
IFB NO. Y13-7052-PH

ISSUED: June 27, 2013

INVITATION FOR BIDS

FOR

LAKE EVE PUMP STATION NO. 3541 REHABILITATION

**PART H
TECHNICAL SPECIFICATIONS**

PART H VOLUME II



**SPECIFICATIONS
ISSUED FOR BID**

**Lake Eve Pump Station No. 3541
Rehabilitation
CDM Smith Project
No. 6059-79165
Volume 1**

Orange County, Florida

June 2013



2301 Maitland Center Parkway
Suite 300
Maitland, Florida 32751
407-660-2552

ORANGE COUNTY, FLORIDA

**LAKE EVE PUMP STATION NO. 3541
REHABILITATION**

Issued for Bid

June 2013

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ORANGE COUNTY, FLORIDA

**LAKE EVE PUMP STATION NO. 3541
REHABILITATION**

Issued for Bid

June 2013

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ORANGE COUNTY, FLORIDA

**LAKE EVE PUMP STATION NO. 3541
REHABILITATION**

Issued for Bid

June 2013

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Geotechnical Investigation Report for the Lake Eve Pump Station Rehabilitation Project

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FDEP Domestic Wastewater Collection/Transmission Individual Permit

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Department of the Army Permit

SECTION 01010

SUMMARY OF WORK

PART 1 - GENERAL

1.01 LOCATION OF WORK

- A. The Work of this Contract is located at the following Orange County Wastewater Pump Station:
 - 1. Lake Eve Pump Station (County No. 3541) near the intersection of Westward Boulevard and South International Drive in Orlando, Florida.

1.02 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and construct the Wastewater Pump Station in its entirety as shown on the Drawings and as specified herein.
- B. The Work includes, but is not necessarily limited to, the following:
 - 1. Demolition of existing valves, piping, 78 hp submersible pumps including guide rails, cables, baseplates and associated appurtenances, wetwell, generator, below ground diesel fuel storage tank, and fence. Specific equipment shall be salvaged, removed from the site and turned over to Orange County, as shown on the Drawings.
 - 2. Perform a boundary survey. Installation of new 120 hp submersible pumps, wetwell, 5 hp submersible mixers, valves, piping, manholes, generator, above ground diesel fuel storage tank, electrical building and associated equipment, SCADA panel, flowmeter, 6-inch water main, access gates, perimeter wall, odor control system, and access road.
 - 3. The Contractor shall provide bypass pumping during construction for the duration of the project or until the new pump station is operational.

1.03 QUALITY ASSURANCE

- A. Laws and Regulations: The Contractor shall give all notices and comply with all laws, ordinances, rules and regulations applicable to the Work. If the Contractor observes that the Specifications or Drawings are at variance therewith, the Contractor shall give the Engineer prompt written notice thereof, and any necessary changes shall be adjusted by an appropriate modification. If the Contractor performs any work knowing or having reason to know that it is contrary to such laws, ordinances, rules and regulations, and without such notice to the Engineer, the Contractor shall bear all costs arising there from; however, it shall not be the Contractor's primary responsibility to make certain that the Specifications and Drawings are in accordance with such laws, ordinances, rules, and regulations.

1.04 WORK SEQUENCE

- A. Perform work to ensure completion of the Work within the Contract Time. Completion dates of the various phases shall be in accordance with the approved construction schedule submitted by the Contractor. The Contractor shall provide a written plan and schedule in the event he desires to perform work from different phases concurrently. A written plan describing the Contractor's intent must be submitted for approval by the Engineer.
- B. Substantial Completion: To satisfy the definition of Substantial Completion, all on-site and off-site work including Certificate of Occupancy and punch list items required by the Contract must be completed to where the Contractor can vacate the site and only those elements of a submittal and closeout nature remain for the attainment of Final Completion and as previously described.
- C. Final Completion: The last stage of construction shall be final construction and shall include the final remaining items subject to Engineer's approval as well as all items listed in Section 01700, Contract Closeout.

1.05 CONTRACTOR'S USE OF PREMISES

- A. Contractor shall have complete and exclusive use of the premises for the performance of the Work.
- B. Contractor shall assume full responsibility for security of all his/her and his/her subcontractor's materials and equipment stored on the site.
- C. If directed by the Owner move any stored items which interfere with operations of Owner or other Contractors.
- D. Obtain and pay for use of additional storage or work areas if needed to perform the Work.

1.06 CONNECTION TO EXISTING LINES

- A. Connection to existing lines to which piping of this Contract must connect:
 - 1. Expose buried lines to confirm or determine pipe diameter, end connection, and pipe material.
 - 2. Furnish and install all material, labor, and equipment including appropriate pipe, fittings, specials, and appurtenances to make proper connections.
 - 3. Coordinate with Owner to schedule installation including nights and weekends, to limit operational outages.
 - 4. Supply temporary plugs and thrust restraint, if piping is not available.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All products shall be approved by the Engineer.

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall coordinate construction and reconstruction work with the Owner and Engineer. Unless otherwise indicated, the Contractor shall be responsible for the sequence of the Work. All work shall be performed in accordance with applicable safety rules and regulations.
- B. The Contractor shall ensure that any utilities connected to structures, equipment, and facilities to be removed, relocated, salvaged, replaced, or abandoned shall be rendered inoperable, replaced with new utilities, or adequately bypassed with temporary utilities before proceeding with reconstruction.
- C. The Contractor shall take precautions to avoid damage to adjacent facilities and to limit the reconstruction activities to the extent indicated. If reconstruction beyond the scope indicated is required, the Contractor shall obtain approval from the Engineer prior to commencing work.

3.02 PROTECTION OF EXISTING FACILITIES

- A. Before beginning any construction work, the Contractor shall carefully survey the existing site and examine the Specifications and Drawings to determine the extent of construction and coordination with the Work. Existing facilities and utilities not subject to construction shall be protected and maintained in accordance with the Contract Documents. Damages to existing facilities and utilities shall be repaired to its previous condition or replaced at no additional cost to the Owner.
- B. Persons shall be afforded safe passages around areas of demolition.
- C. Structural elements shall not be overloaded. The Contractor shall be responsible for shoring, bracing, or adding new supports as may be required for adequate structural support as a result of any reconstruction work performed under this Contract. The Contractor shall remove all temporary protection when the work is complete or when so authorized by the Engineer.
- D. The Contractor shall carefully consider all bearing loads and capacities before placement of equipment and material on site. In the event of any questions as to whether an area to be loaded has adequate bearing capacity, the Contractor shall consult with the Engineer prior to the placement of such equipment or material.

3.03 DEMOLITION, SALVAGE, AND RELOCATION

- A. The Contract Documents indicate existing facilities to be demolished, salvaged, and/or relocated. Auxiliary utilities services such as water, air, chemicals, drainage, lubrication, fluid power, electrical wiring, controls, and instrumentation are not necessarily indicated. The

Contractor shall verify the scope of the Work to remove the equipment indicated; coordinate its shutdown, removal, replacement, or relocation; and submit an outage plan identifying affected areas of the pump station. The removal of existing facilities for demolition, salvaged, and relocation shall include the following requirements at no additional cost to the Owner:

1. All equipment supports, including concrete pads, baseplates, mounting bolts, and support hangers, shall be removed. Damage to the existing structure shall be repaired as indicated.
2. All exposed piping including vent, drains, and valves shall be removed as indicated on the Drawings.
3. All electrical control panels, junction boxes, motor control centers, and local switches and pushbuttons shall be removed.
4. All exposed electrical conduits and associated wiring shall be removed.
5. Connections to embedded electrical conduits shall be removed a minimum of 2 inches from the finished surface of the existing structure. All wiring shall be removed and the resulting openings shall be repaired as indicated.
6. All associated instrumentation devices shall be removed.
7. All auxiliary utility support systems shall be removed.
8. The area shall be thoroughly cleaned such that little or no evidence of the previous equipment installation will remain.
9. Footings, foundation walls, below-grade construction, and concrete slabs on grade shall be demolished and removed to a depth which will not interfere with new construction, but not less than 48-inches below existing ground surface or future ground surface, whichever is lower.
10. Below-grade areas and voids resulting from demolition of structures shall be completely filled. All fill and compaction shall be in accordance with Section 02200 – Earthwork. After fill and compaction, surfaces shall be graded to meet adjacent contours and to provide flow to surface drainage structures, or as shown.
11. When existing piping is removed, the Contractor shall plug all resulting open ends whether shown or not shown. Where removed piping is exposed, the remaining piping shall be blind-flanged or fitted with a removable cap or plug.
12. When existing piping is removed from existing structures, the Contractor shall fill all resulting openings in the structures and repair any damage such that the finished rehabilitated structure shall appear as a new homogeneous unit with little or no indication of where the new and old materials join. The openings in water-bearing structures shall be filled with non-shrink grout to be watertight and reinforced as required or shown. In all locations where the surface of the grout will be exposed to view, the non-shrink grout shall be recessed approximately ½-inch and the recessed area filled with cement mortar grout.

13. All electrical reconstruction shall be performed by the Contractor in a safe and proper manner at all times to avoid injury from electrical shock to the Owner's and Contractor's personnel. Electrical equipment to be shut off for a period of time shall be tagged, locked out, and sealed with a crimped wire and lead seal and made inoperable. At no time shall electrical wiring or connections which are energized or could become energized be accessible to Contractor, Owner, or other personnel without suitable protection or warning signs.

3.04 ABANDONMENT

- A. Existing facilities to be abandoned shall be prepared as indicated. Where existing buried piping is to be abandoned, the Contractor shall remove the abandoned pipe for a distance of 5 feet from any connecting structures. All openings at the existing structures shall be repaired. The remaining pipe shall be capped at both ends prior to backfill. Buried piping, 12-inch diameter or greater, shall be completely sand-filled prior to closure of the piping ends.

3.05 DISPOSAL

- A. Clearing and grubbing and removal of debris shall minimize interference with roads, streets, walks, and other adjacent occupied or used facilities which shall not be closed or obstructed without permission from the Owner. Alternate routes shall be provided around closed or obstructed traffic ways.
- B. Site debris, rubbish, and other materials resulting from reconstruction operations shall be legally removed and disposed of at the Contractor's expense. Structures and equipment to be demolished shall be cleaned prior to demolition and the wash water properly disposed. No trace of these structures shall remain prior to placing of backfill in the areas from which structures were removed.
- C. Refuse, debris, and waste materials resulting from demolition and site clearing operations shall not be burned.

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SECTION 01014

CONSTRUCTION SEQUENCE

PART 1 GENERAL

1.01 SITE CONDITIONS

- A. Construction under this contract must be coordinated with the Orange County personnel and accomplished in a logical order to maintain the process flow through the pump station and the wastewater transmission system and to allow construction to be completed within the time allowed by Contract Documents. Coordinate the activities with the other contractors, if any, to allow orderly and timely completion of all the work.
- B. When access through construction areas must be disrupted, provide alternate acceptable access for the plant operators or other contractors.
- C. Coordinate the activities in the interface or common areas with these other contractors and the plant operators. Submit to the Engineer a description and schedule as to how the common areas will be utilized, recognizing the required coordination with other contractors and the plant operators.
- D. Various interconnections within the pump station will depend on the closure of various valves. Many of these valves and gates are old and may not seal properly. Coordinate with Orange County personnel prior to attempting any such closure and provide any corrective measure of temporary facilities necessary to attain the shut-off needed to perform the work at no additional cost to the Owner and without interrupting the pump station operation.
- E. Various interconnections within the plant may require temporary partial power shutdown. Make every effort necessary to minimize the shutdown time and coordinate with the Orange County personnel and/or utility authorities prior to attempting any such power shutdown. Furthermore, provide any corrective measure or temporary facilities necessary to perform the work at no additional cost to the Owner and without interrupting the pump station operation.
- F. The Contractor shall provide site specific construction sequence and bypass plan for the pump station for acceptance by the Owner. The construction sequence and bypass plan shall include a construction schedule (Section 01310) for bypass operations and drawings and description showing the construction sequence and bypass plan. It shall be the Contractor's responsibility to provide all maintenance to the bypass pumps and piping and to provide proper motor starters, controls and temporary power for the bypass pumping.
- G. The Contractor shall provide all temporary above or below grade piping, valves and fittings required to perform the bypass pumping.
- H. Where water is required in large quantity for pre-operational testing or other use, the Contractor shall provide water or purchase it from the Owner. A meter will be installed on the water main by the Owner (at the Contractor's request). Pay all fees and water usage charges.

- I. During Start-Up Testing, make available the manpower, equipment and manufacturer's representatives required to make any necessary adjustments and training.

1.02 CONSTRUCTION CONSTRAINTS

- A. The following is a list of constraints to consider in developing the overall plan of construction. This list is not intended to release the Contractor from the responsibility to coordinate the work in any manner which will ensure project completion within the time allowed. The following areas are not necessarily listed in their required sequence of construction. A suggested sequence within each area, where necessary, is included.
 1. All work shall be conducted in a manner such that pump station operations are not interrupted. All areas of work shall be completed and brought on line with minimal disruption of the ongoing operations of the pump station. Whenever the pump station ongoing operations are disrupted, the Contractor shall provide any temporary facilities necessary to perform the work without interrupting the flow of wastewater through the transmission system.
 2. In the event any portions of the work require existing facilities to be taken off-line, including pump station shut downs, new pipe connections and by-pass piping installation, this work shall be coordinated in advance with the Owner and Engineer such that operation interferences and disruptions are minimized. The Contractor shall notify the Engineer and Owner a minimum of seven days in advance of a proposed action such as taking any pumps, equipment or facilities off-line for any reason. Contractor shall obtain written approval from Owner prior to starting the proposed action.
 3. The Contractor shall provide temporary power, generator, fuel and by-pass pumping as required to perform construction and switch over between existing and new pump stations, so as to not interrupt the flow of wastewater through the transmission system. The Contractor shall provide a site specific construction sequence and bypass plan for each pump station for acceptance by the Owner.
 4. The Contractor shall perform all work within the existing property boundary.
 5. The Contractor shall be responsible for any wastewater spillage, clean up and associated fines that occur during construction, pump station switchover and/or by-pass pumping operations.
 6. The Contractor shall coordinate the switch over from the existing pump station to the new pump station with the Engineer and Orange County personnel. All required by-pass pumping, temporary power and generators shall be provided by the Contractor. Only one pump station switch over, from the existing pump station to the new pump station, can occur at any time. The new pump station shall operate successfully for 72 hours before the Contractor can start a switch over at another pump station. Emergency pumping equipment shall remain on site for a minimum of 72 hours after the pump station switch over. The emergency pumping equipment shall operate automatically in the event of a new pump station failure.

7. Per FDEP Environmental Resource Permit Specific Conditions – Construction Details, the new Lake Eve Pump Station stormwater pond and pump station facilities shall be constructed in the following phases:
 - a. Phase I: Construct the eastern portion of the stormwater pond as denoted on the drawings. Phase I of the stormwater pond shall be complete prior to the construction of any new facilities. Once Phase I of the new stormwater pond is complete, only the new pump station, new electrical building, new generator, and new generator fuel tank shall be constructed. No other impervious areas shall be constructed during this phase.
 - b. The Contractor shall provide a temporary berm, as necessary, between Phase I and II of the stormwater pond during construction. The temporary berm shall be removed once the existing pump station has been demolished and Phase II construction of the stormwater pond is complete.
 - c. Phase II: Construct the western portion of the stormwater pond as denoted on the drawings. Phase II construction shall occur after the new facilities in Phase I are constructed and fully operational. Once Phase II of the stormwater pond is completed, the remaining portions of the new Lake Eve Pump Station can be constructed.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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SECTION 01025

MEASUREMENT AND PAYMENT

PART 1 – GENERAL

1.01 GENERAL PROVISIONS

- A. Unit Price Contracts: The quantities of work to be done and materials to be furnished under a unit price contract, as given in the Bid Form, are to be considered as approximate only and are to be used solely for the comparison of Bids received and determining an initial Contract Price. The Owner/Engineer do not expressly or by implication represent that the actual quantities involved will correspond exactly herewith; nor shall the Contractor plead misunderstanding or deception because of such estimate or quantities or of the character, location or other conditions pertaining to the Work. Payment to the Contractor will be made only for the actual quantities of work performed or material furnished in accordance with the Drawings and other Contract Documents, and it is understood that the quantities may be increased or diminished as provided in the General Conditions without in any way invalidating any of the unit prices bid.
- B. Lump Sum Contracts: The quantities of work to be done and materials to be furnished, including all labor, equipment and incidentals required to complete the Work, are specified in Divisions 0 through 16 of the Contract Specifications and shown in the Contract Drawings. Payment to the Contractor of the lump sum price bid for the Work will be made and shall fully compensate the Contractor for the construction of the Work, completed and ready for continuous operation and use, in the manner contemplated by the Contract Documents.
- C. Unit Price and Lump Sum Contracts:
 - 1. All schedules are given for the convenience of the Engineer and the Contractor and are not guaranteed to be complete. The Contractor shall assume all responsibility for the making of estimates of the size, kind, and quantity of materials and equipment included in work to be done under this Contract.
 - 2. Where fittings are noted on the Drawings, such notation is for the Contractor's convenience and does not relieve him from laying and jointing different or additional items where required.
 - 3. All contracts shall be subject to 10% minimum retainage as defined in the General Conditions and the Agreement.

1.02 ALLOWANCES

- A. The Contractor shall include in the Total Bid Amount all cash allowances stated hereinafter. Items covered by these allowances shall be supplied for such amounts and by such persons as the Owner/Engineer may direct.

- B. The amount of the allowance shall be adjusted accordingly by Change Order to recognize the actual cost incurred by the Contractor. The Contractor shall submit appropriate documentation to validate the actual cost of the item.
- C. Cash allowances for the purposes of bidding shall be in the following amounts and shall be so reflected in the Bid Form for the designated item.

1.03 MEASUREMENT AND PAYMENT

A. Methods of Payment

- 1. Unit Price Contracts/Items: Payment will be made for actual quantities of work properly installed as approved by the Owner/Engineer unless otherwise indicated herein.
- 2. Lump Sum Contracts/Items: Payment will be made for each individual item on a percentage of completion basis as estimated by the Contractor and approved by the Owner. Quantities provided in the Schedule of Values are for the purpose of estimating the completion status for progress payments. Adjustments to costs provided in the acceptable Schedule of Values may be made only by Change Order.

B. Methods of Measurement

- 1. Units of measurement shall be defined in general terms as follows:
 - a. Linear Feet (LF)
 - b. Square Feet (SF)
 - c. Square Yards (SY)
 - d. Cubic Yards (CY)
 - e. Each (EA)
 - f. Sacks (SK)
 - g. Lump Sum (LS)
- 2. Unit Price Contracts/Items:
 - a. Linear Feet (LF) shall be measured along the horizontal length of the centerline of the installed material, unless otherwise specified. Pipe shall be measured along the length of the completed pipeline, regardless of the type of joint required, without deduction for the length of valves or fittings. Pipe included within the limits of lump sum items will not be measured.
 - b. Square Feet (SF), Square Yards (SY), Cubic Yards (CY), Each (EA) and Sacks (SK) shall be measured as the amount of the unit of measure installed within the limits specified and shown in the Specifications and Drawings. Slope angles and elevations

shall be measured using land-surveying equipment. Contractor shall provide supporting documentation (i.e. drawings, truck tickets, invoices, etc.) to verify actual installed quantities.

- c. No measurement is required for Lump Sum (LS) items.
3. Lump Sum Contracts/Items:
- a. The Measurement of Work for lump sum contracts and/or items shall be based on the information provided in the Contract Documents and compiled through the Contractor's own field verifications, investigations and testing prior to Bidding.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

END OF SECTION

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SECTION 01046

CONTROL OF WORK

PART 1 GENERAL

1.01 PUMP STATION

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

1.02 PRIVATE LAND

- A. Do not enter or occupy private land outside of Orange County property boundaries and easements, except by permission of the land owner.

1.03 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 from laying and jointing different or additional items where required.

1.04 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. 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 the Engineer may require special construction procedures such as limiting the length of the open trench requiring that the trench shall not remain open 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 which could be dangerous to the public at night.

1.05 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.

1.06 MAINTENANCE OF TRAFFIC

- A. 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.
- B. 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. Periods when traffic is being detoured will be strictly controlled by the Owner.
- C. 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. Be fully responsible for damage or injuries whether or not police protection has been provided.

1.07 CARE AND PROTECTION OF PROPERTY

- A. Be responsible for the preservation of all public and private property and use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, 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.

1.08 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

- A. Assume full responsibility for the protection of 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. 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).
- 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 Florida's Dig Safe, telephone 811 at least 72 hours prior to start of work.
- D. If, in the opinion of the Engineer, permanent relocation of a utility owned by Orange County 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 Article 11 of the Supplementary Conditions. If relocation of a privately owned utility is required, the Engineer will notify the Utility to perform the work as expeditiously as possible. Cooperate with the Engineer and Utility.

1.09 WATER FOR CONSTRUCTION PURPOSES

- A. The express approval of the Owner shall be obtained before water is used. Waste of water shall be sufficient cause for withdrawing the privilege of unrestricted use. Hydrants shall only be operated under the supervision of the Owner's personnel.

1.10 MAINTENANCE OF FLOW

- A. 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 Engineer well in advance of the interruption of any flow.

1.11 COOPERATION WITHIN THIS CONTRACT

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

1.12 CLEANUP AND DISPOSAL OF EXCESS MATERIAL

- A. During the course of 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. In order 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. Disposal 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 him 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.

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SECTION 01047

MODIFICATIONS TO EXISTING STRUCTURES, PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to modify, alter and/or convert existing structures as shown or specified and as required for the installation of new mechanical equipment, piping and appurtenances. Work shall be performed within the requirements of Construction Scheduling in Section 01310. Existing piping and equipment shall be removed and dismantled as necessary for the performance of structural alterations in accordance with the requirements herein specified.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

- A. The Contractor shall cut, repair, reuse, excavate, demolish or otherwise remove parts of the existing structures or appurtenances, as indicated on the Contract Drawings, herein specified, or necessary to permit completion of the work under this Contract.
- B. Blasting with explosives will not be permitted to complete any work under this Contract. Care shall be taken not to damage any part of existing buildings, foundations, and exterior structures both below and above ground.
- C. No existing structure, equipment, or appurtenance shall be shifted, cut, removed, or otherwise altered except with the express direction of and to the extent accepted by the Engineer.
- D. When removing materials or portions of existing structures and when making openings in walls and partitions, the Contractor shall take all precautions and use all necessary barriers and other protective devices so as not to damage the structures beyond the limits necessary for the new work, nor to damage the structures or contents by falling or flying debris.
- E. Materials and equipment removed in the course of making alterations and additions shall remain the property of the Owner, except that items not salvageable, as determined by the Engineer and the Owner shall become the property of the Contractor to be disposed of by him off the site of the work at his own place of disposal.
- F. All work of altering existing structures shall be done at such time and in such manner as will comply with the approved time schedule. So far as possible before any part of the work is started, all tools, equipment, and materials shall be assembled and made ready so that the work can be completed without delay.

- G. All workmanship and new materials involved in constructing the alterations shall conform to the General Specifications for the classes of work insofar as such specifications are applicable.
- H. All cutting of existing masonry or other material to provide suitable bonding to new work shall be done in a manner to meet the requirements of the respective section of these specifications covering the new work. When not covered, the work shall be carried on in the manner and to extent directed by the Engineer.
- I. Where holes in existing masonry are required to be sealed, unless otherwise herein specified, they shall be sealed with cement mortar or concrete. The sides of the openings shall be provided with keyed joints and shall be suitably roughened to furnish a good bond and make a watertight joint. All loose or unsound material adjacent to the opening shall be removed and, if necessary, replaced with new material. The method of placing the mortar seal shall provide a suitable means of releasing entrapped air.
- J. Surfaces of seals visible in the completed work shall be made to match as nearly as possible the adjacent surfaces.
- K. Nonshrink grout shall be used for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete and elsewhere as shown.
- L. Operating equipment shall be thoroughly cleaned and then lubricated and greased for protection during prolonged storage.
- M. The Contractor shall provide flumes, hoses, piping, etc. to divert or provide suitable plugs, bulkheads or other means to hold back the flow of wastewater, water or other liquids, all as required in the performance of the work under this Contract.

3.02 CONNECTING TO EXISTING PIPING AND EQUIPMENT

- A. The Contractor shall verify exact location, material, alignment, joint, etc. of existing piping and equipment prior to making the connections called out in the Drawings. The verifications shall be performed with adequate time to correct any potential alignment or other problems prior to the actual time of connection.
- B. The Contractor shall dismantle and remove all existing equipment, piping and other appurtenances required for the completion of the work. Where called for or required, he shall cut existing pipelines for the purpose of making connections thereto. Anchor bolts for equipment and structural steel removed shall be cut off one inch below the concrete surface. Surface shall be finished as specified in Division 3.
- C. At the time that a new connection is made to an existing pipeline, additional new piping, extending to and including the most convenient new valve, shall be installed.

- D. Where necessary or required for the purpose of making connections, the Contractor shall cut existing pipe lines in a manner to provide an approved joint. Where required, he shall weld beads, flanges or provide Dresser couplings, all as needed to accomplish the proposed connections, whether or not such additional items of work are indicated on the drawings.

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SECTION 01050

FIELD ENGINEERING

PART 1 GENERAL

1.01 SCOPE OF WORK

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

1.02 RELATED WORK

- A. Summary of Work is included in Section 01010.
- B. Project Record Documents are included in Section 01720.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, name and address of registered land surveyor or professional engineer.
- B. On request of the Engineer, submit documentation to verify accuracy of field engineering work.
- C. Submit certificate signed by registered land surveyor certifying that elevations and locations of improvements are in conformance, or non-conformance, with Contract Documents.
- D. At the end of the project, and prior to final payment, submit certified drawings with the Surveyor's title block (signed and sealed by the registered land surveyor) of the items listed below. These drawings shall be included with, and made a part of, the project record documents.

1. Certified site survey at 1-in = 10-ft scale on sheets 24-in by 36-in, indicating the building corners, sidewalks, paved areas and location of all above ground structures within the plant or project site.
2. Certified drawing showing the location, lines and grades of all lines 4-in in diameter and larger buried and exterior to buildings and other buried facilities (e.g. valves, tanks, vaults, etc) installed as a result of the work. This shall be at the same scale as the Engineer's yard piping drawing and submitted on reproducible tracing paper.
3. Certified survey at the same scale as the Engineer's line drawings (e.g. sewer, force main, water transmission, etc) indicating lines, grades, elevations and stationing at 100-ft increments. Provide x, y, z elevations of structure bottom, pipe invert(s), buried fittings, buried valves, and bottom and rim elevations on all manholes.

1.04 QUALIFICATIONS OF SURVEYOR OR ENGINEER

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

1.05 SURVEY REFERENCE POINTS

- A. Existing basic horizontal and vertical control points for the project are those designated on Drawings.
- B. Locate and protect control points prior to 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 surveyor to correctly replace project control points which may be lost or destroyed.
 - a. Establish replacements based on original survey control.

1.06 PROJECT SURVEY REQUIREMENTS

- A. Establish a minimum of two permanent bench marks on site, referenced to data established by survey control points.
 1. Record locations, with horizontal and vertical data, on Project 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 same methods.
- D. Establish all lines and grades prior to construction of line work for all force mains, raw water mains and transmission mains at 100-ft increments and at defined breaks in grade.
- E. All work will be performed in accordance with the Minimum Technical Standards set forth by the Florida Board of Land Surveyors in Chapter 21-H, F.A.C. pursuant to Section 472.027 Florida Statutes.

