Piping Systems—General, for gasket requirements.
- B. Gaskets for flanged joints shall be 1/8-inch-thick, cloth-inserted rubber conforming to applicable parts of ANSI B16.21 and AWWA C207. Gasket material shall be free from corrosive alkali or acid ingredients and suitable for use in sewage and reclaimed water lines. Gaskets shall be full-face type for 125-pound flanges.

## 2.08 RETAINER GLANDS

- A. Retainer glands shall be provided for all buried ductile-iron mechanical joints, fitting, and ductile-iron pipe connections to buried valves. Retainer glands shall be designed for joint retaining through the use of a follower gland and set screw-anchoring devices that impart multiple wedging action against the pipe. The mechanical joint-restraint device shall be UL listed and shall have a working pressure of at least 250 psi with a minimum safety factor of 2.
1. Gland: Manufactured of ductile iron conforming to ASTM A536. Gland dimensions shall match ANSI A21.11 and A21.53.
  2. Restraining Devices: Manufactured of ductile iron heat treated to a minimum hardness of 370 BHN. Restraining devices shall incorporate a set screw/twist-off nut bolt to ensure the proper actuating of the restraining device. The twist-off nut shall be designed to come off at the torque limit desired to anchor the restraining device in place on the pipe.
  3. Joint Deflection: Retainer gland joint deflection shall be limited to manufacturer's recommended maximum deflection angle. Joint deflection shall be applied before the set screws are torqued.
  4. Acceptable Manufacturers:
    - a. EBAA Iron, Inc. – Megalug 1100 Series.
    - b. Or approved equal.

## 2.09 EXTERNAL PIPE RESTRAINTS

- A. Ductile iron pipe push-on (bell and spigot) joint restraint shall be provided by a restraining harness consisting of a restraint ring, connecting tie-rods, and split-ring assembly installed at all push-on joints. The restraint ring shall consist of wedging components made from 60-42-12 ductile iron conforming to ASTM A536 and wedges heat treated to minimum 370 BHN. Torque limiting twist-off nuts shall be provided on each wedge to ensure proper applied installation torque. The split ring shall be made from 60-42-12 ductile iron conforming to ASTM A536. The connecting rods shall be made of steel conforming to ANSI/AWWAC111/A12.11. Sizes 4- to 16-inch-diameter restraining harnesses shall have 350-psi maximum working pressure rating and 18- to 36-inch-diameter restraining harnesses shall have 250-psi maximum working pressure rating. All harnesses shall be designed with a 2-to-1 safety factor applied to the maximum working pressure rating.

- B. Acceptable Manufacturers:
  - 1. EBAA Iron, Inc. – Series 1700.
  - 2. Or approved equal.

## 2.10 INTERNAL PIPE RESTRAINT

- A. Acceptable Manufacturers:
  - 1. American Ductile Iron Pipe:
    - a. Fast Grip ® Gasket.
    - b. Flex Ring ® Joint.
  - 2. US Pipe:
    - a. Field Lok ® Gasket.
    - b. TR Flex Restrained Joint Pipe and Fittings.
  - 3. Or Engineer-approved equal.

## 2.11 COLOR CODING OR MARKING

- A. Pipe shall be color coded as indicated in the Pipe Schedule in the Drawings.

## 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, fitting, lining, and coating. Pipe and fittings shall not be dropped. All pipe and fittings shall be examined before installation, and no piece that the Engineer finds defective shall be installed. The Contractor shall repair any damage to the pipe and fittings coating and/or lining as directed by the Engineer. If the Engineer determines that the coating and/or lining cannot be repaired, the Contractor shall replace the damaged pipe and fittings at no additional compensation.
- B. All pipe and fittings shall be subjected to a careful inspection immediately before installation.
- C. If any defective pipe is discovered after it has been installed, the Contractor shall remove and replace it with a pipe in satisfactory condition at no additional expense to the Owner.

- D. Ceramic epoxy and glass-lined pipe and fittings shall be handled only from the outside of the pipe and fittings. No forks, chains, straps, hooks, etc. shall be placed inside the pipe and fittings for lifting, positioning, or laying.

### 3.02 PIPE INSTALLATION

- A. The Contractor shall provide and use proper implements, tools, and facilities for the safe and convenient performance of the work. All pipe, fittings, valves, and appurtenances shall be lowered carefully into the trench and at above-grade locations to prevent damage to the pipe, protective coating, lining, and polyethylene bagging. Under no circumstances shall pipeline materials be dropped off or dumped. A trench shall be dewatered before the pipe is installed.
- B. The Contractor shall carefully examine all pipe fittings, valves, and other appurtenances for damage and other defects immediately before installation and before bagging buried ductile-iron pipe. The Contractor shall mark and hold defective materials for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.
- C. The Contractor shall remove all lumps, blisters, and excess coating from the socket and plain ends of push-on joint pipe for buried service. 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 in trench.
- D. The Contractor shall prevent foreign material from entering the pipe while the pipe is being placed in the trench. During installation, no debris, tools, clothing, or other materials shall be placed in the pipe.
- E. As each length of buried 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. When pipe is not being laid, the open ends of pipe shall be closed by a watertight plug or other means approved by the Engineer. 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 compaction 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.

1. Flanged Joint: Before connecting flanged pipe the Contractor shall thoroughly clean all faces of the flanges of all oil, grease, and foreign material. The rubber gaskets shall be checked for proper fit and thoroughly cleaned. Care shall be taken to ensure proper sealing of the flange gasket. Bolts shall be tightened so that the pressure on the gasket is uniform. Torque-limiting wrenches shall be used to ensure uniform bearing insofar as possible. If joints leak when the hydrostatic test is applied, the gaskets shall be removed and reset and bolts retightened.
  2. Push-On, Restrained Joint, or Mechanical Joint: The Contractor shall joint piping in accordance with the manufacturer's recommendations. Provide all special tools and devices, such as special jacks, chokers, and similar items required for proper installation. Lubricant for the pipe gaskets shall be furnished by the pipe manufacturer, and no substitutes will be permitted under any circumstance.
- 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 ANSI/AWWA C600 and that recommended by the retainer gland manufacturer for mechanical joint pipe and fittings.
- J. Pipe Cutting: For inserting valves, fittings, or closure pieces pipe shall be cut in a neat, workmanlike manner without damaging 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.

### 3.03 ABOVE-GROUND PIPE INSTALLATION

- A. The Contractor shall 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 in accordance with the pipe manufacturer's recommendations.

### 3.04 SURFACE PREPARATION AND PAINTING

- A. All exposed pipe and fittings shall be painted with System No. 10 as specified in Section 09900, Painting and Coating.
- B. All buried steel bolts, nuts, washers, rods, harnesses, clamps, sleeves, and appurtenances shall be painted with System No. 21 as specified in Section 09900, Painting and Coating.

### 3.05 INSPECTION AND TESTING

- A. See Section 15055, Piping Systems—General; Section 15141 and Section 15144, Pressure Testing of Piping.

END OF SECTION



SECTION 15250  
SMALL-DIAMETER PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall provide small-diameter pipe and fittings (nominal diameters less than 4 inches unless noted otherwise on the Drawings) as shown on the Contract Drawings and described in Section 15055, Piping Systems—General.
- B. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 02240, Dewatering.
- F. Section 02305, Earthwork for Utilities.
- G. Section 09900, Painting and Coating.
- H. Section 15055, Piping Systems—General.
- I. Section 15141, Disinfection of Piping.
- J. Section 15144, Pressure Testing of Piping.
- K. Section 15290, Polyvinyl Chloride (PVC) Pipe, 3-inch and Smaller.
- L. Section 15291, Polyvinyl Chloride (PVC) Pressure Pipe and Fittings.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance and Section 15055, Piping Systems—General.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American National Standard Institute (ANSI)
1. ANSI B1.20.1—Pipe Threads, General Purpose (Inch).
  2. ANSI B16.5—Pipe Flanges and Flanged Fittings.
  3. ANSI B16.11—Forge Fittings, Socket-Welding and Threaded.
  4. ANSI B18.2.1—Square and Hex Bolts and Screws Inch Series.
  5. ANSI B36.10—Welded and Seamless Wrought Steel Pipe.
  6. ANSI B36.19M—Welded and Seamless Wrought Steel Pipe.
- B. American Society for Testing and Materials (ASTM)
1. ASTM A53—Standard Specification for Pipe, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
  2. ASTM A90—Standard Test Method for Weight [Mass] of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.
  3. ASTM A105—Standard Specification for Carbon Steel Forgings for Piping Applications.
  4. ASTM A182—Standard Specification for Forged or Rolled Alloy and Stainless Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.
  5. ASTM A193—Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for High Temperature or High Pressure Service and other Special Purpose Applications.
  6. ASTM A194—Standard Specification for Carbon and Alloy Steel Nuts for Bolts for High Pressure or High Temperature Service, or Both.
  7. ASTM A312—Standard Specification for Seamless, Welded, and Heavily Cold Worked Austenitic Stainless Steel Pipes.
  8. ASTM A320—Standard Specification for Alloy-Steel and Stainless Steel Bolting Materials for Low-Temperature Service.
  9. ASTM D1784—Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.
  10. ASTM D1785—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
  11. ASTM D2464—Standard Specification for Threaded Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
  12. ASTM D2466—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
  13. ASTM D2467—Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
  14. ASTM D2564—Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
  15. ASTM F439—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 80.

16. ASTM F441—Standard Specification for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe, Schedules 40 and 80.
17. ASTM F493—Standard Specification for Solvent Cements for Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe and Fittings.
18. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

C. Plastic Pipe Institute (PPI)

1. PPI TR31—Underground Installation of Polyolefin Piping.

D. National Sanitation Foundation (NSF)

1.06 QUALITY ASSURANCE

- A. Piping materials and manufacturing shall adhere to the standards referenced in Section 15055, Piping Systems – General.
- B. The Contractor shall strictly adhere to the manufacturer's written storage, handling, installation, and joining.

1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, and Section 15055, Piping Systems – General, for storing and protecting the items specified in this Section.

1.09 QUALIFICATIONS (NOT USED)

1.10 TESTING REQUIREMENTS (NOT USED)

1.11 MAINTENANCE (NOT USED)

1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 GENERAL

- A. All pipe joints and fittings shall have the same schedule, pressure ratings, thermal resistance, chemical resistance, and other pertinent properties as the pipe being joined or connected. Plastic fittings shall be manufactured of the same resin as used in the manufacture of the pipe being joined.
- B. Each pipe length shall be clearly marked with the manufacturer's name or trademark, applicable ASTM standards, size, pressure rating, and/or schedule.
- C. Provide line size reducing tees for connecting lateral or instrumentation to pipe systems. Seal threaded fittings with Teflon™ tape or Teflon™ paste. Engage threaded fittings in accordance with ASTM A53.
- D. All flange bolts, nuts, and washers shall be AISI Type 304 stainless steel, ASTM A193, Grade B8M hex head bolts and ASTM A194, Grade 8M hex head nuts unless noted otherwise. Bolts shall be fabricated in accordance with ANSI B18.2.1 and shall be provided with washers. Treat all bolts with anti-galling compound before assembly.

### 2.02 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. PVC 3-inch and smaller shall be in conformance with Section 15290, Polyvinyl Chloride (PVC) Pipe, 3-inch and Smaller.
- B. PVC larger than PVC shall be in conformance with Section 15291, Polyvinyl Chloride (PVC) Pressure Pipe and Fittings.

### 2.03 CHLORINATED POLYVINYL CHLORIDE PIPE (CPVC) AND FITTINGS:

- A. Pipe: ASTM F441 Schedule 80 manufactured from Class 23447-B Rigid CPVC Compounds with a hydrostatic design stress of 13.8 MPA (2,000 psi) designated as CPVC 1120.
- B. Joints: All CPVC piping joints shall be Socket-Type unless otherwise indicated on the Drawings. Piping shall be solvent welded or flanged only.
- C. Socket Type Fittings: ASTM F439 manufactured from Class 23447-B Rigid CPVC Compound.

## 2.04 GALVANIZED STEEL PIPE

- A. Pipe: Steel piping shall conform to the requirements of ASTM A53, Type S, Grade B, and ANSI B36.10, Schedule 40 as indicated on the Drawings.
- B. Fittings: Forged steel conforming to ASTM A105 and ANSI B16.11, Class 2000.
- C. Joints: Threaded conforming to ANSI B1.20.1.
- D. Galvanizing: Conform to ASTM A90.

## 2.05 STAINLESS STEEL PIPE

- A. Stainless Steel Pipe—Threaded Joints: Conforming to ASTM A312, Grade TP 304 and 316, and ANSI B36.19M, Schedule 40S.
  - 1. Fittings: Conforming to ASTM A182, Grade F 304 and 316, and ANSI B16.11 Class 2000, or Class 3000 where indicated on the Drawings or in the Specifications.
  - 2. Threaded Joints: Conforming to ANSI B1.20.1.
  - 3. Unions: ASTM A182, Grade F 304 and 316 conforming to ANSI B1.20.1. Schedule to match adjacent piping

## PART 3 EXECUTION

### 3.01 GENERAL INSTALLATION REQUIREMENTS

- A. The Contractor shall lay and maintain all pipes straight and true to line in conformance with the lines, grades, and elevations indicated on the Drawings. Line and grade tolerances, where applicable, shall be in accordance with limits given for specific material.
- B. Trenching, bedding, and backfill shall be in accordance with Section 02305, Earthwork for Utilities, and shall be installed in accordance with Section 15055, Piping Systems—General.
- C. During laying operations, the Contractor shall not permit debris, tools, clothing, or similar items to be placed inside pipes. Pipe interior shall be free of mud and kept clean at all times. The Contractor shall secure the open ends of all piping at the end of construction each work day or any portion of a work day to prevent the intrusion of debris, precipitation, or soil from erosion. The proposed method of securing pipe open ends shall be approved by the Engineer. If the Contractor fails to secure piping or if the secured end is dislodged, the Engineer shall require the Contractor to flush all affected piping to remove accumulated debris and verify

that the piping is free of debris using a method acceptable to the Engineer, at no additional cost to the Owner.

- D. Pipe ends shall be kept clear and clean and the Contractor shall ensure that inside surfaces are maintained smooth and free from any projections that may interfere with joint assembly or flow through the completed line.
- E. The Contractor shall be careful when lowering pipe into trenches or on subgrade to prevent damage or twisting of the pipe. After laying and before completing backfill or cover operations, pipe shall be protected from any vehicular traffic.
- F. Existing piping flanged joints that are disassembled by the Contractor shall be fitted with new gaskets, as specified, upon reassembly.

### 3.02 PRESSURE AND LEAKAGE TESTS

- A. Pressure Testing
  - 1. The Contractor shall pressure test and leak test all new PVC, stainless steel, CPVC, and galvanized steel piping shown on the Drawings, the Flow Stream Identification Drawing, and Section 15055, Piping Systems—General, and Section 15144, Pressure Testing of Piping.

END OF SECTION

SECTION 15290  
POLYVINYL CHLORIDE (PVC) PIPE, 3 INCHES AND SMALLER

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section includes materials, installation, and testing of PVC pipe and fittings of size 3 inches and smaller for use in process piping having a maximum design pressure of 150 psi and having a maximum design temperature of 105°F.
- B. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.

1.02 RELATED WORK (NOT USED)

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 09900, Painting and Coating.
- F. Section 15141, Disinfection of Piping.
- G. Section 15144, Pressure Testing of Piping.

1.03 SUBMITTALS

- A. The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance.
- B. The Contractor shall do the following:
  - 1. Submit materials list showing materials of pipe and fittings with ASTM reference and grade. Submit manufacturer's certification of compliance with referenced standards, e.g., ASTM D1784, D1785, and D2467. Show wall thickness of pipe and fittings. Show fitting dimensions.
  - 2. Submit data sheets for solvent cement and demonstrating compliance with ASTM D2564 and F656.
  - 3. Submit data sheets showing that the pipe and fittings are ANSI/NSF 61 listed for use in potable water service and that the pipe will bear the NSF logo for potable water use.

#### 1.04 WORK SEQUENCE (NOT USED)

#### 1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

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

1. ASTM D1784—Standard Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds.
2. ASTM D1785—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120.
3. ASTM D2464—Standard Specification for Threaded Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
4. ASTM D2467—Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
5. ASTM D2564—Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems.
6. ASTM D2774—Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
7. ASTM D2855—Standard Practice for Making Solvent-Cemented Joints with Poly(Vinyl Chloride) (PVC) Pipe and Fittings.
8. ASTM F656—Standard Specification for Primers for Use in Solvent Cement Joints of Poly(Vinyl Chloride) (PVC) Plastic Pipe and Fittings.

##### B. The Public Health and Safety Company (NSF)

1. NSF/ANSI Standard 61—Drinking Water System Components.

##### C. American National Standards Institute (ANSI)

1. ANSI B1.20.01—Pipe Threads, General Purpose (Inch).
2. ASME/ANSI B16.5—Pipe Flanges and Flanged Fittings.

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 WARRANTIES

- ##### A.
- Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.



## 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

## 1.09 QUALIFICATIONS (NOT USED)

## 1.10 TESTING REQUIREMENTS (NOT USED)

## 1.11 MAINTENANCE (NOT USED)

## 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 PIPE

- A. Pipe shall be Schedule 80, Type I, Grade 1 (Class 12454-B), conforming to ASTM D1784 and D1785. Manufactured from Class 12454-B rigid PVC compounds with a hydrostatic design stress of 13.8 MPa (2,000 psi) designated as PVC 1120.
- B. Pipe shall bear the NSF logo for potable water use.

### 2.02 FITTINGS

- A. Fittings shall be Schedule 80 and shall conform to ASTM D2464 for threaded fittings and ASTM D2467 for socket-type fittings.

### 2.03 FLANGES

- A. PVC flanges shall be of the one-piece solid socket design and shall be made of the same material as the pipe. Pressure rating shall be at least 150 psi at a temperature of 73°F. Minimum burst pressure shall be 500 psi. Flanges shall match the dimensions of ANSI B16.5, Class 150, steel flanges for outside diameter, bolt circle, and bolt holes. Do not use Van Stone flanges.

## 2.04 UNIONS

- A. Unions shall have socket-type ends, Viton O-rings, and shall be Schedule 80. Material shall be Type I, Grade 1 PVC, per ASTM D1784.

## 2.05 JOINTS

- A. Pipe and fitting joints shall be socket welded except where threaded and flanged joints are required to connect to valves and equipment.

## 2.06 SOLVENT CEMENT IN OTHER THAN CHEMICAL AND CHEMICAL CARRIER WATER SERVICE

- A. Solvent cement for socket joints shall comply with ASTM D2564 and F656.

## 2.07 SOLVENT CEMENT IN CHEMICAL AND CHEMICAL CARRIER WATER SERVICE

- A. Solvent cement shall be free of silica. Products: IPS “Weld-On 724” or Oatey “Lo V.O.C. PVC Heavy Duty Gray.”

## 2.08 GASKETS FOR FLANGES

- A. See Section 15055, Piping Systems—General.

## 2.09 BOLTS AND NUTS FOR FLANGES

- A. See Section 15055, Piping Systems—General.

## 2.10 LUBRICANT FOR STAINLESS STEEL BOLTS AND NUTS

- A. See Section 15055, Piping Systems—General.

## 2.11 WYE STRAINERS

- A. PVC wye strainers shall be manufactured of the same material as the pipe, with 30-mesh screens and Viton seals. Connecting ends shall be the socket type, solvent welded. Provide one spare screen for each strainer.

## PART 3 EXECUTION

### 3.01 GENERAL

The Contractor shall adhere to the following:

- A. Do not install PVC pipe when the temperature is below 40°F or above 90°F. Store loose pipes on racks with a maximum support spacing of 3 feet. Provide shade for pipe stored outdoors or installed outdoors until the pipe is filled with water.
- B. Store fittings indoors in their original cartons.
- C. Store solvent cement indoors or, if outdoors, shade from direct sunlight exposure. Do not use solvent cements that have exceeded the shelf life marked on the storage container.
- D. Before installation, check pipe and fittings for cuts, scratches, gouges, buckling, kinking, or splitting on pipe ends. Remove any pipe section containing defects by cutting out the damaged section of pipe.
- E. Do not drag PVC pipe over the ground, drop it onto the ground, or drop objects on it.

### 3.02 SOLVENT-WELDED JOINTS

- A. Before solvent welding, remove fittings and couplings from their cartons and expose them to the air at the same temperature conditions as the pipe for at least 1 hour.
- B. Cut pipe ends square and remove all burrs, chips, and filings before joining pipe or fittings. Bevel solvent-welded pipe ends as recommended by the pipe manufacturer.
- C. Wipe away loose dirt and moisture from the inside and outside of the pipe end and the inside of the fitting before applying solvent cement. Clean the surfaces of both pipes and fittings that are to be solvent welded with a clean cloth moistened with acetone or methylethyl ketone. Do not apply solvent cement to wet surfaces.
- D. The pipe and fitting socket shall have an interference fit. The diametrical clearance between pipe and entrance of the fitting socket shall not exceed 0.04 inch. Check the fit at every joint before applying solvent cement.
- E. Make up solvent-welded joints in accordance with ASTM D2855. Application of cement to both surfaces to be joined and assembly of these surfaces shall produce a continuous bond between them with visual evidence of cement at least flush with the outer end of the fitting bore around the entire circumference.
- F. Allow at least 8 hours of drying time before moving solvent-welded joints or subjecting the joints to any internal or external loads or pressures.

- G. Acceptance criteria for solvent-welded joints shall be as follows:
1. Unfilled Areas in Joint: None permitted.
  2. Unbonded Areas in Joint: None permitted.
  3. Protrusion of Material into Pipe Bore, Percent of Pipe Wall Thickness: Cement, 50%.

### 3.03 FLANGED JOINTS

- A. Lubricate carbon steel bolt threads with graphite and oil before installation.
- B. Tighten bolts on PVC flanges by tightening the nuts diametrically opposite each other using a torque wrench. Complete tightening shall be accomplished in stages and the final torque values shall be as shown in the following table:

Pipe Size (inches)	Final Torque (foot-pounds)
1/2 to 1-1/2	10 to 15
2 to 3	20 to 30

### 3.04 INSTALLATION OF STAINLESS STEEL BOLTS AND NUTS

- A. See Section 15055, Piping Systems—General.

### 3.05 THREADED JOINTS

- A. Cut threaded ends on PVC to the dimensions of ANSI B1.20.1. Ends shall be square cut. Follow the pipe manufacturer's recommendations regarding pipe hold-down methods, saw cutting blade size, and saw cutting speed.
- B. Pipe or tubing cutters shall be specifically designed for use on PVC pipe. Use cutters manufactured by Reed Manufacturing Company, Ridge Tool Company, or equal.
- C. If a hold-down vise is used when the pipe is cut, insert a rubber sheet between the vise jaws and the pipe to avoid scratching the pipe.
- D. Thread cutting dies shall be clean and sharp and shall not be used to cut materials other than plastic.
- E. Apply Teflon® thread compound or Teflon® tape lubricant to threads before screwing on the fitting.

### 3.06 INSTALLING UNIONS

- A. Provide unions on exposed (above grade and in vaults) piping 3 inches and smaller as follows:
  - 1. At every change in direction (horizontal and vertical).
  - 2. Six to 12 inches downstream of valves.
  - 3. Every 40 feet in straight pipe runs.
  - 4. Where shown on the Drawings.

### 3.07 INSTALLING BURIED PIPE

- A. Install in accordance with Section 02305, Earthwork for Utilities, and as follows.
- B. Trench bottom shall be continuous, smooth, and free of rocks. See the details on the Drawings for trench dimensions, pipe bedding, and backfill.
- C. After the pipe has been solvent-welded and the joints have set, snake the pipe in the trench according to the pipe manufacturer's recommendations to allow for thermal expansion and contraction of the pipe.
- D. Do not backfill the pipe trench until the solvent-welded joints have set. Support the pipe uniformly and continuously over its entire length on firm, stable soil. Do not use blocking to change pipe grade or to support pipe in the trench.
- E. Install buried PVC pipe in accordance with ASTM D2774 and the pipe manufacturer's recommendations. Backfill materials in the pipe zone shall be imported sand as specified in Section 02305, Earthwork for Utilities. If water flooding is used, do not add successive layers unless the previous layer is compacted to 90% relative compaction.

### 3.08 INSTALLING ABOVEGROUND OR EXPOSED PIPING

- A. See Section 15055, Piping Systems—General.
- B. Fill empty piping with water, provide temporary shading, or use other means to keep the surface temperature of the pipe below 100°F.

### 3.09 PAINTING AND COATING

- A. Coat piping that is exposed to sunlight as specified Section 09900, Painting and Coating, System No. 41.

### 3.10 PIPE LABELS AND COLOR CODING

- A. Label and color code exposed piping and piping inside concrete pipe trenches with flow stream identification labels and banding in accordance with Section 15075, Process Equipment, Piping, and Valve Identification, and the Piping Schedule on the Drawings.

### 3.11 HYDROSTATIC TESTING AND DISINFECTION

- A. Perform hydrostatic testing for leakage in accordance with Section 15144, Pressure Testing of Piping. Piping used for potable water shall be disinfected in accordance with Section 15141, Disinfection of Piping.

END OF SECTION

SECTION 15291  
POLYVINYL CHLORIDE (PVC) PRESSURE PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section covers the work necessary to furnish, install, and complete the AWWA C900 DR 25 and AWWA C905 DR18 PVC pipe and ductile iron fittings specified.
- B. All piping and equipment of the same type shall be from one manufacturer, unless authorized in writing by the Engineer.

1.02 RELATED WORK

- A. Section 01330, Submittals and Acceptance.
- B. Section 01650, Delivery, Storage, and Handling.
- C. Section 01780, Warranties and Bonds.
- D. Section 01830, Operations and Maintenance Manuals.
- E. Section 02240, Dewatering.
- F. Section 02305, Earthwork for Utilities.
- G. Section 09900, Painting and Coating.
- H. Section 15155, Ductile Iron Pipe and Fittings.

1.03 SUBMITTALS

The Contractor shall submit shop drawings in accordance with Section 01330, Submittals and Acceptance:

- A. All PVC pipe and fittings to be installed under this Contract shall be inspected and tested at the location where the material for this project is manufactured. The Contractor shall submit certificates of such tests and their results.
- B. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

1.04 WORK SEQUENCE (NOT USED)

1.05 REFERENCE STANDARDS

Reference standards and recommended practices referred to in this Specification Section shall be the latest revision of any such document in effect at the bid time. The following documents are a

part of this Section. Where this Section differs from these documents, the requirements of this Section shall apply.

- A. American Society of Testing Materials (ASTM)
  - 1. ASTM A242—Standard Specification for High-Strength Low-Alloy Structural Steel.
  - 2. ASTM A536—Standard Specification for Ductile Iron Castings.
  - 3. ASTM D2241—Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
  - 4. ASTM F477—Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
  
- B. American Water Works Association (AWWA)
  - 1. AWWA C900—Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 inch to 12 inch (100 mm to 300 mm), for Water Transmission and Distribution.
  - 2. AWWA C905—Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters 14 inch through 36 inch.

#### 1.06 QUALITY ASSURANCE (NOT USED)

#### 1.07 WARRANTIES

- A. Warranties shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01780, Warranties and Bonds.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. The Contractor shall adhere to the requirements specified in Section 01650, Delivery, Storage, and Handling, for storing and protecting the items specified in this Section.

#### 1.09 QUALIFICATIONS (NOT USED)

#### 1.10 TESTING REQUIREMENTS (NOT USED)

#### 1.11 MAINTENANCE (NOT USED)



## 1.12 OPERATIONS AND MAINTENANCE (O&M) MANUALS

- A. Operations and Maintenance Manuals shall be in accordance with General Conditions, Supplementary Conditions, and Specification Section 01830, Operations and Maintenance Manuals.

## PART 2 PRODUCTS

### 2.01 LARGE PVC PRESSURE PIPE

#### A. Large PVC Pressure Piping:

- 1. Unless otherwise specified, PVC pressure pipe for nominal diameters 4 inches and larger shall conform to the requirements of AWWA C900 DR 25 up to 12 inches and AWWA C905 DR 18 larger than 12 inches with gasketed integral bell ends. Pipe shall be designed for maximum working pressure of not less than 150 psi. Pipe shall be made to ductile iron pipe ODs instead of IPS. The PVC pipe shall be blue and NSF approved for potable water use, pantone purple for reclaimed water use, and green for sewer and drain use in accordance the Pipe Schedule on the Drawings.

#### B. Bell and Spigot:

- 1. Pipe joints shall be made with integral bell and spigot pipe ends. The bell shall consist of an integral thickened wall section designed to be at least as strong as the pipe wall. The bell shall be supplied with a factory glued rubber ring gasket that conforms to the manufacturer's standard dimensions and tolerances. The gasket shall meet the requirements of ASTM F477 "Elastomeric Seals (Gaskets) for Joining Plastic Pipe." PVC joints shall be "Ring-Tite" as manufactured by J-M Manufacturing Company, Inc. or an equal approved by the Engineer. Nontoxic gasket lubricant shall be as specified by the pipe manufacturer.

#### C. Restrained Joints:

- 1. The following pipe joints and fittings restraint methods can be used to prevent pipe joints and fittings from separating under pressure. No additional financial compensation will be provided to the Contractor for providing the following methods of restraint:
  - a. C-900 PVC pipe bell and spigot joints (4-inch- through 12-inch-diameter pipe) shall be restrained with the EBAA Iron MEGALUG® Series 1600 Restrainer or an equal approved by the Engineer. The Series 1600 restrainers shall provide a minimum of

150-psi restraint to DR 18 (Class 150) pipe with a 3 to 1 safety factor. C-905 PVC pipe bell and spigot shall be restrained with the EBAA Iron MEGALUG® Series 2800 Restrainer or an equal approved by the Engineer. The Series 2800 restrainers shall provide a minimum of 200 psi restraint to DR 18 (Class 235) pipe with a 2 to 1 safety factor. The restraining device and tee head bolts shall be manufactured of high-strength ductile iron meeting ASTM A536, Grade 65-42-10. Clamping bolts and nuts shall be manufactured of corrosion-resistant, high-strength, low-alloy CORTEN steel meeting the requirements of ASTM A242.

- b. Mechanical joint fittings used with PVC pipe (3-inch- through 36-inch-diameter DR 18 pipe) shall be restrained with the EBAA Iron MEGALUG® Series 2000 PV Restrainer or an equal approved by the Engineer. The Series 2000 PV restrainers shall provide a minimum of 150-psi restraint with a 2 to 1 safety factor. The restraining device and Tee head bolts shall be manufactured of high-strength ductile iron meeting ASTM A536, Grade 65-42-10. Clamping bolts and nuts shall be manufactured of corrosion-resistant, high-strength, low-alloy CORTEN steel meeting the requirements of ASTM A242.
- c. All parts of the joint restraint systems shall be coated with System No. 24 in accordance with Section 09900, Painting and Coating, Mega-Bond coating system by EBAA Iron, Inc. or Engineer-approved equal.

## 2.02 LARGE PVC PRESSURE PIPE FITTINGS

- A. Fittings for use with large PVC pipe shall be ductile-iron fittings conforming to the requirements of mechanical joint fittings as specified in Section 15155, Ductile Iron Pipe and Fittings.
- B. Exterior Coating
  - 1. Exterior coating for fittings shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.
- C. Lining
  - 1. Lining for fittings shall be as specified in Section 15155, Ductile Iron Pipe and Fittings.

2. Any damaged lined areas shall be repaired in accordance with the manufacturer's recommendations so that the repaired area is equal to the undamaged lined areas.

### 2.03 SMALL PVC PRESSURE PIPE (NOT USED)

## PART 3 EXECUTION

### 3.01 EXAMINATION

- A. The Contractor shall examine 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 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, and valves shall be lowered carefully into the trench using suitable tools or equipment to prevent damage to pipeline materials. Under no circumstances shall pipeline materials be dropped or dumped into the trench. The trench shall be dewatered before installing the pipe in accordance with the Specifications.
- B. The sealing surface of the pipe, the inside of the bell, and the inside of the gasket shall be cleaned immediately before assembly.
- C. 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.
- D. 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.
- E. At all times when pipe laying is in progress, except when joining another piece of pipe, the open ends of the pipe shall be closed by a watertight plug or other means approved by the Engineer to prevent the entrance of objectionable materials. Care shall be taken to prevent pipe flotation.
- F. Trench width at the top of the pipe, bedding conditions, and backfill placement and compaction shall be in accordance with the Contract Documents.

G. Joint Assembly

1. Pipe joints shall be assembled in accordance with the manufacturer's instructions.

H. Pipe Deflection

1. When it is necessary to deflect pipe from a straight line in either the vertical or horizontal plane, the amount of deflecting shall not exceed 75% of that recommended by the manufacturer.

I. Pipe Cutting

1. 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.
2. Burrs shall be removed from spigots, and ends shall be smoothly beveled. Field cut ends shall be marked for proper depth of joint assembly.

J. Thrust Restraint

1. All pipe, tees, valves, bends, and etc., unless otherwise specified, shall be restrained using mechanical means as specified. Pipe restraint using the specified mechanical restraining system with the restrained joint schedule or tie-rods is also acceptable. Reaction blocking shall not be used on this project.
2. All ductile iron fittings, valves, mechanical restraint harnesses, and other forms of mechanical restraint shall be installed and wrapped in polyethylene tube material as specified in Section 15155, Ductile Iron Pipe and Fittings.

### 3.03 LOCATION AND IDENTIFICATION

- A. All non-metallic reclaimed water, potable water, sewer mains and yard piping piping shall be installed with a continuous, insulated 14-gauge copper wire installed directly on top of pipe for location purposes. Detectable tape may be used in lieu of copper wire and shall be placed 1 foot above the top of the pipe.
- B. All PVC reclaimed water mains shall be a solid pantone purple color. All potable water mains shall be a solid blue color. All sewer and drain mains shall be a solid green color. All lettering shall appear legibly on pipe and shall run the entire length of the pipe. Lettering shall be appropriate for the intended use.

- C. All DIP reclaimed water mains shall be marked with a continuous stripe located within the top 90° of the pipe and shall be a minimum of 2 inches in width and shall be lavender in color. Backfill shall not be placed for 30 minutes following paint application.

#### 3.04 TESTING

- A. All lines shall be tested at the pressures listed in the Pipe Schedule in the Drawings (DWG. No. G5).
- B. See Section 15144, Pressure Testing of Piping, for the requirements of pipe flushing, cleaning, pressure and leakage testing, and inspection requirements.
- C. See Section 15141, Disinfection of Piping, for the disinfection requirements.

END OF SECTION

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**DIVISION 16**  
**ELECTRICAL**

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SECTION 16010  
BASIC ELECTRICAL REQUIREMENTS

PART I GENERAL

1.01 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.

1.02 CODES:

A. The work shall be in conformance with the latest adopted version of the following:

NFPA 70	National Electric Code
FBC	Florida Building Code
NFPA	National Fire Protection Association Codes

B. The installation shall also comply with all applicable rules and regulations of local and state laws and ordinances. Include in the work, without extra cost, any labor, materials, services, apparatus and drawings required to comply with all applicable laws, ordinances, rules and regulations. Inform the engineer of any work or materials which conflict with any of the applicable codes, standards, laws, and regulations before submitting their bid.

1.03 ROUGH-IN:

A. Verify final locations for rough-ins with field measurements and with the requirements of the actual equipment to be connected.

B. Refer to equipment specifications in Divisions 2 through 15 for rough-in requirements.

1.04 ELECTRICAL INSTALLATIONS:

A. Existing services shall not be interrupted without prior consent of the owner's authorized representative and may be interrupted only at, and for, the specific time designated by the owner's authorized representative.

B. Make a thorough examination of the site and the contract documents. No claim for extra compensation will be recognized if difficulties are encountered which an examination of site conditions and contract documents prior to executing contract would have revealed.

C. Coordinate electrical equipment and materials installation with other building components.

- D. Verify all dimensions by field measurements.
- E. Arrange for chases, slots, and openings in other building components to allow for electrical installations.
- F. Coordinate the installation of required supporting devices and sleeves to be set in poured-in-place concrete and other structural components, as they are constructed. Sequence, coordinate, and integrate installations of electrical materials and equipment for efficient flow of the work. Give particular attention to large equipment requiring positioning prior to closing-in the building.
- G. Coordinate the cutting and patching of building components to accommodate the installation of electrical equipment and materials.
- H. Install electrical equipment to facilitate maintenance and repair or replacement of equipment components. As much as practical, connect equipment for ease of disconnecting, with minimum of interference with other installations.
- I. Coordinate the installation of electrical materials and equipment above ceilings with suspension system, mechanical equipment and systems, and structural components.
- J. Temporary electrical service and construction lighting shall be provided under this section. Provide all Temporary electrical equipment as shown on the drawings for the duration of the project. All Temporary electrical equipment and its installation shall not interfere with the operation of the facility and shall not interfere with access to the existing facility's equipment. Provide for all electrical service for construction period, making all connections and removal of same at job conclusion. Furnish and install temporary lighting for construction period. At job completion, all temporary lamps shall be removed and replaced with new lamps; and all temporary electrical equipment shall be disconnected and removed from the project site.
- K. All existing and new conduit/raceways within the project area shall be properly (maximum of 6 feet between supports) supported. Add support to existing conduit as required to comply with the NEC.
- L. All enclosures for new electrical equipment shall be NEMA 4X stainless (316) steel. All enclosures shall have internal mounting plates for components and an interior safety door.
- M. There shall be no penetrations of existing clarifier tank or process basin walls. All conduits shall be run surface mounted or on top of walls. Conduit supports or associated hardware shall NOT penetrate existing clarifier tank walls or process basin walls.

#### 1.05 CUTTING AND PATCHING:

- A. Refer to the Division 1 Section: CUTTING AND PATCHING for general requirements for cutting and patching.
- B. Do not endanger or damage installed work through procedures and processes of cutting and patching.
- C. Arrange for repairs required to restore other work because of damage caused as a result of electrical installations.
- D. No additional compensation will be authorized for cutting and patching work that is necessitated by ill-timed, defective, or non-conforming installations.
- E. Perform cutting, fitting, and patching of electrical equipment and materials required to:
  - 1. Uncover work to provide for installation of ill-timed work.
  - 2. Remove and replace defective work.
  - 3. Remove and replace work not conforming to requirements of the contract documents.
  - 4. Remove samples of installed work as specified for testing.
  - 5. Install equipment and materials in existing structures.
  - 6. Upon written instructions from the engineer, uncover and restore work to provide for engineer observation of concealed work.
- F. Cut, remove and legally dispose of, selected electrical equipment, components, and materials as indicated; including, but not limited to, removal of electrical items indicated to be removed and items made obsolete by the new work.
- G. Protect the structure, furnishings, finishes, and adjacent materials not indicated or scheduled to be removed.
- H. Provide and maintain temporary partitions or dust barriers adequate to prevent the spread of dust and dirt to adjacent areas.
- I. Locate, identify, and protect electrical services passing through remodeling or demolition area and serving other areas required to be maintained operational. When transit services must be interrupted, provide temporary services for the affected areas and notify the owner prior to changeover.

#### 1.06 ELECTRICAL SUBMITTALS:

- A. Refer to the Conditions of the Contract (General and Supplementary) and Division 1 Section: SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES for submittal definitions, requirements, and procedures.

- B. Submittal of shop drawings, product data, and samples will be accepted only when submitted by the contractor. Data submitted from subcontractors and material suppliers directly to the engineer will not be processed.
  - C. Submit Operation and Maintenance Manuals with part lists as specified in Division 1 Project Closeout; for the following electrical equipment: Panel boards, Control Panels, Variable Frequency Drives, Soft Starters, Motor Starters, Motors, Transformers, and Programmable Logic Controllers.
- 1.07 PRODUCT OPTIONS AND SUBSTITUTIONS: Refer to the Instructions to Bidders and the Division 1 Section: PRODUCTS AND SUBSTITUTION for requirements in selecting products and requesting substitutions.
- 1.08 PRODUCT LISTING:
- A. Prepare listing of major electrical equipment and materials for the project.
  - B. Submit this listing as a part of the submittal requirement specified in the Division 1 Section: PRODUCTS AND SUBSTITUTIONS.
  - C. When two or more items of the same material or equipment are required, they shall be of the same manufacturer. Product manufacturer uniformity does not apply to raw materials, bulk materials, wire, conduit, fittings, sheet metal, steel bar stock, welding rods, solder, fasteners, motors for dissimilar equipment units, and similar items used in work, except as otherwise indicated.
  - D. Provide products which are compatible within systems and other connected items.
  - E. No substitution will be considered unless written request has been submitted to the engineer at least ten (10) days prior to the date for receipt of bids.
  - F. If the engineer approves any proposed substitutions, such approval will be set forth in an addendum.
- 1.09 DELIVERY, STORAGE, AND HANDLING:
- A. Deliver products to project properly identified with names, model numbers, types, grades, compliance labels, and similar information needed for distinct identifications; adequately packaged and protected to prevent damage during shipment, storage, and handling.
  - B. Store equipment and materials at the site, unless off-site storage is authorized in writing. Protect stored equipment and materials from damage.
  - C. Coordinate deliveries of electrical materials and equipment to minimize construction site congestion. Limit each shipment of materials and equipment to the items and quantities needed for the smooth and efficient flow of installation.

#### 1.10 RECORD DOCUMENTS:

- A. Refer to the Division 1 Section: **PROJECT CLOSEOUT** or **PROJECT RECORD DOCUMENTS** for requirements. The following paragraphs supplement the requirements of Division 1.
- B. Mark drawings to indicate revisions to conduit size and location, both exterior and interior; actual equipment locations, dimensioned from column lines; concealed equipment, dimensioned to column lines; distribution and branch electrical circuitry; fuse and circuit breaker size and arrangements; support and hanger details; change orders; concealed control system devices.
- C. Mark Specifications to indicate approved substitutions; change orders; actual equipment and materials used.
- D. Contractor shall provide engineer with record drawings (AutoCAD compatible file format) and one set of blueprints.

#### 1.11 WARRANTIES:

- A. Refer to the Division 1 Section: **SPECIFIC WARRANTIES** for procedures and submittal requirements for warranties. Refer to individual equipment specifications for warranty requirements.
- B. Compile and assemble the warranties specified in Division 16 into a separated set of vinyl- covered, three-ring binders, tabulated and indexed for easy reference.
- C. Provide complete warranty information for each item to include product or equipment; date of beginning of warranty or bond; duration of warranty or bond; and names, addresses, and telephone numbers and procedures for filing a claim and obtaining warranty services.