1.07 RECORDS

- A. Maintain a complete, accurate log of all control and survey work as it progresses.
- B. Update the project record drawings on a monthly basis based on the work performed during the month ending at the pay request as a condition for approval of monthly progress payment requests.
- C. Maintain an accurate record of piping changes, revisions, and modifications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

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SECTION 01100

SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 PERMITS

- A. Upon notice of award, the Contractor shall immediately apply for all applicable permits not previously obtained by the Owner to do the work from the appropriate governmental agency or agencies. No work shall commence until all sub-discipline construction applicable permits have been obtained and copies delivered to the Engineer. The costs for obtaining all permits shall be borne by the Contractor.
1. Sub-discipline construction permits (electrical, low voltage, mechanical, structural, plumbing, etc.) shall be obtained from Orange County for the pump station.
- B. Orange County has or will obtain the following permits:
1. Florida Department of Environmental Protection for the construction of a domestic wastewater collection/transmission system for the pump station.
 2. Florida Department of Environmental Protection Environmental Resource Permit for the stormwater and temporary impacts to the wetlands at the pump station.
 3. Orange County will submit the initial Orange County building permit application for the station, including payment of the department review fees.
- C. Contractor shall be responsible for completion, pick-up and payment of building permits from Orange County, including but not limited to trailer, subcontractor trade specialty permits, etc. Contractor shall be responsible for scheduling all permit inspections and obtaining inspection approval from Orange County, as required by the building and sub-discipline construction permits. Contractor shall obtain and pay for all right-of-way utilization and/or underground utility permit(s) prior to construction.
- D. Orange County Utilities Standards And Construction Specifications Manual Appendix D List of Approved Products is provided at the end of this Specification. The Contractor shall refer to this list when selecting manufacturers for the Lake Eve Pump Station No. 3541 Rehabilitation Project. Any deviation from this list shall be as approved by the Engineer and Owner.

1.02 SERVICES OF MANUFACTURERS' FIELD SERVICE TECHNICIAN

- A. Bid prices for equipment furnished under Divisions 11, 13, 15 and 16 shall include the cost of a competent field service technician of the manufacturers 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. The approved manufacturer's operation and maintenance data as specified in Section 01730 shall be delivered to the Engineer prior to

instructing the Owner's personnel. This supervision may be divided into two or more time periods as required by the installation program or as directed by the Engineer.

- B. After installation of the equipment has been completed 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 cracked 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.
 5. Calibration and adjustment of all related instrumentation and controls.
 6. Energize equipment.
 7. Deficiency correction.
 8. Demonstration of compliance with application performance specification.
- C. Upon completion of this work, the manufacturer's field service technician shall submit, in triplicate, to the Engineer a complete, signed report of the results of his/her inspection, operation, adjustments and tests. The report shall include detailed descriptions of the points inspected, tests and adjustments made, quantitative results obtained if such are specified and suggestions for precautions to be taken to ensure proper maintenance.
- D. 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 prior to the startup and performance demonstration hereinafter specified. The certificate shall indicate date and time instruction was given and names of operating personnel in attendance. This certification shall be submitted on the certification sheet, a sample of which is at the end of this Section.
- E. See the detailed Specifications for additional requirements for furnishing the services of the manufacturer's field service technician.
- F. For equipment furnished under other Divisions, unless otherwise specified, furnish the services of accredited field services technicians of the manufacturer only when some evident malfunction or over-heating makes such services necessary in the opinion of the Engineer.

1.03 OPERATING AND MAINTENANCE DATA

- A. Operating and maintenance data covering all equipment furnished shall be delivered directly to the Office of the Engineer for approval within 60 days of shop drawing approval of each piece of equipment. Data shall be prepared and submitted in full conformance with Section 01730.

Final approved copies of operating and maintenance data shall have been delivered to the Engineer prior to scheduling the instruction period with the Owner.

1.04 INSTALLATION OF EQUIPMENT

- A. Special care shall be taken to ensure proper alignment of all equipment with particular reference to mechanical equipment such as pumps, blowers and electric drives. The units shall be carefully aligned on their foundations by qualified millwrights after their sole 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 foundation alignments have been approved by the manufacturer, 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 and after confirmation of all alignments the sole 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.
- B. All wedges, shims, filling pieces, keys, packing, red on white lead grout, or other materials necessary to properly align, level and secure apparatus in place shall be furnished by the Contractor. All parts intended to be plumb or level must be proven exactly so. Any grinding necessary to bring parts to proper bearing after erection shall be done at the expense of the Contractor.

1.05 SLEEVES AND OPENINGS

- A. Provide all openings, channels, chases, etc and install anchor bolts and other items to be embedded in concrete, as required to complete the work under this Contract, together with those required by subcontractors and shall do all cutting and patching, excepting cutting and patching of materials of a specified trade and as stated otherwise in the following Paragraph.
- B. Coordinate with the subcontractors to provide all sleeves, inserts, hangers, anchor bolts, etc of the proper size and material for the execution of the work. Be responsible for any corrective cutting and refinishing required to make the necessary openings, chases, etc. In no case shall beams, lintels or other structural members be cut without the written approval of the Engineer.

1.06 RELOCATIONS

- A. Be responsible for the relocation of structures, including but not limited to light poles, signs, sign poles, fences, piping, conduits and drains that interfere with the positioning of the work as set out on the Drawings. The cost of all such relocations shall be included in the bid for the project and shall not result in any additional cost to the Owner.

1.07 OBSTRUCTIONS

- A. The attention of the Contractor is drawn to the fact that during excavation at the Project site, the possibility exists of the Contractor encountering various water, chemical, electrical, or other lines not shown on the Drawings. Exercise extreme care before and during excavation to locate and flag these lines so as to avoid damage to the existing lines. Should damage occur to an existing line, repair the line at no cost to the Owner.

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

1.08 PROVISIONS FOR CONTROL OF EROSION

- A. Sufficient precautions in accordance with Section 02270 shall be taken during construction to minimize the run-off of polluting substances such as silt, clay, fuels, oils, bitumen, calcium chloride, or other polluting materials harmful to humans, fish, or other life, into the supplies and surface waters of the State. Control measures must be adequate to assure that turbidity in the receiving water will not be increased more than 10 nephelometric turbidity units (NTU), or as otherwise required by the State or other controlling body, in water used for public water supply or fish unless limits have been established for the particular water. In surface water used for other purposes, the turbidity must not exceed 25 NTU unless otherwise permitted. Special precautions shall be taken in the use of construction equipment to prevent operations which promote erosion.
- B. Erosion and sedimentation control shall conform to the requirements of the Orange County Utilities Standards and Construction Specifications Manual.

1.09 PROVISIONS FOR THE CONTROL OF DUST

- A. Sufficient precautions shall be taken during construction to minimize the amount of dust created. Wetting down the site may be required or as directed by the Engineer to prevent dust as a result of vehicular traffic.

1.10 ARCHITECTURAL COATINGS

- A. Maintain coordination among all Sections (windows, window walls, louvers, doors and frames, etc) requiring PVC and PVF coatings. All coatings shall match to the satisfaction of the Engineer with regard to color and texture. Items rejected by the Engineer shall promptly be removed from the job site.

1.11 ON SITE STORAGE

- A. Attention is invited to special storage requirements and possible charges for noncompliance of on-site storage requirements for materials and equipment as specified in Section 01600.

1.12 VALVE INDICES

- A. Furnish and install tags for all valves, sluice gates and weir gates required on the work. Tags on above ground valves shall be non-corrosive metal or plastic, 2-in in diameter, 19 gauge thick. Buried valve tags shall be secured to a concrete base as shown on the Drawings. Submit to the Engineer for review, two samples of each type of tag proposed and the manufacturer's standard color chart and letter styles. Tags shall have stamped or engraved on them the information shown on the Drawings and the data described herein. Submit to the Engineer for approval no less than 120 days before start-up, a valve schedule containing all valves required for his/her work. The schedule shall contain a list of abbreviations used for each valve, the location, type, a number, words or abbreviations to identify the valve's function and the normal operating

position. The information contained in the valve schedules shall be coded on the tags in a system provided by the Owner. Above ground valve tags shall be furnished with non-corrosive metal wire for attachment thereof. The tag shall not be attached to handwheel or crank operators or any part of the valve which would inhibit operation of the valve.

1.13 DISINFECTION

- A. Clean, disinfect and bacteriologically test and clear in accordance with applicable Florida Department of Health regulations all water supply facilities affected by this project which shall come into contact with raw water, water being treated or treated water prior to placing the facility in operation. The above statement shall apply to both new facilities installed and existing facilities which are to be modified.
- B. Employ a disinfection method approved by the Engineer and Owner and shall fully satisfy the Owner that adequate disinfection has been achieved prior to placing a facility on-line.
- C. The cost of all disinfection work and bacteriological clearance tests shall be included in the prices quoted in the Bid Form.
- D. Disinfection shall be performed in accordance with AWWA C651 and the Florida Waterworks Regulations. Disinfection is required for both new facilities installed, and existing facilities which are modified.

1.14 CONNECTIONS TO EXISTING SYSTEMS

- A. Perform all work necessary to locate, excavate and prepare for connections to the terminus of the existing systems all as shown on the Drawings or where directed by the Engineer. The cost for this work and for the actual connection of the existing mains shall be included in the bid for the project and shall not result in any additional cost to the Owner.

1.15 UTILITY CROSSINGS

- A. It is intended that wherever existing utilities such as water, chemical, electrical or other service lines must be crossed, deflection of the pipe within recommended limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated on the Drawings. However, when in the opinion of the Owner or Engineer this procedure is not feasible he/she may direct the use of fittings for a utility crossing as detailed on the Drawings.

1.16 EXISTING UTILITY PROTECTION

- A. Existing utilities are shown in their approximate locations. Locate and protect all utilities whether shown on Drawings or not.
- B. Contact utility companies at least 48 hours before starting construction so maintenance personnel can locate and protect facilities, if required by the utility company.

1.17 WARRANTIES

- A. All equipment supplied under this Section shall be warranted by the Contractor and the equipment manufacturers for a period of 1 year. Warranty period shall commence on the date of Owner acceptance.
- B. 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 in the machine(s) and the unit(s) restored to service at no expense to the Owner.
- C. Obtain equipment warranties in accordance with Section 01740 from each of the respective suppliers or manufacturers for all the equipment specified under Divisions 11, 13, 15 and 16. The form of warranty is included at the end of this Section.
- D. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. In the event that the manufacturer is unwilling to provide a one year warranty commencing at the time of Owner acceptance, obtain from the manufacturer a two year warranty starting at the time of equipment delivery to the job site. This 2 year warranty shall not relieve the Contractor of the 1 year warranty starting at the time of Owner acceptance of the equipment.

1.18 FINAL GUARANTEE

- A. All work shall be guaranteed by the Contractor for a period of 1 year from and after the date of acceptance of the work by the Owner.
- B. If, within the guarantee period, repairs or changes are required in connection with guaranteed work, which, in the opinion of the Engineer, is rendered necessary as the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the Contract, promptly upon receipt of notice from the Owner and without expense to the Owner, do the following.
 - 1. Place in satisfactory condition in every particular all of such guaranteed work and correct all defects therein.
 - 2. Make good all damage to the building or site, or equipment or contents thereof, which, in the opinion of the Engineer, is the result of the use of materials, equipment or workmanship which are inferior, defective, or not in accordance with the terms of the contract.
 - 3. Make good any work or material, or the equipment and contents of building, structure of site disturbed in fulfilling any such guarantee.
- C. If the Contractor, after notice, fails within 10 days to proceed to comply with the terms of this guarantee, the Owner may have the defects corrected, and the Contractor and his/her surety shall be liable for all expense incurred, provided, however, that in case of an emergency where, in the opinion of the Owner, delay would cause loss or damage, repairs may be started without notice being given to the Contractor and the Contractor shall pay the cost thereof.

- D. All special guarantees or warranties applicable to specific parts of the work as may be stipulated in the Contract Documents or other papers forming a part of this Contract shall be subject to the terms of this paragraph during the first year of life of each such guarantee. All special guarantees and manufacturers' warranties shall be assembled by the Contractor and delivered to the Engineer, along with a summary list thereof, before the acceptance of the Work.

1.19 ARCHEOLOGICAL FINDS

- A. Notwithstanding anything to the contrary herein, in the event any archeological artifacts within the project are discovered during the course of the work, the Owner shall have and retain all right, title, and interest to such artifacts and shall have the further right, during the course of the Contract, to examine or cause to have examined, the site of the work for any such artifacts and to perform or have performed archeological excavations and all other related work to explore for, discover, recover and remove such artifacts from the site of the work. In the event the work or archeological examination and related work delays the Contractor's work, he/she shall be entitled to an extension of time to complete the work equal to the number of days he/she is thus delayed. Such delay shall be considered an excusable delay as defined in the supplementary conditions.

1.20 VOLTAGE RATINGS OF MOTORS

- A. Unless otherwise specified, motors in excess of 1/3 Hp shall be nameplate rated for 460 Volt, 3 Phase, 60 Hz current. Motors of 1/3 Hp or less shall be suitable for operation on 115 Volt, single phase, 60 Hz current.

1.21 POWER FACTOR CORRECTION CAPACITORS

- A. All single and multi speed three phase induction motors 5 Hp and larger shall be furnished with factory supplied power factor correction capacitors.
- B. Capacitors shall be sized by the manufacturers such that over voltage due to self excitation will be prevented and transient torques limited to normal values. Full load power factor shall be corrected to not less than 0.95 where such correction will not violate the provisions of NEC Article 460.
- C. Capacitor enclosures shall be compatible with those specified for their respective motors, i.e., dust-tight for indoor installation in non-hazardous areas and weatherproof for outdoor installations.
- D. Capacitors shall be oil insulated with integral fuse protection and discharge resistor. The insulating medium shall be non-flammable and meet U.S. Environmental Protection Agency Standards.
- E. Capacitors shall be installed under Division 16.

1.22 MAINTENANCE OF EXISTING UTILITY SERVICE AND EXISTING WASTEWATER PUMP STATION OPERATION

- A. Cooperate at all times with the Owner in order to maintain pump station operation with the least amount of interference and interruption possible. Public health and safety considerations shall exceed all others and the Contractor's schedule, plan and work shall, at all times, be subject to alteration and revision if necessary for public health and safety considerations.
- B. Contractor is cautioned that this work is being performed on the site of an operating wastewater pump station. Take whatever precautions are necessary to maintain the flow of wastewater, electrical source, etc, to keep the pump station in operation, where such operation is affected by the work. Should a partial or total shutdown be unavoidable, notify the Owner 72 hours in advance.
- C. In no case will the Contractor be permitted to interfere with any existing service until all materials, supplies, equipment, tools and incidentals necessary to complete the work are on the job site.
- D. The Engineer and the Owner reserve the right to require the Contractor to work 24 hours per day in all cases where interferences with existing utility service may result in health hazards, offensive conditions or serious inconveniences to persons served by the system.
- E. Thirty days prior to any interference with existing water lines, submit to the Engineer his/her proposed method for maintaining service. The submittal shall include text and drawings in sufficient detail to describe the method, a list of equipment to be used, and a schedule for completing the work. No interference with service shall be made until the Engineer approves the method and schedule for completing the work.

1.23 EQUIPMENT DATA LIST

- A. Obtain, prepare and submit a complete, detailed listing of equipment and motor data for all electrical items furnished under this Contract. This listing shall be submitted on Equipment Data Sheets, a sample of which is at the end of this Section.
- B. Submit the Equipment Data List prior to the start-up and performance demonstration hereinafter specified.

1.24 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 resulting electrolysis. The insulating material shall be bituminous impregnated felt, heavy bituminous coatings, nonmetallic separators or washers, or other approved materials.

1.25 DAMAGE ON ACCOUNT OF HIGH WATER

- A. Contractor will hold himself responsible for all damage done to his/her work by heavy rains or floods and he/she shall take all reasonable precautions to provide against damages by building

such temporary dikes, channels, or shoring to carry off storm water as the nature of the work may require.

1.26 TOOLS

- A. Any special tools (including grease guns or other lubricating devices) which may be necessary for the adjustment, operation and maintenance of any equipment shall be furnished with the respective equipment.

1.27 GREASE, OIL, FUEL, ELECTRICAL POWER AND TESTING EQUIPMENT

- A. All grease, oil and fuel required for testing of equipment shall be furnished with the respective equipment. Electric power and all equipment and tools required for testing of equipment shall be furnished by the contractor the cost of which shall be included in the prices quoted in the Bid Form. The Owner shall be furnished with a year's supply of required lubricants including grease and oil of the type recommended by the manufacturer with each item of equipment supplied under Divisions 11, 13, 14, 15 and 16.

1.28 EMERGENCY PHONE NUMBERS AND ACCIDENT REPORTS

- A. Emergency phone numbers (fire, medical, police) shall be posted at the Contractor's phone and its location known to all.
- B. Accidents shall be reported immediately to the Engineer by messenger or phone.
- C. All accidents shall be documented and a fully detailed written report submitted to the Engineer after each accident.

1.29 STARTUP AND ACCEPTANCE OF THE PUMP STATION AND RELATED SYSTEMS

A. General Requirements

- 1. Successfully execute the step-by-step procedure of startup and performance demonstration specified hereinafter.
- 2. The startup and performance demonstration shall be successfully executed prior to substantial completion and acceptance by the Owner of the Pump Station 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 the work week of Monday through Friday, unless otherwise specified.

B. Preparation for Startup

- 1. Upon completion of the pump station facilities and all its related systems, all chemical systems, and sewage pipe lines, shall be filled and flushed with non-potable water and hydraulically checked for leaks, cracks, and defects. All sumps, tanks, basins, chambers

and wet wells which under normal operating conditions will contain water, wastewater, chemicals, or sludge shall also be hydraulically checked using non-potable water for leaks, cracks, and defects. Items to be tested include but are not necessarily limited to: the wetwell, submersible pumps, odor control system and components, generator, diesel fuel tank, and mixers.

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 purged as required. All sumps, tanks, basins, chambers, wet wells, and pipe lines which are hydraulically checked shall be drained and returned to their original condition once the non-potable water testing is complete.
3. All instruments and controls shall be calibrated through their full range. Any other adjustments required for proper operation of all instrumentation and control equipment shall be made.
4. Perform all other tasks needed for preparing and conditioning the pump station for proper operation.
5. No testing or equipment operation shall take place until it has been verified by the Engineer that all specified safety equipment has been installed and is in good working order.
6. No testing or equipment operation shall take place until it has been verified by the Engineer that all lubricants, tools, maintenance equipment, spare parts, and approved equipment operation and maintenance manuals have been furnished as specified.

C. Start-up With Raw Sewage and Final Performance Demonstration

1. After preparations for start-up is complete, make the appropriate connections and divert sewage to the new pump station facilities. Demonstrate 7 consecutive 24 hour days of successful operation of the facility with raw sewage, as a prerequisite of substantial completion and acceptance.
2. In the event of failure to demonstrate satisfactory performance of the facility on the first or any subsequent attempt, all necessary alterations, adjustments, repairs and replacements shall be made. 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.
3. Owner will furnish all operating personnel (other than vendor's or subcontractor's service personnel) needed to operate equipment during the final raw sewage performance test period; however, said personnel will perform their duties under 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.

4. At no time during performance tests shall the Contractor allow the facility to be operated in a manner which subjects any equipment to conditions that are more severe than the maximum allowable operating conditions for which the equipment was designed.
5. Startup with sewage and the final performance demonstration shall not begin until all new pump station 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 prior to the startup with raw sewage. All valve tagging as specified in this Section shall also be complete prior to this startup.

1.30 BYPASS PUMPING

- A. The Contractor shall be responsible for providing all labor, equipment, power, material and supplies and performing all operations required to bypass pump when necessary. The Contractor shall provide all pumps, piping, plugs, generators, fuel, and other equipment necessary to accomplish bypass pumping; perform all construction and installation of pumping equipment and accessories; remove equipment and accessories when no longer needed; comply with all sediment and erosion control requirements; obtain all permit; pay all costs; and perform complete restoration of all existing facilities and areas disturbed to conditions equal to or better than pre-construction conditions and to the satisfaction of the Engineer. The Contractor shall provide all temporary connections necessary to perform bypass operations.
- B. Bypass Pumping Locations:
 1. The Contractor should be able to utilize the existing pump station while constructing portions of the new Work; however, the Contractor shall provide all bypass pumping necessary in order to perform the Work, meeting the requirements of this Section. Bypass pumping will be needed to pump out of the existing manhole(s) and/or wetwell and into the existing 36-inch FM located on the north side of the site running north/south. The flow and head conditions necessary for bypass pumping can be derived from the system curve provided by OCU attached. Grade elevation at the site is roughly 78 ft NAVD. Please note that head information provided is based on a system curve at the existing submersible pump location. Losses do not include change in head in the wetwell/manhole, head loss in the suction pipe and head loss in the discharge pipe upstream of the temporary connection.
- C. Violations resulting from sewage spills or overflows, that occur as a result of work activities or the failure of the bypass pumping system to deliver the specified flow and head, shall be the sole responsibility of the Contractor. Should any liquid or solid matter from the sewer collection system be spilled, discharged, leaked or otherwise deposited to the open environment as a result of the Contractor's work activities or flow control operations, he shall be responsible for all cleanup and disinfection of the affected area and all costs associated with same. If any spill or overflow occurs, the Cop shall immediately notify the Owner and perform all required cleanup operations at no additional cost to the Owner.
- D. The bypass system shall meet the requirements of all codes and regulatory agencies having jurisdiction.

- E. The Contractor shall submit to the Engineer a detailed plan and description outlining all provisions and precautions that the Contractor shall take regarding the handling of wastewater flows during bypass pumping operations. The plan shall be submitted to the Owner for review and approval at least 30 days prior to commencing any bypass pumping operation. The plan must be specific and shall include, but not be limited to, the following details:
1. Schedule(s) for installation and maintenance of bypass pumping system.
 2. Staging areas and layout for pumps, piping, equipment and appurtenances.
 3. Bypass pump sizes, flow and discharge head capacities, and quantity of each size pump to be on site.
 4. Power requirements and sources.
 5. Calculations of static lift, friction losses, and flow velocity (pump curves showing pump-operating range shall be submitted).
 6. Plans for modification and restoration of existing manholes or structures used as a suction well.
 7. Force main tapping, stopping and/or plugging methods.
 8. Size, length, material, location and method of installation for suction and discharge piping, piping manifolds, valves, vents, and appurtenances.
 9. Sections showing suction and discharge pipe depth, embedment, and backfill.
 10. Proposed methods of temporary shoring for force main access excavations.
 11. Method of noise control for each pump and/or generator.
 12. Standby power generator size and location, if required.
 13. Thrust and restraint block sizes and locations.
- F. The Contractor shall provide the necessary stop/start and level controls for the bypass pumping system.
- G. The Contractor shall include one stand-by pump of each size to be maintained on site. Back-up pumps shall be on-line, isolated from the primary system by a valve.
- H. Discharge Piping: In order to prevent the accidental spillage of flows, all discharge systems shall be constructed of solid pipe with positive, restrained joints. Only materials that withstand 150 psi pressures and greater and are suitable for contact with domestic sanitary sewage may be used. Under no circumstances will aluminum "irrigation" type piping or glued PVC pipe be allowed. Discharge hose is not permitted for this project. The bypass pumping system shall be 100% watertight.

- I. The Contractor is responsible for locating any existing utilities in the area the Contractor selects to locate the bypass pipelines. The Contractor shall locate his bypass pipelines to minimize any disturbance to existing utilities and shall obtain approval of the pipeline locations from the Owner. All cost associated with relocating utilities and obtaining all approvals shall be paid by the Contractor.
- J. When working inside or near a sewer structure, gravity sewer, or force main, the Contractor shall exercise caution and comply with OSHA requirements for working in the presence of sewer gases, combustible or oxygen-deficient atmospheres, and confined spaces.
- K. Pumps and equipment shall be continuously monitored by the Contractor during the periods that bypass pumping is in operation.
- L. Engines shall be equipped in a manner to keep noise levels below 65dBA.
- M. When flow in a sewer line is plugged, blocked or bypassed by the Contractor, he shall take sufficient precautions to protect the public health and to protect the sewer lines from damage that might result from sewer surcharging. Further, the Contractor shall take precautions to ensure that sewer flow control operations do not cause flooding or damage to public or private property being served by the sewers involved. The Contractor shall be responsible for any damage resulting from his flow control operations.
- N. Any liquid or solid matter, which is bypass pumped from the sewer collection system, shall be discharged to a force main, another sewer manhole, or appropriate vehicle or container only. No such liquid or solid matter shall be discharged, stored or deposited to the open environment. The Contractor shall protect all pumps, conduit, and other equipment used for bypass from traffic and work vehicles.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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WARRANTY FOR EQUIPMENT ITEM

LOCATION OF PROJECT: _____

OWNER:

PROJECT NUMBER:

EQUIPMENT ITEM:

SECTION NO. / ITEM NO.:

SUPPLIER:

SUPPLIER'S ADDRESS: _____

SUPPLIER'S REFERENCE NO.:

The undersigned guarantees that the above equipment is of good merchantable quality, free from defects in material or workmanship, fully meets the type, quality, design and performance requirements defined in the Contract Documents of the above project, and that the equipment will in actual operation satisfactorily perform the functions for which installed.

The undersigned agrees to repair, replace, or otherwise make good, any defect in workmanship or materials in the above described equipment which may develop within a period of one year from the date of final acceptance by the Owner of the above named project.