#### 1.12 CLEANING:

- A. Refer to the Division 1 Section: **PROJECT CLOSEOUT** or **FINAL CLEANING** for general requirements for final cleaning.

END OF SECTION

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SECTION 16110  
RACEWAYS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 specification sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section and is part of each Division 16 section making reference to electrical raceways specified herein.

1.02 DESCRIPTION OF WORK

- A. Extent of raceway work is indicated by drawings and schedules.
- B. Types of raceways specified in this section include the following:

- Heavy Wall Aluminum
  - PVC Schedule 80
  - Liquid-tight flexible PVC coated metal conduit

1.03 QUALITY ASSURANCE

- A. Manufacturers: Firms regularly engaged in manufacture of raceway systems of types and sizes require, whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects with electrical raceway work similar to that required for this project.
- C. Codes and Standards:
  - 1. UL Compliance Labeling: Comply with applicable requirements of UL safety standards pertaining to electrical raceway systems. Provide raceway products and components which have been UL listed and labeled.

## PART 2 PRODUCTS

### 2.01 METAL CONDUIT AND TUBING

- A. General: Provide aluminum conduit, tubing and fittings of types, grades, sizes and weights (wall thickness) for each service indicated.
- B. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements and comply with applicable portions of NEC for raceways.
- C. Rigid aluminum Conduit: Provide rigid aluminum, heavy wall, threaded type.
- D. Liquid-Tight Flexible PVC-Coated Metallic Conduit: Provide liquid-tight flexible PVC-coated metallic conduit for all motor connections.
- E. Conduit Fittings: Couplings and connectors for conduit sizes 2" and smaller shall be aluminum hex-nut, expansion-gland type. Aluminum set screw type fittings may be used for conduit sizes 2½" and larger.

### 2.02 NONMETALLIC CONDUIT AND DUCTS

- A. General: Provide nonmetallic conduit, ducts and fittings of types, sizes and weights for each service indicated. Where types and grades are not indicated, provide proper selection determined by installer to fulfill wiring requirements which comply with provisions for NEC for raceways.
- B. Electrical Plastic Conduit:
  - 1. Heavy Wall Conduit: Schedule 80, 90°C, UL-rated, constructed of Schedule 80, 90 polyvinyl chloride. For direct burial, UL listed and in conformity with NEC Article 347.
  - 2. Standard Wall Conduit: PVC UL rated, constructed of Schedule 40 polyvinyl chloride. For exterior above grade exposure, direct exposure to sunlight, UL listed for direct sunlight and in conformity with NEC Article 352.
- C. Conduit and Tubing Accessories: Provide conduit, tubing and duct accessories of types, sizes and materials, complying with manufacturer's published product information, which mate and match conduit and tubing.
- D. Conduit Bodies: Provide galvanized cast-metal conduit bodies of types, shapes and sizes as required to fulfill job requirements and NEC requirements. Construct conduit bodies with threaded conduit-entrance ends, removable covers, either cast or galvanized steel and corrosion-resistant screws.



## PART 3 EXECUTION

### 3.01 OBSERVATION

- A. Examine areas and conditions under which raceways are to be installed and substrate which will support raceways. Notify contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to installer.

### 3.02 INSTALLATION OF RACEWAYS

- A. General: Raceways run below grade, under floors on grade or in concrete shall be PVC heavy wall type (Schedule 80) conduit, provided rigid aluminum conduit is used on elbows and risers to boxes, cabinets, etc.
- B. Sizes of raceways shall be not less than NEC requirements and shall not in any case be less than indicated on drawings. Larger size raceways and/or pull boxes shall be installed if there is excessive length unbroken run or excessive number of bends. Combining of circuits other than those indicated on the drawings will not be permitted.
- C. Coordinate with other work, including wires/cables, boxes and panel work as necessary to interface installation of electrical raceways and components with other work.
  - 1. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat surfaces with corrosion inhibiting compound before assembling.
  - 2. Use roughing-in dimensions of electrically operated unit furnished by supplier. Set conduit and boxes for connection to units only after receiving review of dimensions and after checking location with other trades.
  - 3. Provide nylon pullcord in empty conduits where indicated. Test all empty conduits with ball mandrel. Clear any conduit which rejects ball mandrel. Pay costs involved for restoration of conduit and surrounding surfaces to original condition.
  - 4. Use liquid-tight flexible conduit where subjected to one or more of the following conditions:
    - a. Exterior location.
    - b. Moist or humid atmosphere where condensate can be expected to accumulate.
    - c. Corrosive atmosphere.
    - d. Subjected to water spray or dripping oil, water or grease.
- D. Cut conduits straight, ream properly and cut threads for heavy wall conduit deep and clean.

- E. Field-bend conduit with benders designed for purpose so as not to distort nor vary internal diameter.
- F. Fasten conduit terminations in sheet metal enclosures by two (2) locknuts and terminate with bushing. Install lock nuts inside and outside enclosure.
- G. Conduits are not to cross pipe shafts or ventilating duct openings.
- H. Keep conduits a minimum distance of 6" from parallel runs of flues, hot water pipes or other sources of heat. Do not install horizontal raceway runs below water and steam piping.
- I. Support riser conduit at each floor level with clamp hangers.
- J. Use of running threads at conduit joints and terminations is prohibited. Where required, use 3-piece union or split couplings.
- K. Complete installation of electrical raceways before starting installation of cables/wires within raceways.
- L. Concealed Conduits:
  - 1. Metallic raceways installed underground or in floors below grade, or outside are to have conduit threads painted with corrosion-inhibiting compound before couplings are assembled. Draw up coupling and conduit sufficiently tight to ensure water tightness.
  - 2. For floors-on-grade, install conduits under concrete slab.
  - 3. Install underground conduits a minimum of 24" below finished grade.
  - 4. All conduits installed below grade or under concrete slab to be minimum of 3/4 inch.
- M. Conduits in Concrete Slab:
  - 1. Place conduits between bottom reinforcing steel and top reinforcing steel. Place conduits either parallel or at 90° to main reinforcing steel.
  - 2. Separate conduits by not less than diameter of largest conduit to ensure proper concrete bond.
  - 3. Conduits crossing in slab must be reviewed for proper cover by engineer.
  - 4. Embedded conduit diameter is not to exceed one-third (1/3) of slab thickness.
- N. Install conduits as not to damage or run through structural members. Avoid horizontal or cross runs in building partitions or side walls.
- O. Exposed Conduits:

1. Install exposed conduits and extensions from concealed conduit systems neatly, parallel with or at right angles to walls of building.
2. Install exposed conduit work as not to interfere with ceiling inserts, lights or ventilation ducts or outlets.
3. Support exposed conduits by use of hangers, clamps or clips. Support conduits minimum of 18" on each side of bends and outlet boxes and on spacing not to exceed 6'-0".
4. Run conduits for outlets on waterproof walls exposed. Set anchors for supporting conduit on waterproof wall in waterproof cement.
5. Above requirements for exposed conduits also apply to conduits installed in space above hung ceilings and in crawl spaces.

P. Non-Metallic Conduits:

1. Make solvent cemented joints in accordance with recommendations of manufacturer.
2. Install PVC conduits in accordance with NEC and in compliance with local utility practices.

Q. Conduit Fittings:

1. Construct locknuts for securing conduit to metal enclosure with sharp edge for digging into metal and ridged outside circumference for proper fastening.
2. Bushings for terminating conduits smaller than 1" and are to have flared bottom and ribbed sides, with smooth upper edges to prevent injury to cable insulation.
3. Install insulated type bushings for terminating conduits 1" and larger. Bushings are to have flared bottom and ribbed sides. Upper edge to have phenolic insulating ring molded into bushing.
4. Bushing of standard or insulated type to have screw type grounding terminal.
5. Miscellaneous fittings such as reducers, chase nipples, 3-piece unions, split couplings and plugs to be specifically designed for their particular application.

### 3.03 FIELD QUALITY CONTROL

- A. General: Mechanically assemble metal enclosures and raceways for conductors to form continuous electrical conductor and connect to electrical boxes, fittings and cabinets as to provide effective electrical continuity and rigid mechanical assembly.
- B. Avoid use of dissimilar metals throughout system to eliminate possibility of electrolysis. Where dissimilar metals are in contact, coat all surfaces with corrosion-inhibiting compound before assembling.

- C. Install expansion fittings in all raceways wherever structural expansion joints are crossed.
- D. Make changes in direction of raceway run with proper fittings supplied by raceway manufacturer. No field bends of raceway sections will be permitted.
- E. Properly support and anchor raceways for their entire length by structural materials. Raceways are not to span any space unsupported.
- F. Use boxes as supplied by raceway manufacturer wherever junction, pull, or device boxes are required. Standard electrical “handy” boxes, etc. shall not be permitted for use with surface raceway installations.
- G. Raceway penetrations of fire-rated walls and/or floors shall be sealed to maintain integrity of construction. All products, materials and methods of installation shall be UL approved and meet NFPA requirements.
- H. Unless otherwise noted on drawings, notified by engineer and/or authorities having jurisdiction, the following materials may be used:
  - 1. Rock Wool: Minimum four pound cubic foot density; flame spread 15, smoke developed 0, fuel contribution 0 by ASTM 384; minimum melting point 2000°F.
  - 2. Concrete and masonry are also approved fire stop materials by NFPA 90A.
  - 3. UL approved products such as Nelson Type CLK Silicon Sealant. Manufacturer’s recommendations shall be strictly followed.
- I. Submit complete data on fire-stopping materials and construction methods for review by engineer before proceeding with work.

END OF SECTION

SECTION 16120  
WIRES AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to wires and cables specified herein.

1.02 DESCRIPTION OF WORK:

- A. Extent of electrical wire and cable work is indicated by drawings and schedules.
- B. Types of electrical wire, cable, and connectors specified in this Section include the following:
  - 1. Copper conductors
  - 2. Split-bolt connectors
  - 3. Wirenut connectors
- C. Applications of electrical wire, cable, and connectors required for project are as follows:
  - 1. For power distribution circuits
  - 2. For lighting circuits
  - 3. For motor-branch circuits
  - 4. For control circuits

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wire and cable products of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than five years.
- B. Installer's Qualifications: Firm with at least three years of successful installation experience with projects utilizing electrical wiring and cabling work similar to that required for this project.
- C. NEC Compliance: Comply with NEC requirements as applicable to construction, installation, and color-coding of electrical wires and cables.

- D. IEEE Compliance: Comply with applicable requirements of IEEE Stds. 82, "Test Procedures for Impulse Voltage Tests on Insulated Conductors", and Std. 241, "IEEE Recommended Practice for Electric Power Systems in Commercial Buildings" pertaining to wiring systems.
- E. ASTM Compliance: Comply with applicable requirements of ASTM B1, 2, 3, 8 and D-753. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).
- F. The following systems of color-coding shall be strictly adhered to:
 

Grounded Leads	Green
Grounded Neutral Leads	White
277/480 Volt, Ungrounded Phase Wires	Brown, Orange and Yellow
120/208 Volt, Ungrounded Phase Wires	Red, Blue, Black
- G. The color code assigned to each phase wire shall be consistently followed throughout.
- H. Where existing base building color-coding differs from color-coding assigned herein. Contractor shall use existing color coding as required to maintain consistency. Advise engineer in writing of color-coding to be used.

1.04 DELIVERY, STORAGE, AND HANDLING:

- A. Deliver wire and cable properly packaged in factory-fabricated type containers, or wound on NEMA specified type wire and cable reels.
- B. Store wire and cable in clean dry space in original containers. Protect products from weather, damaging fumes, construction debris and traffic.
- C. Handle wire and cable carefully to avoid abrading, puncturing and tearing wire and cable insulation and sheathing. Ensure that dielectric resistance integrity of wires/cables is maintained.

PART 2 PRODUCTS

2.01 Building Wires:

- A. Provide factory-fabricated wires of sizes, ampacity ratings, and materials for applications and services indicated.
- B. Conductor insulation shall be dual type THHN/THWN 75°C (167°F) for dry, damp, and wet locations. Conductor insulation with single type marking THHN 90°C (194°F) may be used for dry locations only.

## PART 3 EXECUTION

### 3.01 INSTALLATION OF WIRES AND CABLES:

- A. General: Install electrical cables, wires and wiring connectors as indicated, in compliance with applicable requirements of NEC, NEMA, UL, and NECA's "Standard of Installation" and in accordance with recognized industry practices.
- B. Unless otherwise noted, all branch circuit conductors shall be No. 12 AWG. Branch circuits over 75 feet in length shall be No. 10 AWG unless noted otherwise.
- C. Install UL Type THWN or THHN wiring in conduit, for feeders and branch circuits.
- D. Pull conductors simultaneously where more than one is being installed in same raceway.
- E. Use pulling compound or lubricant, where necessary. Compound used must not deteriorate conductor or insulation.
- F. Use pulling means including, fish tape, cable, rope, and basket weave wire/cable grips which will not damage cables or raceway.
- G. Keep conductor splices to minimum.
- H. Install splices and tapes which possess equivalent-or-better mechanical strength and insulation ratings than conductors being spliced. Use splices and tap connectors which are compatible with conductor material.

### 3.02 FIELD QUALITY CONTROL:

- A. Prior to energization of circuitry, check installed feeder wires and cables with megohm meter to determine insulation resistance levels to ensure requirements are fulfilled. A list of feeders tested shall be submitted to the engineer indicating the insulation resistance level for each cable.
- B. Prior to energization, test wires and cables for electrical continuity and for short-circuits.
- C. Subsequent to wire and cable hook-ups, energize circuitry and demonstrate functioning in accordance with requirements. Where necessary, correct malfunctioning units, and then retest to demonstrate compliance.

END OF SECTION

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SECTION 16135  
ELECTRICAL BOXES & FITTINGS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is a part of each Division 16 section making reference to electrical wiring boxes and fittings specified herein.

1.02 DESCRIPTION OF WORK:

- A. Extent of electrical box and associated fitting work is indicated by drawings and schedules.
- B. Types of electrical boxes and fittings specified in this Section include the following:
  - 1. Control Panels
  - 2. Outlet boxes.
  - 3. Junction boxes.
  - 4. Pull boxes.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in the manufacture of electrical boxes and fittings of types, sizes, and capacities required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. Installer's Qualifications: Firms with at least three (3) years of successful installation experience on projects utilizing electrical boxes and fittings similar to those required for this project.
- C. NEC Compliance: Comply with NEC as applicable to construction and installation of electrical wiring boxes and fittings.
- D. UL Compliance: Comply with applicable requirements of UL 50, UL 514-Series, and UL 886 pertaining to electrical boxes and fittings. Provide electrical boxes and fittings which are UL listed and labeled.

## PART 2 PRODUCTS

### 2.01 FABRICATED MATERIALS:

- A. **Outlet Boxes:** Provide aluminum outlet wiring boxes, of shapes, cubic inch capacities, and sizes (including box depths as indicated), suitable for installation at respective locations. Construct outlet boxes with mounting holes and with cable and conduit-size knockout openings in bottom and sides.
1. **Outlet Box Accessories:** Provide outlet box accessories as required for each installation; including box supports, mounting ears and brackets, wallboard hangers, box extension rings, fixture studs, cable clamps and metal straps for supporting outlet boxes, which are compatible with outlet boxes being used to fulfill installation requirements for individual wiring situations.
- B. **Device Boxes:** Provide aluminum, non-gangable device boxes, of shapes, cubic inch capacities, and sizes (including box depths as indicated), suitable for installation at respective locations. Construct device boxes for flush mounting with mounting holes, and with cable-size knockout openings in bottom and ends and with threaded screw holes in end plates for fastening devices. Provide cable clamps and corrosion-resistant screws for fastening cable clamps and for equipment type grounding.
1. **Device Box Accessories:** Provide device box accessories as required for each installation; including mounting brackets, device box extensions, switch box supports, plaster ears, and plaster board expandable grip fasteners, which are compatible with device boxes being utilized to fulfill installation requirements for individual wiring situations.
  2. Flush mounted wall outlets shall be 4" square boxes or gang boxes, not less than 1½" deep. Boxes shall be provided with extension rings and/or covers with sufficient depth to bring the covers flush with the finished wall.
  3. Boxes for flush mounting in concrete block work with one or two devices shall have covers with square corners on the raised portion of the cover. The covers shall have a sufficient amount of depth to be flush with the face of the block. The bottom side of the covers or boxes shall be installed at the masonry course nearest to the dimension specified or noted.
  4. Outlet boxes for exposed wall mounting and outdoor installation shall be cast aluminum boxes with suitable cast aluminum covers. Weatherproof receptacle covers shall have spring hinged lids.
- C. **Rain-Tight Outlet Boxes:** Provide corrosion-resistant, cast-aluminum, rain-tight outlet wiring boxes; of types, shapes and sizes (including depth of boxes), with threaded conduit holes for fastening electrical conduit, cast- aluminum face plates with spring-hinged watertight caps suitably configured for each application, including face plate gaskets and corrosion- resistant plugs and fasteners.

- D. Junction and Pull Boxes: Provide aluminum junction and pull boxes, with screw-on covers; of types, shapes and sizes, to suit each respective location and installation; with welded seams and equipped with stainless steel nuts, bolts, screws and washers. All junction boxes shall be designated with permanent marker circuit numbers and panelboard numbers of circuits contained within.
- E. Control Panels/Enclosures:
1. The control panel/enclosures shall contain, as a minimum, devices and equipment indicated on the drawings or other sections of these specifications. All control panel/enclosures shall contain interior mounting plate.
  2. The control panel enclosure shall be NEMA 4X stainless steel, Underwriters Laboratories (UL) 50 type 4 listed.
  3. The control panel enclosure shall be NEMA 9 (Explosion Proof) for Class 1, Div. 1 & 2 environment.
  4. There shall be permanently affixed to the interior side of the exterior enclosure door both a nameplate and a 10" x 12" pocket for drawing storage. The nameplate shall contain the following information: voltage, phase, date manufactured and intended use – equipment service or function.
  5. Inner safety door (dead front) shall be aluminum.
  6. Provide surge arrestor per county requirements.
  7. Contractor shall furnish shop drawings for control panel. Include dimension, mounting and material requirements of control panel. Furnish wiring diagrams of all internal components and devices. Schematic diagram of system and PLC connection diagrams and data sheet and programming functions. Furnish operating and maintenance and programming manuals.

## PART 3 EXECUTION

### 3.01 INSTALLATION OF ELECTRICAL BOXES AND FITTINGS:

- A. General: Install electrical boxes and fittings as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, and in accordance with recognized industry practices to fulfill project requirements.
- B. Coordinate installation of electrical boxes and fittings with wire/cable, wiring devices, and raceway installation work.
- C. Provide weather-tight outlets for interior and exterior locations exposed to weather or moisture.
- D. Provide knockout closures to cap unused knockout holes where blanks have been

removed.

- E. Install electrical boxes in those locations which ensure ready accessibility to enclosed electrical wiring. All existing and new junction boxes within the project area shall be made accessible. Relocate existing junction boxes as required to comply with the NEC.
- F. Metallic and approved nonmetallic electrical outlet boxes may be installed in vertical fire resistive assemblies classified as 2-hour or less without affecting the fire classification, provided such openings occur on one side only in each framing space and that openings do not exceed 16 square inches. Boxes located opposite sides of walls or partitions shall be separated by a horizontal distance of 24".
- G. Fasten electrical boxes firmly and rigidly to substrates, or structural surfaces to which attached, or solidly embed electrical boxes in concrete or masonry.
- H. Subsequent to installation of boxes, protect boxes from construction debris and damage.

END OF SECTION

SECTION 16142  
ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to electrical connections for equipment specified herein.

1.02 DESCRIPTION OF WORK:

- A. Extent of electrical connections for equipment is indicated by drawings and schedules. Electrical connections are hereby defined to include connections used for providing electrical power to equipment.
- B. Electrical connections for equipment, not furnished as integral part of equipment, are specified in other Division 16 sections, and are work of this Section.
- C. Motor starters and controllers not furnished as integral part of equipment are specified in applicable Division 16 sections and are work of this Section.
- D. Junction boxes and disconnect switches required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this Section.
- E. Electrical identification for wire/cable conductors is specified in Division 16 section, "Electrical Identification", and is work of this Section.
- F. Raceways and wires/cables required for connecting motors and other electrical units of equipment are specified in applicable Division 16 sections, and are work of this Section.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical connectors and terminals, of types and ratings required, and ancillary connection materials, including electrical insulating tape, soldering fluxes, and cable ties; whose products have been in satisfactory use in similar service for not less than five (5) years.

- B. Installer's Qualifications: Firms with at least two (2) years of successful installation experience with projects utilizing electrical connections for equipment similar to that required for this project.
- C. NEC Compliance: Comply with applicable requirements of NEC as to type products used and installation of electrical power connections (terminals and splices) for junction boxes, motor starters, and disconnect switches.
- D. UL Compliance: Comply with UL Std 486A, "Wire Connectors and Soldering Lugs for Use With Copper Conductors" including, but not limited to, tightening of electrical connectors to torque values indicated. Provide electrical connection products and materials which are UL listed and labeled.