COMPANY _____

COMPANY ADDRESS _____

BY _____

TITLE _____

SIGNED _____

DATE _____

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EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION
TESTING AND INSTRUCTION

Client _____

Project _____

Contract No. _____

CDM No. _____

EQUIPMENT SPECIFICATION SECTION _____

EQUIPMENT DESCRIPTION _____

I _____, Authorized representative of
(Print Name)

(Print manufacturer's name)

hereby CERTIFY that _____
(Print equipment name & model w/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 unit(s)
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 Pump Station Operating Personnel have received classroom and hands on instruction on the operation, lubrication, and maintenance of the subject equipment and prepared to assume normal operational responsibility for the equipment:

_____ DATE: _____

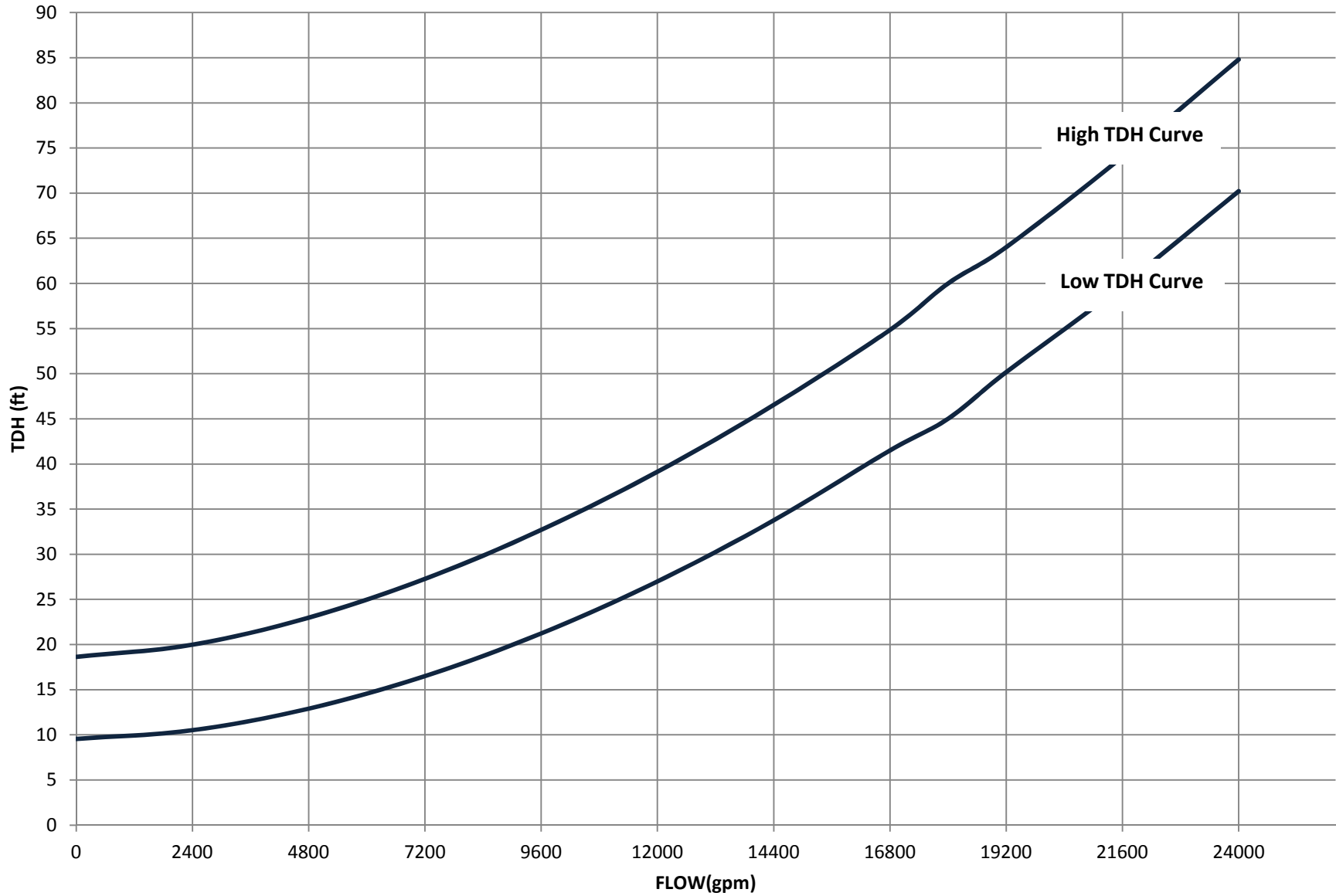
_____ DATE: _____

_____ DATE: _____

_____ DATE: _____

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Lake Eve Pump Station No. 3541 System Curves



Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Air Release	ARV Enclosure	All ARV above ground enclosures shall be vented with tamper proof locking device						
		Water Plus Polyethylene Enclosure	131632 H30-B	Blue 44" Tall	131632 H30-P	Pantone 44"	131632 H30-G	Green 44" Tall
			171730 H40-B	Blue 30" Tall	171730 H40-P	Pantone 30"	171730 H40-G	Green 30" Tall
		Hot Box Vent Guard Fiberglass Enclosure	AVG2036 Encl	Blue 36" Tall	AVG2036 Encl	Pantone 36" Tall	AVG2036 Encl	Green 36" Tall
			GP3232 Base		GP3232 Base		GP3232 Base	
			AVG2041 Encl	Blue 41" Tall	AVG2041 Encl	Pantone 41" Tall	AVG2041 Encl	Green 41" Tall
		GP3232 Base		GP3232 Base		GP3232 Base		
	Safety-Guard/Hydro Guard	15100 Encl	Blue 34" Tall	15100 Encl	Pantone 34" Tall	15100 Encl	Green 34" Tall	
	Air Release Valves	Air Release Valves shall be Combination Type, 316 SS						
		ARI	D-040SS	Combination	D-040SS	Combination	D-020 (SS)	Combination
H-TEC		NA	NA	NA	NA	986 (316SS)	Combination	
Vent-O-Mat		Series RBX DN50	2"	Series RBX DN50	2"	RGX series		
ARV Vault	Air Release Valve Frame and Cover							
	US Foundry	NA	NA	NA	NA	USF 7665-HH-HJ		
Blow Off	Auto Blow Off	Automatic Blow Off Valve						
		Hydro Guard	HG-1 Standard Unit	Automatic	NA	NA	NA	NA
	Blow Off Valve	Blow Off Valve - Fits standard 5-1/4 inch Valve Box						
		Kupferle Foundry Co	Truflo Series TF #550		Truflo Series TF #550		NA	NA
	Water Plus Corp	The Hydrant Plus Series VB 2000B		The Hydrant Plus Series VB 2000B		NA	NA	
Casing Seals / Spacers	Casing End Seals	Casing End Seals. Annular space between pipe and steel casing shall be brick and mortar with end seals to secure ends.						
		Advance Products	Model AC and AW		Model AC and AW		Model AC and AW	
		BWM Company	Model WR and PO		Model WR and PO		Model WR and PO	
		Cascade Water Works	Model CCES		Model CCES		Model CCES	
		CCI Pipeline	Model ESW and ESC		Model ESW and ESC		Model ESW and ESC	
		Pipeline Seal & Insulator, Inc (PSI)	Model C and W		Model C and W		Model C and W	
		Power Seal	Model 4810ES		Model 4810ES		Model 4810ES	

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Casing Seals / Spacers	Casing spacer	Casing spacers shall be a min. 8-inches wide for pipe 12" Dia or less or min. 12-inches wide for pipe 16 or greater , shall have a minimum 14 gauge 304 stainless steel shell/band, minimum 10 gauge 304 reinforced risers; minimum thickness of 0.090 EPDM or PVC interior liners, glass reinforces polymer or ultra high molecular weight polyethylene and 304 stainless bolts, nuts and washers.						
		Advance Products	SSI8 / SSI12		SSI8 / SSI12		SSI8 / SSI12	
		BWM Company	BWM-SS-8 / SS-12		BWM-SS-8 / SS-12		BWM-SS-8 / SS-12	
		Cascade Water Works	Series CCS 8" / 12"		Series CCS 8" / 12"		Series CCS 8" / 12"	
		CCI Pipeline	Model CCS8 / CSS12		Model CCS8 / CSS12		Model CCS8 / CSS12	
		Pipeline Seal & Insulator, Inc (PSI)	Series S8G-2 / S12G-2		Series S8G-2 / S12G-2		Series S8G-2 / S12G-2	
Coatings	Exterior Coatings for Exposed Metal Assets	Coatings: Aerial pipe, hydrants, above ground piping, fittings, valves and Appurtenances - System 1 Zinc / Urethane / Fluoropolymer application and color code per Section 3119 Coatings & Linings. Coating shall not be in contact with Potable water unless NSF 61 approved.						
		Carboline	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils
			Carbothane 133 HB	3.0 -5.0 mils	Carbothane 133 HB	3.0 -5.0 mils	Carbothane 133 HB	3.0 -5.0 mils
			Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils
		Tnemec	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils
			Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils
			EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils
	Hydroflon Series 700		2.0 - 3.0 mils	Hydroflon Series 700	2.0 - 3.0 mils	Hydroflon Series 700	2.0 - 3.0 mils	
	Exterior Coatings for Exposed Metal Assets	Coatings: Aerial pipe, hydrants, above ground piping, fittings, valves and Appurtenances - System 2 Zinc / Epoxy / Urethane application and color code per Section 3119 Coatings & Linings. Coating shall not be in contact with Potable water unless NSF 61 approved.						
		Carboline	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils	Carbozinc 621	3.0 - 8.0 mils
			Carboguard 60	4.0 -6.0 mils	Carboguard 60	4.0 -6.0 mils	Carboguard 60	4.0 -6.0 mils
			Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils	Carboxane 950	2.0 - 3.0 mils
		Tnemec	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils	Zinc Series 90-97	2.5 - 3.5 mils
			Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils	Typoxy Series 27WB	4.0 -14.0 mils
Hi-Build Epoxoline II			4.0 - 10.0 mils	Hi-Build Epoxoline II	4.0 - 10.0 mils	Hi-Build Epoxoline II	4.0 - 10.0 mils	
Series N69			Series N69		Series N69			
PPG / Ameron	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils	EnduraShield Series73	2.0 - 3.0 mils		
	Amercoat 68HS	Min 3.0 mils	Amercoat 68HS	Min 3.0 mils	Amercoat 68HS	Min 3.0 mils		
	Amercoat 385	4.0 - 6.0 mils	Amercoat 385	4.0 - 6.0 mils	Amercoat 385	4.0 - 6.0 mils		
	Amercoat 450H	2.0 - 3.0 mils	Amercoat 450H	2.0 - 3.0 mils	Amercoat 450H	2.0 - 3.0 mils		

APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Fittings	Fittings	Ductile Iron Fittings C153 SSB / C110 FLG: (Water & Reclaimed Water fittings shall cement lined or holiday free fusion bonded epoxy lined) (Wastewater fittings interior shall be Protecto 401 and holiday free)						
		American	30" & up	FBE / Cement	30" & up	FBE / Cement	30" & up	Protecto 401
		Sigma		FBE / Cement		FBE / Cement		Protecto 401
		Star		FBE / Cement		FBE / Cement		Protecto 401
		Tyler Union & Clow		FBE / Cement		FBE / Cement		Protecto 401
Flow Meter	Flow Meter	Flow Meters With Replaceable Sensors						
		EMCO	NA	NA	NA	NA	Unimag 4411E	
Hydrants	Hydrants	Hydrants Shall open left, 1-1/2 Pentagon operating nut, NST hose & pumper thread, rotate 360 degrees, closed drains, epoxy on shoe in & out and 304 SS nuts & bolts below ground.						
		American Flow Control	B-84-B (6 inch)		NA	NA	NA	NA
		Clow	Medallion 2545		NA	NA	NA	NA
		Mueller	Super Centurion 250		NA	NA	NA	NA
Joint Restraints	Ductile iron pipe MJ Restraints	Mechanical Joint Wedge-action Restraining Gland, Epoxy Coated Restrain ductile iron pipe to mechanical joint fittings, pipe and appurtenances.						
		EBAA Iron Inc	Megalug Series 1100		Megalug Series 1100		Megalug Series 1100	
		Ford / Uni-Flange	UFR-1400		UFR-1400		UFR-1400	
		Sigma	OneLok Series SLD/SLDE		OneLok Series SLD/SLDE		OneLok Series SLD/SLDE	
		Smith Blair	Cam Lok Series 111		Cam Lok Series 111		Cam Lok Series 111	
		Star	Star Grip Series 3000		Star Grip Series 3000		Star Grip Series 3000	
		Tyler Union	TufGrip Series TLD		TufGrip Series TLD		TufGrip Series TLD	
	DIP Bell Joint Restraints (4" - 12") (New & Existing)	Bell Joint Restraints for Ductile Iron Pipe (4"-12") (New & Existing) - All restraints split serrated on bell and spigot ends. Pipe 16" and greater shall have restraint gaskets or locking bells. (Wastewater only for restraint of existing DIP FM)						
		EBAA Iron Inc	Tru-Dual Series 1500TD		Tru-Dual Series 1500TD		Tru-Dual Series 1500TD	
		Ford / Uni-Flange	Uni-Flange Series 1390C		Uni-Flange Series 1390C		Uni-Flange Series 1390C	
		Sigma	PV-Lok Series PWP-C		PV-Lok Series PWP-C		PV-Lok Series PWP-C	
		Smith Blair	Bell-Lock Series 165		Bell-Lock Series 165		Bell-Lock Series 165	
		Star	StarGrip Series 3100S		StarGrip Series 3100S		StarGrip Series 3100S	
DIP Bell Joint Restraints (16" & Greater)	Ductile Iron Pipe Bell Joint Restraints for Ductile Iron Pipe (16" & Greater) - All restraints shall have a split back-up ring for the bell and a serrated or wedge action gland for the spigot end. New installation for water & reclaimed water piping 16" and greater shall have restraint gaskets or locking bells.							
	EBAA Iron Inc	Series 1100HD	Existing Only	Series 1100HD	Existing Only	Series 1100HD	Existing Only	
	Sigma	Series SSLDH	Existing Only	Series SSLDH	Existing Only	Series SSLDH	Existing Only	
	Star	Series 3100S	Existing Only	Series 3100S	Existing Only	Series 3100S	Existing Only	

APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Joint Restraints	Ductile iron pipe Bell Joint Restraint Gaskets and Locking Bell (4" & Above)	Bell Joint Restraint Gaskets and Locking Bell (4" & Above) Stainless Steel locking wedges built into the gasket-rubber. ANSI/AWWA C111/A21.11 Standard for Rubber-Gasket Joints for Ductile Iron Pressure Pipe. Ductile Iron Bell Joint Restraint for Push-On Pipe- Locking bell joint system that prevents joint separation and allows for joint deflection. Bells shall be painted red to verify restrained gasket.						
		American	Fast Grip Gasket	Gasket	Fast Grip Gasket	Gasket	NA	NA
			Flex-Ring Joint	Bell Lock	Flex-Ring Joint	Bell Lock	NA	NA
			Lok-Ring Joint	Bell Lock	Lok-Ring Joint	Bell Lock	NA	NA
		Griffin	Talon RJ Gasket	Gasket	Talon RJ Gasket	Gasket	NA	NA
			Snap-Lok	Bell Lock	Snap-Lok	Bell Lock	NA	NA
			McWane Inc. DI Pipe Group	Sure Stop 350 Gasket	Gasket	Sure Stop 350 Gasket	Gasket	NA
		Thrust-Lock		Bell Lock	Thrust-Lock	Bell Lock	NA	NA
		TR-Flex		Bell Lock	TR-Flex	Bell Lock	NA	NA
		Super-Lock		Bell Lock	Super-Lock	Bell Lock	NA	NA
		US Pipe	Field Lok 350 Gasket	Gasket	Field Lok 350 Gasket	Gasket	NA	NA
			Field Lok Gasket	Gasket	Field Lok Gasket	Gasket	NA	NA
			TR-Flex	Bell Lock	TR-Flex	Bell Lock	NA	NA
			HP Lok Restraint Joint	Bell Lock	HP Lok Restraint Joint	Bell Lock	NA	NA
	SS to DIP Transition Restraint	SS to DIP Transition Restraint -Flanged stainless steel pipe from Wetwell to Valve box restrained joint transition (epoxy coated, SS hardware) Flg x PE RJ.						
		EBAA Iron Inc	NA	NA	NA	NA	Megaflange 2100	
		Sigma	NA	NA	NA	NA	SigmaFlange with One Lock SLDE	
		Smith Blair	NA	NA	NA	NA	911 Flange - Lock Restrained FCA	
	PVC Pipe MJ Restraints	Mechanical Joint Wedge-action Restraining Gland, Epoxy Coated Restrain PVC pipe to mechanical joint fittings, and appurtenances.						
		EBAA Iron Inc	Mega-lug Series 2000PV		Mega-lug Series 2000PV		Mega-lug Series 2000PV	
			NA	NA	NA	NA	Megalug Series 2200 (42"-48")	
		Ford / Uni-Flange	UFR 1500 Series		UFR 1500 Series		UFR 1500 Series	
		Sigma	One Lok Series SLC/SLCE		One Lok Series SLC/SLCE		One Lok Series SLC/SLCE	
		Smith Blair	Cam Lok Series 120		Cam Lok Series 120		Cam Lok Series 120	
		Star	Star Grip Series 4000		Star Grip Series 4000		Star Grip Series 4000	
	Tyler Union	TufGrip Series TLP		TufGrip Series TLP		TufGrip Series TLP		
	PVC Bell Joint Restraints (4" - 12") (New & Existing)	PVC Bell Joint Restraints: PVC pipe Split Serrated on Bell End and Spigot End. (4" - 12") (New & Existing)						
		EBAA Iron Inc	Tru-Dual Series 1500TD		Tru-Dual Series 1500TD		Tru-Dual Series 1500TD	
Ford / Uni-Flange		Uni-Flange Series 1390		Uni-Flange Series 1390		Uni-Flange Series 1390		
Sigma		PV-Lok Series PWP		PV-Lok Series PWP		PV-Lok Series PWP		
Smith Blair		Bell-Lock Series 165		Bell-Lock Series 165		Bell-Lock Series 165		
Star		Series 1100C		Series 1100C		Series 1100C		
Tyler Union		TufGrip 300C		TufGrip 300C		TufGrip 300C		

APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Joint Restraints	PVC Bell Joint Restraints (16" & Greater)	PVC Bell Joint Restraints: (16" & Greater) PVC pipe Split Serrated on Bell End and Spigot End. Water & Reclaimed Water Existing pipe only. Wastewater shall be new and existing pipe.						
		Ford / Uni-Flange	Series 1390	Existing Only	Series 1390	Existing Only	Series 1390	
		JCM	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	Existing Only	Sur-Grip Series 621	
		Sigma	PV-Lok PWP	Existing Only	PV-Lok PWP	Existing Only	PV-Lok PWP	
		Smith Blair	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	Existing Only	Bell-Lock Series 165	
		Star	Series 1100C	Existing Only	Series 1100C	Existing Only	Series 1100C	
Pipe	PVC C900 DR 18 Bell & Spigot (4" - 12")	C900 Bell & Spigot PVC Pipe: 4 to 12-inch - AWWA C-900, Minimum DR18 for Water, Reclaimed and Wastewater. DR14 for Fire Lines. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.						
		Certaiteed 4" to 12"	Certa-Lok C900/RJ	Blue	Certa-Lok C900/RJ	Pantone Purple	Certa-Lok C900/RJ	Green
		Diamond Plastics Corp	C-900	Blue	C-900	Pantone Purple	Diamond C900	Green
		Ipex Inc	C-900 Blue Brute	Blue	C-900	Pantone Purple	C900 Blue Brute	Green
		JM Eagle	C-900	Blue	C-900	Pantone Purple	C-900	Green
		National Pipe & Plastics Inc	C-900 Dura- Blue	Blue	C-900	Pantone Purple	C-900 Pipe	Green
		North American Pipe Corp (NAPCO)	C-900	Blue	C-900	Pantone Purple	C-900	Green
		Sanderson Pipe Corp	C-900	Blue	C-900	Pantone Purple	C-900	Green
	PVC C905 DR 18 Bell & Spigot 16" and Larger	C905 Bell & Spigot PVC Pipe 16" and Larger: AWWA C-905, Minimum DR18 for all Force Mains up to 24". Minimum DR21/DR25 for 30" and greater. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.						
		Certaiteed 16"	NA	NA	NA	NA	Certa-Lok C905/RJ	NA
		Diamond Plastics Corp	NA	NA	NA	NA	Trans-21 DR18	Green
		Ipex Inc	NA	NA	NA	NA	IPEX Centurion	Green
		JM Eagle	NA	NA	NA	NA	C905 Big Blue	Green
National Pipe & Plastics Inc		NA	NA	NA	NA	C905	Green	
HDPE C906 DR11	HDPE Pipe DR11 AWWA C906 shall be Ductile Iron Pipe Size, PE 3408/3608/4710 DIPS manufactured in accordance with ASTM F-714 and listed with NSF. Pipe shall be marked in accordance with either AWWA C901,AWWA C906. Compression type connections are not acceptable in new installations. Pipe joints shall be butt fusion or electro-fusion with flange or adapter. All HDPE shall be color coded to the Utility. Color identifications are in accordance with the APWA/ULCC Uniform Color Code. Manufacturers shall be members in good standing with PPI to maintain approval status.							
	JM Eagle	HDPE	DR11 Blue	HDPE	DR11 Pantone	HDPE	DR11Green	
	Performance Pipe(Chevron)	Driscoplex 4000	DR11 Blue	Driscoplex 4000	DR11 Pantone	Driscoplex 4300	DR11 Green	
	PolyPipe, Inc.	EHMW Poly Pipe	DR11 Blue	EHMW	DR11 Pantone	EHMW	DR11Green	

APPENDIX D

LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pipe	Ductile Iron Pipe	Ductile iron/Cast iron: (4" to 12" = Class 350, 16" to 24" - Class 250, 30" to 64" = Class 200). Water and Reclaimed water shall be cement lined. Wastewater Piping shall be Protecto 401 and Holiday Free. Exterior coatings as specified. Wastewater DIP piping shall be for pump station piping only. Manufacturers shall be members in good standing with DIPRA to maintain approval status.						
		American	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		Griffin	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		McWane Inc. DI Pipe Group	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
		US Pipe	Cement Lined	Blue	Cement Lined	Pantone Purple	Protecto 401	Pump Station
Sample	Sample Station	Sample Stations - Bacteriological Sample Station with built in flush system, all internal piping to be 2", brass and includes lockable green enclosures.						
		Safety-Guard	SG-BSS-05 pedestal #77	green enclosure	NA	NA	NA	NA
		Water Plus Corp	Model 5000	green	NA	NA	NA	NA
Services	Brass Service Saddles	Brass Service Saddles for 1" & 2" water & reclaimed water services on 4" through 12" Mains - Service saddles can be hinge or bolt controlled OD saddles to be used on C-900 and existing IPS OD PVC pipe.						
		Ford	Series S-70, S-90	4"-12"	Series S-70, S-90	4"-12"	NA	NA
		AY McDonald	Model 3891 / 3895,3801 / 3805	4"-12"	Model 3891 / 3895,3801 / 3805	4"-12"	NA	NA
		Mueller	Series S-13000/H-13000	4"-12"	Series S-13000/H-13000	4"-12"	NA	NA
	Services	Service Saddles	Service Saddles for 1" (CC) & 2" (Iron pipe threads) Water & Reclaimed Water services on mains greater than 12". Service saddles for 2" taps (iron pipe threads) on 4" mains and greater for Waste Water. : Epoxy or nylon coated stainless steel 18-8-type 304 double straps, controlled O.D. saddles to be used on C-900 / C905 or DI for all 1-in and -2in taps on pipes over 12in.					
Ford			Series FC202	16" & greater	Series FC202	16" & greater	Series FC202	4" & greater
JCM			Series 406	16" & greater	Series 406	16" & greater	Series 406	4" & greater
Mueller			DR2S	16" & greater	DR2S	16" & greater	DR2S	4" & greater
Romac			Series 202NS	16" & greater	Series 202NS	16" & greater	Series 202NS	4" & greater
Smith Blair			Series 317	16" & greater	Series 317	16" & greater	Series 317	4" & greater
Services	Service Saddles for HDPE	Service Saddles for 1" (CC) & 2" (Iron Pipe threads) Water and Reclaimed Water Services: Epoxy or nylon coated stainless steel 18-8-type 304 double straps, controlled O.D. saddles to be used on HDPE for all 1-in and -2in taps. Taps to HDPE pipe shall be approved on a case by case basis.						
		Ford	Series FCP202		Series FCP202		Series FCP202	
		Romac	Series 202N-H		Series 202N-H		Series 202N-H	
		Smith Blair	Series 317-1 for HDPE		Series 317-1 for HDPE		Series 317-1 for HDPE	
Corporation	Stops Ball Type	Corporation Stops Ball Type (1-inch with AWWA taper C threads only/pack joint outlet for CTS) 2" Corporation Stop Ball Type shall be 2" MIP X FIP threads.						
		Ford	FB1000, FB1700-7		FB1000, FB1700-7		FB1700-7	2" ARV
		AY McDonald	4701B-22, 3149B2		4701B-22, 3149B2		3149B2	2" ARV
		Mueller	P25008, B-20046		P25008, B-20046		B-20046	2" ARV

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Services	Curb Stops	Curb Stops - Straight Valves: Ball type compression 2" cts O.D. tubing by 2" FIP						
		Ford	B41-777W		B41-777W		NA	NA
		AY McDonald	6102W-22		6102W-22		NA	NA
		Mueller	P25172		P25172		NA	NA
	Curb Stops	Curb Stops - Straight Valves: ball type compression x compression						
		Ford	B44-444W		B44-444W		NA	NA
		AY McDonald	6100W-22		6100W-22		NA	NA
		Mueller	P25146		P25146		NA	NA
	PE tubing	Polyethylene tubing: AWWA C901. UV protection (SDR-9) 1-inch and 2-inch only. PE 3408 / PE 4710						
		Charter Plastics	Blue Ice		Lav Ice		NA	NA
		Endot	Endopure Blue		Endocore Lavender		NA	NA
		JM Eagle	Pure-Core		NA	NA	NA	NA
Line Stops	Line Stops							
	JCM							
	Romac							
	Smith Blair							
Tapping Sleeves and Valves	Tapping Sleeves	Tapping Sleeves: (Mechanical joint for taps on cast iron, ductile iron, PVC & AC pipe, including size on size) with stainless steel nuts and bolts.						
		American Flow Control	Series 2800		Series 2800		Series 2800	
			Series 1004		Series 1004		Series 1004	
		Clow	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC	Series F-5205	DIP/PVC
			Series F-5207	A/C Pipe	Series F-5207	A/C Pipe	Series F-5207	A/C Pipe
		JCM	Series 414	FBE	Series 414	FBE	Series 414	FBE
		Mueller	Series H-615	DIP/PVC	Series H-615	DIP/PVC	Series H-615	DIP/PVC
			Series H-619	A/C Pipe	Series H-619	A/C Pipe	Series H-619	A/C Pipe
Smith Blair	Style 623	FBE	Style 623	FBE	Style 623	FBE		
Tapping Valves: 12" and smaller	Tapping Valves: 12" and smaller - Tapping Valves shall be furnished with an alignment lip and installed in the vertical position for Water and Reclaim Water. Wastewater shall be installed horizontally and abandoned in the open position. Tapping valves shall be resilient seated only and meet the requirements of AWWA C509 or C515							
	American Flow Control	Series 2500	Alignment Lip	Series 2500	Alignment Lip	Series 2500	Alignment Lip	
	Clow	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip	Series F-6114	Alignment Lip	
	Mueller	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip	Series T2360 (4"-12")	Alignment Lip	

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LIST OF APPROVED PRODUCTS - TRANSMISSION SYSTEMS

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Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Tapping Sleeves and Valves	Tapping Valves: 16" and Larger	Tapping Valves: 16" and Larger - Tapping valves shall be furnished with an alignment lip and be installed in the vertical position for Water and Reclaimed Water. No tapping valve shall be installed horizontally for Water and Reclaim Water unless approved by the engineer. Tapping Valves 16" and larger AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a spur gear actuator unless noted by the engineer. All tapping valves above 24" shall be furnished with NPT pipe plugs for flushing the tracks when valves are installed horizontally. Tapping valves for Wastewater shall be installed horizontally and abandoned in open position.						
		American Flow Control	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port	Series 2500	Alignment Lip & flushing port
		Clow	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port	Series F-6114	Alignment Lip & flushing port
		Mueller	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port	Series T2361 (14"&up)	Alignment Lip & flushing port
Valves	Butterfly Valve 42" and Above	Butterfly Valves 42"and above. AWWA C504. Actuators input torques based on 150 psi valve pressure and 16 fps velocity with a maximum input of 80 ft-lb on 2" nuts and shall withstand 250 ft-lbs. Valve seats shall be leak-tight in both directions at 150 psi.						
		Clow	Style #1450		Style #1450		NA	NA
		Dezurik	BAW		BAW		NA	NA
		Mueller / Pratt	LINSEAL III / Groundhog		LINSEAL III / Groundhog		NA	NA
	Check Valves	Valves (Check) 4-inch and Larger (8 mil epoxy lined)						
American Flow Control		NA		NA		Series 600 or 50 line		
Clow / M&H / Kennedy		NA		NA		106		
Gate Valves 4" - 12"	Gate Valves 12" and smaller - resilient seated only AWWA C509 or C515. Valve seat shall be leak-tight in both directions at 150 psi.							
	American Flow Control	Series 2500		Series 2500		NA	NA	
	Clow	Series F-6100		Series F-6100		NA	NA	
	Mueller	Series A-2360		Series A-2360		NA	NA	
Gate Valves (Vertical) 16" and Up	Gate Valves 16" and larger (Vertical Installation) AWWA C515 resilient seated only (16" and 24" no gearing required) above 24" shall be installed vertically with a gear actuator unless noted by the engineer. Valve seat shall be leak-tight in both directions at 150 psi.							
	American Flow Control	Series 2500		Series 2500		NA	NA	
	Clow	Series F-6100		Series F-6100				
	Mueller	Series A-2361		Series A-2361		NA	NA	

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater			
			Model #	Comments	Model #	Comments	Model #	Comments		
Valves	Plug Valves	Plug Valves - Bi-directional, MJ & Flanged (min. 8mil fusion bonded epoxy with stainless steel bolts), gear operator to be sized for rated pressure of the valve. Valves 4"-20" shall be 80% Full Port and valves 24" and greater shall be minimum of 70% full port. Valve shall be factory tested to minimum 100 PSI in both directions.								
		Clow	NA	NA	NA	NA	F-5412 FLG	4" & up		
			NA	NA	NA	NA	F-5413 MJ	4" & up		
		Dezurik	NA	NA	NA	NA	Series PEF or PEC	4" & up		
		Millikan / Pratt	NA	NA	NA	NA	Eccentric / Ballcentric	4" & up		
			NA	NA	NA	NA	5600 or 5800 (FLG)	4" & up		
Val-Matic	NA	NA	NA	NA	5700 or 5900 (MJ)	4" & up				
Valve Boxes	Valve Boxes with Locking Lids (Cast Iron)	Two piece standard screw type Heavy Duty Valve Boxes with Locking Lids (Cast Iron) and type of service cast in heavy duty traffic lid (H2O loading) ASTM A48								
		Bingham/Taylor	Series 4905	Box	NA	NA	Series 4905	Box		
			4905-X	Extension	NA	NA	4905-X	Extension		
			4904-L	Blue Water Locking Lid	NA	NA	4904-L	Green Sewer locking Lid		
		Sigma	Series VB 261X-267X	Box	VB-25031LK-VB-2612	Box	Series VB 261X-267X	Box		
			VB 6302	Extension	VB-6302	Extension	VB 6302	Extension		
			VB 4650W	Blue Water Locking Lid	VB2503LK	Purple Square Locking Lid	VB 4650S	Green Sewer locking Lid		
		Star	Series VB-0002	Box	NA	NA	Series VB-0002	Box		
			VBEX 12-24S	Extension	NA	NA	VBEX 12-24S	Extension		
			VBLIDLOCK	Blue Water Locking Lid	NA	NA	VBLIDLOCK	Green Sewer locking Lid		
		Tyler Union	Series 6850	Box	NA	NA	Series 6850	Box		
			58, 59, 60	Extension	NA	NA	58, 59, 60	Extension		
			Locking Lid	Blue Water Locking Lid	NA	NA	Locking Lid	Green Sewer locking Lid		
		Valve Box	Valve Box	For mains equal to, or greater than, 16" diameter or equal to greater than 6' feet deep						
				American Flow Control	# 2A - 9A Retrofit Valve Box Insert	Fit inside std valve boxes	NA		2A - 9A Retrofit Valve Box Insert	Green Sewer locking Lid
Mueller Company	MVB050C thru MVB130C with Extension Stem			Blue Water Locking Lid	MVB050CR thru MVB130CR with Extension Stem	Purple Square Locking Reclaim Lid	MVB050C thru MVB130C with Extension Stem	Green Sewer locking Lid		
		MVB875 Guide Plate		MVB875 Guide Plate		MVB875 Guide Plate				

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LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Coatings	Anti-Graffiti Paint	Block Walls-Anti-Graffiti Paint per Section 3119 Coatings & Linings						
		American Building Restoration Products	NA	NA	NA	NA	Polyshield Graffiti Preventer for Unpainted Masonry Type B	Super Bio Strip or Strip it all
		Tnemec / Chemprobe	NA	NA	NA	NA	626 DUR A PEL	680 Mark A Way
		Professional Products of Kansas, Inc	NA	NA	NA	NA	Professional Water Seal & Anti-Graffitiant (PWS-15 Super Strength)	Professional Phase II Cleaner
	Coatings for Existing Manholes	Rehabilitation corrosion protection system per Section 3119 Coatings & Linings. Interior coating for force main connections to existing concrete manholes only. New precast structures and existing pump stations shall be lined.						
		CCI Spectrum, Inc	NA	NA	NA	NA	Spectrashield	min of 500 mils
		Kerneos Aluminate Technologies	NA	NA	NA	NA	Sewpercoat	1" (1000mil)
		Raven Lining System	NA	NA	NA	NA	Raven 155 Primer Raven 405	min 8 mils min 125 mils
		Sauereisen	NA	NA	NA	NA	210 Series Topcoat Glaze 210G	min 125 mils min 20 mils
		Tnemec	NA	NA	NA	NA	Series 434 Topcoat Glaze 435	min 125 mils 15-20 mils
PVC Pipe and fittings	Pipe SDR 35 Gravity Mains	PVC Pipe for Gravity SDR26/SDR 35 (Green in color) ASTM-D034. Manufacturers shall be members in good standing with Uni-Bell to maintain approval status.						
		Certainteed	NA	NA	NA	NA	Gravity Sewer Pipe	
		Diamond Plastics Corp	NA	NA	NA	NA	Sani-21 SDR-35	
		JM Eagle	NA	NA	NA	NA	Gravity Sewer	
		National Pipe & Plastics, Inc.	NA	NA	NA	NA	Ever-Green Sewer Pipe	
		North American Pipe Corp (NAPCO)	NA	NA	NA	NA	Gravity Sewer	
		Sanderson Pipe Corp	NA	NA	NA	NA	Gravity Sewer	
	Locate Balls	Locating Marker Systems - Wastewater Locator balls placed at all sanitary sewer cleanouts						
		3M	NA	NA	NA	NA	3M™ EMS 4" Extended Range 5' Ball Marker 1404-XR	
	Fittings SDR 35	Fittings, Adapters and Plugs - Gravity PVC ASTM-D3034, Min SDR26/ SDR 35						
		GPK Products, Inc.	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Harrington Corporation (HARCO)	NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings	
		Multi Fittings Corp.	NA	NA	NA	NA	SDR26/SDR 35 Trench Tough Sewer Fittings	
JM Eagle		NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings		
Plastic Trends Inc		NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings		
TIGRE USA, Inc.		NA	NA	NA	NA	SDR26/SDR35 Gasketed sewer fittings		

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LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
PVC Pipe a	Flexible Pipe Connectors	Flexible Pipe Connectors and Transitions						
		Fernco	NA	NA	NA	NA	1002, 1051, 1056 Series	
		Indiana Seal	NA	NA	NA	NA	102, 151, 156 Series	
		Mission Rubber	NA	NA	NA	NA	MR02, MR51, MR 56 Series	
Precast Concrete Structures	MH Lids	Frame and Cover						
		USF Fabrication Inc.	NA	NA	NA	NA	USF 225-AS	
	Adj Ring	Top Adjusting Rings - HDPE with heavy duty loading (H-20)						
		Ladtech, Inc	NA	NA	NA	NA	24R, 24S with Rope Sealant CS2455	
	Hatches	Wet Well and Valve Vault Access Frames and Covers (Include the term "Confined Space" etched or cast into the cover with recessed lock & hasp. Frames and covers per manufacturers specifications.						
		Halliday Products	NA	NA	NA	NA	S1R or S2R Series	
		USF Fabrication Inc.	NA	NA	NA	NA	APS or APD Series	
	Precast Concrete Structures	Precast Manhole and Wetwell Structures ASTM C478. Precast concrete shall be batched with concrete dyed crystalline waterproofing admixture with corrosion protection. Concrete without admixture or without color tint /tracer shall be rejected.						
		Allied Precast	NA	NA	NA	NA	Dyed Admix	
		Atlantic Concrete Products, Inc.	NA	NA	NA	NA	Dyed Admix	
		Delzotto Products, Inc.	NA	NA	NA	NA	Dyed Admix	
		Dura Stress Underground Inc.	NA	NA	NA	NA	Dyed Admix	
		Hanson Pipe & Product	NA	NA	NA	NA	Dyed Admix	
		Mack Concrete	NA	NA	NA	NA	Dyed Admix	
		Oldcastle Precast	NA	NA	NA	NA	Dyed Admix	
	Standard Precast Inc.	NA	NA	NA	NA	Dyed Admix		
	Concrete Admix	Crystalline Waterproofing Concrete Admix with color dye shall be added to all concrete structures (precast and cast-in-place) to provide waterproofing and corrosion resistance. Concrete without admixture or without color tint / tracer shall be rejected. % concentration of admix with colored dye added to the mix shall be based on weight of cement.						
Kryton International		NA	NA	NA	NA	KIM K-301R (with red dye)	2%	
Xypex Chemical Corp		NA	NA	NA	NA	Xypex Admix C-1000Red (with red dye)	3.0 - 3.5%	
Liners	Interior Liner for New or existing Precast Manhole and Precast Wetwell Structures per Section 3119 Coatings & Linings							
	AFE	NA	NA	NA	NA	Fiberglass Liner		
	AGRU Liner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)		
	Containment Solutions Inc. (Flowtite)	NA	NA	NA	NA	Fiberglass Liner		
	GSE Studliner	NA	NA	NA	NA	HDPE Liner (Min 2 mm for Manhole / Min 5 mm for Pump Station)		
	GU Liner	NA	NA	NA	NA	Reinforced Plastic Liner		
		L & F Manufacturing	NA	NA	NA	NA	Fiberglass Liner	

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LIST OF APPROVED PRODUCTS - GRAVITY SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater		
			Model #	Comments	Model #	Comments	Model #	Comments	
Precast Concrete Structures	Heat Shrink Seal	Heat Shrink Seal - Precast structures shall be primed with manufacturer approved primer prior to application of heat shrunk encapsulation.							
		Canusa-CPS	NA	NA	NA	NA	Wrapid Seal with WrapidSeal Primer (Canusa G Primer)		
		Pipeline Seal & Insulator, Inc (PSI)	NA	NA	NA	NA	Riser Wrap with Polyken 1027 or 1039 primer		
	Joining Material	Joining Material Min. 2" width for all products to ensure squeeze out with manufacturer approved primer.							
		Henry Company	NA	NA	NA	NA	Ram-Nek	with Primer	
		Martin Asphalt Company	NA	NA	NA	NA	Evergrip 990	with Primer	
		Trelleborg Pipe Seals	NA	NA	NA	NA	NPC – Bidco C-56	with Primer	
	Pipe Seals Gravity	Resilient Connector Pipe Seals, Manhole - Gravity less than 12-inch and less than 15-ft deep							
		Atlantic Concrete	NA	NA	NA	NA	A-Lok (cast-in-place)		
		Hail Mary Rubber	NA	NA	NA	NA	Star Seal (cast-in-place)		
		IPS	NA	NA	NA	NA	Wedge Style		
		NPC	NA	NA	NA	NA	Kor-N-Seal Model WS		
		Press seal gasket	NA	NA	NA	NA	PSX Direct Drive		
	Pipe Seals Gravity	Cast in Place Pipe Seals, Manhole - Gravity Greater Than or Equal to 12-inch and all pipe sizes greater than 15-ft deep							
		Atlantic Concrete	NA	NA	NA	NA	A-Lok	cast in place	
		Hail Mary Rubber	NA	NA	NA	NA	Star Seal	cast in place	
	FM Pipe Seals	Modular Pipe Seals for Wet Well and Valve Box penetrations and all forcemain connections to existing and new precast concrete structures. EPDM Rubber with 316 SS Hardware							
		CCI Pipeline Systems	NA	NA	NA	NA	Wrap-It Link WL-SS Series		
		Pipeline Seal & Insulator, Inc / Link Seal	NA	NA	NA	NA	Link-Seal S-316 Modular Seal		
		Proco Products, Inc	NA	NA	NA	NA	PenSeal ES-PS Series		

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LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Generator	Gen	Generator Systems, Fixed Shall be UL 2200 Certified.						
		Caterpillar	NA	NA	NA	NA	CAT Diesel Generator Set	
		Cummins Power Generation	NA	NA	NA	NA	Diesel Generator Set	
	Fuel Tanks	Generator Fuel Tanks. Shall be UL2085 certified.						
		Convault	NA	NA	NA	NA	CVT-3SF or CVT-3FF	
		Phoenix	NA	NA	NA	NA	Envirovault	
	GR	Generator Receptacle (GR)						
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042 (230V, 200A, 3P, 4W) With AJA1 Angle Adaptor	
		Cooper Crouse-Hinds	NA	NA	NA	NA	AR2042-S22 (460V, 200A, 3P, 4W) With AJA1 Angle Adaptor	
		Pyle National	NA	NA	NA	NA	JRE-4100 (230V, 100A, 3P, 4W)	
ATS	Generator Transfer Switch							
	Russelectric	NA	NA	NA	NA	RMTD Series with model 2000 controller	NEMA 12/3R 316SS Enclosure	
Odor Control Units	Biotrickling Filters	Biotrickling filters						
		BioAir	NA	NA	NA	NA		
		Bioem	NA	NA	NA	NA	Biosorbens BTF	
		Envirogen	NA	NA	NA	NA	BTF	
		Siemens	NA	NA	NA	NA	Zabocs BTF	
	Carbon Adsorption Units	Carbon Adsorption Units						
		Calgon	NA	NA	NA	NA		
		Pure Air Filtration	NA	NA	NA	NA		
		Siemens	NA	NA	NA	NA		
	Pressure Gauges	Pressure Gauges shall have Diaphragm Seals. Oil filled.						
Ashcroft		NA	NA	NA	NA	10 1008SL 02L 60#	Gauge Diaphragm Seal	
		25 200SS 02T XYTSE						
Terice		NA	NA	NA	NA	D83LFSS4002LA100 - Gauge		
						M51001SSSS - Diaphragm Seal		
Winter Gauges	NA	NA	NA	NA	D99100 Fill and Mount Charge			
Pumps	Submersible Pumps							
	ABS	NA	NA	NA	NA			
	Flygt	NA	NA	NA	NA	PFQ770 0-60 PSI D70950 top D70954 Bottom		

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FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pumps	Floats	Float Regulator (FR) - Duplex and Triplex Pump Stations						
		Atlantic Scientific	NA	NA	NA	NA	Roto-Float	
	Radar	Radar - Pulse Burst Radar Transmitter. Input 24 VDC and Output 4-20 mA						
		Magnetrol	NA	NA	NA	NA	R82-520A-011	
Pump Station Main Ser	Main Srvce Disconnect	Main Service Disconnect Breaker						
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)	
	Surge Protector Device	Surge Protector - UL 1449, 3rd Edition listed and labeled, minimum 10 year warranty, NEMA LS-1 and IEEE C62, 41/45 tested with NEMA 4X enclosure, internal fusing, voltage and phase to match service. Rated 80,000 amps per mode for Duplex & Triplex stations and 150,000 Amperes per mode for Master Stations. All devices shall be provided with a NEMA 4X Plastic enclosure which is approved in lieu of stainless steel.						
		Current Technology (Power & Systems)	NA	NA	NA	NA	XN-80, TG-150 or CurrentGuard 150 Plus Series	
		Joslyn AKA (Total Protection Solutions)	NA	NA	NA	NA	TSS-ST 160 Series, ST 300 Series or JSP-300 Series	
		Surge Suppressors, Inc	NA	NA	NA	NA	LSE Series or SHL Series	
Sub Panel	Sub Panel	Sub-Panel Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated finish inside and out, With 3 Point Pad lockable Handle, and Door Stop						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
Pump Station Control Panel	Control Panel	Control Panel Supplier						
		ECS	NA	NA	NA	NA		
		Sta-Con Inc	NA	NA	NA	NA		
	Enclosure	Enclosure - NEMA 12/3R Enclosure 316SS, white polyester Powder coated finish inside and out, With 3 Point Pad lockable Handle, and Door Stop						
		Hoffman	NA	NA	NA	NA		
		Schaefer	NA	NA	NA	NA		
		Universal enclosure systems	NA	NA	NA	NA		
	Mnts	Mounting Channel for Enclosures						
		Unistrut Stainless Steel	NA	NA	NA	NA	1" 5/8 x 1" 5/8 316 SS	
	Seal-off	Explosion-Proof Sealoff						
	Cooper Crouse-Hinds	NA	NA	NA	NA	EYSR - 2 Inch Min.		
FL	Flasher (FL)							
		MPE	NA	NA	NA	NA	025-120-105	
		SSAC	NA	NA	NA	NA	FS-126	

APPENDIX D

LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater		
			Model #	Comments	Model #	Comments	Model #	Comments	
Pump Station Control Panel	AL	Alarm Light / With Base and Globe (AL)							
	American Electric	NA	NA	NA	NA	F32552			
	Red Dot Globe	NA	NA	NA	NA	VGLR-01			
	Red Dot Base					VA-01			
	AH	Alarm Horn (AH)							
	Wheelock	NA	NA	NA	NA	3IT-115-R			
	Fuse	Fuses (F)							
	Bussmann	NA	NA	NA	NA	FNQ-R or KTK-R			
	HOA	Hand-Auto-Off Selector (HOA)							
	Square D	NA	NA	NA	NA	9001-SKS43B			
	HSS	Horn Silence Button (HSS)							
	Square D	NA	NA	NA	NA	9001-SKR1RH5			
	Inter-lock	Mechanical Interlock							
	Square D	NA	NA	NA	NA	S29354			
	Breakers	Control Panel Main Circuit Breaker (MCB) With S29450 Circuit Breaker Auxiliary Switch							
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)		
		Emergency Circuit Breaker (ECB) With S29450 Circuit Breaker Auxiliary Switch							
		Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)		
		Motor Circuit Breaker (MB)							
	Square D	NA	NA	NA	NA	H or J Frame 3 Pole 600 Volt (HGL or JGL determined by amperage)			
	Control Circuit Breaker/ GFCI Receptacle Breaker/ SCADA Breaker								
	Square D	NA	NA	NA	NA	QOU120			
	MS	Motor Starter (MS)							
Square D	NA	NA	NA	NA	Type S Class 8536				
OL	Overload Heater(OL)								
Square D	NA	NA	NA	NA	Part number will vary with size needed				
OR	Overload Reset								
Square D	NA	NA	NA	NA	9066-RA1				
Transformer	Control Circuit Transformer (XMFR)								
	Square D	NA	NA	NA	NA	9070TF75D23	120/24 Volt .075 KVA		
	Main Circuit Transformer (MCT)								
Square D	NA	NA	NA	NA	9070T2000D1	480/120 2KVA			
SPB	Supplemental Protector Breaker - 3 pole, 1-amp for Phase Monitor								
Square D	NA	NA	NA	NA	MG24532				

APPENDIX D

LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pump Station Control Panel	PM	Phase Monitor (PM)						
		MPE 240 V.	NA	NA	NA	NA	001-230-118-OVG5	
		MPE 480 V.	NA	NA	NA	NA	002-480-123-OVG5	
	Pump Alternator	Pump Automatic Alternator (PAA)						
		Diversified Duplex	NA	NA	NA	NA	ARA-120-ACA	
		Diversified Triplex	NA	NA	NA	NA	ARA-120-AME	
		MPE Duplex	NA	NA	NA	NA	008-120-13SP	
		MPE Triplex	NA	NA	NA	NA	009-120-23P	
	MPE Triplex Socket	NA	NA	NA	NA	SD-12-PC		
	Alt. Test Switch	Alt. Test Switch						
		Carling Technologies	NA	NA	NA	NA	6GG5E-78	
		Honeywell	NA	NA	NA	NA	2TL1-50	
	Relay	Relay						
		Potter Brumfield 24 Volt	NA	NA	NA	NA	KRPA-11AN-24	
		Potter Brumfield 120 Volt	NA	NA	NA	NA	KRPA-11AN-120	
		Square D 24 Volt	NA	NA	NA	NA	8501KP12P14V14	
	Square D 120Volt	NA	NA	NA	NA	8501KP12P14V20		
	Relay Base	Relay Base						
		IEDC 8 Pin Relay Base 600 Volt	NA	NA	NA	NA	SR2P-06	
	Duplex Receptacle / GFCI	Duplex Receptacle/GFCI (DR) Upgraded to 20 Amp						
		Hubbell	NA	NA	NA	NA	GFTR20BK	
		Pass & Seymour	NA	NA	NA	NA	2095TRBK	
	ETM	Elapse Time Meter (ETM)						
		Reddington	NA	NA	NA	NA	711-0160	
	Grounding	Grounding System						
		Marathon	NA	NA	NA	NA	Neutral Isolation Block 1421570	
		Panduit	NA	NA	NA	NA	Ground Lug LAM2A 1/0 - 014 -6Y	
	Square D	NA	NA	NA	NA	Ground Buss PK7GTA		
TS	Terminal Strip (TS)							
	Marathon	NA	NA	NA	NA	Series 200		
	Square D	NA	NA	NA	NA	9080GR6		
TS	Terminal Strip End Blocks and End Clamps							
	Square D	NA	NA	NA	NA	9080GM6B & 9080GH10		

APPENDIX D

LIST OF APPROVED PRODUCTS - PUMP STATION SYSTEMS

FEBRUARY 11, 2011

Cat.	Desc	Manufacturer	Water		Reclaimed Water		Wastewater	
			Model #	Comments	Model #	Comments	Model #	Comments
Pump Station Control Pane	PL	Pilot Light (PL) 24 Volt with 1819 Bulb						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelight 930507X	
	RL	Run Indicator Light (RL) 120 Volt						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelites 930507X With 120MB Bulb	
	MT	Moisture and Temperature Failure Light (MT) 120 Volt with 120MB Bulb						
		Dialight	NA	NA	NA	NA	803-1710	
		Lighting Components & Design	NA	NA	NA	NA	Littlelites 930507X	
Sluice Gate	Sluice Gate for Wet Well with Motorized Operator							
	BNW	NA	NA	NA	NA	Model 77 - 316 SS		
	Fontaine	NA	NA	NA	NA	Model 20 - 316 SS		
VFD	Variable Frequency Drives							
	Square D	NA	NA	NA	NA			

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SECTION 01110

ENVIRONMENTAL PROTECTION PROCEDURES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment and perform 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. For the purpose of this Section, environmental pollution is defined as the presence of chemical, physical, or biological elements or agents which 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 consideration of air, water and land, and involves management of noise and solid waste, as well as other pollutants.
- C. Schedule and conduct all work in a manner that will minimize the erosion of soils in the area of the work. Provide erosion control measures such as diversion channels, sedimentation or filtration systems, berms, staked hay bales, seeding, mulching or other special surface treatments as are required to prevent silting and muddying of streams, rivers, impoundments, lakes, etc. All erosion control measures shall be in place in an area prior to any construction activity in that area. Specific requirements for erosion and sedimentation controls are specified in Section 02270.
- 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 approval of the Florida Department of Environmental Protection (FDEP). Prepare sedimentation and erosion control drawings meeting the requirements for approval by that agency. Upon approval, furnish two copies of the approved Drawing to the Engineer.

1.02 APPLICABLE REGULATIONS

- A. Comply with all applicable Federal, State and local laws and regulations concerning environmental pollution control and abatement.

1.03 NOTIFICATIONS

- A. The Engineer will notify the Contractor in writing of any non-compliance with the foregoing provisions or of any environmentally objectionable acts and corrective action to be taken. State or local agencies responsible for verification of certain aspects of the environmental protection requirements shall notify the Contractor in writing, through the Engineer, of any

non-compliance with State or local requirements. After receipt of such notice from the Engineer or from the regulatory agency through the Engineer, immediately take corrective action. Such notice, when delivered to the Contractor or his authorized representative at the site of the work, shall be deemed sufficient for the purpose. If the Contractor fails or refuses to comply promptly, the Owner 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 any such stop orders shall be made the subject of a claim for extension of time or for excess costs or damages by the Contractor unless it is later determined that the Contractor was in compliance.

1.04 IMPLEMENTATION

- A. Prior to commencement of the work, meet with the Engineer to develop mutual understandings relative to compliance with these provisions and administration of the environmental pollution control program.
- B. Remove temporary environmental control features, when approved by the Engineer and incorporate permanent control features into the project at the earliest practicable time.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 EROSION CONTROL

- A. Provide positive means of erosion control such as shallow ditches around construction to carry off surface water. Erosion control measures, such as siltation basins, hay check dams, mulching, jute netting and other equivalent techniques, shall be used as appropriate. Offsite surface water shall be diverted around the site, to a downstream channel ahead of siltation barriers. Flow of surface water into excavated areas shall be prevented. Ditches around construction area shall also be used to carry away water resulting from dewatering of excavated areas. At the completion of the work, ditches shall be backfilled and the ground surface restored to original condition.

3.02 PROTECTION OF STREAMS AND SURFACE WATERS

- A. Take all precautions 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, that contains oils or sediments that will reduce the quality of the water in the stream, shall not be directly returned to the stream. Divert such waters through a settling basin or filter before being directed into streams or surface waters.
- B. Do 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. Take all preventative measures 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. Submit two copies of approved contingency plans to the Engineer.

- D. Water being flushed from structures or pipelines after disinfection, with a Cl₂ residue of 2 mg/l or greater shall be treated with a dechlorination solution, in a method approved by the Engineer, prior to discharge.

3.03 PROTECTION OF LAND RESOURCES

- A. Restore land resources within the project boundaries and outside the limits of permanent work to a condition, after completion of construction that will appear to be natural and not detract from the appearance of the project. Confine all construction activities to areas shown on the Drawings.
- B. Outside of areas requiring earthwork for the construction of the new facilities, do 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, 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. Before beginning operations near them, 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 Engineer 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-in 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 are beyond saving in the opinion of the Engineer, shall be immediately removed and replaced.
- E. The locations of the Contractor's storage and other construction buildings required temporarily in the performance of the work, shall be 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. The preservation of the landscape shall be an imperative consideration in the selection of all sites and in the construction of buildings. Drawings showing storage facilities shall be submitted for approval of the Engineer.

- F. If the Contractor proposes to construct temporary roads or embankments and excavations for plant and/or work areas, he shall submit the following for approval at least ten days prior to 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. A landscaping drawing showing the proposed restoration of the area. Indicate the proposed removal of any trees and shrubs outside the limits of existing clearing area. Indicate locations of guard posts or barriers required to control vehicular traffic and protect trees and shrubs to be maintained undamaged. The Drawing 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. Remove all signs of temporary construction facilities such as haul roads, work areas, structures, foundations of temporary structures, stockpiles of excess of 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 which will permit the growth of vegetation thereon. The disturbed areas shall be prepared and seeded as described in Section 02930, or as approved by the Engineer.
- 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 – The use of burning at the project site for the disposal of refuse and debris will not be permitted.
- B. Dust Control – Maintain all excavations, embankment, stockpiles, access roads, plant sites, waste areas, borrow areas and all other work areas within or without 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. Sprinkling, to be approved, 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 Engineer.

3.05 NOISE CONTROL

- A. 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. 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

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SECTION 01152

APPLICATIONS FOR PAYMENT

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Submit Applications for Payment to the Engineer in accordance with the schedule established by Conditions of the Contract and Agreement between Owner and Contractor.
- B. The accepted Schedule of Values, Section 01370, shall be used as the basis for the Contractor's Application for Payment.

1.02 RELATED WORK

- A. Agreement Between Owner and Contractor is included in Section E, Division 0.
- B. Standard General Conditions of the Construction Contract is included in Section F, Division 0.
- C. Field Engineering is included in Section 01050.
- D. Schedule of Values are included in Section 01370.
- E. Construction Photographs are included in Section 01300.
- F. Contract Closeout is included in Section 01700.
- G. Project Record Documents are included in Section 01720.

1.03 SUBMITTALS

- A. Submit to the Resident Project Representative, in accordance with Section 01300, applications typed on forms provided by the Owner, Application for Payment, with itemized data typed on 8-1/2-in by 11-in or 8-1/2-in by 14-in white paper continuation sheets.
- B. Provide itemized data on continuation sheet.
 - 1. Format, schedules, line items and values: Those of the Schedule of Values accepted by the Owner.
- C. Provide construction photographs in accordance with Section 01300.

1.04 PREPARATION OF APPLICATION FOR EACH PROGRESS PAYMENT

A. Application Form

1. Fill in required information, including that for Change Orders executed prior to date of submittal of application.
2. Fill in summary of dollar values to agree with respective totals indicated on continuation sheets.
3. Execute certification with signature of a responsible officer of Contract firm.

B. Continuation Sheets

1. Fill in total list of all scheduled component items of Work, with item number and scheduled dollar value for each item.
2. Fill in dollar value in each column for each scheduled line item when work has been performed or products stored.
 - a. Round off values to nearest dollar, or as specified for Schedule of Values.
3. List each Change Order executed prior to date of submission, at the end of the continuation sheets.
 - a. List by Change Order Number and description, as for an original component item of work.
4. To receive approval for payment on component material stored on site, submit copies of the original paid invoices with the application for payment.

1.05 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

- A. When the Owner or the Engineer requires substantiating data, submit suitable information, with a cover letter identifying:
1. Project
 2. Application number and date
 3. Detailed list of enclosures
 4. For stored products:
 - a. Item number and identification as shown on application
 - b. Description of specific material

- B. Submit one copy of data and cover letter for each copy of application.
- C. As a prerequisite for payment, submit a “Surety Acknowledgement of Payment Request” letter showing amount of progress payment which the Contractor is requesting.
- D. Maintain an updated set of drawings to be used as record drawings in accordance with Section 01720. As a prerequisite for monthly progress payments, exhibit the updated record drawings for review by the Owner and the Engineer.

1.06 PREPARATION OF APPLICATION FOR FINAL PAYMENT

- A. Fill in Application form as specified for progress payments.
- B. Use continuation sheet for presenting the final statement of accounting as specified in Section 01700 - Contract Closeout.
- C. Submit all Project Record Documents in accordance with Sections 01050 and 01720.

1.07 SUBMITTAL PROCEDURE

- A. Submit Applications for Payment to the Engineer at the times stipulated in the Agreement.
- B. Number: Five copies of each Application.
- C. When the Engineer finds Application properly completed and correct, he/she will transmit certificate for payment to Owner, with copy to Contractor.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 01200

PROJECT MEETINGS

PART 1 - GENERAL

1.01 REQUIREMENTS INCLUDED

- A. The Engineer shall schedule and administer pre-construction meeting, periodic progress meetings and specially called meetings throughout progress of the Work.
 - 1. Prepare agenda for meetings.
 - 2. Make physical arrangements for meetings.
 - 3. Preside at meetings.
 - 4. Record the minutes; include significant proceedings and decisions.
 - 5. Reproduce and distribute copies of minutes within 15 working days after each meeting.
 - a. To participants in the meeting.
 - b. To parties affected by decisions made at the meeting.
- B. Representatives of Contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.
- C. Attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.02 RELATED REQUIREMENTS

- A. Instructions to Bidders are included in Part C.
- B. Construction Schedules are included in Section 01310.
- C. Shop Drawings, Working Drawings and Samples are included in Section 01300.
- D. Project Record Documents are included in Section 01720.
- E. Operating and Maintenance Data is included in Section 01730.