## PART 2 PRODUCTS

### 2.01 MATERIALS AND COMPONENTS:

- A. General: For each electrical connection indicated, provide complete assembly of materials; including, but not necessarily limited to, pressure connectors, terminals (lugs), electrical insulating tape, cable ties, solderless wirenuts, and other items and accessories as needed to complete splices and terminations of types indicated. Metal shall not be used for outdoor applications. The contractor shall use aluminum for outdoor installations.
- B. Metal Conduit, Tubing and Fittings, General: Provide metal conduit, tubing and fittings of types, grades, sizes and weights (wall thicknesses) indicated for each type service. Where types and grades are not indicated, provide proper selection as determined by installer to fulfill wiring requirements and comply with NEC requirements for raceways. Provide products complying with Division 16 Basic Electrical and in accordance with the following listing of metal conduit, tubing and fittings:
  - 1. Rigid aluminum conduit.
  - 2. Rigid metal conduit fittings.
  - 3. Electrical metallic tubing.
  - 4. EMT fittings.
  - 5. Flexible metal conduit.
  - 6. Flexible metal conduit fittings.
  - 7. Liquid-tight flexible metal conduit.
  - 8. Liquid-tight flexible metal conduit fittings.
- C. Wires, Cables, and Connectors:
  - 1. General: Provide wires, cables, and connectors complying with Division 16 Basic Electrical Materials And Methods section "Wires and Cables."

2. Wires/Cables: Unless otherwise indicated, provide wires/cables (conductors) for electrical connections which match (including sizes and ratings) wires/cables which are supplying electrical power. Provide copper conductors with conductivity of not less than 98% at 20°C (68°F).
- D. Connectors and Terminals: Provide electrical connectors and terminals which mate and match (including sizes and ratings) with equipment terminals, and are recommended by equipment manufacturer for intended applications.

## PART 3 EXECUTION

### 3.01 OBSERVATION:

- A. Observe area and conditions under which electrical connections for equipment are to be installed and notify contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

### 3.02 INSTALLATION OF ELECTRICAL CONNECTIONS:

- A. Install electrical connections as indicated; in accordance with equipment manufacturer's written instructions, with recognized industry practices, and complying with applicable requirements of UL and NEC to ensure that products fulfill requirements.
- B. Coordinate with other work, including wires/cables, raceway, and equipment installation as necessary to properly interface installation of electrical connections for equipment with other work.
- C. Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Mate and match conductors of electrical connections for proper interface between electrical power supplies and installed equipment.
- D. Maintain existing electrical service and feeders to occupied areas and operational facilities unless otherwise indicated, or when authorized otherwise in writing by owner or engineer. Provide temporary service during interruptions to existing facilities. When necessary, schedule momentary outages for replacing existing wiring systems with new wiring systems. When that "cutting-over" has been successfully accomplished, remove, relocate, or abandon existing wiring as indicated.
- E. Cover splices with electrical insulating material equivalent to, or of greater insulation resistivity rating, than electrical insulation rating of those conductors being spliced.

- F. Prepare cables and wires by cutting and stripping covering armor, jacket, and insulation properly to ensure uniform and neat appearance where cables and wires are terminated. Exercise care to avoid cutting through tapes which will remain on conductors. Also avoid "ringing" copper conductors while skinning wire.
- G. Trim cables and wires as short as practicable and arrange routing to facilitate inspection, testing, and maintenance.
- H. Provide flexible conduit for motor connections and other electrical equipment connections where subject to movement and vibration.
- I. Provide liquid-tight flexible conduit for connection of motors and other electrical equipment where subject to movement and vibration; and also where connections are subjected to one or more of the following conditions:
  - 1. Exterior location.
  - 2. Moist or humid atmosphere where condensate can be expected to accumulate.
  - 3. Corrosive atmosphere.
  - 4. Water spray.
  - 5. Dripping oil, grease, or water.

### 3.03 FIELD QUALITY CONTROL:

- A. Upon completion of installation of electrical connections, and after circuitry has been energized with rated power source, test connections to demonstrate capability and compliance with requirements. Ensure that direction of rotation of each motor fulfills requirement. Correct malfunctioning units at site, then retest to demonstrate compliance.

END OF SECTION



SECTION 16143  
WIRING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to wiring devices specified herein.

1.02 DESCRIPTION OF WORK:

- A. The extent of wiring device work is indicated by drawings and schedules. Wiring devices are defined as single discrete units of electrical distribution systems which are intended to carry but not utilize electric energy.
- B. Types of electrical wiring devices in this section include the following:
  - 1. Receptacles.
  - 2. Ground-fault circuit interrupters.
  - 3. Switches.
  - 4. Wallplates.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of electrical wiring devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. Installer's Qualifications: Firm with at least two (2) years of successful installation experience on projects utilizing wiring devices similar to those required for this project.
- C. NEC Compliance: Comply with NEC as applicable to installation and wiring of electrical wiring devices.
- D. UL Compliance: Provide wiring devices which are UL listed and labeled.

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on electrical wiring devices.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS:

- A. Manufacturers: Subject to compliance with requirements, manufacturers providing wiring devices which may be incorporated in the work include; but are not limited to, the following (for each type and rating of wiring device):
1. Arrow-Hart, Cooper Industries
  2. Eagle Electric Manufacturing Co., Inc.
  3. Harvey Hubbell Inc.
  4. Pass and Seymour Inc.

### 2.02 FABRICATED WIRING DEVICES:

- A. General: Provide factory-fabricated wiring devices, in types, colors, and electrical ratings for applications indicated and which comply with NEMA Standards. Pub/No. WD1. Provide ivory color devices except as otherwise indicated.
- B. Receptacles:
1. All receptacles shall be the grounding type with ground connection made through an extra pole that shall be permanently connected to the green grounding conductor.
  2. Duplex receptacles for 20 ampere, 120 volt service shall be two-pole, three-wire receptacles, rated 20 amperes at 125 volts. Receptacles shall be Harvey Hubbell, Inc., Catalog No. 5362-W.
  3. Single receptacles for 20 amps, 120 volts service shall be two-pole, three-wire rated 20 amperes at 125 volts. Receptacles shall be Harvey Hubbell Inc., Catalog No. 5361-W.
- C. Switches:
1. Snap: Provide toggle switches, rated 20 amperes at 120/277 volts, quiet type, and shall be UL approved without derating for tungsten lamp loads or inductive loads. All switches shall have a grounding terminal which shall be connected to the green grounding conductor. The following catalog numbers are Harvey Hubbell, Inc.

<u>Type</u>	<u>Catalog No.</u>
Single Pole	HBL 1221-W

### 2.03 WIRING DEVICE ACCESSORIES:

- A. 'In Use' covers for exterior receptacles.
- B. Weatherproof caps for switches.

## PART 3 - EXECUTION

### 3.01 INSTALLATION OF WIRING DEVICES:

- A. Install wiring devices as indicated, in accordance with manufacturer's written instructions, applicable requirements of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices to fulfill project requirements.
- B. Install wiring devices only in electrical boxes which are clean; free from excess building materials, dirt, and debris.
- C. Install wiring devices after wiring work is completed.
- D. Install wallplates after painting work is completed.

### 3.02 PROTECTION OF WALLPLATES AND RECEPTACLES:

- A. Upon installation of wallplates and receptacles, advise contractor regarding proper and cautious use of convenience outlets. At time of substantial completion, replace those items which have been damaged, including those burned and scored by faulty plugs.

### 3.03 GROUNDING:

- A. Provide equipment grounding connections for all wiring devices, unless otherwise indicated.

### 3.04 TESTING:

- A. Prior to energizing circuitry, test wiring for electrical continuity and for short-circuits. Ensure proper polarity of connections is maintained. Subsequent to energization, test wiring devices to demonstrate compliance with requirements.

END OF SECTION

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SECTION 16170  
CIRCUIT AND MOTOR DISCONNECTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to circuit and motor disconnects specified herein.

1.02 DESCRIPTION OF WORK:

- A. Extent of circuit and motor disconnect switch work is indicated on drawings and schedules.
- B. Types of circuit and motor disconnect switches in this Section include the following:
  - 1. Equipment disconnects.
  - 2. Appliance disconnects.
  - 3. Motor-circuit disconnects.
- C. Wires/cables, raceways, and electrical boxes and fittings required in connection with circuit and motor disconnect work are specified in other Division 16 Basic Electrical Materials and Methods sections.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of circuit and motor disconnect switches of types and capacities required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience with projects utilizing circuit and motor disconnect work similar to that required for this project.
- C. NEC Compliance: Comply with NEC requirements pertaining to construction and installation of electrical circuit and motor disconnect devices.
- D. UL Compliance: Comply with requirements of UL 98, "Enclosed and Dead-Front Switches." Provide circuit and motor disconnect switches which have been UL listed and labeled.

- E. NEMA Compliance: Comply with applicable requirements of NEMA Stds. Pub No. KS 1, "Enclosed Switches" and 250, "Enclosures for Electrical Equipment (1000 Volts Maximum)."

#### 1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on circuit and motor disconnect switches.
- B. Submit shop drawings in booklet form with separate sheet for each circuit and motor disconnect with proposed switch and accessories clearly identified on each sheet. Identify each device with corresponding names, abbreviations (numbers and lettering) to match terminology of contract documents.

### PART 2 PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering circuit and motor disconnects which may be incorporated in the work are limited to:
  - 1. Square D Company.
  - 2. Westinghouse/Cutler-Hammer
  - 3. General Electric Co.

#### 2.02 FABRICATED SWITCHES:

- A. Heavy-Duty Safety Switches: Provide surface-mounted, heavy-duty type, NEMA 4X stainless steel enclosed safety switches, of types, sizes and electrical characteristics indicated; incorporating quick-make, quick-break type switches. Construct so that switch blades are visible in OFF position with door open. Equip with operating handle which is integral part of enclosure base and whose operating position is easily recognizable, and is padlockable in OFF position. Construct current carrying parts of high-conductivity copper, with silver-tungsten type switch contacts and positive pressure type reinforced fuse clips.
  - 1. All fuses for safety switches shall be dual element, cartridge type. Fuses shall be Bussman "Fusetron" or Chase-Shawmut "Trionic." The contractor shall furnish and install proper size fuses where required for all fusible equipment and shall furnish to the owner one spare fuse for each fuse installed.

## PART 3 EXECUTION

### 3.01 INSTALLATION OF CIRCUIT AND MOTOR DISCONNECT SWITCHES:

- A. Install circuit and motor disconnect switches as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NEMA, NECA's "Standard of Installation", and in accordance with recognized industry practices.
- B. Install disconnect switches for use with motor-driven appliances and motors and controllers within sight of controller position unless otherwise indicated.
- C. Unless otherwise indicated, protective devices shall be mounted with top of cabinet or enclosure 6'-6" above finished floor; shall be properly aligned; and shall be adequately supported independently of the connecting raceways and other equipment. All steel shapes, etc., necessary for the support of the equipment shall be furnished and installed where the building structure is not suitable for mounting the equipment directly thereon. Unless otherwise indicated, all branch circuit protective devices enclosures shall be NEMA type I, general purpose type. Branch circuit protective devices installed outdoors or exposed to the weather shall have weatherproof enclosures, NEMA Type 4X.

### 3.02 GROUNDING:

- A. Provide equipment grounding connections sufficiently tight to assure a permanent and effective ground for electrical disconnect switches where indicated.

### 3.03 FIELD QUALITY CONTROL:

- A. Subsequent to completion of installation of electrical disconnect switches, energize circuitry and demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at project site, then retest to demonstrate compliance. Otherwise remove and replace with new units and retest.

END OF SECTION

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SECTION 16190  
SUPPORTING DEVICES

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is a part of each Division 16 section making reference to electrical supporting devices specified herein.

1.02 DESCRIPTION OF WORK:

- A. Extent of supports, anchors, sleeves, and seals is indicated by drawings and schedules and/or specified in other Division 16 sections.
- B. Types of supports, anchors, sleeves, and seals specified in this Section include the following:
  - 1. Clevis hangers.
  - 2. One-hole conduit straps.
  - 3. Two-hole conduit straps.
  - 4. Round steel rods.
  - 5. Expansion anchors.
  - 6. Toggle bolts.
  - 7. Wall and floor seals.
  - 8. Corn Clamps.
- C. Supports, anchors, sleeves, and seals furnished as part of factory fabricated equipment are specified as part of that equipment assembly in other Division 16 sections.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in manufacture of supporting devices, of types, sizes, and ratings required, whose products have been in satisfactory use in similar service for not less than three (3) years.
- B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience with projects utilizing electrical supporting device work similar to that required for this project.

- C. NECA Compliance: Comply with National Electrical Contractors Association's "Standard of Installation", pertaining to anchors, fasteners, hangers, supports, and equipment mounting.
- D. UL Compliance: Provide electrical components which are UL listed and labeled.

#### 1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on supporting devices, including catalog cuts, specifications, and installation instructions for each type of support, anchor, sleeve, and seal.

### PART 2 PRODUCTS

#### 2.01 MANUFACTURED SUPPORTING DEVICES:

- A. General: Provide supporting devices which comply with manufacturer's standard materials, design and construction, in accordance with published product information and as required for complete installation and as herein specified. Where more than one type of supporting device meets indicated requirements, selection is installer's option.
- B. Supports: Provide supporting devices of types, sizes, and materials indicated and having the following construction features:
  - 1. Clevis Hangers: For supporting conduit; aluminum with ½" diameter hole for round steel rod, approximately 54 pounds per 100 units.
  - 2. Reducing Couplings: Aluminum rod reducing coupling, ½" by 5/8", approximately 16 pounds per hundred 100 units.
  - 3. One-Hole Conduit Straps: For supporting conduit; aluminum.
  - 4. Two-Hole Conduit Straps: For supporting conduit; aluminum.
  - 5. Hexagon Nuts: For ½" rod size, aluminum.
  - 6. Round Aluminum Rod: ½" diameter.
  - 7. Offset Conduit Clamps: For supporting 2" rigid metal conduit; aluminum.
- C. Anchors: Provide anchors of types, sizes, and materials indicated with the following construction features: (all aluminum).
  - 1. Expansion Anchors: ½".
  - 2. Toggle Bolts: Springhead, 3/16" by 4".
- D. Sleeves and Seals: Provide sleeves and seals, of types, sizes and materials indicated, with the following construction features:
  - 1. Wall and Floor Seals: Provide factory-assembled watertight wall and floor seals, of types and sizes indicated, suitable for sealing around conduit, pipe, or tubing passing through concrete floors and walls. Construct seals

with steel sleeves, malleable iron body, neoprene sealing grommets and rings, metal pressure rings, pressure clamps, and cap screws. Seals shall be fire-rated where required.

- E. U-Channel Strut Systems: Provide U-channel strut system for supporting electrical equipment; aluminum of types and sizes indicated. Construct with 3/16" diameter holes, 8" O.C. on top surface, and with the following fittings which mate and match with U-channel:
  - 1. Fixture hangers.
  - 2. Channel hangers.
  - 3. End caps.
  - 4. Beam clamps.
  - 5. Wiring studs.
  - 6. Thinwall conduit clamps.
  - 7. Rigid conduit clamps.
  - 8. Conduit hangers.

## 2.02 FABRICATED SUPPORTING DEVICES:

- A. Pipe Sleeves: Provide pipe sleeves of Aluminum Pipe: Fabricate from schedule 40 galvanized aluminum pipe. Remove burrs.
- B. Sleeve Seals: Provide sleeves for piping which penetrate foundation walls below grade or exterior walls. Caulk between sleeve and pipe with nontoxic, UL classified caulking material to ensure watertight seal. Seals shall be fire-rated where required.

## PART 3 EXECUTION

### 3.01 INSTALLATION OF SUPPORTING DEVICES:

- A. Install hangers, anchors, sleeves, and seals as indicated, in accordance with manufacturer's written instructions and with recognized industry practices to insure supporting devices comply with requirements. Comply with requirements of NECA and NEC for installation of supporting devices.
- B. Coordinate with other electrical work, including raceway and wiring work, as necessary to interface installation of supporting devices with other work.
- C. Install hangers, supports and attachments to support piping properly from building structure. Arrange for grouping of parallel runs of horizontal conduits to be supported together on trapeze type hangers where possible. Install supports with spacings indicated and in compliance with NEC requirements.

END OF SECTION

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SECTION 16195  
ELECTRICAL IDENTIFICATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 section making reference to electrical identification specified herein.

1.02 DESCRIPTION OF WORK:

- A. Extent of electrical identification work is indicated by drawings and schedules.
- B. Types of electrical identification work specified in this Section include the following:  
  
Equipment/system identification signs.

PART 2 PRODUCTS

2.01 ELECTRICAL IDENTIFICATION MATERIALS:

- A. Engraved Plastic-Laminate Signs:
  - 1. General: Provide engraving stock melamine plastic laminate in sizes and thicknesses indicated, engraved with engraver's standard letter style of sizes and wording indicated; black face and white core plies (letter color) except as otherwise indicated, punched for mechanical fastening except where adhesive mounting is necessary because of substrate.
  - 2. Signs shall be black face with white core plies (letter color).
    - a. Thickness:  $\frac{1}{16}$ ", except as otherwise indicated.
    - b. Fasteners: Self-tapping stainless steel screws, except contact-type permanent adhesive where screws cannot, or should not, penetrate substrate.
    - c. Nameplates for essential electrical systems shall be red with white letters.

## B. Conduit Labels

1. Products and Manufacturers: Provide one of the following:
  - a. Stainless Steel Laser Etched Conduit Tags by Marking Services Incorporated.
  - b. Or equal.
2. Shall be 316 stainless steel construction.
3. Attach with stainless steel straps.
4. Shall be 1" x 4" minimum, and custom made to match conduit labels as identified in the Contract drawings.
5. Custom Labels:
  - a. Shall have black laser etched lettering on stainless steel background.

### 2.02 LETTERING AND GRAPHICS:

- A. General: Coordinate names, abbreviations, and other designations used in electrical identification work with corresponding designations shown, specified, or scheduled. Provide numbers, lettering and wording as indicated or, if not otherwise indicated, as recommended by manufacturer or as required for proper identification and operation/maintenance of electrical systems and equipment.

## PART 3 EXECUTION

### 3.01 APPLICATION AND INSTALLATION:

- A. General Installation Requirements:
  1. Install electrical identification products as indicated, in accordance with manufacturer's written instructions and requirements of NEC.
  2. Coordination: Where identification is to be applied to surfaces which require finish, install identification after completion of painting.
  3. Regulations: Comply with governing regulations and requests of governing authorities for identification of electrical work.
- B. Equipment/System Identification:
  1. General: Install engraved plastic-laminate sign on each major unit of electrical equipment in building; including central or master unit of each electrical system including communication/ control/signal systems, unless unit is specified with its own self-explanatory identification or signal system. Provide text matching terminology and numbering of the contract documents and shop drawings. Provide signs for each unit of the following categories of electrical work:
    - a. Panelboards, electrical cabinets and enclosures.

- b. Access panels/doors to electrical facilities.
  - c. Transformers.
  - d. Fire alarm equipment cabinets.
  - e. Disconnect switches, motor starters, contactors, including current origination.
2. Install signs at locations indicated or, where not otherwise indicated, at location for best convenience of viewing without interference with operation and maintenance of equipment. Secure to substrate with fasteners, except use adhesive where fasteners should not, or cannot, penetrate substrate.

END OF SECTION

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SECTION 16452  
GROUNDING

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Materials and Methods section, and is part of each Division 16 Section making reference to grounding specified herein.

1.02 SUMMARY:

- A. The extent of electrical grounding and bonding work is indicated by drawings and schedules, and as specified herein. Grounding and bonding work is defined to encompass systems, circuits, and equipment. All new grounding electrodes (rods) and new ground conductors shall be bonded to the existing grounding grid at four locations, minimum. All new control panels, electrical panels and cabinets shall be grounded with new ground rods and shall also be bonded to the existing grounding grid. All new connections to the existing grounding grid shall be made by exothermic weld process. Contractor shall obtain approval the grounding connections from owner before installation. Contractor shall furnish and install one grounding test station. Test station shall include in grade box with removable lid to exposed top of ground rod and grounding conductor; all connections in test station shall be mechanical type – not exothermic weld.
- B. The type of electrical grounding and bonding work specified in this Section includes the following:

Solidly grounded
- C. Applications of electrical grounding and bonding work in this Section includes the following:
  - 1. Electrical power systems
  - 2. Grounding electrodes
  - 3. Separately derived systems
  - 4. Raceways
  - 5. Service equipment
  - 6. Enclosures/Control Panels
  - 7. Equipment

- D. Refer to other Division 16 sections for wires/cables, electrical raceways, boxes and fittings, and wiring devices which are required in conjunction with electrical grounding and bonding work; not work of this section.

### 1.03 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on grounding and bonding products and associated accessories.

### 1.04 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of grounding and bonding products, of types and ratings required, and ancillary grounding materials; including stranded cable, copper braid and bus, grounding electrodes and plate electrodes, and bonding jumpers; whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects with electrical grounding work similar to that required for project.
- C. Codes and Standards:
  - 1. Electrical Code Compliance: Comply with applicable local electrical code requirements of the authority having jurisdiction and NEC as applicable to electrical grounding and bonding, pertaining to systems, circuits, and equipment.
  - 2. UL Compliance: Comply with applicable requirements of UL Standards No.'s 467, "Electrical Grounding and Bonding Equipment", and 869, "Electrical Service Equipment", pertaining to grounding and bonding of systems, circuits, and equipment. In addition, comply with UL Std. 486A, "Wire Connectors and Soldering Lugs for Use with Copper Conductors." Provide grounding and bonding products that are UL listed and labeled for their intended usage.