1.03 PRE-CONSTRUCTION MEETING

- A. Schedule a preconstruction meeting no later than 20 days after the effective date of the Contract but before Contractor starts work at the site.

B. Location: A central site, convenient for all parties, designated by the Owner.

C. Attendance.

1. Owner's Representative
2. Engineer and his/her professional consultants
3. Resident Project Representative
4. Contractor's Superintendent
5. Major Subcontractors
6. Major suppliers
7. Utilities
8. Others as appropriate

D. Suggested Agenda.

1. Distribution and discussion of:
 - a. List of major subcontractors and suppliers
 - b. Projected Construction Schedules
2. Critical work sequencing
3. Major equipment deliveries and priorities
4. Project Coordination
 - a. Designation of responsible personnel
5. Procedures and processing of:
 - a. Field decisions
 - b. Proposal requests
 - c. Submittals
 - d. Change Orders
 - e. Applications for Payment
6. Adequacy of distribution of Contract Documents

7. Procedures for maintaining Record Documents
8. Use of premises:
 - a. Office, work and storage areas
 - b. Owner's requirements
9. Construction facilities, controls and construction aids
10. Temporary utilities
11. Housekeeping procedures

1.04 PROGRESS MEETINGS

- A. Schedule regular periodic meetings. The progress meetings will be held every 30 days with the first meeting 30 days after the pre-construction meeting or 30 days after the date of Notice to Proceed.
- B. Hold called meetings as required by progress of the Work.
- C. Location of the meetings: Project field office of Contractor or Engineer.
- D. Attendance.
 1. Engineer and his/her professional consultants as needed
 2. Subcontractors as appropriate to the agenda
 3. Suppliers as appropriate to the agenda
 4. Others as appropriate
- E. Suggested Agenda.
 1. Review, approval of minutes of previous meeting
 2. Review of work progress since previous meeting
 3. Field observations, problems and conflicts
 4. Problems which impede Construction Schedule
 5. Review of off-site fabrication, delivery schedules
 6. Corrective measures and procedures to regain projected schedule
 7. Revisions to Construction Schedule

8. Progress, schedule, during succeeding work period
 9. Coordination of schedules
 10. Review submittal schedules; expedite as required
 11. Maintenance of quality standards
 12. Pending changes and substitutions
 13. Review proposed changes for:
 - a. Effect on Construction Schedule and on completion date
 - b. Effect on other contracts of the project
 14. Other business
 15. Construction schedule
 16. Critical/long lead items
- F. Attend progress meetings and is to study previous meeting minutes and current agenda items, in order to be prepared to discuss pertinent topics such as deliveries of materials and equipment, progress of the Work, etc.
- G. Provide a current submittal log at each progress meeting in accordance with Section 01300.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 01300

SUBMITTALS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section includes the requirements for compiling, processing and transmitting submittals required for execution of the project.
- B. Submittals are categorized into two types: Action Submittals and Informational Submittals, as follows:
 - 1. **Action Submittal:** Written and graphic information submitted by the Contractor that requires the Engineer's approval. The following are examples of action submittals:
 - a. Shop drawings (including working drawings and product data)
 - b. Samples
 - c. Operation & maintenance manuals
 - d. Site Usage Plan (Contractor's staging - including trailer siting and material laydown area)
 - e. Schedule of values
 - f. Payment application format
 - 2. **Informational Submittal:** Information submitted by the Contractor that does not require the Engineer's approval. The following are examples of informational submittals:
 - a. Shop drawing schedule
 - b. Construction schedule
 - c. Statements of qualifications
 - d. Health and Safety Plans
 - e. Construction photography and videography
 - f. Work plans
 - g. Maintenance of traffic plans
 - h. Outage requests

- i. Proposed testing procedures
- j. Test records and reports
- k. Vendor training outlines/plans
- l. Test and start-up reports
- m. Certifications
- n. Record Drawings
- o. Record Shop Drawings
- p. Submittals required by laws, regulations and governing agencies
- q. Submittals required by funding agencies
- r. Other requirements found within the technical specifications
- s. Warranties and bonds
- t. As-built surveys
- u. Contract close-out documents

1.02 RELATED WORK

- A. Additional requirements may be specified in the General Conditions for the Contract.
- B. Additional submittal requirements may be specified in the respective technical Specification Sections.
- C. Operation and Maintenance manuals are included in Section 01730.
- D. Contract closeout submittals are included in Section 01700.
- E. Warranties and Bonds are included in Section 01740.
- F. Applications for Payment are included in Section 01152.
- G. Construction Schedules are included in Section 01310.
- H. Field Engineering 01050.
- I. Project Record Documents are included in Section 01720.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. All submittals shall be clearly identified as follows:

1. Date of submission
2. Project number
3. Project name
4. Contractor identification
 - a. Contractor
 - b. Supplier
 - c. Manufacturer
 - d. Manufacturer or supplier representative
5. Identification of the product
6. Reference to Contract drawing(s)
7. Reference to specification section number, page and paragraph(s)
8. Reference to applicable standards, such as ASTM or Federal Standards numbers
9. Indication of Contractor's approval
10. Contractor's Certification statement
11. Identification of deviations from the Contract Documents, if any
12. Reference to previous submittal (for resubmittals)

B. Submittals shall be clear and legible, and of sufficient size for legibility and clarity of the presented data.

C. SUBMITTAL LOG

Maintain a log of all submittals. The submittal log shall be kept accurate and up to date. This log should include the following items (as applicable):

1. Description
2. Submittal number
3. Date transmitted to the Engineer

4. Date returned to Contractor (from Engineer)
5. Status of Submittal (Approved/Not Approved/etc.)
6. Date of Resubmittal to Engineer and Return from Engineer (if applicable and repeat as necessary)
7. Date material released for fabrication
8. Projected (or actual) delivery date

D. NUMBERING SYSTEM

Utilize a 9-character submittal identification numbering system in the following manner:

1. The first character shall be a D, S, M or I which represents Shop Drawing (including working drawings and product data), Sample, Manual (Operating & Maintenance) or Informational, respectively.
2. The next five digits shall be the applicable Section Number.
3. The next two digits shall be the numbers 01 to 99 to sequentially number each separate item or drawing submitted under each specific Specification Section, in the order submitted.
4. The last character shall be a letter, A to Z, indicating the submission (or resubmission) of the same submittal, i.e., "A" = 1st submission, "B" = 2nd submission, "C" = 3rd submission, etc. A typical submittal number would be as follows:

D-03300-008-B

D	= Shop Drawing
03300	= Section for Concrete
08	= the eighth different submittal under this section
B	= the second submission (first resubmission) of that particular shop drawing

E. VARIANCES

Notify the Engineer in writing, at the time of submittal, of any deviations in the submittals from the requirements of the Contract Documents.

Notify the Engineer in writing, at the time of re-submittal (resubmission), of all deviations from previous submissions of that particular shop drawing, except those deviations which are the specific result of prior comments from the Engineer.

F. ACTION SUBMITTALS

1. SHOP DRAWINGS, WORKING DRAWINGS, PRODUCT DATA AND SAMPLES

a. SHOP DRAWINGS

- 1) Shop drawings as defined in the General Conditions, and as specified in individual Sections include, but are not necessarily limited to, custom prepared data such as fabrication and erection/installation (working) drawings, scheduled information, setting diagrams, actual shop work manufacturing instructions, custom templates, wiring diagrams, coordination drawings, equipment inspection and test reports, including performance curves and certifications, as applicable to the work.
- 2) Contactor shall verify all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and coordinate each item with other related shop drawings and the Contract requirements.
- 3) All details on shop drawings shall show clearly the relation of the various parts to the main members and lines of the structure and where correct fabrication of the work depends upon field measurements, such measurements shall be made and noted on the drawings before being submitted.
- 4) All shop drawings submitted by subcontractors and vendors shall be reviewed by the Contractor for field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data, and that it has been coordinated with other related shop drawings and the Contract requirements. Submittals directly from subcontractors or vendors will not be accepted by the Engineer.
- 5) The Contractor shall be responsible the accuracy of the subcontractor's or vendor's submittal; and, for their submission in a timely manner to support the requirements of the Contractor's construction schedule. Shop drawings found to be inaccurate or otherwise in error shall be returned to the subcontractor or vendor to correct before submission to the Engineer. All shop drawings shall be approved by the Contractor.
- 6) Delays to construction due to the untimely submission of submittals will constitute inexcusable delays, for which Contactor shall not be eligible for additional cost nor additional contract time. Inexcusable delays consist of any delay within the Contactor's control.
- 7) Submittals for equipment specified under Divisions 11, 13, 14, 15 and 16 shall include a listing of installations where identical or similar equipment manufactured by that manufacturer has been installed and in operation for a period of at least five years.

b. WORKING DRAWINGS

- 1) Detailed installation drawings (sewers, equipment, piping, electrical conduits and controls, HVAC work, and plumbing, etc.) shall be prepared and submitted for review and approval by the Engineer prior to installing such work. Installation drawings shall be to-scale and shall be fully dimensioned.
- 2) Piping working drawings shall show the laying dimensions of all pipes, fittings, valves, as well as the equipment to which it is being connected. In addition, all pipe supports shall be shown.

- 3) Equipment working drawings shall show all equipment dimensions, anchor bolts, support pads, piping connections and electrical connections. In addition, show clearances required around such equipment for maintenance of the equipment.
- 4) Electrical working drawings shall show conduits, junction boxes, disconnects, control devices, lighting fixtures, support details, control panels, lighting and power panels, and Motor Control Centers. Coordinate all locations with the Contract Documents and the Contractor's other working drawings.

c. **PRODUCT DATA**

Product data, as specified in individual Specification Sections, include, but are not limited to, the manufacturer's standard prepared data for manufactured products (catalog data), such as the product specifications, installation instructions, availability of colors and patterns, rough-in diagrams and templates, product photographs (or diagrams), wiring diagrams, performance curves, quality control inspection and reports, certifications of compliance (as specified or otherwise required), mill reports, product operating and maintenance instructions, recommended spare parts and product warranties, as applicable.

d. **SAMPLES**

- 1) Furnish, samples required by the Contract Documents for the Engineer's approval. Samples shall be delivered to the Engineer as specified or directed. Unless specified otherwise, provide at least two samples of each required item. Materials or equipment for which samples are required shall not be used in the work unless and until approved by the Engineer.
- 2) Samples specified in individual Specification Sections, include, but are not limited to: physical examples of the work (such as sections of manufactured or fabricated work), small cuts or containers of materials, complete units of repetitively-used products, color/texture/pattern swatches and range sets, specimens for coordination of visual effect, graphic symbols, and other specified units of work.
- 3) Approval of a sample shall be only for the characteristics or use named in such approval and shall not be construed to change or modify and Contract Requirements.
- 4) Approved samples not destroyed in testing shall be sent to the Engineer or stored at the site of the work. Approved samples of the hardware in good condition will be marked for identification and may be used in the work. Materials and equipment incorporated in work shall match the approved samples. Samples which fail testing or are not approved will be returned to the Contractor at his expense, if so requested at time of submission.

e. **PROFESSIONAL ENGINEER (P.E.) CERTIFICATION FORM**

If specifically required in any of the technical Specification Sections, submit a Professional Engineer (P.E.) Certification for each item required, using the form appended to this Section, signed and sealed by the P.E. licensed or registered in the state wherein the work is located.

2. CONTRACTOR'S CERTIFICATION

- a. Each shop drawing, working drawings, product data, and sample shall have affixed to it the following Certification Statement:

"Certification Statement: by this submittal, I hereby represent that I have determined and verified all field measurements, field construction criteria, materials, dimensions, catalog numbers and similar data and I have checked and coordinated each item with other applicable approved shop drawings and all Contract requirements."

- b. Shop drawings, working drawings, and product data sheets 11-in x 17-in and smaller shall be bound together in an orderly fashion and bear the above Certification Statement on the cover sheet. The transmittal cover sheet for each identified shop drawing shall fully describe the packaged data and include a listing of all items within the package.
3. No submittals will be approved unless they have the manufacturer's Certification Statement affixed to them, or a waiver has been applied for and received. No materials or equipment shall be shipped to the site without the Certification Statement or waiver.
4. The review and approval of shop drawings, working drawings, product data, or samples by the Engineer shall not relieve the Contractor from the responsibility for the fulfillment of the terms of the Contract. All risks of error and omission are assumed by the Contractor and the Engineer will have no responsibility therefor.
5. Project work, materials, fabrication, and installation shall conform to approved shop drawings (including working drawings and product data) and applicable samples.
6. No portion of the work requiring a shop drawing (including working drawings and product data) or sample shall be started, nor shall any materials be fabricated or installed before approval of such item. Procurement, fabrication, delivery or installation of products or materials that do not conform to approved shop drawings shall be at the Contractor's risk. Furthermore, such products or materials delivered or installed without approved shop drawings, or in non-conformance with the approved shop drawings will not be eligible for progress payment until such time as the product or material is approved or brought into compliance with approved shop drawings. Neither the Owner nor Engineer will be liable for any expense or delay due to corrections or remedies required to accomplish conformity.

7. OPERATION AND MAINTENANCE DATA

Operation and maintenance data shall be submitted in assembled manuals as specified. Such manuals shall include detailed instructions for Owner personnel on safe operation procedures, controls, start-up, shut-down, emergency procedures, storage, protection, lubrication, testing, trouble-shooting, adjustments, repair procedures, and other maintenance requirements.

8. SCHEDULE OF VALUES

On projects consisting of lump sums (in whole or in part) submit a proposed schedule of values providing a breakdown of lump sum items in to reasonably small components – generally disaggregated by building, area, and/or discipline. The purpose of the schedule of values is for processing partial payment applications. If requested by the Engineer, provide sufficient substantiation for all or some items as necessary to determine the proposed schedule of values is a reasonable representation of the true cost breakdown of the Work. The schedule of values shall not be unbalanced to achieve early payment or over-payment in excess of the value of work or any other mis-distribution of the costs. If, in the opinion of the Engineer, the schedule of values is unbalanced, Contractor shall reallocate components to achieve a balanced schedule acceptable to Engineer.

9. PAYMENT APPLICATION FORMAT

If an application form is included in the Contract Documents, use that form unless otherwise approved by the Engineer and Owner. If an application form is not included in the Contract Documents, Contractor may propose a form for approval.

10. SITE USAGE

Submit a proposed site staging plan, including but not limited to the location of office trailers, storage trailers and material laydown. Such plan shall be a graphic presentation (drawing) of the proposed locations; and, shall include on-site traffic modifications, and temporary utilities, as may be applicable.

G. INFORMATIONAL SUBMITTALS

1. SHOP DRAWING SCHEDULE

Prepare and submit a schedule indicating when shop drawings are required to be submitted to support the as-planned construction schedule. The submittal schedule shall allow sufficient time for preparation and submittal, review and approval, and fabrication and delivery to support the construction schedule.

2. CONSTRUCTION SCHEDULE

Prepare and submit construction schedules and monthly status reports as specified.

3. STATEMENTS OF QUALIFICATIONS

Provide evidence of qualification, certification, or registration, as required in the Contract Documents, to verify qualifications of licensed land surveyor, professional engineer, materials testing laboratory, specialty subcontractor, technical specialist, consultant, specialty installer, and other professionals.

4. HEALTH AND SAFETY PLANS

When specified, prepare and submit a general company Health and Safety Plan (HSP), modified or supplemented to include job-specific considerations.

5. CONSTRUCTION PHOTOGRAPHY AND VIDEOGRAPHY

Provide periodic construction photographs and videography as specified – including but not limited to preconstruction photographs and/or video, monthly progress photos and/or video and post-construction photographs and/or video.

6. WORK PLANS

Prepare and submit copies of all work plans needed to demonstrate to the Owner that Contractor has adequately thought-out the means and methods of construction and their interface with existing facilities.

7. MAINTENANCE OF TRAFFIC PLANS

Prepare maintenance of traffic plans where and when required by the Contract Documents and by local ordinances or regulations. If Contractor is not already knowledgeable about local ordinances and regulations regarding maintenance of traffic requirements, become familiar with such requirements and include all costs for preparation and submittal of traffic management plans and all associated costs for permits and fees to implement the traffic management plan, in the bid amount. In addition, unless a supplemental payment provision is provided in the bid form, include the cost of police attendance, when required.

8. OUTAGE REQUESTS

Provide sufficient notification of any outages required (electrical, flow processes, etc) as may be required to tie-in new work into existing facilities. Unless specified otherwise elsewhere, a minimum of seven calendar days notice shall be provided.

9. PROPOSED TESTING PROCEDURES

Prepare and submit testing procedures it proposes to use to perform testing required by the various technical specifications.

10. TEST RECORDS AND REPORTS

Provide copies of all test records and reports as specified in the various technical specifications.

11. VENDOR TRAINING OUTLINES/PLANS

At least two weeks before scheduled training of Owner's personnel, provide lesson plans for vendor training in accordance with the specification for O&M manuals.

12. TEST AND START-UP REPORTS

Manufacture shall perform all pre-start-up installation inspection, calibrations, alignments, and performance testing as specified in the respective Specification Section. Provide copies of all such test and start-up reports.

13. CERTIFICATIONS

- a. Provide various certifications as required by the technical specifications. Such certifications shall be signed by an officer (of the firm) or other individual authorized to sign documents on behalf of that entity.
- b. Certifications may include, but are not limited to:
 - 1) Welding certifications and welders qualifications
 - 2) Certifications of Installation, Testing and Training for all equipment
 - 3) Material Testing reports furnished by an independent testing firm
 - 4) Certifications from manufacturer(s) for specified factory testing
 - 5) Certifications required to indicate compliance with any sustainability or LEEDS accreditation requirements indicated in the Contract Documents

14. RECORD DRAWINGS

No later than Substantial Completion, submit a record of all changes during construction not already incorporated into drawings – in accordance with specification on Project Record Documents.

15. SUBMITTALS REQUIRED BY LAWS, REGULATIONS AND GOVERNING AGENCIES

Prepare and submit all documentation required by state or local law, regulation or government agency directly to the applicable agency. This includes, but is not limited to, notifications, reports, certifications, certified payroll (for projects subject to wage requirements) and other documentation required to satisfy all requirements. Provide to Engineer one copy of each submittal made in accordance with this paragraph.

16. SUBMITTALS REQUIRED BY FUNDING AGENCIES

Prepare and submit all documentation required by funding agencies. This includes, but is not limited to segregated pay applications and change orders when required to properly allocate funds to different funding sources; and certified payrolls for projects subject to wage requirements. Provide one copy of each submittal made in accordance with this paragraph to the Engineer.

17. OTHER REQUIREMENTS OF THE TECHNICAL SPECIFICATION SECTIONS

Comply with all other requirements of the technical specifications.

18. WARRANTIES AND BONDS

Assemble a book(let) of all warranties and bonds as specified in the various technical specifications and in accordance with the specification on Warranties and Bonds and provide to the Engineer.

19. AS-BUILT SURVEYS

Engage the services of a licensed land surveyor in accordance with the Project Controls specification. Prior to Final Completion, provide an as-built survey of the constructed facility, as specified.

20. CONTRACT CLOSE-OUT DOCUMENTS

Submit Contract documentation as indicated in the specification for Contract Close-out.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SUBMITTAL SCHEDULE

- A. Provide an initial submittal schedule at the pre-construction meeting for review by Owner and Engineer. Incorporate comments from Owner or Engineer into a revised submittal schedule.
- B. Maintain the submittal schedule and provide sufficient copies for review by Owner and Engineer. An up-to-date submittal schedule shall be provided at each project progress meeting.

3.02 TRANSMITTALS

- A. Prepare separate transmittal sheets for each submittal. Each transmittal sheet shall include at least the following: the Contractor's name and address, Owner's name, project name, project number, submittal number, description of submittal and number of copies submitted.
- B. Submittals shall be transmitted or delivered directly to the office of the Engineer, as indicated in the Contact Documents or as otherwise directed by the Engineer.
- C. Provide copies of transmittals (only, i.e., without copies of the respective submittal) directly to the Resident Project Representative.

3.03 PROCEDURES

A. ACTION SUBMITTALS

1. CONTRACTOR'S RESPONSIBILITIES

- a. Coordination of Submittal Times: Prepare and transmit each submittal sufficiently in advance of performing the related work or other applicable activities, or within the time specified in the individual work of other related Sections, so that the installation will not be delayed by processing times including disapproval and resubmittal (if required). Coordinate with other submittals, testing, purchasing, fabrication, delivery and similar sequenced activities. Extensions to the Contract Time will not be approved for the Contractor's failure to transmit submittals sufficiently in advance of the Work.
- b. The submittals of all shop drawings (including working drawings and product data) shall be sufficiently in advance of construction requirements to allow for possible need of re-submittals, including the specified review time for the Engineer.
- c. No less than 30 calendar days will be required for Engineer's review time for shop drawings and O&M manuals involving only one engineering discipline. No less than 45 calendar days will be required for Engineer's review time for shop drawings and O&M manuals that require review by more than one engineering discipline. Resubmittals will be subject to the same review time.
- d. Submittals of operation and maintenance data shall be provided within 30 days of approval of the related shop drawing(s).
- e. Before submission to the Engineer, review shop drawings as follows:
 - 1) Make corrections and add field measurements, as required
 - 2) Use any color for its notations except red (reserved for the Engineer's notations) and black (to be able to distinguish notations on black and white documents)
 - 3) Identify and describe each and every deviation or variation from Contract documents or from previous submissions, except those specifically resulting from a comment from the Engineer on a previous submission
 - 4) Include the required Contractor's Certification statement
 - 5) Provide field measurements (as needed)
 - 6) Coordinate with other submittals
 - 7) Indicate relationships to other features of the Work
 - 8) Highlight information applicable to the Work and/or delete information not applicable to the Work
- f. Submit the following number of copies:
 - 1) Shop drawings (including working drawings and product data) – Submit no fewer than six, and no more than nine; five of which will be retained by the Engineer.
 - 2) Samples – three
 - 3) Site Usage Plan – three copies
 - 4) Schedule of values – four copies
 - 5) Payment application format – four copies

- g. If Contractor considers any correction indicated on the shop drawings to constitute a change to the Contract Documents, provide written notice thereof to the Engineer immediately; and do not release for manufacture before such notice has been received by the Engineer.
- h. When the shop drawings have been completed to the satisfaction of the Engineer, carry out the construction in accordance therewith; and make no further changes therein except upon written instructions from the Engineer.

2. ENGINEER'S RESPONSIBILITIES

- a. Engineer will not review shop drawings (including working drawings and product data) that do not include the Contractor's approval stamp. Such submittals will be returned to the Contractor, without action, for correction.
- b. Partial shop drawings (including working drawings and product data) will not be reviewed. If, in the opinion of the Engineer, a submittal is incomplete, that submittal will be returned to the Contractor for completion. Such submittals may be returned with comments from Engineer indicating the deficiencies requiring correction.
- c. If shop drawings (including working drawings and product data) meet the submittal requirements, Engineer will forward copies to appropriate reviewer(s). Otherwise, noncompliant submittals will be returned to the Contractor without action - with the Engineer retaining one copy.
- d. Submittals which are transmitted in accordance with the specified requirements will be reviewed by the Engineer within the time specified herein. The time for review will commence upon receipt of submittal by Engineer.

3. REVIEW OF SHOP DRAWINGS (INCLUDING WORKING DRAWINGS AND PRODUCT DATA) AND SAMPLES

- a. The review of shop drawings, working drawings, data and samples will be for general conformance with the design concept and Contract Documents. They shall not be construed:
 - 1) As permitting any departure from the Contract requirements
 - 2) As relieving the Contractor of responsibility for any errors, including details, dimensions, and materials
 - 3) As approving departures from details furnished by the Engineer, except as otherwise provided herein
- b. The Contractor remains responsible for details and accuracy, for coordinating the Work with all other associated work and trades, for selecting fabrication processes, for techniques of assembly, and for performing work in a safe manner.
- c. If the shop drawings (including working drawings and product data) or samples as submitted describe variations and indicate a deviation from the Contract requirements that, in the opinion of the Engineer are in the interest of the Owner and are so minor as

not to involve a change in Contract Price or Contract Time, the Engineer may return the reviewed drawings without noting an exception.

- d. Only the Engineer will utilize the color “RED” in marking submittals.
- e. Shop drawings will be returned to the Contractor with one of the following codes.

Code 1 – “APPROVED” – This code is assigned when there are no notations or comments on the submittal. When returned under this code the Contractor may release the equipment and/or material for manufacture.

Code 2 – "APPROVED AS NOTED" – This code is assigned when a confirmation of the notations and comments IS NOT required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product.

Code 3 – "APPROVED AS NOTED/CONFIRM" – This combination of codes is assigned when a confirmation of the notations and comments is required by the Contractor. The Contractor may release the equipment or material for manufacture; however, all notations and comments must be incorporated into the final product. This confirmation shall specifically address each omission and nonconforming item that was noted. Confirmation is to be received by the Engineer within 15 calendar days of the date of the Engineer's transmittal requiring the confirmation.

Code 4 – "APPROVED AS NOTED/RESUBMIT" – This combination of codes is assigned when notations and comments are extensive enough to require a resubmittal of the entire package. This resubmittal is to address all comments, omissions and non-conforming items that were noted. Resubmittal is to be received by the Engineer within 30 calendar days of the date of the Engineer's transmittal requiring the resubmittal.

Code 5 – “NOT APPROVED” – This code is assigned when the submittal does not meet the intent of the contract documents. The Contractor must resubmit the entire package revised to bring the submittal into conformance. It may be necessary to resubmit using a different manufacturer/vendor to meet the requirements of the contract documents.

Code 6 – “COMMENTS ATTACHED” – This code is assigned where there are comments attached to the returned submittal, which provide additional data to aid the Contractor.

Code 7 – “RECEIPT ACKNOWLEDGED” – (Not subject to Engineer’s Review or Approval)” – This code is assigned to acknowledge receipt of a submittal that is not subject to the Engineer’s review and approval, and is being filed for informational purposes only. This code is generally used in acknowledging receipt of means and methods of construction work plans, field conformance test reports, and health and safety plans.

Codes 1 through 5 designate the status of the reviewed submittal with Code 6 showing there has been an attachment of additional data.

- f. REPETITIVE REVIEWS: Shop drawings, O&M manuals and other submittals will be reviewed no more than twice at the Owner's expense. All subsequent reviews will be performed at the Contractor's expense. Reimburse the Owner for all costs invoiced by Engineer for the third and subsequent reviews.

4. ELECTRONIC TRANSMISSION

- a. ACTION SUBMITTALS may be transmitted by electronic means provided the following conditions are met:
 - 1) The above-specified transmittal form is included.
 - 2) All other requirements specified above have been met including, but not limited to, coordination by the Contractor, review and approval by the Contractor, and the Contractor's Certification.
 - 3) The submittal contains no pages or sheets large than 11 x 17 inches.
 - 4) With the exception of the transmittal sheet, the entire submittal is included in a single file.
 - 5) The electronic files are PDF format (with printing enabled).
 - 6) In addition, transmit three hard-copy (paper) originals to the Engineer.
 - 7) The Engineer's review time will commence upon receipt of the hard copies of the submittal.
 - 8) For Submittals that require certification, corporate seal, or professional embossment (i.e. P.E.s, Surveyors, etc) transmit at least two hard-copy originals to the Engineer. In addition, provide additional photocopied or scanned copies, as specified above, showing the required certification, corporate seal, or professional seal.

C. INFORMATIONAL SUBMITTALS

1. CONTRACTOR'S RESPONSIBILITIES

- a. Number of copies: Submit three copies, unless otherwise indicated in individual Specification sections.
- b. Refer to individual technical Specification Sections for specific submittal requirements.

2. ENGINEERS'S RESPONSIBILITIES

- a. The Engineer will review each informational submittal within 15 days. If the informational submittal complies with the Contract requirements, Engineer will file for the project record and transmit a copy to the Owner. Engineer may elect not to respond to Contractor regarding informational submittals meeting the Contract requirements.
- b. If an informational submittal does not comply with the Contract requirements, Engineer will respond accordingly to the Contractor within 15 days. Thereafter, the

Contractor shall perform the required corrective action, including retesting, if needed, until the submittal, in the opinion of the Engineer, is in conformance with the Contract Documents.

3. ELECTRONIC TRANSMISSION

- a. INFORMATIONAL SUBMITTALS may be transmitted by electronic means providing all of the following conditions are met:
- 1) The above-specified transmittal form is included.
 - 2) The submittal contains no pages or sheets large than 11 x 17 inches.
 - 3) With the exception of the transmittal sheet, the entire submittal is included in a single file.
 - 4) The electronic files are PDF format (printing enabled).
 - 5) For Submittals that require certification, corporate seal, or professional embossment (i.e. P.E.s, Surveyors, etc) transmit two hard-copy originals to the Engineer.

END OF SECTION

P.E. CERTIFICATION FORM

The undersigned hereby certifies that he/she is a professional engineer registered in the State of Florida and that he/she has been employed by

_____ to design
(Name of Contractor)

(Insert P.E. Responsibilities)

In accordance with Specification Section _____ for the
_____.
(Lake Eve Pump Station Rehabilitation)

The undersigned further certifies that he/she has performed the said design in conformance with all applicable local, state and federal codes, rules and regulations; and, that his/her signature and P.E. stamp have been affixed to all calculations and drawings used in, and resulting from, the design.

The undersigned hereby agrees to make all original design drawings and calculations available to the

(Orange County, FL)

or Owner's representative within seven days following written request therefor by the Owner.

P.E. Name

Contractor's Name

Signature

Signature

Address

Title

Address

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SECTION 01310

CONSTRUCTION SCHEDULING

PART 1- GENERAL

1.01 PROGRAM DESCRIPTION

- A. A Critical Path Method (CPM) construction schedule shall be used to control the Work and to provide a basis for determining job progress. The construction schedule shall be prepared and maintained by the Contractor. All work shall be done in accordance with the established CPM schedule. The Contractor and all subcontractors shall cooperate fully in developing the construction schedule and in executing the work in accordance with the CPM schedule.
- B. The construction schedule shall consist of a computerized CPM network (diagram of activities) presented in a time-scaled graphic (print-out) with reports, as specified herein.

1.02 QUALIFICATIONS

- A. The Contractor shall have the capability of preparing and utilizing the specified CPM schedule, or engage the services of a specialized scheduling professional to do so. Within seven days of the award of contract, provide a résumé or qualifications statement for the individual within the Contractor's organization, or the outside consultant, who is being proposed as the responsible party for development and maintenance of the CPM schedule. The résumé or qualifications statement shall demonstrate that the proposed responsible party has successfully developed and maintained CPM schedules for at least three construction projects of the same size or greater than this project. The proposed responsible party for the CPM schedule is subject to approval by the Engineer and Owner. If the proposed responsible party for the CPM schedule is not approved by the Engineer and/or Owner, Contractor shall resubmit a more-appropriate candidate for approval.

1.03 SUBMITTALS

- A. Contractor shall submit Interim, Preliminary, Baseline (also known as "as-planned") CPM schedules, revisions, and Monthly Status Reports, all including graphics, reports, and narratives, and an as-built schedule, as specified herein.

PART 2 - PRODUCTS

2.01 SOFTWARE

- A. Unless otherwise approved by the Engineer, the computer-based schedule shall be generated using Oracle-Primavera Contractor.

2.02 NETWORK REQUIREMENTS

- A. Each schedule submittal shall contain the following identifying information:
 - 1. Project Title, Owner's Contract Number, and the Engineer's Project Number
 - 2. Contractor's name
 - 3. All Contract milestones, as specified
 - 4. The project calendar(s) (including work week and holidays)
 - 5. Type of submittal (e.g., Interim, Preliminary, Baseline or Monthly Status Report)
 - 6. A summary contract milestones
 - 7. Data date and run (print) date
- B. The network of activities shall show the order and inter-dependence of activities; and, show the sequence in which the work is to be accomplished, as planned by the Contractor. The basic concept of a network analysis diagram shall be followed to show how each activity is dependent on preceding activities (predecessors) and following activities (successors).
- C. Detailed network activities shall include, but are not limited to:
 - 1. Mobilization activities
 - 2. Procurement activities (submittals, review and approval, fabrication, and delivery)
 - 3. Permitting and regulatory activities
 - 4. Right-of-way activities (including utility agreements that require others to relocate existing utilities that affect the project)
 - 5. Construction activities (including demolition, rehabilitation, new construction and testing)
 - 6. Maintenance of existing facilities
 - 7. Test and start-up activities (including testing, start-up, training, performance testing, and commissioning)
 - 8. Contract milestones (fixed and floating)
 - 9. Specified sequences, outages and coordination activities
 - 10. Any other activities needed to properly identify the scope of work and contract requirements

- D. All activities shall be sufficiently identified and/or described so that the scope of work of each activity is clear. All work tasks shall be broken down into appropriate scopes and durations to facilitate monitoring progress. Unless otherwise approved by the Engineer, no activities shall have durations of more than one month; except for off-site activities such as procurement and delivery of materials and equipment - or administrative or management activities that span the project duration that do not reflect earned progress.
- E. Network activities shall be organized (grouped) by phases (or stages), physical areas, buildings, elevations, or other portions of the project.
- F. Separate network activities shall be provided for each significant identifiable function in each trade area in each facility. Separate network activities shall be provided for subcontractors.
- G. The number of network activities, sufficiency of description, and level of breakdown shall be subject to the Engineer's review and approval to confirm conformance with the specified requirements.
- H. The format of the schedule network graphic shall be a time-scaled logic diagram - with a list of network activities and the specified data fields presented adjacent to the graphic display.
- I. The following general requirements also apply to the network diagram.
 - 1. The Critical Path (the sequence of project network activities that add up to the longest overall duration and thereby determines the shortest time possible to complete the project) shall be identified - preferably in 'red'.
 - 2. Unless otherwise approved by the Engineer the Contractor's work schedule shall be based on 'normal work week' as defined in the Contract Documents - (typically 40 hours per week, consisting of five 8-hour days).
 - 3. The graphics shall indicate the calendar(s) on which activity durations are based (i.e., 5-day workweek or 7 calendar day week). When multiple calendars or work weeks are used, the graphics shall clearly indicate which calendars are used where.
 - 4. The project calendar shall include exclusions for holidays observed by the Contractor and those indicated in the Contract Documents.
- J. Each network activity shall have the following information (fields) listed alongside the activity on the graphic display.
 - 1. Activity ID - a manually assigned designation (numeric or alphanumeric). The Contractor should use a logical approach to assigning identification to network activities to facilitate grouping (sorting) of activities.
 - 2. Activity Description
 - 3. Original Duration - including allowances for adverse weather interruptions - normal for the project location. Normal weather shall mean seasonally average weather conditions, as recorded by NOAA.

4. Percent complete – the Contractor’s estimated percent complete for each network activity as of the data date for the respective report.
5. Remaining Duration - a calculated value based on Original Duration of each network activity and the estimated percent of completion for each activity.
6. Early Start Date
7. Early Finish Date
8. Late Start Date
9. Latest Finish Date
10. Total Float

2.03 SUBMITTAL REQUIREMENTS

- A. Each schedule submittal shall include the following elements:
 1. Graphics – unless otherwise approved by the Engineer, the network graphics shall be printed on 24-inch by 36-inch sheets; including a list of activities and the specified data fields.
 2. Narrative
 - a. The Narrative shall consist of a written report by the Contractor providing an overview of the schedule – specific to each submittal.
 - b. The Narratives for developmental submittals, i.e., Interim and Preliminary, shall describe the Contractor’s approach to executing the project Work.
 - c. The Narrative for the Baseline Schedule shall:
 - 1) explain key activities and assumptions on which the schedule is based;
 - 2) describe the Critical Path;
 - 3) discuss key deliveries that might adversely affect the project schedule; and,
 - 4) explain the Contractor’s approach to adverse weather interruptions – normal for the project location. Normal weather shall mean seasonally average weather conditions, as recorded by NOAA.
 - d. The Narratives provided with Monthly Status Reports (updates) shall also identify:
 - 1) any changes the Contractor has made to the CPM logic (including any added, modified or deleted activities,
 - 2) any delays that have been encountered, and
 - 3) remedial actions or recovery steps the Contractor will employ to arrest and/or recover from such delays.

B. Reports

1. The following reports are required to be submitted with Baseline Schedule, when a major revision is made to the schedule, and when requested by the Engineer.
 - a. Activity – a report listing all network activities, sorted by activity ID
 - b. Early Start – a report listing all network activities, sorted by Early Start date
 - c. Total Float – a report listing all network activities, sorted by Total Float (ascending from low to high)
 - d. Predecessor/Successor – a report of all activities, sorted by Activity ID that lists all predecessor and successor activities for each network activity

2.04 ACCEPTABILITY

- A. The Contractor shall submit the CPM schedule submittals, as specified, and resubmit as needed, until they are in compliance with Contract requirements.
- B. The Engineer's review of the Contractor's construction schedule submittals will only be for conformance with the Contract requirements – including but not limited to contract time and work sequences specified in the contract documents. The Engineer's review of the schedule shall not include the Contractor's means and methods of construction or safety. The Engineer's concurrence, acceptance, or approval of the Contractor's schedule submittals will not relieve the Contractor from responsibility for complying with the Contract Scope, Contract Time or any other contract requirement. Any indication of concurrence, acceptance, or approval of the Contractor's schedule will only indicate a general conformance with the Contract Requirements.
- C. Engineer's review of the Contractor's construction schedule submittals shall not relieve the Contractor from responsibility for any deviations from the Contract Documents unless the Contractor has in writing called Engineer's attention to such deviations at the time of submission and Engineer has given written concurrence to the specific deviations, nor shall any concurrence by the Engineer relieve Contractor from responsibility for errors and omissions in the submittals. Concurrence of the CPM Activity Network by the Engineer is advisory only and shall not relieve the Contractor of responsibility for accomplishing the Work within the Contract completion date(s).
- D. Concurrence, acceptance, or approval of the Contractor's CPM schedule by the Engineer in no way makes the Engineer an insurer of the CPM schedule's success, nor liable for time or cost overruns resulting therefrom.
- E. Failure to include any element of work required for the performance of this Contract will not excuse the Contractor from completing all Work required within the Contract completion date(s), notwithstanding the review of the network by the Engineer.
- F. CPM schedules that contain activities with negative float, or which extend beyond the contract completion date, will not be acceptable.

- G. Except where earlier completions are specified, CPM schedules which show completion of all work prior to the contract completion date may be indicated; however, in no event shall they constitute a basis for claim for delay by the Contractor.

PART 3 - EXECUTION

3.01 IMPLEMENTATION SCHEDULE

A. Interim Schedule

1. Within 15 days following the receipt of the Notice to Proceed, submit an Interim Schedule indicating the planned operations during the first 60 calendar days after Notice to Proceed. In addition, the Contractor shall indicate its general approach for the balance of the project.
2. While the Preliminary schedule is being developed, the Contractor shall update the Interim schedule on a monthly basis – indicating actual progress - until the Preliminary schedule is submitted.

B. Preliminary Schedule

1. Within 45 days following the receipt of Notice to Proceed, submit a proposed Preliminary Schedule to the Engineer. The Preliminary Schedule shall consist of a draft computer-generated CPM-schedule showing the entire Scope of Work. The Preliminary Schedule shall not include any actual progress earned during development of the schedule (i.e., status as of the Notice to Proceed).
2. Within 15 days of submittal of the Preliminary Schedule (i.e., within 60 days of receipt of the Notice to Proceed), meet with the Engineer to discuss the review comments.
3. Once the Preliminary Schedule is submitted, Contractor shall discontinue updating the Interim Schedule. Provide monthly updates of the Preliminary Schedule until concurrence, acceptance, or approval of the Baseline Schedule.

C. Baseline (as-planned) Schedule

1. With 10 days of the review meeting on the Preliminary Schedule submittal, the Contractor shall incorporate the Engineer's comments into the network and submit a Baseline Schedule. Resubmit the Baseline Schedule, as required until it is deemed acceptable as stated in paragraph 2.04, above.
2. Upon concurrence, acceptance, or approval of the Contractor's initial Baseline Schedule, status as of the Notice to Proceed date, it shall be recognized as the basis against which the Contractor's progress shall be measured.

D. Monthly Status Reports

1. Monthly Status Reports shall include updated graphics and a narrative. In addition, if requested by the Engineer, Contractor shall provide copies of one or more of the standard reports listed in 2.03.B.

2. The Contractor shall provide Monthly Status Reports (schedule updates) commencing approximately 30 days after submission of the Interim Schedule. Unless approved otherwise by the Engineer, the status of the Monthly Status Reports shall be reported as of the end of each calendar month.
3. While the Preliminary Schedule is being developed, the Contractor shall update the Interim schedule on a monthly basis – indicating actual progress - until the Preliminary Schedule is submitted.
4. While the Baseline Schedule is being developed, the Contractor shall update the Preliminary Schedule on a monthly basis – indicating actual progress - until concurrence, acceptance, or approval of the Baseline Schedule.
5. Once the initial Baseline Schedule is complete, Monthly Status Reports shall be based on the Baseline Schedule.

E. As-Built Schedule

1. Upon achieving Substantial Completion, the Contractor shall submit an as-built schedule, showing all activities from the Notice to Proceed through Substantial Completion. In addition, provide the reports listed in 2.03.B. A Narrative is not required.

3.02 DELIVERABLES

- A. Unless approved otherwise by the Engineer, all schedule submittals shall be printed in color on sheets 11-in by 17 -in and may be divided into as many separate sheets as required.
- B. Interim Schedule: Submit three copies to the Engineer.
- C. Preliminary Schedule: Submit three hard (paper) copies to the Engineer.
- D. Baseline Schedule: Submit three hard (paper) copies, one electronic copy (PDF), and a copy of the program files to the Engineer.
- E. Monthly Status Reports: Submit three copies and one electronic copy on CD to the Engineer; and if requested, an electronic copy of the program files for the respective update.
- F. As-Built Schedule: Submit one hard copy; one electronic (PDF), and, if requested, an electronic copy of the program files.

3.03 PROGRESS REPORTING

- A. Progress under the approved CPM schedule shall be reported monthly by the Contractor by submitting a Monthly Status Report. Unless otherwise approved by the Engineer, not less than seven days prior to the due date of the Monthly Status Report, the Contractor shall meet with the Engineer's representative to jointly evaluate the status of each network activity. Each activity shall be updated to reflect the actual progress (percent complete) and the actual dates activities were started and completed, as applicable.

- B. The Monthly Status Report shall include an update of the computer-generated network graphics and a Narrative report. The Narrative shall include:
1. A description of the progress during the reporting period in terms of completed activities
 2. A summary of the Critical Path
 3. An description or explanation of each delays to network activities
 4. A description of problem areas, current and anticipated delaying factors and their anticipated effect on the performance of other activities and completion dates
 5. An explanation of corrective action taken or proposed

This report, as well as the CPM Status Report, will be discussed at each progress meeting.

3.04 RESPONSIBILITY FOR SCHEDULE COMPLIANCE

- A. Whenever it becomes apparent from the current CPM schedule and CPM Status Report that delays to the critical path have resulted and the contract completion date will not be met, or when so directed by the Engineer, take some or all of the following actions at no additional cost to the Owner. Submit to the Engineer for approval, a written statement of the steps intended to take to remove or arrest the delay to the critical path in the approved schedule.
1. Increase construction manpower in such quantities and crafts,
 2. Increase the number of working hours per shift, shifts per day, working days per week,
 3. Increase the amount of construction equipment, and/or
 4. Reschedule activities to maximize the concurrence of activities and comply with the revised schedule.
- B. If when so requested by the Engineer, failure to submit a written statement of the steps intended to take or should fail to take such steps as approved by the Engineer, the Engineer may direct the Contractor to increase the level of effort in man-power (trades), equipment and work schedule (overtime, weekend and holiday work, etc) to be employed by the Contractor in order to remove or arrest the delay to the critical path in the approved schedule and the Contractor shall promptly provide such level of effort at no additional cost to the Owner.

3.05 ADJUSTMENT OF CONTRACT SCHEDULE AND COMPLETION TIME

- A. If the Contractor wants or needs to make changes in his/her execution of the construction schedule that would affect the approved CPM schedule, he/she shall notify the Engineer in writing stating what changes are proposed and the reasons for the changes. If the Engineer approves such changes, the Contractor shall revise and submit a revised schedule for approval - without additional cost to the Owner. The CPM schedule shall be adjusted by the Contractor only after prior approval of his/her proposed changes. Adjustments may consist of changing portions of the activity sequence, activity durations, division of approved activities, or other

adjustments as may be approved by the Engineer; however, the addition of extraneous, non-working activities and activities that add unapproved restraints to the CPM schedule will not be allowed.

- B. Shop drawings that are not approved on the first submittal will require the addition of network activities for the resubmittals.
- C. Equipment that does not pass the specified tests will require the addition of network activities for the retesting.
- D. The contract completion time will be adjusted only for causes specified in this Contract. In the event the Contractor requests an extension of any contract completion date, he/she shall furnish such justification and supporting evidence as the Engineer may deem necessary to determine whether the Contractor is entitled to an extension of time under the provisions of this Contract. After receipt of such justification and supporting evidence, the Engineer's shall perform an assessment or evaluation of the appropriate change in contract time based upon the currently approved CPM schedule and on all data relevant to the extension. Inexcusable delays (attributable to the Contractor) and non-critical delays (delays to activities which, according to the CPM schedule, do not affect any contract completion date shown by the Critical Path) shall not be the basis for a change in contract time. The Engineer will provide a written recommendation to the Owner based on its assessment, with a copy to the Contractor. The Contractor shall not change any fixed contract milestones or required completion dates without the approval of the Owner, evidenced by the execution of a contract change order. However, the Contractor should make note of such requests for changes in contract time in the narrative of monthly schedule status reports.
- E. Each request for change in any contract completion date shall be submitted by the Contractor to the Engineer in accordance with the notification requirements stipulated in the form of contract or general conditions. No time extension will be granted for requests that are not submitted in accordance with the Contract requirements.
- F. Total float in the approved CPM network belongs to the project; i.e., either the Owner or Contractor may take advantage of available total float on a first-come, first-served basis. Therefore, without obligation to extend either the overall completion date, or any intermediate completion dates set out in the CPM network, the Owner may initiate changes to the work or delay work that absorb available total float existing at the time of the change or delay. Owner initiated changes or delays that affect the Critical Path on the approved CPM network shall be the sole grounds for extending (or contracting) contract completion dates or fixed milestones.

END OF SECTION

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SECTION 01370

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Submit to the Engineer a Schedule of Values allocated to the various portions of the work, within 21 days after the effective date of the Agreement.
- B. Upon request of the Engineer, support the values with data which will substantiate their correctness.
- C. The accepted Schedule of Values shall be used only as the basis for the Contractor's Applications for Payment.

1.02 RELATED REQUIREMENTS

- A. Standard General Conditions of the Construction Contract are included in Part F General Conditions.
- B. Application for Payment is included in Section 01152.

1.03 FORM AND CONTENT OF SCHEDULE OF VALUES

- A. Type schedule on an 8-1/2-in by 11-in or 8-1/2-in by 14-in white paper furnished by the Owner; Contractor's standard forms and automated printout will be considered for approval by the Engineer upon Contractor's request. Identify schedule with:
 - 1. Title of Project and location.
 - 2. Engineer and Project number.
 - 3. Name and Address of Contractor.
 - 4. Contract designation.
 - 5. Date of submission.
- B. Schedule shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction.
- C. Identify each line item with the number and title of the respective Section.
- D. For each major line item list sub-values of major products or operations under the item.

- E. For the various portions of the work:
 - 1. Each item shall include a directly proportional amount of the Contractor's overhead and profit.
 - 2. For items on which progress payments will be requested for stored materials, break down the value into:
 - a. The cost of the materials, delivered and unloaded, with taxes paid. Paid invoices are required for materials upon request by the Engineer.
 - b. The total installed value.
- F. The sum of all values listed in the schedule shall equal the total Contract Sum.

1.04 SUBSCHEDULE OF UNIT MATERIAL VALUES

- A. Submit a sub-schedule of unit costs and quantities for:
 - 1. Products on which progress payments will be requested for stored products.
- B. The form of submittal shall parallel that of the Schedule of Values, with each item identified the same as the line item in the Schedule of Values.
- C. The unit quantity for bulk materials shall include an allowance for normal waste.
- D. The unit values for the materials shall be broken down into:
 - 1. Cost of the material, delivered and unloaded at the site, with taxes paid.
 - 2. Copies of invoices for component material shall be included with the payment request in which the material first appears.
 - 3. Paid invoices shall be provided with the second payment request in which the material appears or no payment shall be allowed and/or may be deleted from the request.
- E. The installed unit value multiplied by the quantity listed shall equal the cost of that item in the Schedule of Values.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01410

TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Owner will employ and pay for the services of an Independent Testing Laboratory to perform testing specifically indicated on the Contract Documents and may at any other time elect to have materials and equipment tested for conformity with the Contract Documents.
 - 1. Cooperate with the laboratory to facilitate the execution of its required services.
 - 2. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the work of the Contract.

1.02 RELATED REQUIREMENTS

- 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 is required for but not limited to the following:
 - 1. Earthwork is included in Section 02100.
 - 2. Trenching, Backfilling and Compaction is included in Section 02221.
 - 3. Asphaltic Concrete Pavement is included in Section 02500.
 - 4. Concrete Paving is included in Section 02520.
 - 5. Concrete Reinforcement is included in Section 03200.
 - 6. Cast-in-Place Concrete is included in Section 03300.

1.03 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

- A. Laboratory is not authorized to:
 - 1. Release, revoke, alter or enlarge on requirements of Contract Documents.
 - 2. Approve or accept any portion of the work.

3. Perform any duties of the Contractor.

1.04 CONTRACTOR'S RESPONSIBILITIES

- A. Cooperate with laboratory personnel, provide access to work, to manufacturer's operations.
- B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.
- C. Provide to the laboratory the preliminary design mix proposed to be used for concrete and other materials mixes which require control by the testing laboratory.
- D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard requirements for quality and workmanship are indicated in the Contract Documents. The Engineer may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor, and no extra charge to the Owner shall be allowed on account of such testing and certification.
- E. Furnish incidental labor and facilities:
 1. To provide access to work to be tested.
 2. To obtain and handle samples at the project site or at the source of the product to be tested.
 3. To facilitate inspections and tests.
 4. For storage and curing of test samples.
- F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.
 1. When tests or inspections cannot be performed after such notice, reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.
- G. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience.
- H. If the test results indicate the material or equipment complies with the Contract Documents, the Owner shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the Contractor may pay for the laboratory costs directly to the testing firm or the total of such costs shall be deducted from any payments due the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01445

PIPELINE TESTING AND CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and test and clean all new pipelines installed under this Contract as specified herein, including chlorination of all potable water lines.

1.02 RELATED WORK

- A. Buried pipelines are included in Division 2.
- B. Above grade and exposed pipelines are included in Division 15.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

- A. Furnish all necessary equipment and labor for cleaning and testing and chlorinating the pipelines. The procedures and methods shall be approved by the Engineer.
- B. Make any taps and furnish all necessary caps, plugs, etc, as required in conjunction with testing pipelines. Furnish a test pump, gauges and any other equipment required in conjunction with carrying out the hydrostatic tests.

3.02 CLEANING PIPELINES

- A. As pipe laying progresses and at the conclusion of the work thoroughly clean all new pipelines by flushing with water or other means to remove all dirt, stones, pieces of wood or other material which may have entered during the construction period. If, after this cleaning, obstructions remain, they shall be removed.

3.03 TESTING GRAVITY PIPELINES

- A. All gravity pipelines shall be tested for leakage by an infiltration or exfiltration test. Buried piping shall be tested by an infiltration test if the groundwater is more than 2-ft above the crown of the pipe for the full length of the section to be tested. Air testing may be used in lieu of an exfiltration test subject to approval of the Engineer.

B. Exfiltration Test

1. Leakage tests by exfiltration shall be made by creating a head in the pipeline to be tested by filling the line and either a manhole or temporary riser on one end of the line with water. The length of pipe to be tested shall be such that the head over the crown at the upstream end is not less than 2-ft and the head over the downstream crown is not more than 6-ft. The pipe shall be plugged by pneumatic bags or mechanical plugs in such a manner that the air can be released from the pipe while it is being filled with water. Before any measurements are made, the pipe shall be kept full of water long enough to allow absorption and the escape of any trapped air to take place. Following this, a test period of at least one hour shall begin. Provisions shall be made for measuring the amount of water required to maintain the water at a constant level during the test period.
2. If any joint shows an appreciable amount of leakage, the jointing material shall be removed and the joint repaired. If any pipe is defective, it shall be removed and replaced. If the quantity of water required to maintain a constant head in the pipe does not exceed 1.9 gallons per inch of diameter per day per 100-ft of pipe and if all the leakage is not confined to a few joints, workmanship shall be considered satisfactory.

C. Infiltration Test

1. Pipe shall be tested for infiltration after the backfill has been placed and the ground water allowed to return to normal elevation. The length of line to be tested shall be not less than the length between adjacent manholes and not more than the total length of each size of pipe. The allowable infiltration shall be 1.9 gallons per inch of diameter per day per 100-ft of pipe in each section tested. There shall be no gushing or spurting leaks.
2. If an inspection of the completed pipeline or any part thereof shows pipes or joints which allow noticeable infiltration of water, the defective work or material shall be replaced or repaired as directed.
3. Rates of infiltration shall be determined by means of V-notch weirs, pipe spigots, or by plugs in the end of the pipe installed in an approved manner and at such times and locations as may be directed by the Engineer.

D. When the pipeline to be tested is reinforced concrete pipe, the allowable leakage in the above tests shall be 4.7 gallons per inch of diameter per 100-ft of pipe.

E. Low Pressure Air Test

1. Low-pressure air tests shall be made with equipment specifically designed and manufactured for the purpose of testing pipelines using low-pressure air. The equipment shall be provided with an air regulator valve or air safety valve so set that the internal air pressure in the pipeline cannot exceed 8 psig. Pneumatic plugs shall have a sealing length equal to or greater than the diameter of the pipe to be tested. All air used shall pass through a single control panel.
2. Install plugs at manholes. Brace plugs securely as required for safety and allow no one in the manholes while pressurizing the line or during the test.

3. Low-pressure air shall be introduced into the sealed line until the internal air pressure reaches 4 psig. The internal air pressure in the sealed line shall not be allowed to exceed 8 psig. At least 2 minutes shall be allowed for the air pressure to stabilize in the section under test. After the stabilization period, the low-pressure air supply hose shall be quickly disconnected from the control panel. The time required in minutes for the pressure in the section under test to decrease from 3.5 to 2.5 psig shall not be less than that shown in Table 1 of ASTM F1417.
4. If the pipe section does not pass the air test, sectionalize the section tested to determine the location of the leak. Once the leak has been located, repair and retest.

3.04 TESTING PRESSURE PIPELINES

- A. All pressure pipelines shall be pressure and leakage tested. Pipelines shall be subjected to a hydrostatic pressure of 50 percent above the normal operating pressure and this pressure maintained for at least 10 minutes. The leakage test shall be conducted at the maximum operating pressure as determined by the Engineer, and this pressure shall be maintained for at least two hours. The test pump and water supply shall be arranged to allow accurate measurement of the water required to maintain the test pressure. Where applicable, hydrant branch gate valves shall remain open during this test. The amount of leakage which will be permitted shall be in accordance with AWWA C600.

3.05 CHLORINATION OF PIPELINES

- A. Before being placed in service, all new potable water pipelines (including reuse water) shall be chlorinated using the continuous feed method specified in AWWA C651. The procedure shall be approved by the Engineer in advance.
- B. The location of the chlorination and sampling points will be determined by the Engineer in the field. Taps for chlorination and sampling shall be installed. Uncover and backfill the taps as required.
- C. The general procedure for chlorination shall be first to flush all dirty or discolored water from the lines and then introduce chlorine in approved dosages through a tap at one end, while water is being withdrawn at the other end of the line. The chlorine solution shall remain in the pipeline for 24 hours.
- D. Following the chlorination period, all treated water shall be flushed from the lines at their extremities and replaced with potable water. All treated water flushed from the lines shall be disposed of by discharging to the nearest sanitary sewer or by other approved means. No discharge to any storm sewer or natural water course will be allowed. Bacteriological sampling and analysis of the replacement water may then be made by the Engineer in full accordance with AWWA C651. Rechlorinate, if necessary and the line shall not be placed in service until the requirements of the Orange County Health Department are met.

- E. Special disinfecting procedures shall be used in connections to existing pipelines and where the method outlined above is not practical.