## PART 2 PRODUCTS

### 2.01 GROUNDING AND BONDING:

- A. Materials and Components, General: Except as otherwise indicated, provide electrical grounding and bonding systems indicated; with assembly of materials, including, but not limited to, cables/wires, connectors, solderless lug terminals, grounding electrodes and plate electrodes, bonding jumper braid, surge arresters, and additional accessories needed for a complete installation. Where more than one type component product meets indicated requirements, selection is installer's option. Where materials or components are not indicated, provide products that comply with NEC and UL, requirements, and with established industry standards for those applications indicated.

- B. Conductors: Unless otherwise indicated, provide electrical grounding conductors for grounding system connections that match power supply wiring materials and are sized according to NEC.
- C. Bonding Plates, Connectors, Terminals and Clamps: Provide electrical bonding plates, connectors, terminals, lugs, and clamps as recommended by bonding plate, connector, terminal, and clamp manufacturers for indicated applications.
- D. Ground Electrodes: Solid copper, 5 Ohms, three-quarter inch ( $\frac{3}{4}$ " ) diameter by twenty feet (20').

## PART 3 EXECUTION

### 3.01 EXAMINATION:

- A. Examine areas and conditions under which electrical grounding and bonding connections are to be made, and notify contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

### 3.02 INSTALLATION OF ELECTRICAL GROUNDING AND BONDING SYSTEMS:

- A. General: Install electrical grounding and bonding systems as indicated, in accordance with manufacturer's instructions; applicable portions of NEC, NECA's "Standard of Installation", and in accordance with recognized industry practices, to ensure that products comply with requirements.
- B. Coordinate with other electrical work as necessary to interface installation of electrical grounding and bonding system work with other work.
- C. Ground electrical service system neutral at service entrance to the building cold water line and to three (3) three-fourths inch ( $\frac{3}{4}$ " ) diameter, twenty feet (20') long ground rods spaced ten feet (10') apart.
- D. Ground each separately-derived system neutral to separate grounding electrode.
- E. Connect together system neutral, service equipment enclosures, exposed noncurrent carrying metal parts of electrical equipment, metal raceway systems, grounding conductor in raceways and cables, receptacle ground connectors, and plumbing systems.
- F. All raceways with No. 10 or 12 AWG phase conductors for receptacles, lighting fixtures, and similar circuits shall be provided with a parity-sized green equipment ground conductor. Ground conductor shall be installed in entire raceway system, including wall switches and flexible conduit to light fixtures. Equipment ground conductor sizes for circuits with phase conductors larger than No. 12 AWG are indicated on drawings. Ground conductors shall be connected to ground buss in panelboards. All power, lighting, control circuits shall have a fully sized insulated copper conductor run the entire length of the circuit. The raceway/conduit system shall not be used as a means of the grounding system.

- G. Terminate feeder and branch circuit insulated equipment-grounding conductors with grounding lug, bus, or bushing. Conductors looped under screw or bolt heads will not be permitted.
- H. Connect grounding electrode conductors to one inch (1”) diameter or greater metallic cold water pipe, using a suitably sized ground clamp. Provide connections to flanged piping at street side of flange.
- I. Install clamp-on connectors on clean metal contact surfaces to ensure electrical conductivity and circuit integrity.
- J. Provide a grounding bushing and a continuous copper bonding jumper from the bushing to the equipment ground bus in all feeders. The bonding jumper shall be the same size as the equipment ground conductor.

### 3.03 FIELD QUALITY CONTROL

- A. Upon completion of installation of electrical grounding and bonding systems, test ground resistance with ground resistance tester. Where tests show resistance-to-ground is over twenty-five (25) ohms, take appropriate action to reduce resistance to twenty-five (25) ohms or less by driving additional ground rods then retest to demonstrate compliance.
- B. Submit test results (3 copies) to engineer of record. Test results shall include grounding test method used, equipment used (manufacturer and model number) with certification of calibration and data results.

END OF SECTION

SECTION 16460  
TRANSFORMERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 Section making reference to transformers specified herein.

1.02 DESCRIPTION OF WORK:

- A. Extent of transformer work is indicated by drawings and schedules.
- B. Types of transformers specified in this Section include the following:  
  
Dry-Type Transformers
- C. Electrical wiring connections for transformers are specified in applicable Division 16 sections.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in the manufacture of power/distribution transformers of types and ratings required; whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firm with at least five (5) years of successful installation experience on projects utilizing electrical power and distribution transformers similar to those required for this project.
- C. NEC Compliance: Comply with NEC as applicable to installation and construction of electrical power/distribution transformers.
- D. ANSI Compliance: Comply with applicable requirements of ANSI Standards C57-Series pertaining to power/distribution transformers.
- E. NEMA Compliance: Comply with requirements of NEMA Std Pub/No.'s ST 20; "Dry-Type Transformers for General Applications", TR 1, and TR 27.
- F. UL Compliance: Comply with applicable requirements of ANSI/UL 506; "Safety Standard for Specialty Transformers".

- G. NESC Compliance: Comply with applicable requirements of National Electrical Safety Code (ANSI Std C2) pertaining to indoor and outdoor installation of transformers.

#### 1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's technical product data; including rated kVA, frequency, primary and secondary voltages, and percent taps.

### PART 2 PRODUCTS

#### 2.01 ACCEPTABLE MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work, but are not limited to, the following:
  1. General Electric Co.
  2. Square D Co.
  3. Cutler Hammer/Eaton

#### 2.02 POWER/DISTRIBUTION TRANSFORMERS:

- A. General: Except as otherwise indicated, provide manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by manufacturer, and as required for complete installation.
- B. Dry-Type Distribution Transformers:
  1. Transformers sized 15 kVA and below shall have two (2) – 2 ½ percent taps above and below rated primary voltage.
  2. Transformers 15 kVA and below shall be 115°C temperature rise above 40°C ambient, unless noted otherwise.
  3. Limit transformer surface temperature rise to maximum of 50°C rise above a 40°C ambient. Provide wiring connectors suitable for copper or aluminum wiring. Cushion-mount transformers with external vibration isolation supports; sound-level ratings not to exceed 45 dB for transformers 15 to 45 kVA and 50 dB for 50 to 150 kVA as determined in accordance with ANSI/NEMA standards. Electrically ground core and coils to transformer enclosure by means of flexible metal grounding strap. Provide transformers with fully-enclosed sheet-steel enclosures. Provide transformers suitable for wall mounting.
- C. Equipment/System Identification: Provide equipment/system identification nameplates complying with Division 16 Basic Electrical Materials and Methods section "Electrical Identification" in accordance with the following listing:

Equipment/System Identification.

- D. Finishes: Coat interior and exterior surfaces of transformer, including bolted joints, with manufacturer's standard color baked-on enamel.

### PART 3 - EXECUTION

- 3.01 INSPECTION: Installer must examine areas and conditions under which power/distribution transformers and ancillary equipment are to be installed, and notify contractor in writing of conditions detrimental to proper completion of the work. Do not proceed with the work until satisfactory conditions have been corrected in a manner acceptable to installer.
- 3.02 INSTALLATION OF TRANSFORMERS: Install transformers as indicated, complying with manufacturer's written instructions, applicable requirements of NEC, NESC, NEMA, ANSI, and IEEE standards, and in accordance with recognized industry practices to ensure that products fulfill requirements.
- 3.03 GROUNDING: Provide equipment grounding connections for power/distribution transformers as indicated.
- 3.04 TESTING:
  - A. Prior to energization of transformers, check all accessible connections for compliance with manufacturer's torque tightening specifications.
  - B. Prior to energization, check circuitry for electrical continuity and for short-circuits.
  - C. Upon completion of installation of transformers, energize primary circuitry at rated voltage and frequency from normal power source, and test transformers; including (but not limited to) audible sound levels, to demonstrate capability and compliance with requirements.
  - D. Where possible, correct malfunctioning units at site, then retest to demonstrate compliance; otherwise, remove and replace with new units or components, and proceed with retesting.

END OF SECTION

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SECTION 16470  
PANELBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is a part of each Division 16 section making reference to panelboards specified herein.

1.02 SUMMARY:

- A. Extent of panelboard and enclosure work, including cabinets and cutout boxes, is indicated by drawings and schedules and as specified herein.
- B. Types of panelboards and enclosures required for the project include the following:  
  
Power Distribution Panelboards  
Lighting and Appliance Panelboards
- C. Refer to other Division 16 Sections for wires/cables, electrical boxes and fittings and raceway work required in conjunction with installation of panelboards and enclosures.

1.03 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on panelboards and enclosures. Shop drawings shall indicate arrangement of busses, branch circuits, enclosures, dimensions, etc.

1.04 QUALITY ASSURANCE:

- A. Manufacturer's Qualifications: Firms regularly engaged in the manufacture of panelboards and enclosures, of types, sizes, and ratings required; whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: A firm with at least three (3) years of successful installation experience on projects utilizing panelboards similar to those required for this project.

C. Codes and Standards:

1. Electrical Code Compliance: Comply with applicable local code requirements of the authority having jurisdiction and NEC Article 384 as applicable to the installation and construction of electrical panelboards and enclosures.
2. UL Compliance: Comply with applicable requirements of UL 67, "Electric Panelboards", and UL codes 50, 869, and 1053 pertaining to panelboards, accessories and enclosures. Provide panelboard units that are UL listed and labeled.

## PART 2 PRODUCTS

### 2.01 MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering electrical panelboard products that may be incorporated in the work include, but are not limited to, the following:
1. General Electric Company.
  2. Square D Company.
  3. Cutler-Hammer / Eaton Corp.

### 2.02 PANELBOARDS:

- A. General: Except as otherwise indicated, provide panelboards, enclosures, and ancillary components, of types, sizes, and ratings indicated, which comply with manufacturer's standard materials; with the design and construction in accordance with published product information. Equip with proper number of unit panelboard devices as required for complete installation. Where types, sizes, or ratings are not indicated, comply with NEC, UL, and established industry standards for those applications indicated.
- B. Power Distribution Panelboards: Provide dead-front, safety-type power distribution panelboards as indicated; with panelboard switching and protective devices in quantities, ratings, types, and with arrangement shown; with anti-turn, solderless pressure type main lug connectors approved for use with copper conductors. Select unit with feeders connecting at top of panel. Equip with copper bus bars with not less than 98 percent conductivity, and with full-sized neutral bus. Provide suitable lugs on neutral bus for outgoing feeders requiring neutral connections. Provide bolt-on, molded-case circuit breaker types for each circuit, with toggle handles that indicate when tripped. Provide panelboards with bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards which mate and match properly with panelboards.
1. Power panelboards shall be General Electric type 'Spectra', Square D type 'I Line', or Cutler-Hammer type 'PRL3a'. Voltage shall be as indicated.

- C. Lighting and Appliance Panelboards: Provide dead-front safety type lighting and appliance panelboards as indicated; with switching and protective devices in quantities, ratings, types and arrangements shown; with anti-burn solderless pressure type lug connectors approved for use with copper conductors. Construct unit for connecting feeders at top of panel. Equip with copper bus bars, full-sized neutral bar, with bolt-in type heavy-duty, quick-make, quick-break, circuit breakers, with toggle handles that indicate when tripped. Provide suitable lugs on neutral bus for each outgoing feeder required, and provide bare uninsulated grounding bars suitable for bolting to enclosures. Select enclosures fabricated by same manufacturer as panelboards that mate and match properly with panelboards.
1. Panelboards shall be General Electric A-Series, Square D type "NQ", or Cutler-Hammer type PRL2. Panelboard boxes shall be five and three-fourths inches (5 ¾") deep. Voltage shall be as indicated.
- D. Panelboard Enclosures: Provide galvanized sheet steel cabinet-type enclosures, in sizes and NEMA types as indicated; code-gauge, minimum 16-gauge thickness. Cabinets shall be furnished without knockouts and all holes for raceways shall be drilled and punched on the job. Panelboard enclosures shall be five and three-fourths inches (5 ¾") deep. Provide fronts with adjustable trim clamps and doors with flush locks and keys; all panelboard enclosures keyed alike, with concealed piano door hinges and door swings as indicated. Provide baked gray enamel finish over a rust inhibitor coating. Design enclosures for recessed mounting. Provide enclosures that are fabricated by same manufacturer as panelboards that mate and match properly with panelboards to be enclosed.
- E. All panelboards shall be connected distributed phase with circuit numbering as indicated on the drawings. Panelboards shall be numbered with odd numbers on the left side of the panel and even numbers on the right side of the panel. Panelboards shall have a circuit directory card mounted in a frame with plastic cover, mounted on the inside of the door, and directory cards shall be completed with a typewriter to indicated areas and/or devices served by each circuit. All new and existing panelboards being used for this project shall have new typed directories.
- F. Molded-Case Circuit Breakers: Provide factory-assembled, bolt-on, molded-case circuit breakers of frame sizes, characteristics, and ratings, including RMS symmetrical interrupting ratings indicated. Select breakers with permanent thermal and instantaneous magnetic trip, and with fault-current limiting protection; ampere ratings as indicated. Multi-pole breakers shall have a common trip bar so that the tripping of one pole will automatically trip all poles of the breaker. Construct with over-center, trip-free, toggle-type operating mechanisms with quick-make, quick-break action, and positive handle trip indication. Construct breakers for mounting and operating in any physical position and operating in an ambient temperature of 40°C. Provide breakers with mechanical screw type removable connector lugs; AL/CU rated.

1. Individual Enclosed Circuit Breakers: Circuit breakers shall be molded case type. Breakers shall have thermal-magnetic trip units and magnetic trip shall be adjustable. Breakers shall have a common trip bar so that the tripping of one pole will automatically trip all poles of the breaker. Breakers shall be trip free and trip indicating and shall have quick-make, quick-break contacts. Enclosure shall have insulated, groundable neutral.
- G. Panelboards shall be installed complete with connectors and associated hardware for all circuit breakers and circuit breaker spaces listed in the panelboard schedule.
- H. When connecting equipment to existing panelboards, the new and existing circuit breakers shall be identified. A new circuit directory card shall be provided.

### PART 3 EXECUTION

#### 3.01 EXAMINATION:

Examine areas and conditions under which panelboards and enclosures are to be installed and notify contractor in writing of conditions detrimental to proper completion of work. Do not proceed with work until unsatisfactory conditions have been corrected in a manner acceptable to installer.

#### 3.02 INSTALLATION OF PANELBOARDS:

- A. Install panelboards and enclosures as indicated, in accordance with manufacturer's written instruction, applicable requirements of NEC standards, NECA's "Standards of Installation", and in compliance with recognized industry practices to ensure that products fulfill requirements.
- B. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque-tightening values for equipment connectors.
- C. Fasten enclosures firmly to walls and structural surfaces, ensuring that they are permanently and mechanically anchored.

#### 3.03 GROUNDING:

- A. Provide equipment grounding connections for panelboard enclosures as indicated.
- B. Prior to energization, check panelboards for electrical continuity of circuits and for short-circuits.

3.04 ADJUSTING AND CLEANING:

- A. Adjust operating mechanisms for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finishes.

END OF SECTION

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SECTION 16480  
MOTORS

PART 1 GENERAL

1.01 DESCRIPTION

- A. Furnish and install the motors as hereinafter specified and as called for in other sections of these Specifications.

1.02 QUALIFICATIONS

- A. Motor 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.

1.03 SUBMITTALS

- A. The motor manufacturer shall submit to the Engineer certified dimension prints showing nameplate data and outline dimensions within three weeks of the date they receive the order.
- B. Submit Operation and Maintenance Manual and parts lists as specified in Division 1 PROJECT CLOSEOUT.
- C. Guarantee: All equipment furnished and installed under this Section shall be guaranteed against defects of workmanship, materials and improper installation for a period of eighteen month from date of acceptance. All such equipment or parts proven defective, due to the above noted causes, shall be replaced in the machines by the CONTRACTOR at no expense to the Owner.
- D. Provide equipment warranty in accordance with Division 1 SPECIFIC WARRANTIES.

PART 2 PRODUCTS

2.01 RATING

- A. Unless otherwise noted, all motors shall be of the low voltage type. All motors 2 through 100 horsepower shall be rated 230/460 volt, 3 phase, 60 Hertz A.C.; motors 125 horsepower through 300 horsepower shall be rated 460 volt, 3-phase, 60 Hertz, and motors below 2 horsepower shall be rated 115/230 volt, 1 phase, 60 Hertz A.C.

## 2.02 THREE PHASE INDUCTION MOTORS

- A. Motors 25 HP and larger shall have a 120-volt space heater for moisture control.
- B. Unless specifically noted in other sections of these Specifications, all motors shall have an efficiency as indicated in the table below. Motors shall be "premium efficiency" type.

TABLE 1

Motor HP	Min. Eff.	Max. dba	Motor HP	Min. Eff.	Max. dba
1-2	84.0%	74	25-30	92.0%	92
3-5	86.5%	79	40-50	93.0%	97
7.5-10	90.2%	84	60-75	94.0%	100
15-20	91.0%	89	100	94.1%	102

- C. Motors operating with variable frequency drives shall indicate on the nameplate that they are suitable for their intended applications (Inverter duty Rated) and they shall be provided with an integral temperature switch that opens on high temperature. Motors operating with Variable Frequency Drives (VFD's) shall meet the requirements of NEMA MG1 Part 31.

## 2.03 CONSTRUCTION

- A. General:
  - 1. All drip-proof and weather protected Type I motors shall have epoxy encapsulated windings. Totally enclosed motors shall not be encapsulated. Motors not readily available with encapsulated windings may be standard type. Motors exposed to the outside atmosphere shall be totally enclosed fan cooled (TEFC) unless otherwise specified.
  - 2. Squirrel-cage rotors shall be made from high-grade steel laminations adequately fastened together and to the shaft, or shall be cast aluminum or bar-type construction with brazed end rings.



B. Low Voltage, Three Phase Motors:

1. Motors shall be of the squirrel-cage induction type, NEMA design B. 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.
2. 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. Outdoor motors shall be totally enclosed fan-cooled construction with 1.15 service factor unless otherwise noted. Indoor motors shall be ODP unless otherwise noted.
4. Outdoor motors shall be mill and chemical duty suitable for operation in moist air with hydrogen sulfide gas present.
5. The output shaft shall be suitable for direct connection or belt drive as required.
6. Motors shall have a Class B nonhygroscopic insulation system. Class F insulation may be used but shall be limited to Class B temperature rise.
7. 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.
8. All fittings, bolts, nuts, and screws shall be 316 stainless steel. Bolts and nuts shall have hex heads.
9. All machine surfaces shall be coated with rust inhibitor for easy disassembly.
10. Conduit boxes shall be gasketed. Lead wires between motor frame and conduit box shall be gasketed.
11. Totally enclosed motors shall be provided with condensate drain hole and epoxy coated motor windings to protect against moisture.
12. Nameplates shall be stainless steel. Lifting lugs or "O" type bolts shall be supplied on all frames 254T and larger. Enclosures will have stainless steel screen and motors shall be protected for corrosion, fungus and insects.
13. Low voltage, three phase motors shall be manufactured by General Electric, U.S. Motors, Westinghouse or approved equal.

14. Fractional Horsepower:

- a. 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.
- b. 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.
- c. All motors shall be equipped with vacuum-degassed (sealed) 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.

15. Integral Horsepower:

- a. 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.
- b. Windings shall be adequately insulated and securely braced to resist failure due to electrical stresses and vibrations.
- c. 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.
- d. 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.
- e. All motors shall be equipped with vacuum-degassed (sealed) 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.

- f. Bearings of high thrust motors will be locked for momentary up thrust of 30% down thrust. All bearings shall have a minimum B10 life rating of 100,000 hours in accordance with AFBMA life and thrust values.
- g. Vertical hollow-shaft motors will have nonreverse ratchets to prevent backspin.

C. Low Voltage, Single Phase Motors:

- 1. Single phase motors shall be split-phase and capacitor-start induction types rated for continuous horsepower at the rpm called for on the Drawings. Motors shall be rated 115/230 volts, 60 Hertz, single phase, open drip proof, or totally enclosed fan cooled as called for on the Drawings, with temperature rise in accordance with NEMA Standards for Class B insulation.
- 2. Totally enclosed fan cooled 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 a corrosion protective plating.
- 4. Mechanical characteristics shall be the same as specified for polyphase fractional horsepower motors.

## PART 3 EXECUTION

### 3.01 INSTALLATION

- A. Motor Connections: All motors shall be connected to the conduit system by means of a short section of flexible conduit, 18 inch minimum and 60 inches maximum, unless otherwise indicated. For all motor connections, the CONTRACTOR shall install a grounding conductor in the conduit and terminate at the motor control center with an approved grounding clamp.
- B. Connection to motor leads shall be compression type with 3M brand heat shrink boot.

### 3.02 TESTS AND CHECKS

- A. The following tests shall be performed on all motors after installation but before putting motors into service.
  - 1. The CONTRACTOR shall megger each motor winding before energizing the motor, and, if insulation resistance is found to be low, shall notify the Engineer and shall not energize the motor. The CONTRACTOR shall check direction of rotation of all motors and reverse connections if necessary. The following table gives minimum acceptable insulation resistance in megohms at various temperatures and for various voltages with readings being taken after one minute of megger test run.