END OF SECTION

SECTION 01465

EQUIPMENT TESTING AND STARTUP

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. 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. Perform specified equipment field performance tests, final acceptance tests and startup services.

1.02 RELATED WORK

- A. Operation and Maintenance Data is included in Section 01730.
- B. Performance and acceptance testing and startup requirements are included in the respective sections of Divisions 11, 13, 15 and 16.

1.03 SUBMITTALS

- A. Submit name, address and resume of proposed field services technicians at least 30 days in advance of the need for such services.
- B. Submit, in accordance with Section 01300, detailed testing procedures for shop tests, field performance tests and final acceptance tests as specified in the various equipment sections. Submittals shall include the following:
 - 1. Test procedures shall be submitted at least 30 days in advance of the proposed test dates and shall include at least the following information:
 - a. Name of equipment to be tested, including reference to specifications section number and title.
 - b. Testing schedule of proposed dates and times for testing.
 - c. Summary of power, lighting, chemical, water, sludge, gas, etc, needs and identification of who will provide them.
 - d. Outline specific assignment of the responsibilities of the Contractor and manufacturers' factory representatives or field service personnel.
 - e. 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).

- f. Samples of forms to be used to collect and record test data and to present tabulated test results.
2. 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 and modified to reflect actual conduct of the tests and the following additional information:
 - a. Copy of all test data sheets and results of lab analyses.
 - b. Summary comparison of specified test and performance requirements vs. actual test results.
 - c. Should actual test results fail to meet specified test and performance requirements, describe action to be taken prior to re-testing the equipment.
3. Copies of the manufacturer's field service technician's report summarizing the results of his/her 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 herein.

1.04 REFERENCE STANDARDS

- A. American Water Works Association (AWWA)
- 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.

1.05 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.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PRELIMINARY REQUIREMENTS

- A. After installation of the equipment has been completed and the equipment is presumably ready for operation, 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 crack 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 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 designed personnel and/or Owner's representatives.

3.03 STARTUP AND ACCEPTANCE OF THE PUMP STATION AND RELATED SYSTEM

- A. See Specification Section 01100 for Startup and Acceptance requirements.

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EQUIPMENT SUPPLIER'S CERTIFICATE OF INSTALLATION

Owner _____

Project _____

Contract 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 tested and adjusted, and is (are) ready for final acceptance testing and operation on :

Date _____

Time _____

CERTIFIED BY: _____
(Signature of Manufacturer's Representative)

Date: _____

END OF SECTION

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SECTION 01480

WATERTIGHTNESS TEST FOR HYDRAULIC STRUCTURES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and incidentals required and perform watertightness testing of liquid-containing structures as listed herein and all retesting until the structures meet the requirements as specified herein.

1.02 RELATED WORK

- A. Concrete is included in Division 03.
- B. Waterproofing is included in Division 07.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, the results of each watertightness test of each structure. The submittal format shall be similar to that shown in Figure A attached to end of this Section.

1.04 REFERENCE STANDARDS

- A. American Concrete Institute (ACI)
 - 1. ACI 350.1 – Tightness Testing of Environmental Engineering Concrete Structures.
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 PROJECT/SITE REQUIREMENTS

- A. Coordinate timing and procedures for obtaining testing water and structure testing with the Owner well in advance of the actual testing. The Contractor, if required by the Owner, shall pay for all water, at current OCU rates, used for testing.
- B. Water Source and Disposal
 - 1. Water for testing shall be provided by the Contractor. The Contractor may use the Owners water subject to approval by the Owner.
 - 2. Test water shall be disposed of by the Contractor in an approved manner. Water shall not be disposed of by discharging it onto the ground surface of public or private land.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

- A. The testing of reinforced concrete tanks or water containment structures shall conform to the following standards and as modified herein:
 - 1. Reinforced concrete liquid-containing structures - ACI 350.1 and as specified herein.
- B. Perform watertightness tests prior to placing backfill around structures in order to permit observation and detection of leakage points. Walls may be backfilled prior to testing only when approved in writing by the Engineer. The request to backfill prior to testing shall include a description of the method proposed to detect leakage points after the backfill is in place. Approval to place backfill prior to testing shall not relieve the Contractor of the responsibility for conducting watertightness tests.

3.02 PREPARATION

- A. Thoroughly clean the structure to be tested of dirt, mud and construction debris prior to initiating watertightness tests. The floor and sumps shall be flushed with water to provide a clean surface, ready for testing.
- B. Inspect the structure to be tested for potential leakage paths such as cracks, voids, etc and repair such paths in compliance with the provisions specified herein or as approved by the Engineer.
- C. Confirm adequacy of seals around gates and valves and reset or seal as approved by the Engineer. Estimates of gate or valve leakage will not be allowed as adjustments to the measured tank or structure leakage.
- D. Inlet and outlet pipes not required to be operational for the tests may be temporarily sealed or bulkheaded prior to testing.

3.03 TESTING PROCEDURES

- A. Conditions of Testing
 - 1. Perform tightness testing in conformance with Chapter 2 of ACI 350.1 (hydrostatic test).
 - 2. Do not begin initial filling of concrete structures until all concrete elements of the structure have attained the design compressive strength of the concrete, nor less than 14 days after all concrete walls or base slabs have been placed.
 - 3. Initial filling rate, water depth and waiting period shall conform to the requirements of ACI 350.1.

B. Testing Procedures

1. Duration of the test shall not be less than that required for a drop in the water surface of 3/8-in based on the calculated maximum allowable leakage rate but need not exceed 5 days.
2. Loss of volume measurements shall be taken at 24 hour intervals. The loss of volume is usually determined by measuring the drop in water surface elevation and computing the change in volume of the contained water. Measure water surface elevation at not less than two locations at 180 degrees apart and preferably at four locations 90 degrees apart. Record water temperature 18-in below the water surface when taking the first and last sets of measurements.

C. Reports

1. Submit to the Engineer watertightness test results for each structure tested using the form shown in Figure A or a similar form showing the necessary information.
2. Notify the Engineer of the scheduling of tests 3 working days prior to the tests. The Engineer may monitor any watertightness testing performed on the structures.

3.04 ACCEPTANCE

- A. The following conditions shall be considered as NOT meeting the criteria for acceptance regardless of the actual loss of water volume from the structure.
1. Ground water leakage into the structure.
 2. Structures which exhibit water flowing from the tank or from beneath the foundation (except for underdrain systems).
 3. Structures on which moisture can be picked up by a dry hand from the exterior surface.
- B. The watertightness of concrete tanks and structures shall be considered acceptable when loss of water volume is within the criteria listed below:
1. For unlined (or partially lined) reinforced concrete tanks, loss of volume not exceeding 0.10 percent in 24 hours (HST-100).
 2. For reinforced concrete tanks with fully lined walls and for all circular concrete tanks, loss of volume not exceeding 0.05 percent in 24 hours (HST-050).
 3. For completely lined tanks, no measurable loss of volume (HST-NML).

3.05 REPAIRS AND RETESTING

- A. Repair structures which fail the watertightness test and structures showing visible leakage in compliance with the provisions specified herein or as approved by the Engineer.
- B. Repairs and retesting of tanks shall be accomplished at no additional cost to the Owner.

3.06 SCHEDULE

- A. The following structures shall be tested for watertightness:
 - 1. Pump Station Wet wells.

FIGURE A

WATERTIGHTNESS TEST REPORT

PROJECT _____ SUBMITTED BY _____

STRUCTURE* _____ TEST DATES _____

Allowable loss of water volume _____ percent in 24 hrs.

Measured loss of water volume _____ percent in 24 hrs.

TEST READINGS

Water temperature at start _____ degrees F
F Water temperature at end _____ degrees

	<u>Date</u>	<u>Time</u>	<u>Location</u> <u>1</u>	<u>Location</u> <u>2</u>	<u>Location</u> <u>3</u>	<u>Location</u> <u>4</u>	<u>Initials</u>
1.	_____	_____	_____	_____	_____	_____	_____
2.	_____	_____	_____	_____	_____	_____	_____
3.	_____	_____	_____	_____	_____	_____	_____
4.	_____	_____	_____	_____	_____	_____	_____
5.	_____	_____	_____	_____	_____	_____	_____

Change in level _____

Average change in level _____

Correction for precipitation/evaporation _____

Corrected change in level = CL = _____

$(CL) \times (\text{surface area}) \times (100) = \text{measured percent water loss in 24 hrs.}$

$(\text{initial water volume}) \times (\text{number of test days})$

Notes and field observations**

* Attach a sketch showing a plan of the structure and measurement locations.

** Place date and initials at the beginning of each entry.

END OF SECTION

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SECTION 01500

TEMPORARY FACILITIES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, equipment, materials, and incidentals necessary and provide separate temporary facilities for the Contractor's use, as specified herein and as shown on the drawings.
- B. Operate and maintain temporary facilities for the duration of the project and as directed by the Engineer. All cost and use charges for temporary facilities shall be included in the Contract Price.

1.02 RELATED WORK

- A. Control of Work is included in Section 01046.
- B. Special Project Procedures is included in Section 01100.

1.03 SUBMITTALS

- A. Submit shop drawings and product data, in accordance with Section 01300, showing materials of construction and details of installation for:
 - 1. Site Plan: Show the proposed locations for temporary facilities including offices, temporary utilities, storage containers/buildings, vehicle access and parking areas, material laydown and staging areas, temporary fencing, and other security measures.
 - 2. Engineer's Field Office: Dimensioned floor plan, office systems, furnishings, and equipment.
 - 3. Temporary Fence: Layout drawings which indicate dimensions, access to fire hydrants, gate locations and opening sizes, and other site specific requirements.
 - 4. Project Sign: Layout, graphics, and wording.
- B. Submittals shall be received by the Engineer no later than the date of the Preconstruction Meeting.

1.04 QUALITY ASSURANCE

- A. Temporary facilities shall comply with all applicable state and local ordinances, codes and regulations.
- B. Coordinate with authorities having jurisdiction to inspect (and test if required) temporary facilities.
- C. Obtain all required permits for temporary facilities.

1.05 DEFINITIONS

- A. Duration of the project: The period of time from the date of the Notice to Proceed to the date of Substantial Completion, inclusive.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Temporary Fence: Fabric shall be No. 9 gauge galvanized wire woven in 2-in diamond mesh with top and bottom twisted selvage. Intermediate and terminal posts shall be galvanized steel H or pipe, minimum 2-3/8-in OD line posts, 2-7/8-in OD corner and pull posts, and 1-5/8-in OD top rails.
- B. Project Sign: Plywood shall be A-A EXT-APA grade, 1-in thick. Posts and braces shall be pressure treated lumber.

2.02 EQUIPMENT

- A. Fire Extinguishers: Provide portable, UL-rated with class and extinguishing agent required by locations and classes of fire exposure. Provide at least one for each trailer/office.
- B. Temporary Heat: Provide vented, self-contained, liquid propane gas or fuel oil heaters with individual space thermostatic control. Equipment shall be listed and labeled for type of fuel consumed and marked for intended use.

2.03 Engineer's Field Office

- A. General:
 - 1. Provide minimum 12-ft by 50-ft office trailer for the Engineer's exclusive use for the duration of the project. Field office trailer shall have at least one office, one conference room, one bathroom, one closet, and two exterior doors.
 - 2. The bathroom shall include toilet, sink and faucet, shower stall and faucet, medicine cabinet, and exhaust fan.
 - 3. The conference room shall include built-in plan table.
 - 4. The engineer's field office shall be weather-tight construction with floor, walls, and ceiling completely insulated. Each room shall have at least one operating window. Each window shall have a venetian blind and full insect screen. Furnish two sets of keys for each exterior door. Provide fully insulated skirting on all sides of the field office trailer. Provide steps, platforms, handrails, and boot scrapers for each exterior door.
 - 5. Field office trailer shall be Mobile Mini, ModSpace, Williams Scotsman, or equal. Converted storage or box containers will not be acceptable.

B. Furnishings

1. Contractor shall provide the following furnishings for the Engineer's temporary field office for the duration of the project. All furnishings shall be new – or in very good condition – subject to approval of the Engineer.
 - a. [Three] 60-in by 30-in desks with file drawer and 5 drawers, all lockable. ne upholstered swivel type chair with arms for each desk.
 - b. One 30-in by 84-in conference table
 - c. Eight armless side chairs (stacking type)
 - d. Two 54-in by 30-in folding tables
 - e. Six file cabinet, 4 drawer, legal size, Hon No. HN-315C, or equal
 - f. Four wastebaskets
 - g. One rolling plan storage rack, 10-stick capacity
 - h. One lockable storage cabinet, 72-in high, 36-in wide, and 18-in deep
 - i. Two wooden bookcase units, 4 shelves high, Hon No. HN-S48 ABC, or equal
 - j. One digital telephone answering machine
 - k. 24 painted steel coat hangers
 - l. One electric bottled water dispenser with hot and cold outlets and refrigerator unit. Adequate water bottles shall be provided (and paid for by the Contractor) until Final Completion
 - m. One wall-mounted first aid kit, McMaster-Carr 9501T1 or equal
 - n. Two smoke detectors, with batteries
 - o. Two dry erase boards, aluminum frame, 36-in by 60-in, markers and eraser, Quartet Model No. TS-S 535 or equal
 - p. One 1000-watt minimum 1.4-cuft microwave oven
 - q. One 6-cf refrigerator
 - r. Commercial duty cross-cut shredder with basket, designed for 3 to 5 users, Fellowes Powershred SB-125i, or equal
 - s. One first aid kit, OSHA (1910.151.b) and ANSI (Z308.1-2003) compliant, suitable for ten people.

C. Equipment

1. Contractor shall provide the following equipment for the Engineer's temporary field office for the duration of the project. All equipment shall be new.
 - a. A multifunction Photocopier, printer, facsimile and scanner.
 1. With 50-sheet auto-feeder, capable of copying and printing
 2. Letter-sized, legal-sized, and 11x17-inch documents.
 3. Contractor to provide paper and ink cartridges, as required, for the duration of the project.
 - b. Answering machine with digital recorder.
 - c. Digital Camera: provide one new digital camera for the Engineer's use for the project duration. Camera shall be a major brand name (e.g., Minolta, Cannon, Olympic, Pentax, etc – subject to the Engineer's approval) and shall have an automatic date function, 3 Mega pixel or greater, 3x optical zoom or better, and at least one GB of memory (on board or supplemental memory card). The camera shall come complete with carrying case, storage card, rechargeable batteries, battery charger, flash memory reader, USB cables and all necessary software. After completion of project the camera will become the property of the Owner.
 - d. Four 8-outlet surge protectors with six foot cord and minimum 1800-joule energy rating or greater; as manufactured by Belkin, or equal.
 - e. One 12-cup coffeemaker with timer, by Krups, or equal.

D. Services

1. Provide the following services for the duration of the project. Services shall include all costs for installation, use, maintenance, and removal of all products, services and equipment billed by each provider for each service specified herein.
2. Field office shall have complete and fully functional electrical, plumbing, and HVAC systems. Provide at least two smoke detectors hard-wired into the electrical system. Perform all scheduled and unscheduled maintenance for all systems and as directed by the Engineer.
3. Electrical System: Provide connection to temporary electric service. Comply with the electrical requirements of the furnished office trailer. Provide main circuit panel, sufficient GFCI outlets and lighting in each room, exterior lights at each exterior door, and proper grounding of entire electrical system.
4. Plumbing system: Connect to existing potable water supply. Provide hot water heater and hot and cold water to each fixture. Connect waste pipes to existing sanitary system or a waste holding tank. Where potable water service is not available, Contractor shall provide bottle water service with water chiller/dispenser.

5. HVAC System: Provide central heating and air conditioning system with programmable thermostat. System shall be capable of maintaining an interior temperature of 70°F when the exterior temperature is 0°F and an interior temperature of 75°F when the exterior temperature is 100°F.
 6. Bottled water service: Provide bottled water service complete with dispenser with hot and cold water taps and regular bottle and cup replenishment as directed by the Engineer.
 7. Janitorial service: Provide janitorial services (at least weekly) that include dusting, sweeping, vacuuming, mopping, disinfection, and trash removal.
 8. Sanitary service: Provide regular pumping of waste holding tank, if applicable, as needed.
 9. Communications
 - a. Install two telephone lines in the Engineer's field office for the Engineer's exclusive use:
 - 1) one voice grade line with caller ID and call-waiting features
 - 2) a second line for a dedicated fax line.
 - 3) Provide two cellular phones for the duration of the project for the Engineer's use. Include unlimited service plans, with long distance service for each unit, including voice mail and text messaging service. Provide chargers in both office and vehicle for each unit. Provide holsters for each unit.
 10. Internet Access
 - a. Provide a high-speed DSL data line or T1 cable line with internet access for the duration of the project.
 11. Pay all costs for installation, maintenance, and removal of the telephone and internet service and instruments. The monthly cost of all calls made and received by the Engineer, including toll and long distance calls, shall be paid for by the Contractor for the duration of the project.
- E. Supplies: Provide the following supplies for the duration of the project: copy paper, toner, toilet paper, paper towels, soap, light bulbs, and other consumables as required by the Engineer.

PART 3 EXECUTION

3.01 ENGINEER'S OFFICE

- A. Engineer's trailer shall be set up and ready for occupancy within 30 days of the Notice to Proceed and prior to commencement of Work at the site. All systems, furnishings, equipment, and services specified herein shall be furnished, installed, and completely operational for the field office to be considered established.
 1. Provide regular office cleaning services for the duration of the project.
 2. Provide supplies including, but not limited to restroom supplies (toilet tissue paper, paper towel, and soap), as well as light bulbs, air conditioner filters, etc.

3. Provide office supplies for printers and fax machines, etc.
 4. Supply all fuel for heating and pay all utility bills.
- B. Install field office plumb and level.
- C. Engineer's trailer shall be removed and the site shall be cleaned up and restored before Final Completion of the project.

3.02 CONTRACTOR'S FIELD OFFICE

- A. Provide a temporary field office(s) for the Contractor's use for the duration of the project. An authorized representative of the Contractor shall be present at all times while the Work is in progress. Instructions received at the Contractors field office from the Engineer shall be considered delivered to the Contractor.
- B. Locate field office(s) in accordance with approved shop drawings and as directed by the Owner.
- C. Establish and occupy field office within 30 days of the Notice to Proceed, unless otherwise approved by the Engineer or Owner.

3.03 TEMPORARY POWER AND LIGHT

- A. Provide connections to existing facilities sized to provide service required for power and lighting. Contractor shall pay the costs of power used.
- B. Provide properly configured NEMA polarized outlets to prevent insertion of 110-120 Volt plugs into higher voltage outlets. For connection of power tools and equipment, provide outlets equipped with ground-fault circuit interrupters, reset button and pilot light.
- C. Provide grounded extension cords. Use heavy duty cords where exposed to abrasion and traffic. Provide waterproof connectors to connect separate lengths of electric cords if more than one length is required.
- D. Provide general service incandescent lamps as required for adequate illumination. Provide guard cages or tempered glass enclosures where exposed to breakage. Provide exterior fixtures where exposed to moisture.

3.04 WEATHER PROTECTION

- A. The Contractor shall furnish temporary heating and cooling units (UL or FM listed) to maintain reasonable temperatures within temporary enclosures.

3.05 TEMPORARY AIR, STEAM AND WATER

- A. Provide all air, steam and water, including temporary piping and appurtenances required for cleaning and testing pipelines and equipment. Remove temporary piping and appurtenances upon approval of equipment being tested.

3.06 SANITARY FACILITIES

- A. Provide self-contained, single occupant toilet units of the chemical, aerated recirculation, or combustion type, properly vented and fully enclosed in a fiberglass or other approved non-absorbent shell.

3.07 CONSTRUCTION AIDS

- A. Provide temporary elevators, hoists, cranes, scaffolding and platforms as necessary to perform the Work. Provide temporary stairs where ladders are not adequate. Protect permanent stairs from damage from construction operations.

3.08 VEHICLE ACCESS AND PARKING

- A. Provide temporary access roads, parking areas, traffic control devices and staging areas as approved by the Engineer and Owner.
- B. Provide minimum 12-ft by 24-ft by 6-in deep dense graded crushed stone or paved parking area adjacent to Engineer's field office for exclusive use by the Engineer for the duration of the project.
- C. Clear snow and ice from all drives, walks, and stairs to maintain safe vehicle and pedestrian access to the site and facilities as directed by the Engineer.

3.09 TEMPORARY FENCE

- A. Provide temporary fence as shown on the Drawings, as specified herein, and as the Contractor requires for site security.
 - 1. Provide 6-ft high chain link fence with at least two vehicle and two pedestrian access gates. Gates shall be equipped with locking hardware and padlocks. Furnish two sets of keys to Engineer and Owner. Coordinate with local first responders for access during non-work hours.
 - 2. Fence installation shall comply with ASTM F567. Post spacing shall not exceed 8-ft on center. Posts shall be set plumb in concrete footings.
 - 3. Perform daily inspections of fence and immediately repair or replace damaged or compromised sections and as directed by the Engineer.

3.10 WASTE MANAGEMENT

- A. Provide covered dumpster, minimum 4-cubic yards, dedicated for field office waste. Provide separate covered dumpster of adequate size for construction debris. Empty dumpsters on a regular basis and as directed by the Engineer. Dumpsters shall not exceed their capacities at any time.

3.11 PROJECT SIGNS

- A. Furnish and install the project signs indicated in the Contract Documents. Signs shall be placed as directed by the Engineer; and, shall remain maintained in good condition for the life of the construction period.
- B. Remove signs at final acceptance, unless otherwise directed.

3.12 REMOVAL AND RESTORATION

- A. Remove each temporary facility complete when need for its service has ended and as approved by the Engineer. Coordinate removal of temporary facilities with authorities having jurisdiction.
- B. Restore all improvements damaged by the installation, operation, and removal of the temporary facilities. Obtain prior approval from Owner and Engineer for restoration work. Comply with the restoration requirements of Section 01046.

END OF SECTION

SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 GENERAL

1.01 REQUIREMENTS

- A. Furnish, install and maintain project identification sign.
- B. Remove sign on completion of construction.
- C. Allow no other signs to be displayed.

1.02 SUBMITTALS

- A. Submit in accordance with the requirements of Section 01300.

1.03 PROJECT IDENTIFICATION SIGN

- A. One painted sign, of not less than 32 square feet (3 square meters) area, with painted graphic content to include:
 - 1. Title of Project.
 - 2. Name of Owner.
 - 3. Names and titles of authorities:
 - 4. Names and title of:
 - a. Engineer.
 - b. Professional Consultants.
 - 5. Prime Contractor.
 - 6. Major subcontractors.
- B. Graphic design, style of lettering and colors: As approved by the Engineer and subject to the approval of the local Community Appearance Board (CAB) or its equivalent and applicable local regulations for signs.
- C. Erect on the site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the Engineer and the Owner.

1.04 INFORMATIONAL SIGNS

- A. Painted signs with painted lettering, or standard products.
 - 1. Size of signs and lettering: as required by regulatory agencies, or as appropriate to usage.
 - 2. Colors: as required by regulatory agencies, otherwise of uniform colors throughout Project.
- B. Erect at appropriate location to provide required information.

1.05 QUALITY ASSURANCE

- A. Sign Painter: Professional Experience in type of work required.
- B. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction period.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

- A. Structure and Framing: May be new or used, wood or metal, in sound condition structurally adequate to work and suitable for specified finish.
- B. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints.
 - 1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.
- C. Rough Hardware: Galvanized
- D. Paint: Exterior quality, as specified in Division 9.
 - 1. Use Bulletin colors for graphics.
 - 2. Colors for structure, framing, sign surfaces and graphics: As selected by the Engineer.

PART 3 EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

- A. Paint exposed surfaces of supports, framing and surface material; one coat of primer and one coat of exterior paint.
- B. Paint graphics in styles, sizes and colors selected.

3.02 MAINTENANCE

- A. Maintain signs and supports in a neat, clean condition; repair damages to structure, framing or sign.

3.03 REMOVAL

- A. Remove signs, framing, supports and foundations at completion of project.

END OF SECTION

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SECTION 01600

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 for all items required in the construction of the work. Specific requirements, if any, are specified with the related item.

1.02 TRANSPORTATION AND DELIVERY

- A. Transport and handle items in accordance with manufacturer's instructions.
- B. Schedule delivery to reduce long term on-site storage prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.
- C. Coordinate delivery with installation to ensure minimum holding time for items that are hazardous, flammable, easily damaged or sensitive to deterioration.
- D. Deliver products to the site in manufacturer's original sealed containers or other packing systems, complete with instructions for handling, storing, unpacking, protecting and installing.
- E. All items delivered to the site shall be unloaded and placed in a manner which will not hamper the Contractor's normal construction operation or those of subcontractors and other contractors and will not interfere with the flow of necessary traffic.
- F. Provide necessary equipment and personnel to unload all items delivered to the site.
- G. Promptly inspect shipment to assure that products comply with requirements, quantities are correct and items are undamaged. For items furnished by others (i.e. Owner, other Contractors), perform inspection in the presence of the Engineer. Notify Engineer verbally, and in writing, of any problems.
- H. If any item has been damaged, such damage shall be repaired at no additional cost to the Owner.

1.03 STORAGE AND PROTECTION

- A. Store and protect products in accordance with the manufacturer's instructions, with seals and labels intact and legible. Storage instruction shall be studied by the Contractor and reviewed with the Engineer by him/her. Instruction shall be carefully followed and a written record of this kept by the Contractor. Arrange storage to permit access for inspection.
- B. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

- C. Cement and lime shall be stored under a roof and off the ground and shall be kept 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. Brick, block and similar masonry products shall be handled and stored in a manner to reduce breakage, cracking and spalling to a minimum.
- D. All mechanical and electrical equipment and instruments subject to corrosive damage by the atmosphere if stored outdoors (even though covered by canvas) shall be stored in a weathertight building to prevent injury. The building may be a temporary structure on the site or elsewhere, but it must be satisfactory to the Engineer. Building shall be provided with adequate ventilation to prevent condensation. Maintain temperature and humidity within range required by manufacturer.
1. All equipment shall be stored fully lubricated with oil, grease and other lubricants unless otherwise instructed by the manufacturer.
 2. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to ensure that the equipment does not deteriorate from lack of use.
 3. Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. New lubricants shall be put into the equipment at the time of acceptance.
 4. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.
- E. All paint and other coating products shall be stored in areas protected from the weather. Follow all storage requirements set forth by the paint and coating manufacturers.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01700
CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies administrative, verification and procedural requirements for project closeout, including but not limited to:
1. Final cleaning Section 01710.
 2. Project Record Documents Section 01720.
 3. Spare parts and maintenance materials (spare paint, lubricants, special tools) in applicable Sections in Divisions 9 through 16.
 4. Warranties, guarantees, and bonds Section 01740 and applicable Sections in Technical Divisions 10 through 16.
 5. Reconciliation of final accounting, final change order, final payment application Section 01152 and General Conditions and Contractor's releases.
 6. As-built construction schedule Section 01310.
 7. Permit close-outs including Certificate of Occupancy or Certificate of Completion.

1.02 RELATED WORK

- A. Operation and Maintenance (O&M) data and manuals Section 01730 and applicable Sections in Technical Divisions.
- B. Certified Surveyor documentation submittals Section 01050.

1.03 CLOSEOUT PROCEDURES

- A. Provide all deliverables as specified, prior to submitting the final payment application.
- B. Provide submittals to Engineer that are required by governing or other authorities having applicable jurisdiction including but not limited to permit close out information, certificates of occupancy, etc.
- C. Submit Application for Final Payment identifying total adjusted Contract Sum, previous payments and sum remaining due, following submittal and approval of Record Documents and Record Drawings.
- D. Submit Contractor's Final Release and Release of Liens with final payment application.

1.04 FINAL CLEANING

- A. Contractor to complete final cleaning prior to submittal of the final application for payment.
- B. Contractor to comply with requirements as specified in Section 01710.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01710

CLEANING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Execute cleaning, during progress of the work, and at completion of the work, as required by General Conditions.

1.02 RELATED WORK

- A. Standard General Conditions of the Construction Contract are included in Section 00700.
- B. Each Section: Cleaning for specific products or work.

1.03 DISPOSAL AND CLEANING

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

PART 2 PRODUCTS

2.01 MATERIALS

- A. Use only those cleaning materials which will not create hazards to health or property and which will not damage surfaces.
- B. Use only those cleaning materials and methods recommended by manufacturer of the surface material to be cleaned.
- C. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

- A. Execute periodic cleaning to keep the work, the site and adjacent properties free from accumulations of waste materials, rubbish and windblown debris, resulting from construction operations.
- B. Provide on-site containers for the collection of waste materials, debris and rubbish.
- C. Remove waste materials, debris and rubbish from the site periodically and dispose of at legal disposal areas away from the site.