TABLE 2

Degree Winding Temperature		Voltage		
°F	°C	115V	230V	460V
37	3.9	60	108	210
50	10	32	60	120
68	20	13	26	50
86	30	5.6	11	21
104	45	2.4	4.5	8.8
122	50	1	2	3.7
140	60	.5	.85	1.6

2. The CONTRACTOR shall check each motor for correct clearances and alignment and for correct lubrication, and shall lubricate if required in accordance with manufacturer's instructions.

END OF SECTION

SECTION 16482  
MOTOR STARTERS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 Section making reference to motor starters herein.

1.02 DESCRIPTION OF WORK:

- A. Extent of motor starter work is indicated by drawings and schedules.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in the manufacture of motor starters of types, ratings, and characteristics required; whose products have been in satisfactory use in similar service for not less than five (5) years.
- B. Installer's Qualifications: Firm with at least three (3) years of successful installation experience on projects utilizing motor starters similar to that required for this project.
- C. NEC Compliance: Comply with NEC as applicable to wiring methods, construction, and installation of motor starters.
- D. UL Compliance: Provide motor starters and components which are UL listed and labeled.

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on motor starters.

## PART 2 PRODUCTS

### 2.01 ACCEPTABLE MANUFACTURERS:

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering motor starters which may be incorporated in the work include, but are not limited to, the following:
  - 1. Allen-Bradley Co.
  - 2. General Electric Co.
  - 3. Siemens Energy & Automation, Inc.
  - 4. Square D Co.
  - 5. Westinghouse Corp.

### 2.02 MOTOR STARTERS:

- A. General: Except as otherwise indicated, provide motor starters and ancillary components which comply with manufacturer's standard materials, design, and construction in accordance with published product information, and as required for complete installation.
- B. Manual motor starters for 115 volts, single phase motors one horsepower and smaller shall be single pole, horsepower rated switches with thermal overload units and heaters. Starters shall be Square D Class 2510, with stainless steel cover plates.
- C. Magnetic full voltage starters for three phase motors shall be three pole, horsepower- rated, magnetically operated, with three thermal overload units and four extra auxiliary contacts. Control voltage shall be 120 volts supplied from a control power transformer. A Hand-Off-Automatic, HOA switch shall be mounted in front cover. Starters shall be Square D Class 8536.
- D. Combination magnetic, full voltage starters for three phase motors shall be three pole horsepower-rated, magnetically operated switches, with three thermal overload units and four extra auxiliary contacts. Control voltage shall be 120 volts supplied from a control power transformer. A three pole horsepower-rated, non-fusible disconnect switch shall also be included in the enclosure. An HOA switch shall be mounted in front cover. Starters shall be Square D Class 8538.
- E. Phase loss protection shall be provided on all starters serving motors 15 horsepower or larger.
- F. Provide 0-15 minute on-delay auto restart function on each starter.
- G. Provide PLC contact. Coordinate with PLC controls contractor.

## PART 3 EXECUTION

### 3.01 INSTALLATION OF MOTOR STARTERS:

- A. Install motor starters as indicated, in accordance with equipment manufacturer's written instructions and with recognized industry practices; complying with applicable requirements of NEC, UL and NEMA standards to insure that products fulfill requirements.
- B. Motor starters or any other electrical equipment located in smoke or fire rated walls shall be mounted on Unistrut channels. Channels shall be supported from floor and structure above ceiling. There shall be no penetrations of the fire rated assembly pursuant to the equipment installation.
- C. Unless otherwise indicated, motor starters shown on the drawing shall be furnished and installed under this Section. The full load current and starting characteristics of each motor shall be verified for proper selection of motor over load devices.
- D. Furnish and install all steel shapes, etc., necessary for a support of all motor starters.
- E. Tighten connectors and terminals, including screws and bolts, in accordance with equipment manufacturer's published torque tightening values for equipment connectors.

### 3.02 ADJUSTING AND CLEANING:

- A. Inspect electrical starter's operating mechanisms for malfunctioning and, where necessary, adjust units for free mechanical movement.
- B. Touch-up scratched or marred surfaces to match original finish.

### 3.03 FIELD QUALITY CONTROL:

- A. Subsequent to connecting wires/cables, energize motor starter circuitry and demonstrate functioning of equipment in accordance with requirements. Where necessary correct malfunctioning units, and then retest to demonstrate compliance. Ensure that direction of rotation of each motor fulfills requirements.

END OF SECTION

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SECTION 16620  
SURGE SUPPRESSION

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is a part of each Division 16 section making reference to electrical surge suppression specified herein.

1.02 DESCRIPTION OF WORK:

- A. The work required under this division shall include all materials, labor, and auxiliaries required to furnish and install complete surge suppression for the protection of building electrical and electronics systems from the effects of line-induced transient voltage surge and lightning discharge, as indicated on drawings or specified in this section.
- B. Types of surge suppression specified in this section include the following:
  - Service entrance type.
  - Distribution and branch circuit panels.
  - Point of use type (receptacle and plug-in units).

1.03 QUALITY ASSURANCE:

- A. All surge suppression devices shall be manufactured by a company normally engaged in the design, development, and manufacture of such devices for electrical and electronics systems equipment.
- B. The surge suppressor manufacturer shall offer technical assistance through support by a factory representative and local stocking distributor.
- C. Submittals: Surge suppression submittal shall include:
  - Manufacturer's performance data on each suppressor type.
  - Dimensioned drawing of each suppressor type.

- D. To establish the type and operating characteristics of the surge suppression devices, equipment manufactured by Atlantic Scientific is used as a guide in determining the functions of the surge suppression system. Other equipment will be considered for approval provided the following is submitted in writing to the architect/engineer in accordance with the specifications.
- E. Equipment Certification: Items shall be listed by Underwriters' Laboratories, shall bear the UL seal, and be marked in accordance with referenced standard.
- F. Surge suppression devices shall be installed and located in accordance with requirements of all applicable National Fire Protection Association (NFPA) Codes.

#### 1.04 WARRANTY:

- A. All surge suppression devices shall be warranted to be free from defects in materials and workmanship under normal use in accordance with the instructions provided for a period of five (5) years.
- B. Any suppressor which shows evidence of failure or incorrect operating during the warranty period shall be repaired or replaced by the manufacturer and installer.

#### 1.05 CODES AND STANDARDS:

- A. The following standards and publications are referenced in various parts of this specification and shall apply:
  - 1. UL 1449-1987 (Second Edition, August 17, 1998): Standard for Safety, Transient Voltage Surge Suppressors.
  - 2. ANSI/IEEE C62.41-1991 (IEEE 587): Guide for Surge Voltages in Low-Voltage AC Power Circuits.
  - 3. ANSI/IEEE C62.33-1982: Standard Test Specifications for Varistor Surge Protection Devices.
  - 4. ANSI/IEEE C62.45-1992: IEEE Guide for Surge Testing for Equipment Connected to Low-Voltage AC Power Circuits.

#### 1.06 REQUIRED SUPPRESSORS:

- A. Provide surge suppression for the equipment described herein:
  - 1. On main electrical service entrance panels as shown in the project drawings.
  - 2. On distribution and branch circuit panels as shown in the project drawings.

3. On 120 volt power connections for the fire alarm control panel, intercom, television and sound equipment, telephone power supplies, nurse call equipment, and other dedicated circuits, as identified in the project drawings.
4. At point of use locations (receptacles, plug-in units) as shown on the drawings.
5. On all equipment identified in the project drawings.

## PART 2 PRODUCTS

### 2.01 SUPPRESSORS:

- A. The surge suppressor manufacturer shall offer a complete line of surge suppression products to support the required suppressors listed in Part 1.
- B. The service entrance surge suppressors shall be designed with replaceable modules for purposes of in-service replacement. The unit suppressor shall be designed with redundant back-up surge protection in the event of a module failure.
- C. Module status indicators shall be provided to indicate individual module status. When a module has failed, the module LED status indicator shall indicate said failure.
- D. Unit status indicators shall be provided to indicate the status of the complete unit suppressor. The LED status indicators shall be located on the hinged front cover to redundantly indicate module or unit failure. The unit suppressor shall include alarm contacts (one N.O. and one N.C.) for remote annunciation of unit status.
- E. Suppressors shall be designed for the specific type and voltage of electrical service and shall provide clamping action for both normal (L-N) and common (L-N-G) mode protection.
- F. Service entrance suppressors shall utilize normal and common modes of protection - each phase line to neutral, each phase line to ground and neutral to ground.
- G. Distribution and branch circuit panel suppressors shall utilize protection of each phase line to ground and neutral to ground (if neutral conductor present).
- H. Suppressors shall be of a hybrid design and include circuitry with tight, wave-tracking clamping characteristics.
- I. Suppressors shall be designed to withstand a maximum continuous operating voltage of not less than 115% of nominal RMS line voltage.

- J. Suppressors shall utilize internal safety fusing or a UL/IEEE approved method to disconnect the suppressor from the electrical source if the suppressor fails. The suppressor shall be internally protected from fault current damage as a result of a suppressor failure.
- K. Each suppressor shall have an internal disconnect switch when not connected to a separate circuit breaker or fused disconnect switch which is dedicated specifically for the suppressor.
- L. Suppressors shall be failsafe, shall allow no follow-through current, shall have repeated surge capability, shall be solid state, shall be self-restoring, and shall be fully automatic.
- M. Suppressors shall be UL 1449 listed and shall be approved for the location in which they are installed.
- N. Suppressors shall have an operating temperature range of -40°C to +85°C.

## 2.02 SUPPRESSOR CRITERIA:

- A. Suppressors shall meet or exceed the following criteria:
  - 1. Service Entrance: Zonemaster 150 (Zonemaster PE) Nema 1 or approved equal. 277/480 Volt, 3 Phase, 4 Wire, Wye: Minimum surge capacity of 150,000 Amps per phase.
  - 2. Distribution secondary: Zone Defender Pro Series or approved equal. Minimum surge capacity of 120KA amps per phase.
  - 3. Sub panels Zone Defender Pro Series 80kA.
- B. Suppressors shall be sequential surge tested as per IEEE C62.45-1992, and shall withstand 1000 test cycles at 3 KA.
- C. Suppressors shall have a minimum phase to ground clamping voltage of 400V for 120V applications and 800V applications.
- D. Dedicated 120 volt, 20 amp power plug-in suppressors shall be Atlantic Scientific MA Series or approved equal. Provide hardwire or receptacle type device to match equipment when required.

## 2.03 ACCEPTABLE MANUFACTURERS:

- A. Atlantic Scientific.
- B. LEA International.
- C. Joslyn.
- D. Current Technology.
- E. Liebert

## PART 3 EXECUTION

### 3.01 INSTALLATION OF SUPPRESSORS:

- A. Suppressors shall be installed as close as practical to the electric panel or electronic equipment to be protected, consistent with available space. Suppressors shall be close nipped to the device being protected in a position near the point of connections, which will minimize lead length between suppressor and the buses or control breaker to which the suppressor connects. Suppressor leads shall not extend beyond the suppressor manufacturer's recommended maximum lead length without specific approval of the engineer.
- B. Suppressors shall be installed in a neat, workmanlike manner. Lead dress shall be as short and as straight as possible and be consistent with recommended industry practices for the system on which these devices are installed.
- C. Supplementary grounding and bonding connections required between the bonding bus or ground plane for each equipment cluster and other locations as indicated herein shall be accomplished using #6 AWG core copper conductor and approved connections, unless otherwise noted, referenced to a common earth ground.
- D. Suppressors shall be installed in a manner that allows simple replacement within short periods of downtime.
- E. Service entrance and panel type suppressors shall be installed with a means of disconnecting the suppressor. If no dedicated circuit breaker is included in panel, manufacturer shall provide an integral fused disconnect.
- F. The surge suppression equipment shall be UL listed and installed per the NEC and the manufacturer's specifications.

END OF SECTION

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SECTION 16670  
LIGHTNING PROTECTION SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS:

- A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- B. This Section is a Division 16 Basic Electrical Materials and Methods section, and is part of each Division 16 Section making reference to lightning protection systems specified herein.

1.02 DESCRIPTION OF WORK: Extent of lightning protection system work is indicated on the project drawings.

1.03 QUALITY ASSURANCE:

- A. Manufacturers: Firms regularly engaged in the manufacture of early streamer emission lightning protection system components of types, sizes, and ratings required; whose products have been in satisfactory use in similar service for not less than three (3) years, and who are certified with ETL and listed with UL.
- B. NEC Compliance: Comply with NEC requirements pertaining to lightning (surge) arresters, grounding, grounding electrodes, and down conductor clearances.
- C. The lightning protection manufacturer shall provide a \$10,000,000.00, 100 year guarantee to the original building owner to provide lightning protection for the protected area as shown and installed per the manufacturer's shop drawings.

1.04 SUBMITTALS:

- A. Product Data: Submit manufacturer's data on lightning protection systems and associated components.
- B. Shop Drawings: Submit layout drawings of lightning protection system equipment and components including, but not limited to, air terminals, mounting details, conductor routing, connections, and grounding.

## PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS: Subject to compliance with requirements, the manufacturer of lightning protection components shall be Lightning Preventor of America.

### 2.03 LIGHTNING PROTECTION SYSTEM COMPONENTS:

- A. General: Provide material and components, of types, sizes, ratings, for early streamer emission (ESE) lightning protection of buildings and property, which comply with manufacturer's standard materials, design, and construction in accordance with published product information, and as required for complete installation. Where type components or materials are not otherwise indicated, comply with proposed NFPA 781 standards. Unless noted otherwise, all air terminals, conductors, connectors, and ground rods shall be copper.
- B. ESE Air Terminal: The complete assembly shall consist of a stainless steel air terminal, 5/8" diameter minimum, stainless steel housing, with the ESE initiator, sensing mechanism, triggering mechanism, to be completely sealed. Provide threaded base for connection to mast and nameplate.
- C. Copper conductors shall be 28 strands of 14 gauge wire rope lay, with a net weight of 375 pounds per 1,000 feet, minimum, or copper strip of equivalent capacity.
- D. Aluminum mast height to be determined by the area of protection, with threaded connections for the ESE air terminal and bonding plate for cable connection. Wind and safety factors shall be engineered to comply with geographic location, to determine the size and structure of mast. All masts are to be ETL listed.
- E. Ground rods shall be copper-clad 3/4" x 20' minimum. One set of tripod (DELTA) grounds shall be installed for each down conductor, two (2) minimum per system with allowed exceptions.
- F. Provide all connectors, fittings, fasteners, hardware, clamps, lugs, crimps, etc. as required to connect and install all parts of the system. All material to be ESE system certified by ETL and listed.
- G. All equipment shall be fabricated from copper and/or bronze, stainless steel, and be ESE system certified by ETL for the type of installation.
- H. All connections between dissimilar metals shall have connectors that are ESE system certified by ETL for the type of installation.



## PART 3 EXECUTION

### 3.01 INSTALLATION OF LIGHTNING PROTECTION SYSTEMS:

- A. Installation of equipment shall be done under the direct supervision of a manufacturer's certified installer and in accordance with equipment manufacturer's written instructions.
- B. All work shall be installed in accessible locations and properly guarded and protected.
- C. All material shall be installed in a manner to prevent electrolytic action under presence of moisture.
- D. All wall or other building penetrations shall be made in a manner to prevent the ingress of water or moisture.
- E. PVC sleeves shall be provided where conductors pass through all floors.
- F. All conductors shall be secured every 3'0" maximum. Fasteners and clips utilized shall be of equal corrosion resistance as the material being secured to.
- G. Bonding of all conductive material within six (6) feet of the conductor shall be accomplished via secondary conductors no smaller than #6 copper.
- H. Bare copper material shall not be installed on dissimilar metals. Corrosion resistant copper or bronze equipment shall be utilized where these conditions exist. Corrosion resistant copper conductors and fittings shall be utilized where corrosive atmospheres are present.
- I. Conductors shall be installed so that a conductor shall always have a horizontal or downward path, free of "U" or "V" pockets, with the exception that an eight (8) inch maximum rise or a rise of three (3) inches maximum from every twelve (12) inches of conductor length shall be permitted in a main conductor run.
- J. Each ESE terminal shall have two (2) paths to ground from the base plate of the mast.
- K. The electrical contractor shall furnish and install all necessary PVC conduit (1") for concealed down conductors.
- L. No bend of a conductor shall be less than ninety (90) degrees and shall not have a radius of bend of less than eight (8) inches. Exceptions are through roof and wall assemblies and "T" connections.
- M. Notify architect/engineer prior to installation if lightning protection equipment and/or installation will conflict with other building materials.

- N. Coordinate with other work, including electrical wiring and roofing work, as necessary to interface installation of lightning protection system with other work.
- O. The complete lightning protection system shall be fully tested in the presence of the engineer, and a certified ground test is to be performed and witnessed by the engineer with all documents to be completed and forwarded to the ESE manufacturer and engineer for evaluation, certification, archiving, and documentation.
- P. The completed system shall be videotaped and documented during installation. Documentation and videotape is to be returned to manufacturer for certification and issuance of manufacturer's guarantees and warranties, and for archiving and system documentation.

### 3.02 GROUNDING AND BONDING:

- A. Provide equipment grounding and bonding connections, sufficiently tight to assure permanent and effective grounds and bonds, for lightning protection connection devices as indicated.
- B. Ground rods, ground plates and ground loop conductors shall be installed a minimum of two (2) feet below grade and a minimum of two (2) feet away from the foundation.
- C. A minimum of one (1) inspection and test well, rated for the traffic of the installation area, shall be installed for each down conductor or two (2) minimum per ground loop.
- D. Bonding of grounded systems shall be via main size conductors. The bonding shall be accomplished to achieve equal potential of all grounds. All grounding connections shall be via Burndy high compression crimps, or Cadweld, or via a pre-approved connection suitable for direct burial.
- E. All ground grids are to have a ground resistance of ten (10) ohms or less. Testing method shall be of the "Fall of Potential Method" as described by IEEE. Delta grids shall be tested without the service ground connection, and documented as such, then connection to the service ground can be made, and retested and documented for future testing and trends.
- F. The ground resistance of the completed system shall be tested in the presence of the engineer and shall be so noted on a Certified Ground Test document.

END OF SECTION

SECTION 16775  
VARIABLE FREQUENCY DRIVES

PART 1 GENERAL

- 1.01 RELATED DOCUMENTS: Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this Section.
- 1.02 DESCRIPTION OF WORK: Extent of variable frequency drives work required by this Section is indicated on drawings and schedules, and by requirements of this Section below:
- A. Belt Filter Press.
  - B. Cake Pump.
- 1.03 SUBMITTALS:
- A. Product Data: Submit manufacturer's drive specifications and installation and start-up instructions.
  - B. Shop Drawings: Submit manufacturer's assembly-type shop drawings indicating dimensions, weight loadings, required clearances, and methods of assembly of components.
  - C. Maintenance Data: Submit maintenance data and parts lists.
- 1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING:
- A. Handle variable frequency drives and components carefully to prevent damage, breaking, denting, and scoring. Do not install damaged drives or components; replace with new.
  - B. Store drives and components in clean dry place. Protect from weather, dirt, fumes, water, construction debris, and physical damage.
  - C. Comply with manufacturer's installation instructions for unloading drives and moving them to final location.
- 1.05 WARRANTY: All units shall be warranted for a period of 24 months from the date of delivery to site. Any warranty expense during that time shall be born entirely by the manufacturer, including any travel costs or living expenses necessary to repair in warranty equipment.

## PART 2 PRODUCTS

### 2.01 VARIABLE FREQUENCY DRIVE:

- A. The speed control for variable speed pumps shall be variable frequency drives suitable for installation as shown on the drawings.
- B. The variable frequency drives shall include all internal auxiliaries required to meet the functional specifications.
- C. The variable frequency drives shall conform to all requirements stipulated in this section and Division 16 - Electrical, and shall be designed for an extended speed range of 60% to 100% of full load motor speed.
- D. Each drive shall have the following design features.
  - 1. The drive shall employ microprocessor-based inverter logic isolated from power circuits.
  - 2. The drive shall employ a diode or fully gated bridge on the input.
  - 3. The drive shall employ a DC bus inductor to reduce line harmonics and improve power factor.
  - 4. Variable frequency drive harmonic distortion shall be limited in accordance with IEEE 519.
  - 5. The drive shall employ a common Main Control Board.
  - 6. The drive shall employ a Pulse Width Modulated (PWM) inverter system using third generation IGBT's to minimize audible motor noise and increase overall performance.
  - 7. The drive shall employ a switching logic power supply operating from the DC bus.
  - 8. The drive shall employ phase to phase and phase to ground MOV protection.
  - 9. The drive shall employ gold-plated plug-in connections on printed circuit boards.
  - 10. The drive shall be designed to have an internal communications bus to enable attaching common options.
  - 11. The drive shall be designed to have carrier frequency such to minimize audible motor noise.

12. The drive shall be designed such that it does not require an isolation transformer for protection from normal line transients.
13. The drive shall be designed to operate on an AC line which may contain line notching and up to 10% harmonic distortion.
14. The drive shall be designed to shut down with no component failure in the event of an output phase to phase or phase to ground short circuit and provide annunciation of the fault condition.
15. The drive shall be designed with a common control connection diagram for all ratings.
16. The drive shall be designed such that the inverter section power semiconductors do not require commutation capacitors.
17. The drive shall be designed to be selectable for variable. The drive shall supply 115% of rated current for up to one minute.
18. The drive shall be designed to allow all adjustments to be made with the door closed.
19. The drive shall be designed to have a K factor of 4.0 or less.
20. The drive shall be designed with a common Customer Interface for all horsepower ratings. The Interface shall include an LCD digital display, programming keypad and operator keys option.
21. The drive shall provide multiple programmable stop modes, including ramp, coast, brake and S-curve.
22. The drive shall be designed to have an adjustable output frequency up to 60 Hz  $\pm$ 10%.

E. The drives shall have the following options.

1. Interface: The drive shall provide a removable Human Interface Module with integral display to show drive operating conditions, adjustments, and fault indications. The display shall be removable under power without causing a drive fault and be visible and operable without opening the enclosure door. The display shall consist of two lines of 16-character, alphanumeric, back-lit LCD with the display being configurable for two display values simultaneously with customized multi-lingual text, all scaled to user units. The module shall also provide LED indication of drive direction and commanded speed. The display shall be capable of remote mounting by means of cable connection up to 10 meters (33 feet)

from the drive and be capable of being used as a hand held terminal. The Human Interface Module shall be capable, as standard, of programming and displaying in at least seven languages without modification.

2. Volts per Hertz Adjustment: Drive programming shall provide the ability to fully configure the volts per hertz for squared, cubed, straight line or full custom patterns.
3. Current Limit: The drive shall provide a programmable current limit from 20% to 150% of variable torque rating. Current limit shall be active for all drive states; accelerating, constant speed, and decelerating. The drive shall employ PI Regulation for smooth transition.
4. Acceleration/Deceleration: The Accel/Decel settings shall provide separate adjustments to allow either setting to be adjusted from 0 seconds to 600 seconds. The drive shall provide a second set of remotely selectable Accel/Decel settings.
5. Speed Regulation: The drive shall be capable of operating in a variety of speed regulation modes, including:
  - a. Closed loop encoder feedback with 0.1% speed regulation.
  - b. Slip compensation with 0.5% speed regulation.
  - c. Droop - Negative slop compensation.
  - d. Transverse function.
  - e. Phase lock loop.
  - f. Open loop.
6. Speed Profiles: The drive shall be capable of producing speed profiles with linear acceleration/ deceleration or 'S-Curve' profiles that provide changing Accel/Decel rates. S-Curve profiles shall be selectable for fixed or adjustable values.
7. Adjustments: The digital interface shall be used for all set-up, operation, and adjustment settings. All adjustments shall be stored in non-volatile memory for factory default values as well as a programmable set of user defaults.
8. Auto Commissioning: The drive shall be capable of automatically determining the motor's stator resistance by outputting both an AC and DC voltage to the motor and monitoring motor current. Stator resistance shall be stored in drive memory for determining proper voltage and current requirements.
9. IR Compensation (DC Boost): The drive shall provide a selectable range for offsetting motor losses at low frequency operation DC Boost shall be

current regulated and shall automatically adjust, on each start, to load changes. DC Boost shall be programmable from 15% to 120% of drive rated current.

10. Fault Reset/Run: The drive shall provide up to four automatic fault reset and restarts following a fault condition before locking out and requiring manual restart (or switching to bypass operation). The automatic mode shall not be applicable to a ground fault or shorted output faults.
11. Skip Tendencies: The drive shall provide three adjustable setpoints to lock out continuous operation at frequencies which may product mechanical resonance. The setpoints shall have an adjustable bandwidth of 0 Hz to 60 Hz.
12. Run On Power Up: The drive shall provide for automatic restart of equipment after restoration of power after an outage.
13. Fault Memory: The drive shall provide a means to store the last four faults as well as operating frequency, drive status, and power mode at time of fault. Information shall be maintained in the event of power loss.
14. Overload Protection: The drive shall provide NEC motor overload protection testing in accordance with UL Standard 991.
15. Terminal Blocks: The drive shall provide separate terminal blocks for control and power wiring.
16. Operator's Devices: The drive shall provide an option for Start, Stop, Jog, and Speed Control as an integral part of the Human Interface Module.
17. Control Inputs: The drive shall provide a separate control input terminal block for customer wiring to remote start, stop, auxiliary, remote speed reference access and enable inputs. Four additional inputs shall be provided as programmable for functions such as preset speed access, job, second Accel and Decel time access and local control selection. Inputs shall be programmable to configure the drive for standard 3 wire, 2 wire, EC and serial operation requirements.
18. Ride Through: The drive shall be capable of control logic ride through in the event of power outages up to 2 seconds in duration.
19. Loss of Reference: In the event of loss of the 4 mA to 20 mA reference signal, the drive shall be user programmable to the following:
  - a. Fault and stop
  - b. Alarm and maintain last reference (within 10%)
  - c. Alarm and got to preset speed

- d. Alarm and go to minimum speed
  - e. Alarm and go to maximum speed.
20. Analog Output: The drive shall supply an output signal, jumper selectable between 0 volt DC to 10 volt DC or 0 mA to 20 mA which shall be user programmable such that is proportional to output frequency, output current, bus voltage or output power. A programmable offset shall be provided to allow modification of the analog output to obtain 2 volt DC to 10 volt DC or 2 mA to 20 mA.
21. Digital I/O: The drive contact output ratings shall be 115 volt AC / 30 volt DC, 5.0 amps resistive, 2.0 amp inductive. The four contacts provided shall be as follows:
- a. Form A Run Contact
  - b. Form C Fault Contact
  - c. Form C Alarm Contact
  - d. Form A Programmable Contract for at speed, at frequency, at current or at torque.
22. Reference Signals:
- a. Digital: The drive shall be capable of operating from a pulse input with programmable Phase Lock Loop for input/output synchronization.
  - b. Analog: The drive shall be capable of operating from the following speed reference signals:
    - i. Remote potentiometer
    - ii. 4 mA to 20 mA signal
    - iii. 0 volt DC to 10 volt DC signal
  - c. The remote potentiometer shall also be programmable to be used as a trip pot for the 4 mA to 20 mA or 0 volt DC to 10 volt DC analog signal. Analog signals shall be programmable as normal or inverted.
23. Bypass (to be provided for 200 hp pump only):
- a. Manual Bypass: This option provides a means to manually transfer a signal motor from drive control to line power operation when a drive fault occurs. A full voltage, non--reversing contactor and Class 20 overload relay are provided for line operation. The bypass contactor is electrically interlocked with a drive output contactor. Option includes Drive/ Off/ Bypass switches mounted on the enclosure door. Please note that the Bypass Operation



capability provided by this options does not allow for maintenance of the drive or entry into the enclosure with power applied while operating in the bypass mode.

- F. Acceptable manufacturers for the variable frequency drive units by one of the following:
  - 1. Allen Bradley, Inc. – Powerflex Series.
  - 2. Yaskawa – IQ Series, provided by Icon Technologies.
  - 3. Schneider Electric.

### PART 3 EXECUTION

3.01 INSPECTION: Examine areas and conditions under which variable frequency drives are to be installed. Do not proceed with work until unsatisfactory conditions have been corrected in manner acceptable to Installer.

#### 3.02 INSTALLATION OF DRIVES:

- A. General: Install variable frequency drives where indicated, in accordance with manufacturer's published installation instructions, complying with recognized industry practices to insure that system complies with requirements and services intended purposes.
- B. Access: Provide access space around drives for service as indicated, but in no case less than that recommended by the manufacturer.

END OF SECTION

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**APPENDIX A**

**GEO TECHNICAL REPORT**

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# UNIVERSAL ENGINEERING SCIENCES

Consultants In: Geotechnical Engineering • Environmental Sciences  
Geophysical Services • Construction Materials Testing • Threshold Inspection  
Building Inspection • Plan Review • Building Code Administration

LOCATIONS:

- Atlanta
- Daytona Beach
- Fort Myers
- Fort Pierce
- Gainesville
- Jacksonville
- Kissimmee
- Leesburg
- Miami
- Ocala
- Orlando (Headquarters)
- Palm Coast
- Panama City
- Pensacola
- Rockledge
- Sarasota
- Tampa
- West Palm Beach

June 6, 2017

Jones, Edmunds & Associates, Inc.  
324 S. Hyde Park Avenue, Suite 250  
Tampa, FL 33606

Attention: Mr. Anthony Holmes  
[aholmes@jonesedmunds.com](mailto:aholmes@jonesedmunds.com)

Reference: **Geotechnical Exploration**  
Proposed Turnpike WWTP Relocation  
Lake County, Florida  
UES Project No. 0130.1700177.0000  
UES Report No. 1458100

Dear Mr. Holmes:

Universal Engineering Sciences (UES) is pleased to submit our report of our limited geotechnical exploration services performed at the referenced property. Our findings are presented in the following paragraphs.

## 1.0 PROJECT DESCRIPTION

We understand this project consists of providing a new mobile sludge dewatering system along with associated support facilities to serve as the dewatering system for the Turnpike WWTP. The new support facilities required at the WWTP to accommodate the new mobile dewatering system will generally include: a pre-engineered building to house the mobile dewatering unit trailer. The pre-engineered metal building will be provided with forced air ventilation and will have a rough foot print of 40 feet x 60 feet with a 12 ft eave height. We understand the proposed building will be secured to a Mat Foundation.

The client provided Universal with a marked up aerial photograph identifying the location of the proposed structure.

No site or project facilities/improvements, other than those described herein, should be designed using the soil information presented in this report. Moreover, UES will not be responsible for the performance of any site improvement so designed and constructed.



## 2.0 LITERATURE REVIEW

### 2.1 USDA SCS SOIL SURVEY

There is one (1) soil type mapped within the general area of the site according to the USDA NRCS Soil Survey of Lake County. A brief summary of the mapped surficial soil type is presented in Table below. We note that the shallow on-site soils and their associated engineering properties may have been altered during the previous development activities of the site.

#### SUMMARY OF PUBLISHED SOIL DATA

Soil Symbol	Soil Type	Hydrologic Group	Drainage Characteristics	Depth of Published Seasonal High GWT (feet)
1	Sparr sand, 0 to 5 % slopes	C	Moderately well drained	1 to 3.5

<sup>1</sup> Data obtained from the NRCSS online webpage

## 3.0 FIELD SERVICES

UES was initially requested to perform two (2) borings for this project. However, in May 2017, we were requested to perform only one (1) boring (which was staked at the location by the client).

The SPT boring, designated B-1 on the attached Boring Location Plan in Appendix B, was performed in general accordance with the procedures of ASTM D 1586 "Standard Method for Penetration Test and Split-Barrel Sampling of Soils". SPT sampling was performed continuously within the top 10 feet to detect variations in the near surface soil profile and on approximate 5 feet centers thereafter.

The soil borings were performed with an ATV mounted drilling rig. The boring location was staked by the client prior to our field activities. The boring location was not surveyed and the location shown on the plan should be considered accurate to the degree implied by the methodologies employed.

## 4.0 FINDINGS

The results of our field exploration and laboratory analysis, together with pertinent information obtained from the SPT borings, such as soil profiles and groundwater levels are shown on the included boring logs. The Key to Boring Logs and Soil Classification Chart are also included. The soil profiles were prepared from field logs after the recovered soil samples were examined by a Geotechnical Engineer. The stratification



lines shown on the boring logs represent the approximate boundaries between soil types, and may not depict exact subsurface soil conditions. The actual soil boundaries may be more transitional than depicted.

In general, the soils encountered at the boring location consist of loose to medium dense fine sands and fine sand with clay [SP and SP-SC] from existing grade to a depth of about 25 feet below existing grades. SPT “N” blow counts ranged from 5 to 21 blows per foot (bpf). For a more detailed soil profile, see the attached boring log.

#### 4.1 SOIL CORROSION CHARACTERISTICS

For this project Universal submitted one (1) representative sample of the shallow soils found on site for corrosion series testing. The results of the individual tests are shown in the table below.

**SUMMARY OF CORROSION PARAMETERS**

Sample Location	Sample Depth (ft)	pH	Resistivity (Ohm-cm)	Sulfate (ppm)	Chloride (ppm)	Environmental Classification	
						Concrete	Steel
B-1	2 to 5	7.2	5,000	< 10	30	Slightly Aggressive	Slightly Aggressive

According to the guidelines presented within Section 1.3 Environmental Classifications of the FDOT Structures Design Guidelines, FDOT Structures Manual, Volume 1, dated January 2015 and based on the three tier scale of slightly, moderately, and extremely aggressive, the results of the corrosion series tests indicate that the surficial soils in the building pad are “slightly aggressive” to concrete and to steel.

We recommend the use of a Class II concrete for below grade, cast in-place concrete construction in accordance with Table 1.4.3-1 Structural Concrete Class Requirements. Minimum concrete cover should be provided for concrete substructures in accordance with Section 1.4.2 Concrete Cover, as presented in the FDOT Structures Design Guidelines, FDOT Structures Manual, Volume 1, dated January 2015.

## 5.0 GROUNDWATER CONDITIONS

### 5.1 EXISTING GROUNDWATER LEVEL

We measured the water levels in the boreholes on May 26, 2017 after the completion of drilling operations. No groundwater was encountered within the top 10 feet of drilling, at which point drilling fluid was introduced within the boring. Fluctuations in groundwater levels should be anticipated throughout the year, primarily due to seasonal variations in



rainfall, surface runoff, and other factors that may vary from the time the borings were conducted.

## **5.2 SEASONAL HIGH GROUNDWATER LEVEL**

Based on historical data, the rainy season in Central Florida is between June and October of the year. In order to estimate the seasonal high water level at the boring locations, many factors are examined, including the following:

- Measured groundwater level
- Drainage characteristics of existing soil types
- Current & historical rainfall data
- Natural relief points (such as lakes, rivers, wetlands, etc.)
- Man-made drainage systems (ditches, canals, retention basins, etc.)
- On-site types of vegetation
- Review of available data (soil surveys, USGS maps, etc.)
- Redoximorphic features (mottling, stripping, etc.)

Based on the results of our field exploration and the factors listed above, we estimate that the seasonal high groundwater level may form as a transient, perched groundwater table at a depth of about 5½ feet below existing grade. The estimated seasonal high groundwater level at the boring location is shown on the attached boring log.

It should be noted that the estimated seasonal high water levels do not provide any assurance that groundwater levels will not exceed these estimated levels during any given year in the future. Should the impediments to surface water drainage be present, or should rainfall intensity and duration, or total rainfall quantities, exceed the normally anticipated rainfall quantities, groundwater levels might exceed our seasonal high estimates. Further, it should be understood that changes in the surface hydrology and subsurface drainage from on-site and/or off-site improvements could have significant effects on the normal and seasonal high groundwater levels.

Ground surface elevations at the boring locations would be beneficial to allow us to identify any anomalies in our measured and estimated seasonal high groundwater levels, as well as improve the usefulness the groundwater information during the civil engineering design of the site.

## **6.0 FOUNDATION RECOMMENDATIONS**

The following recommendations are made based upon a review of the attached soil test data, our understanding of the proposed construction, and experience with similar projects and subsurface conditions. The applicability of geotechnical recommendations is very dependent upon project characteristics such as improvement locations, and





grade alterations. UES must review the final site and grading plans to validate all recommendations rendered herein.

Additionally, if subsurface conditions are encountered during construction, which were not encountered in the borings, report those conditions immediately to us for observation and recommendations.

As mentioned previously, we understand this project consists of providing a new mobile sludge dewatering system along with associated support facilities to serve as the dewatering system for the Turnpike WWTP in Leesburg, Lake County, Florida. The proposed mobile dewatering unit trailer is designed to be supported on a concrete pad foundation, roughly 40 feet by 60 feet in plan dimension, located as shown on the Boring Location Plan in Appendix B. We assume that the top of pad level will be roughly at existing grades (i.e. within 12 inches), depending upon location. Preliminary structural loading information was not provided by the client at the time of this proposal.

Prior to finalizing any design, the structural information outlined above should be confirmed by a structural engineer. This is crucial to our evaluation and estimates of settlements. If any of this information is incorrect or if you anticipate any changes, please inform Universal Engineering Sciences, Inc. immediately so that we may review and modify our recommendations as appropriate.

## 6.1 RECOMMENDATIONS

Based upon our understanding of the project and provided that existing subgrade soils and any subsequent fills are prepared as listed in Section 6.2 of this report, we recommend the following design parameters as presented in the table below.

### RECOMMENDED FOUNDATION DESIGN PARAMETERS

Design Parameter	Recommended Value
Maximum Allowable Net Vertical Soil Bearing Pressure	2,500 psf
Maximum Allowable Lateral Soil Bearing Pressure	250 psf
Modulus of Subgrade Reaction (k)	100 pci
Coefficient of Friction to Resist Lateral Sliding	0.3
Estimated Total Settlement	Less than 1 inch
Estimated Differential Settlement	Less than ½ inch



The foundations should be embedded in accordance with the FLBC. We recommend stormwater and surface water be diverted away from the building exterior, both during and after construction, to reduce the possibility of erosion beneath the exterior foundations. Furthermore, we recommend using a sheet vapor barrier (in accordance with Florida Building Code requirements) beneath the building slab-on-grade to help control moisture migration through the slab.

## **6.2 SITE PREPARATION PROCEDURES**

Following is a list of our recommended site preparation procedures to prepare the site for the proposed construction.

1. Strip the construction limits of any existing vegetation, roots, organics, debris, rubble, etc. Any collapsible or leak prone utilities should be completely removed from beneath the proposed building pad. Stripping should be performed at least 5 feet beyond foundation lines, where possible. We strongly recommend that the stripped/excavated surface be observed and probed by representatives of Universal Engineering Sciences, Inc. Any deleterious matter remaining should be removed and replaced with compacted select backfill.
2. Compact the exposed subgrade soils to at least 95 percent of the Modified Proctor test maximum dry density (ASTM D 1557) to a depth of at least 2 feet below bottom of pad level, or stripped surface, whichever is deeper. Vibratory compaction on this site is not recommended due to the close proximity of the existing structures. Should vibratory compaction be deemed necessary to obtain the required density, small walk-behind plate compactors should be used.
3. If any structural fill/backfill is needed, the fill should be placed in maximum 12 inch loose lifts with each lift densified to at least 95 percent of the Modified Proctor test maximum dry density of the soil (ASTM D 1557) and tested for compaction and approved before the placement of subsequent lifts.
4. Compaction beneath the foundation pad should be verified to a depth of 2 feet immediately prior to the placement of reinforcing steel and concrete, and should meet at least 95 percent of the Modified Proctor test maximum dry density of the soil (ASTM D 1557).
5. Field density tests should be performed by Universal at appropriate times during earthwork operations in order to verify that the compaction requirements have been satisfied. These tests should be performed after compaction in the existing soils, after placement of each lift of structural fill, and beneath all concrete slab-on-grade locations. Compaction tests should be performed at a frequency of not less than three test locations per each foot of compacted increment as specified herein.



Stability of the compacted soils is essential and independent of compaction and density control. If the near surface soils or the structural fill experience “pumping” conditions, terminate all earthwork activities in that area. Pumping conditions occur when there is too much water present in the soil-water matrix. Earthwork activities are actually attempting to compact the water and not the soil. The disturbed soils should be dried in place by scarification and aeration prior to any additional earthwork activities.

## **7.0 DEWATERING AND EXCAVATION CONSIDERATIONS**

Depending upon the time of year construction commences and the depth of excavation required, dewatering maybe required for the successful construction of this project. Where excavations will extend only a few feet below the groundwater table, a sump pump may be sufficient to control the groundwater table. Deeper excavations may require well points and/or sock drains to control the groundwater table. Regardless of the method(s) used, we recommend drawing down the water level at least 2 feet below the bottom of the excavation. The actual method(s) of dewatering should be determined by the contractor. The design and discharge of the dewatering system must be performed in accordance with applicable regulatory criteria (i.e. water management district, etc.) and compliance with such criteria is the sole responsibility of the contractor.

Excavations should be sloped as necessary to prevent slope failure and to allow backfilling. As a minimum, temporary excavations below 4-foot depth should be sloped in accordance with OSHA regulations. Where lateral confinement will not permit slopes to be laid back, the excavation should be shored in accordance with OSHA requirements. During excavation, excavated material should not be stockpiled at the top of the slope within a horizontal distance equal to the excavation depth. Provisions for maintaining workman safety within excavations is the sole responsibility of the contractor.

## **8.0 LIMITATIONS**

This report has been prepared for the exclusive use of **Jones, Edmunds & Associates, Inc.** and other designated members of their design/construction team associated with the proposed construction for the specific project discussed in this report. No other site or project facilities should be designed using the soil information contained in this report. As such, UES will not be responsible for the performance of any other site improvement designed using the data in this report.

This report should not be relied upon for final design recommendations or professional opinions by unauthorized third parties without the expressed written consent of Universal Engineering Sciences. Unauthorized third parties that rely upon the information contained herein without the expressed written consent of Universal Engineering Sciences, Inc. assume all risk and liability for such reliance.



The recommendations submitted in this report are based upon the data obtained from the soil borings performed at the locations indicated on the Boring Location Plan and from other information as referenced. This report does not reflect any variations which may occur between the boring locations. The nature and extent of such variations may not become evident until the course of construction. If variations become evident, it will then be necessary for a re-evaluation of the recommendations of this report after performing on-site observations during the construction period and noting the characteristics of the variations.

Borings for a typical geotechnical report are widely spaced and generally not sufficient for reliably detecting the presence of isolated, anomalous surface or subsurface conditions, or reliably estimating unsuitable or suitable material quantities. Accordingly, UES does not recommend relying on our boring information for estimation of material quantities unless our contracted services **specifically** include sufficient exploration for such purpose(s) and within the report we so state that the level of exploration provided should be sufficient to detect anomalous conditions or estimate such quantities. Therefore, UES will not be responsible for any extrapolation or use of our data by others beyond the purpose(s) for which it is applicable or intended.

All users of this report are cautioned that there was no requirement for Universal to attempt to locate any man-made buried objects or identify any other potentially hazardous conditions that may exist at the site during the course of this exploration. Therefore no attempt was made by Universal to locate or identify such concerns. Universal cannot be responsible for any buried man-made objects or environmental hazards which may be subsequently encountered during construction that are not discussed within the text of this report. We can provide this service if requested.

During the early stages of most construction projects, geotechnical issues not addressed in this report may arise. Because of the natural limitations inherent in working with the subsurface, it is not possible for a geotechnical engineer to predict and address all possible problems. Geotechnical Business Council (GBC) publication, "Important Information About This Geotechnical Engineering Report" appears in Appendix, and will help explain the nature of geotechnical issues.

Further, we present documents in Appendix: Constraints and Restrictions, to bring to your attention the potential concerns and the basic limitations of a typical geotechnical report.



## 9.0 CLOSURE

We trust this report meets your current needs. Should you have any questions concerning this information please do not hesitate to call us. We appreciate the opportunity to serve the **Jones, Edmunds & Associates, Inc.** on this project.

Sincerely,

**Universal Engineering Sciences, Inc.**

Certificate of Authorization No. 549

Gautham S. Pillappa, P.E.  
Senior Geotechnical Engineer

Guy H. Rabens, M.S., P.E.  
Geotechnical Manager  
Florida Registration No. 60917

### Distribution:

Client hard copies and email

Mr. Anthony R. Holmes, P.E., [aholmes@jonesedmunds.com](mailto:aholmes@jonesedmunds.com)

### Appendices:

USGS Site Location Map

Boring Location Plan

Boring Log

Keys to Boring Log Sheet

GBC Document

Constraints and Restrictions





SOURCE: USGS QUADRANGLE MAP OF "CENTER HILL, FLORIDA".

SCALE (FT.)



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ENGINEERING SCIENCES

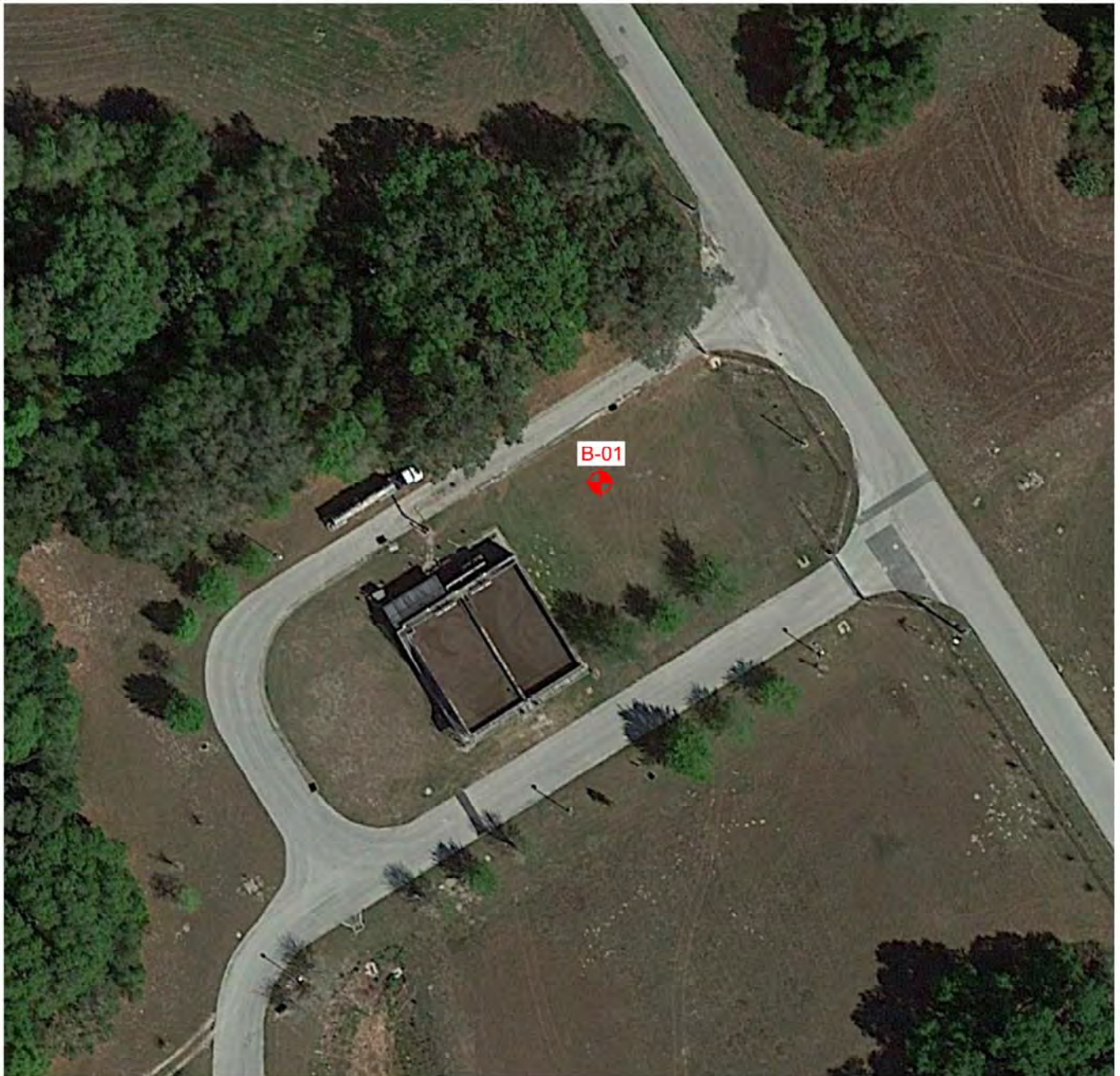
GEOTECHNICAL EXPLORATION  
PROPOSED TURNPIKE WWTP RELOCATION  
LAKE COUNTY, FLORIDA

SITE LOCATION MAP

DRAWN BY: N.F.	DATE: 5-31-17	CHECKED BY: GSP	DATE: 6.2.2017
SCALE: AS SHOWN	PROJECT NO: 0130.1700177.0000	REPORT NO: 1458100	PAGE NO: A-1

17-0215-01



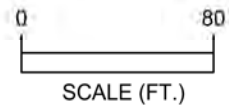


**LEGEND**



APPROX. STANDARD PENETRATION TEST  
BORING LOCATION (SPT)

BORINGS PERFORMED 5/26/17



AERIAL PHOTO SOURCE: GOOGLE EARTH



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**GEOTECHNICAL EXPLORATION  
PROPOSED TURNPIKE WWTP RELOCATION  
LAKE COUNTY, FLORIDA**

**BORING LOCATION PLAN**

<b>DRAWN BY:</b> N.F.	<b>DATE:</b> 5 - 31 - 17	<b>CHECKED BY:</b> GSP	<b>DATE:</b> 6.2.2017
<b>SCALE:</b> AS SHOWN	<b>PROJECT NO:</b> 0130.1700177.0000	<b>REPORT NO:</b> 1458100	<b>PAGE NO:</b> B-1

17-0215-01



# UNIVERSAL ENGINEERING SCIENCES BORING LOG

PROJECT NO.: 0130.1700177.0000

REPORT NO.: 1458100

PAGE: B-2.1

PROJECT: GEOTECHNICAL EXPLORATION  
PROPOSED TURNPIKE WWTP RELOCATION  
LAKE COUNTY, FLORIDA

BORING I.D.: **B-01**

SECTION:

TOWNSHIP:

SHEET: **1 of 1**

RANGE:

CLIENT: JONES, EDMUNDS & ASSOCIATES, INC.

G.S. ELEVATION (ft): N.S.

DATE STARTED: 5/26/17

LOCATION: SEE BORING LOCATION PLAN

WATER TABLE (ft): NE

DATE FINISHED: 5/26/17

REMARKS: SHGWT = SEASONAL HIGH GROUNDWATER TABLE, N.S. = NOT SURVEYED, NE = NOT ENCOUNTERED, HAND AUGER FIRST 4 FEET, \* = REPRESENTS PERCHED CONDITION

DATE OF READING: 5/26/2017

DRILLED BY: ORL - JB/CM/DM

EST. SHGWT (ft): 5.5\*

TYPE OF SAMPLING: ASTM D 1586

DEPTH (FT.)	SAMPLE	BLOWS PER 6" INCREMENT	N BLOWS / FT	W.T.	SYMBOL	DESCRIPTION	-200 (%)	MC (%)	ATTERBERG LIMITS		K (FT/DAY)	ORG. CONT. (%)
									LL	PI		
0						Brown fine SAND [SP]						
						-- light brown						
						-- loose						
5		2-3-2	5									
		2-2-4	6			Loose grey brown fine SAND with clay [SP-SC]						
		3-4-4	8			-- medium dense	11	12				
10		6-7-6	13			-- light brown						
15		4-6-7	13									
20		7-7-7	14			Medium dense grey brown coarse SAND [SP]						
25		6-10-11	21			BORING TERMINATED AT 25.0 FEET						
30												

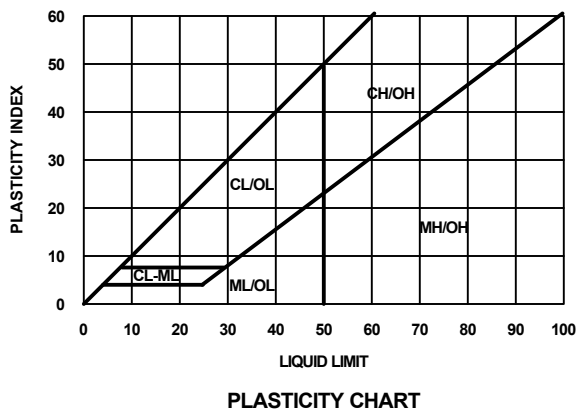
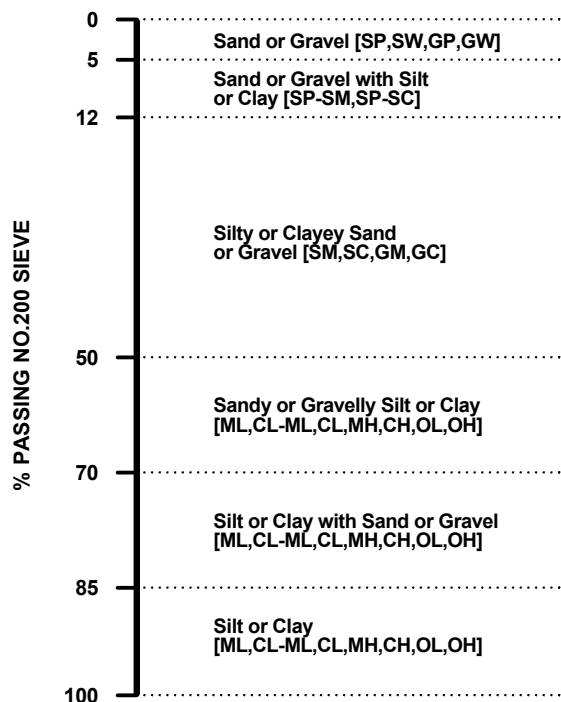


# KEY TO BORING LOGS

## SOIL CLASSIFICATION CHART\*

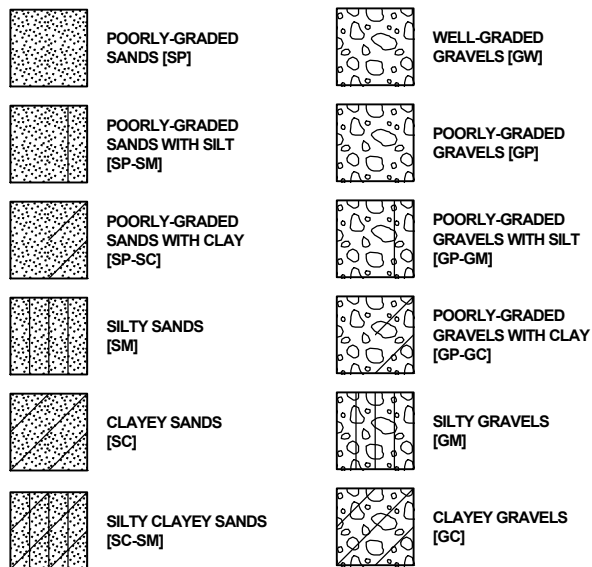


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ENGINEERING  
SCIENCES, INC.**

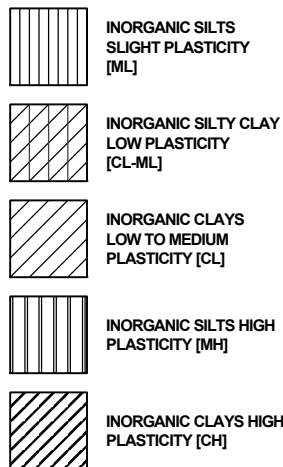


### GROUP NAME AND SYMBOL

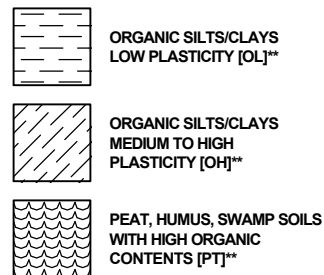
#### COARSE GRAINED SOILS



#### FINE GRAINED SOILS



#### HIGHLY ORGANIC SOILS



\* IN ACCORDANCE WITH ASTM D 2487 - UNIFIED SOIL CLASSIFICATION SYSTEM.

\*\* LOCALLY MAY BE KNOWN AS MUCK.

#### RELATIVE DENSITY

(SAND AND GRAVEL)

VERY LOOSE - 0 to 4 Blows/ft.  
 LOOSE - 5 to 10 Blows/ft.  
 MEDIUM DENSE - 11 to 30 Blows/ft.  
 DENSE - 31 to 50 Blows/ft.  
 VERY DENSE - more than 50 Blows/ft.

#### CONSISTENCY

(SILT AND CLAY)

VERY SOFT - 0 to 2 Blows/ft.  
 SOFT - 3 to 4 Blows/ft.  
 FIRM - 5 to 8 Blows/ft.  
 STIFF - 9 to 16 Blows/ft.  
 VERY STIFF - 17 to 30 Blows/ft.  
 HARD - more than 30 Blows/ft.

#### MISCELLANEOUS SYMBOLS

	ENCOUNTERED WATER TABLE
	ESTIMATED SEASONAL HIGH WATER TABLE
-200	PERCENT PASSING NO. 200 SIEVE
MC	MOISTURE CONTENT, %
WOR	SPOON ADVANCES DUE TO WEIGHT OF RODS AND/OR HAMMER

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

# Important Information about This

# Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

## Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a civil engineer may not fulfill the needs of a constructor — a construction contractor — or even another civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. No one except you should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you — should apply this report for any purpose or project except the one originally contemplated.*

## Read the Full Report

Serious problems have occurred because those relying on a geotechnical-engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

## Geotechnical Engineers Base Each Report on a Unique Set of Project-Specific Factors

Geotechnical engineers consider many unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk-management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical-engineering report that was:

- not prepared for you;
- not prepared for your project;
- not prepared for the specific site explored; or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical-engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an

assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

## Subsurface Conditions Can Change

A geotechnical-engineering report is based on conditions that existed at the time the geotechnical engineer performed the study. *Do not rely on a geotechnical-engineering report whose adequacy may have been affected by:* the passage of time; man-made events, such as construction on or adjacent to the site; or natural events, such as floods, droughts, earthquakes, or groundwater fluctuations. *Contact the geotechnical engineer before applying this report to determine if it is still reliable.* A minor amount of additional testing or analysis could prevent major problems.

## Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ — sometimes significantly — from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide geotechnical-construction observation is the most effective method of managing the risks associated with unanticipated conditions.

## A Report's Recommendations Are Not Final

Do not overrely on the confirmation-dependent recommendations included in your report. *Confirmation-dependent recommendations are not final*, because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations *only* by observing actual subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's confirmation-dependent recommendations if that engineer does not perform the geotechnical-construction observation required to confirm the recommendations' applicability.*

## A Geotechnical-Engineering Report Is Subject to Misinterpretation

Other design-team members' misinterpretation of geotechnical-engineering reports has resulted in costly

problems. Confront that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Constructors can also misinterpret a geotechnical-engineering report. Confront that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing geotechnical construction observation.

### **Do Not Redraw the Engineer's Logs**

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical-engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

### **Give Constructors a Complete Report and Guidance**

Some owners and design professionals mistakenly believe they can make constructors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give constructors the complete geotechnical-engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise constructors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure constructors have sufficient time* to perform additional study. Only then might you be in a position to give constructors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

### **Read Responsibility Provisions Closely**

Some clients, design professionals, and constructors fail to recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help

others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

### **Environmental Concerns Are Not Covered**

The equipment, techniques, and personnel used to perform an *environmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. *Do not rely on an environmental report prepared for someone else.*

### **Obtain Professional Assistance To Deal with Mold**

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold-prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, many mold-prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical-engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; *none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.*

### **Rely, on Your GBC-Member Geotechnical Engineer for Additional Assistance**

Membership in the Geotechnical Business Council of the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your GBC-Member geotechnical engineer for more information.



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## **CONSTRAINTS AND RESTRICTIONS**

### **WARRANTY**

Universal Engineering Sciences has prepared this report for our client for his exclusive use, in accordance with generally accepted soil and foundation engineering practices, and makes no other warranty either expressed or implied as to the professional advice provided in the report.

### **UNANTICIPATED SOIL CONDITIONS**

The analysis and recommendations submitted in this report are based upon the data obtained from soil borings performed at the locations indicated on the Boring Location Plan. This report does not reflect any variations which may occur between these borings.

The nature and extent of variations between borings may not become known until excavation begins. If variations appear, we may have to re-evaluate our recommendations after performing on-site observations and noting the characteristics of any variations.

### **CHANGED CONDITIONS**

We recommend that the specifications for the project require that the contractor immediately notify Universal Engineering Sciences, as well as the owner, when subsurface conditions are encountered that are different from those present in this report.

No claim by the contractor for any conditions differing from those anticipated in the plans, specifications, and those found in this report, should be allowed unless the contractor notifies the owner and Universal Engineering Sciences of such changed conditions. Further, we recommend that all foundation work and site improvements be observed by a representative of Universal Engineering Sciences to monitor field conditions and changes, to verify design assumptions and to evaluate and recommend any appropriate modifications to this report.

### **MISINTERPRETATION OF SOIL ENGINEERING REPORT**

Universal Engineering Sciences is responsible for the conclusions and opinions contained within this report based upon the data relating only to the specific project and location discussed herein. If the conclusions or recommendations based upon the data presented are made by others, those conclusions or recommendations are not the responsibility of Universal Engineering Sciences.

### **CHANGED STRUCTURE OR LOCATION**

This report was prepared in order to aid in the evaluation of this project and to assist the architect or engineer in the design of this project. If any changes in the design or location of the structure as outlined in this report are planned, or if any structures are included or added that are not discussed in the report, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions modified or approved by Universal Engineering Sciences.

### **USE OF REPORT BY BIDDERS**

Bidders who are examining the report prior to submission of a bid are cautioned that this report was prepared as an aid to the designers of the project and it may affect actual construction operations.



Bidders are urged to make their own soil borings, test pits, test caissons or other investigations to determine those conditions that may affect construction operations. Universal Engineering Sciences cannot be responsible for any interpretations made from this report or the attached boring logs with regard to their adequacy in reflecting subsurface conditions which will affect construction operations.

### **STRATA CHANGES**

Strata changes are indicated by a definite line on the boring logs which accompany this report. However, the actual change in the ground may be more gradual. Where changes occur between soil samples, the location of the change must necessarily be estimated using all available information and may not be shown at the exact depth.

### **OBSERVATIONS DURING DRILLING**

Attempts are made to detect and/or identify occurrences during drilling and sampling, such as: water level, boulders, zones of lost circulation, relative ease or resistance to drilling progress, unusual sample recovery, variation of driving resistance, obstructions, etc.; however, lack of mention does not preclude their presence.

### **WATER LEVELS**

Water level readings have been made in the drill holes during drilling and they indicate normally occurring conditions. Water levels may not have been stabilized at the last reading. This data has been reviewed and interpretations made in this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, tides, and other factors not evident at the time measurements were made and reported. Since the probability of such variations is anticipated, design drawings and specifications should accommodate such possibilities and construction planning should be based upon such assumptions of variations.

### **LOCATION OF BURIED OBJECTS**

All users of this report are cautioned that there was no requirement for Universal Engineering Sciences to attempt to locate any man-made buried objects during the course of this exploration and that no attempt was made by Universal Engineering Sciences to locate any such buried objects. Universal Engineering Sciences cannot be responsible for any buried man-made objects which are subsequently encountered during construction that are not discussed within the text of this report.

### **TIME**

This report reflects the soil conditions at the time of field activities. If the report is not used in a reasonable amount of time, significant changes to the site may occur and additional reviews may be required.