3.02 DUST CONTROL

- A. Clean interior spaces prior to the start of finish painting and continue cleaning on an as-needed basis until painting is finished.
- B. Schedule operations so that dust and other contaminants resulting from cleaning process will not fall on wet or newly-coated surfaces.

3.03 FINAL CLEANING

- A. Employ skilled workmen for final cleaning.
- B. Remove grease, mastic, adhesives, dust, dirt, stains, fingerprints, labels and other foreign materials from sight-exposed interior and exterior surfaces.
- C. Wash and shine glazing and mirrors.
- D. Polish glossy surfaces to a clear shine.
- E. Ventilating Systems:
 - 1. Clean permanent filters and replace disposable filters if units were operated during construction.
 - 2. Clean ducts, blowers and coils if units were operated without filters during construction.
- F. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- G. Prior to final completion, or Owner occupancy, conduct an inspection of sight-exposed interior and exterior surfaces and all work areas, to verify that the entire work is clean.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 SCOPE

- A. The Contractor shall keep and maintain, at the job site, a copy of contract documents, marked up to indicate all changes made during the course of a project, as specified herein.

1.02 RELATED REQUIREMENTS

- A. Contract close-out submittals are included in Section 01700.
- B. Warranties and bonds are included in Section 01740.
- C. As-built construction schedules are included in Section 01310.
- D. As-built wiring diagrams are included in Section 01730.
- E. As-built surveys are included in Section 01050.

1.03 REQUIREMENTS INCLUDED

- A. Contractor shall maintain a record copy of the following documents, marked up to indicate all changes made during the course of a project:
 - 1. Contract Drawings
- B. Contractor shall assemble copies of the following documents for turnover to the Engineer at the end of the project, as specified.
 - 1. Field Orders, Change Orders, Design Modifications, and RFIs
 - 2. Field Test records
 - 3. Permits and permit close-outs (final approvals)
 - 4. Certificate of Occupancy or Certificate of Completion, as applicable
 - 5. Laboratory test reports (e.g., bacteriological and primary & secondary water quality)
 - 6. Certificates of Compliance for materials and equipment
 - 7. Samples

C. RECORD DRAWINGS

1. The Contractor shall annotate (mark-up) the Contract Drawings to indicate all project conditions, locations, configurations, and any other changes or deviations that vary from the original Contract Drawings. This requirement includes, but is not limited to, buried or concealed construction, and utility features that are revealed during the course of construction. Special attention shall be given to recording the locations (horizontal and vertical) and material of all buried utilities that are encountered during construction – whether or not they were indicated on the Contract Drawings. The record information added to the drawings may be supplemented by detailed sketches, if necessary, clearly indicating, the Work, as constructed.
2. These annotated Contract Drawings constitute The Contractor's Record Drawings and are actual representations of as-built conditions, including all revisions made necessary by change orders, design modifications, requests for information and field orders.
3. Record drawings shall be accessible to the Owner and Engineer at all times during the construction period.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.01 MAINTENANCE OF RECORD DOCUMENTS AND SAMPLES

- A. Store documents and samples in Contractor's field office apart from documents used for construction.
 1. Provide files and racks for storage of the record documents.
 2. Provide locked cabinet(s) or secure storage space for storage of samples.
- B. File documents and samples in accordance with Construction Specifications Institute (CSI) format.
- C. Maintain documents in a clean, dry, legible, condition and in good order. Do not use record documents for construction purposes.
- D. Make documents and sample available for inspection by the Engineer or Owner at all times.
- E. Up-to-date Record Drawings may be a pre-requisite of processing periodic monthly pay applications, if so specified under the section for progress payments.

3.02 MARKING METHOD

- A. Use the color *Red* (indelible ink) to record information on the Drawings.
- B. Label each document "PROJECT RECORD" in neat large printed letters.

- C. Unless otherwise specified elsewhere, notations shall be affixed to hardcopies of documents.
- D. Record information contemporaneously with construction progress.
- E. Legibly mark drawings with as-built information:
 - 1. Elevations and dimensions of structures and structural elements
 - 2. All underground utilities (piping and electrical), structures, and appurtenances
 - a. Changes to existing structure, piping and appurtenance locations.
 - b. Record horizontal and vertical locations of underground structures, piping, utilities and appurtenances, referenced to permanent surface improvements.
 - c. Record actual installed pipe material, class, size, joint type, etc.

3.03 RECORD INFORMATION COMPILATION

- A. Do not conceal any Work until the required information is acquired.
- B. Items to be recorded include, but are not limited to:
 - 1. Location of internal utilities and appurtenances concealed in the construction – referenced to visible and accessible features.
 - 2. Field changes of dimensions and/or details
 - a. Interior equipment and piping relocations.
 - b. Architectural and structural changes, including relocation of doors, windows, etc.
 - c. Architectural schedule changes.
- C. Changes made by Field Order, Change Order, design modification, and RFI.
- D. Details not indicated on the original Contract Drawings.

3.04 SUBMITTAL

- A. If specified under the section for progress payments, monthly applications for payment will be contingent upon up-to-date Record Drawings. If requested by the Engineer or Owner, Contractor shall provide a copy of the Record Drawings, or present them for review prior to processing monthly applications for payment.
- B. Upon substantial completion of the Work and prior to final acceptance, the Contractor shall finalize and deliver a complete set of Record Drawings to the Engineer conforming to the construction records of the Contractor. The set of drawings shall consist of corrected and annotated drawings showing the recorded location(s) of the Work. Unless specified otherwise elsewhere, Record Drawings shall be in the form of a set of prints with annotations carefully and neatly superimposed on the drawings in red.

- C. Upon substantial completion of the Work and prior to final acceptance, the Contractor shall finalize and deliver a complete set of Record Documents to the Engineer conforming to the construction records of the Contractor. The set of documents shall consist of corrected and annotated documents showing the as-installed equipment and all other as-built conditions not indicated on the Record Drawings.
- D. The information submitted by the Contractor into the Record Drawings and Record Documents will be assumed to be correct, and the Contractor shall be responsible for the accuracy of such information, and shall bear the costs resulting from the correction of incorrect data.
- E. Delivery of Record Drawings and Record Documents to the Engineer will be a prerequisite to Final payment.
- F. The Contractor shall maintain a copy of all books, records, and documents pertinent to the performance under this Agreement for a period of five years following completion of the contract.

END OF SECTION

SECTION 01730

OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section includes procedural requirements for compiling and submitting operation and maintenance data required to complete the project.

1.02 RELATED WORK

- A. Submittals are included in Section 01300.
- B. Contract closeout is included in Section 01700.
- C. Warranties and Bonds are included in Section 01740.

1.03 OPERATING MANUALS

- A. Provide operation and maintenance instructions for all electrical, mechanical, and instrumentation & controls equipment furnished under various technical specifications Sections.
- B. Separate manuals shall be provided for each type of equipment, or each Section number. Each manual shall contain the following:

- 1. Format and Materials

- a. Binders:

- 1) Commercial quality three ring binders with durable and cleanable plastic covers
- 2) Maximum ring width capacity: 3 inches
- 3) When multiple binders are used, correlate the data into related consistent groupings/volumes.

- b. Identification: Identify each volume on the cover and spine with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". Include the following:

- 1) Title of Project.
- 2) Identify the general subject matter covered in the manual
- 3) Identify structure(s) and/or location(s), as applicable
- 4) Specification Section number

- c. 20 lb loose leaf paper, with hole reinforcement

- d. Page size: 8-1/2 inch by 11 inch

- e. Provide heavy-duty fly leafs (section separators), matching the table of contents, for each separate product, each piece of operating equipment, and organizational sections of the manual.
 - f. Provide reinforced punched binder tab; bind in with text.
 - g. Reduce larger drawings and fold to the size of text pages - but not larger than 11 inches x 17 inches - or provide a suitable clear plastic pocket (with drawing identification) for such folded drawings/diagrams.
2. Contents:
- a. A table of contents/Index
 - b. Specific description of each system and components
 - c. Name, address, telephone number(s) and e-mail address(es) of vendor(s) and local service representative(s)
 - d. Specific on-site operating instructions (including starting and stopping procedures)
 - e. Safety considerations
 - f. Project specific operational procedures
 - g. Project specific maintenance procedures
 - h. Manufacturer's operating and maintenance instructions – specific to the project
 - i. Copy of each wiring diagram
 - j. Copy of approved shop drawing(s) and Contractor's coordination/layout drawing(s)
 - k. List of spare parts and recommended quantities
 - l. Product Data: Mark each sheet to clearly identify specific products and component parts and data applicable to installation. Delete inapplicable information.
 - m. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams
 - n. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions specified.
 - o. Warranties and Bonds, as specified in the General Conditions

3. Transmittals
 - a. Prepare separate transmittal sheets for each manual. Each transmittal sheet shall include at least the following: the Contractor's name and address, Owner's name, project name, project number, submittal number, description of submittal and number of copies submitted.
 - b. Submittals shall be transmitted or delivered directly to the office of the Engineer, as indicated in the Contact Documents or otherwise directed by the Engineer.
 - c. Provide copies of transmittals (only, i.e., without copies of the respective submittal) directly to the Resident Project Representative.
- C. Manuals for Equipment and Systems – In addition to the requirements listed above, for each System, provide the following:
 1. Overview of system and description of unit or system and component parts. Identify function, normal operating characteristics and limiting conditions. Include performance curves, with engineering data and tests and complete nomenclature and commercial number of replaceable parts.
 2. Panelboard circuit directories including electrical service characteristics, controls and communications and color coded wiring diagrams as installed.
 3. Operating procedures: include start-up, break-in and routine normal operating instructions and sequences; regulation, control, stopping, shut-down and emergency instructions; and summer, winter and any special operating instructions.
 4. Maintenance Requirements:
 - a. Procedures and guides for trouble-shooting; disassembly, repair, and reassembly instructions
 - b. Alignment, adjusting, balancing and checking instructions
 - c. Servicing and lubrication schedule and list of recommended lubricants
 - d. Manufacturer's printed operation and maintenance instructions
 - e. Sequence of operation by instrumentation and controls manufacturer
 - f. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance
 5. Control diagrams by controls manufacturer as installed (as-built)
 6. Contractor's coordination drawings, with color coded piping diagrams, as installed (as-built)

7. Charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams. Include equipment and instrument tag numbers on diagrams.
8. List of original manufacturer's spare parts and recommended quantities to be maintained in storage
9. Test and balancing reports, as required
10. Additional Requirements as specified in individual product specification
11. Design data for systems engineered by the Contractor or its Suppliers

D. Electronic Transmission of O&M Manuals

1. Unless otherwise approved by the Engineer, O&M manuals may not be transmitted by electronic means other than by CD-ROM. Electronic O&M manuals shall meet the following conditions:
 - a. The above-specified transmittal form is included.
 - b. All other requirements specified above have been met, including, but not limited to, coordination by the Contractor, review and approval by the Contactor.
 - c. The submittal contains no pages or sheets large than 11 x 17 inches.
 - d. With the exception of the transmittal sheet, the entire submittal is included in a single file.
 - e. Files are Portable Document Format (PDF) – with the printing function enabled.
2. When electronic copies are provided, transmit two hard-copy (paper) originals to the Engineer with an electronic copy on CD-ROM.
3. The electronic copy of the O&M manual must be identical in organization, format and content to the hard copies of the manual.

1.04 SERVICES OF MANUFACTURERS' REPRESENTATIVE

- A. All electrical, mechanical, and instrumentation & controls equipment furnished under various technical specifications Sections shall include the cost of a competent representative of the manufacturers 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. This supervision may be divided into two or more time periods to suit the Contractor's schedule and/or the Owner's personnel availability.
- B. See the detailed specifications for additional requirements for furnishing the services of manufacturer's representatives.

- C. The manufacturer's representative shall certify that the installation of the equipment is satisfactory; that the unit has been satisfactorily tested; that the equipment is ready for operation; and, that the operating personnel have been suitably instructed in the operation, maintenance, care, and safe operation of the equipment. The *Equipment Manufacturer's Certificate of Installation, Testing, and Instruction* attached to this Section shall be used for this certification.
- D. For other materials furnished under other specification Sections, furnish the services of approved representative(s) of the manufacturer when, in the opinion of the Engineer, some evident product failure or malfunction makes such services necessary.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 SUBMITTAL SCHEDULE

- A. Operation and maintenance manuals shall be delivered directly to the office of the Engineer, as follows:
 - 1. Preliminary copies of manuals shall be submitted to the office of the Engineer, no later than 30 days following approval of the respective shop drawings.
 - 2. Provide 6 final copies of complete manuals prior to testing and start-up.
- B. The Engineer will review Operation and Maintenance manuals submittals on operating equipment for conformance with the requirements of the applicable specification Section. The review will generally be based on the *O&M Manual Review Checklist* appended to this Section.
- C. If during test and start-up of equipment, any changes were made to the equipment, provide copies (the number specified in paragraph 3.01.A.2) of as-built drawings or any other amendments for insertion in the final manuals. Submit the required number within 30 days of start-up and testing of the facility.

3.02 VENDOR TRAINING/INSTRUCTIONS (TO OWNER'S PERSONNEL)

- A. Before final initiation of operation, Contractor's vendors shall train/instruct Owner's designated personnel in the operation, adjustment, and maintenance of products, equipment and systems at times convenient to the Owner.
- B. Unless specified otherwise under the respective equipment specification section, vendor training/instruction shall consist of eight hours of training for each type of equipment. Such training/instruction shall be scheduled and held at times to accommodate the work schedules of Owner's personnel, including splitting the required training/instruction time into separate sessions and/or presented at reasonable times other than the Contractor's "normal working hours" or the Owner's normal day shift.
- C. Use operation and maintenance manuals as basis for instruction. Train/instruct the Owner's personnel, in detail, based on the contents of manual explaining all aspects of operation and

maintenance of the equipment. If the respective equipment is inter-related to the operation of other equipment, all interlock, constraints, and permissives shall be explained.

- D. At least two weeks prior to the schedule for vendor training, a detailed lesson plan, representative of the material to be covered during instruction, shall be submitted to the Engineer for approval. Lesson plans shall consist of in-depth outlines of the training material, including a table of contents, resume of the instructor, materials to be covered, start-up procedures, maintenance requirements, safety considerations, and shut-down procedures.
- E. Prepare and insert additional data in each Operation and Maintenance Manual when the need for such data becomes apparent during training/instruction.
- F. Vendor's training/instruction will be considered acceptable based on the completed *Owner's Acknowledgement of Manufacturer's Instruction* as indicated on the Equipment Manufacturer's Certification of Installation, Testing, and Instruction appended to this Section.

EQUIPMENT MANUFACTURER'S CERTIFICATE OF INSTALLATION, TESTING
AND INSTRUCTION

Owner: _____

Project: _____

Contract No. _____

CDM Project 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 unit[s] on Date: _____ Time: _____.

CERTIFIED BY: _____ DATE: _____
(Signature of Manufacturer's Representative)

OWNER'S ACKNOWLEDGMENT 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: _____

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O&M Manual Review Checklist

Submittal No.: _____

Project No.: _____

Manufacturer: _____

Equipment Submitted: _____

Specification Section: _____

Date of Submittal: _____

General Data

- _____ 1. Are the area representative's name, address, e-mail address and telephone number included?
- _____ 2. Is the nameplate data for each component included?
- _____ 3. Are all associated components related to the specific equipment included?
- _____ 4. Is non-pertinent data crossed out or deleted?
- _____ 5. Are drawings neatly folded and/or inserted into packets?

Operations and Maintenance Data

- _____ 6. Is an overview description of the equipment and/or process included?
- _____ 7. Does the description include the practical theory of operation?
- _____ 8. Does each equipment component include specific details (design characteristics, operating parameters, control descriptions, and selector switch positions and functions)?
- _____ 9. Are alarm and shutdown conditions clearly identified? Does it describe possible causes and recommended remedies?
- _____ 10. Are step procedures for starting, stopping, and troubleshooting the equipment included?
- _____ 11. Is a list of operational parameters to monitor and record for specific equipment included?
- _____ 12. Is a proposed operating log sheet included?
- _____ 13. Is a spare parts inventory list included for each component?
- _____ 14. Is a lubrication schedule for each component included - or does it clearly state "No Lubrication Required"?
- _____ 15. Is a maintenance schedule for each component included?
- _____ 16. Is a copy of the warranty information included?

Review Comments

Is the submittal fully approved (yes/no)?

If not, see the following are the points of rejection that must be addressed and require resubmittal by the Contractor:

Item No.

- 1. _____
- 2. _____
- 3. _____
- 4. _____
- 5. _____
- 6. _____
- 7. _____
- 8. _____
- 9. _____
- 10. _____
- 11. _____
- 12. _____
- 13. _____
- 14. _____
- 15. _____

Reviewed By: _____ Date: _____

Legend

- 1 = OK
- 2 = Not Adequate
- 3 = Not Included

Note: This submittal has been reviewed for compliance with the Contract Documents.

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section specifies general administrative and procedural requirements for warranties and bonds required by the Contract Documents, including manufacturer's standard warranties on products and special warranties.

1.02 RELATED WORK

- A. Refer to Conditions of Contract for the general requirements relating to warranties and bonds.
- B. General closeout requirements are included in Section 01700 Contract Closeout.
- C. Specific requirements for warranties for the work and products and installations that are specified to be warranted are included in the individual Sections of Division 2 through 16.

1.03 SUBMITTALS

- A. Submit written warranties to the Owner prior to the date fixed by the Engineer for Substantial Completion. If the Certificate of Substantial Completion designates a commencement date for warranties other than the date of Substantial Completion for the work, or a designated portion of the work, submit written warranties upon request of the Owner.
- B. When a designated portion of the work is completed and occupied or used by the Owner, by separate agreement with the Contractor during the construction period, submit properly executed warranties to the Owner within 15 days of completion of that designated portion of the Work.
- C. When a special warranty is required to be executed by the Contractor, or the Contractor and a subcontractor, supplier or manufacturer, prepare a written document that contains appropriate terms and identification, ready for execution by the required parties. Submit a draft to the Owner for approval prior to final execution.
- D. Refer to individual Sections of Divisions 2 through 16 for specific content requirements, and particular requirements for submittal of special warranties.
- E. At Final Completion compile two copies of each required warranty and bond properly executed by the Contractor, or by the Contractor, subcontractor, supplier, or manufacturer. Organize the warranty documents into an orderly sequence based on the table of contents of the Project Manual.
- F. Bind warranties and bonds in heavy-duty, commercial quality, durable 3-ring vinyl covered loose-leaf binders, thickness as necessary to accommodate contents and sized to receive 8-1/2-in by 11-in paper.

- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the Section in which specified and the name of the product or work item.
- H. Provide heavy paper dividers with celluloid covered tabs for each separate warranty. Mark the tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of the installer, supplier and manufacturer.
- I. Identify each binder on the front and the spine with the typed or printed title "WARRANTIES AND BONDS", the project title or name and the name, address, and telephone number of the Contractor.
- J. When operating and maintenance manuals are required for warranted construction, provide additional copies of each required warranty, as necessary, for inclusion in each required manual.

1.04 WARRANTY REQUIREMENT

- A. Related Damages and Losses: When correcting warranted work that has failed, remove and replace other work that has been damaged as a result of such failure or that must be removed and replaced to provide access for correction of warranted work.
- B. Reinstatement of Warranty: When work covered by a warranty has failed and been corrected by replacement or rebuilding, reinstate the warranty by written endorsement. The reinstated warranty shall be equal to the original warranty with an equitable adjustment for depreciation.
- C. Replacement Cost: Upon determination that work covered by a warranty has failed, replace or rebuild the work to an acceptable condition complying with requirements of Contract Documents. The Contractor is responsible for the cost of replacing or rebuilding defective work regardless of whether the Owner has benefited from use of the work through a portion of its anticipated useful service life.
- D. Owner's Recourse: Written warranties made to the Owner are in addition to implied warranties, and shall not limit the duties, obligations, rights and remedies otherwise available under the law, nor shall warranty periods be interpreted as limitations on time in which the Owner can enforce such other duties, obligations, rights, or remedies.
- E. Rejection of Warranties: The Owner reserves the right to reject warranties and to limit selections to products with warranties not in conflict with requirements of the contract Documents.
- F. The Owner reserves the right to refuse to accept work for the project where a special warranty, certification, or similar commitment is required on such work or part of the work, until evidence is presented that entities required to countersign such commitments are willing to do so.
- G. Disclaimers and Limitations: Manufacturer's disclaimers and limitations on product warranties do not relieve the Contractor of the warranty on the work that incorporates the products, nor does it relieve suppliers, manufacturers and subcontractors required to countersign special warranties with the Contractor.

1.05 DEFINITIONS

- A. Standard Product Warranties are preprinted written warranties published by individual manufacturers for particular products and are specifically endorsed by the manufacturer to the Owner.
- B. Special Warranties are written warranties required by or incorporated in the Contract Documents, either to extend time limits provided by standard warranties or to provide greater rights for the Owner.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 02050

DEMOLITION AND MODIFICATIONS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and demolish, modify, remove and dispose of work shown on the Drawings and as specified herein.
- B. Included, but not limited to, are demolition, modifications and removal of existing materials, equipment or work necessary to install the new work as shown on the Drawings and as specified herein and to connect with existing work in 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, but are not limited to:
 - 1. Demolition of the existing pump station wetwell as shown on the Drawings.
 - 2. Demolition of existing piping, valves, and appurtenances as shown on the Drawings.
 - 3. Demolition of the existing flow meter and meter vault.
 - 4. Demolition of the existing pumps (to be salvaged), pump rails, and appurtenances.
 - 5. Demolition of the existing pump station asphalt pad.
 - 6. Demolition of the existing pump station chain link fence.
- E. Blasting and the use of explosives will not be permitted for any demolition work.

1.02 RELATED WORK

- A. Summary of Work is included in Section 01010.
- B. Submittals are included in Section 01300.
- C. Construction Schedule is included in Section 01310.
- D. Trenching, Backfilling and Compaction are included in Section 02221.
- E. Environmental Protection is included in Section 01110.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, proposed methods and operations of demolition of the structures and modifications prior to the start of 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. Sequence shall be compatible with sequence of construction and shutdown coordination requirements as specified in Section 01014.
- C. Before commencing demolition work, all modifications necessary to bypass the affected structure shall be completed. Actual work shall not begin until the Owner's Representative has inspected and approved the modifications and authorized commencement of the demolition work in writing.
- D. Prior to performing modifications to existing pipelines, submit, in accordance with Section 01300, manufacturer's data on type of caps and/or plugs to be installed for each application.

1.04 JOB CONDITIONS

- A. Protection
 - 1. Execute the demolition and removal work to prevent damage or injury to structures, occupants thereof and 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.
 - 2. Closing or obstructing of roadways, sidewalks and passageways adjacent to the work by the placement or storage of materials will not be permitted and all operations shall be conducted with a minimum interference to traffic on these ways.
 - 3. Erect and maintain barriers, lights, sidewalk sheds and other required protective devices.
- 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 prior to commencement of a demolition or removal, notify the Owner's Representative in writing of proposed schedule therefor. Owner shall inspect the existing equipment and to identify and mark those items which are to remain the property of the Owner. No removals shall be started without the permission of the Owner's Representative.
- 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 prior to the start of demolition work.

E. Repairs to Damage

1. Promptly repair damage caused to adjacent facilities by demolition operation when directed by Owner's Representative and at no additional cost to the Owner. Repairs shall be made to a condition at least equal to that which existed prior to construction.

F. Traffic Access

1. Conduct demolition and modification operations and the removal of equipment and debris to ensure minimum interference with roads, streets, walks both onsite and offsite 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.
3. Do not close or obstruct streets, walks or other occupied or used facilities without permission from the Owner's Representative. Furnish alternate routes around closed or obstructed traffic in access ways.

1.05 RULES AND REGULATIONS

- A. The Building Code of the State of Florida 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.

1.06 DISPOSAL OF MATERIAL

- A. Salvageable material and equipment listed hereinafter shall become the property of the Owner. Dismantle all such items to a size that can be readily handled and deliver them to a designated storage area.
- B. The following materials and items of equipment shall remain the property of the Owner and delivered to a designated storage area off-site as directed by the Owner. Any such material damaged due to improper handling will not be accepted and the replacement value of the material deducted from the payment to the Contractor.
 1. Four (4) existing submersible pumps
 2. Existing Generator
 3. Four (4) existing ARV's
 4. All existing bypass valves.

- C. All other material and items of equipment shall become the Contractor's property and must be removed from the site.
- D. The storage or sale of 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 which 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, cleaned and stored on or adjacent to the site in a protected place specified by the Owner's Representative or loaded onto trucks provided by the Owner.
- B. Dispose of all demolition materials, equipment, debris and all other items not 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 prior to the start of the work.

3.02 STRUCTURAL REMOVALS

- A. Remove structures to the lines and grades shown unless otherwise directed by the Owner's Representative. Where no limits are shown, the limits shall be 4-in outside the item to be installed. The removal of masonry beyond these limits shall be at the Contractor's expense and these excess removals shall be reconstructed to the satisfaction of the Owner's Representative with no additional compensation to the Contractor.
- B. All concrete, concrete block, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure shall be removed and taken from the site, unless otherwise approved by the Owner's Representative. Demolished items shall not be used in backfill adjacent to structures or in pipeline trenches.

3.03 MECHANICAL REMOVALS

- A. Mechanical removals shall consist of dismantling and removing of existing piping, pumps, motors, equipment and other appurtenances as specified, shown, or required for the completion of the work. It shall include cutting, capping, and plugging as required, except that the cutting of existing piping for the purpose of making connections thereto will be included under Division 15.
- B. Existing process, water, chemical, gas, fuel oil and other piping not required for the new work shall be removed where shown or where it will interfere with new work. Piping not indicated to be removed or which does not interfere with new work shall be removed to the nearest solid support, capped and left in place. Chemical and fuel lines and tanks shall be purged and made safe prior to removal or capping. Where piping that is to be removed passes through existing walls, it shall be cut off and properly capped on each side of the wall.
- C. When underground piping is to be altered or removed, the remaining piping shall be properly capped. Where existing buried piping is to be abandoned, the Contractor shall remove the abandoned pipe for a distance of 5 feet from any connecting structures. All openings at the existing structures shall be repaired. The remaining pipe shall be capped at both ends prior to backfill. Buried piping, 12-inch diameter or greater, shall be completely sand-filled prior to closure of the piping ends.
- D. Any changes to potable water piping shall be made in conformance with all applicable codes and under the same requirements as other underground piping. All portions of the potable water system that have been altered or opened shall be pressure tested and disinfected in accordance with Section 01445 and OCU Standards.

3.04 ELECTRICAL REMOVALS

- A. Electrical removals shall consist of the removal of existing transformers, distribution switchboards, control panels, motors, conduits and wires, panelboards and miscellaneous electrical equipment all as shown on the Drawings, specified herein, or required to perform the work.
- B. Contractor shall demolish and remove all electrical associated with the existing PS 3541 after new pump station is operational and accepted by the owner. Contractor shall remove all conduit and wire and shall coordinate with the power utility to disconnect and remove the existing pad mounted transformed, utility meter and service conductors.
- C. All existing electrical equipment and fixtures to be removed shall be removed with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to maintain the integrity of the grounding systems.
- D. Conduits and wires shall be abandoned or removed where shown. All wires in abandoned conduits shall be removed, salvaged and stored. Exposed conduits and their supports shall be disassembled and removed from the site.
- E. Where shown or otherwise required, wiring in the underground duct system shall be removed. All such wiring shall be salvaged and stored as specified. Verify the function of all wiring before disconnection and removing it.

- F. Where required, direct-burial cable shall be abandoned. Such cable shall be disconnected at both ends of the run. Where it enters a structure, the cable shall be cut back to the point of entrance.

3.05 PIPE REMOVAL, CAPPING, AND GROUTING

- A. Pipe designated to be removed and disposed by the Contractor shall be completely drained and the contents properly disposed. The pipe shall then be completely removed from the site, including fittings, valves and other inline devices.
- B. Grout: Where designated on the drawings, pipe to be grouted shall be filled with grout in accordance with Section 03601, Grouting.
- C. Caps/Plugs: Pipe to be grouted shall be capped, or plugged with fittings. All caps and plugs shall be of the types listed in the latest edition of the Orange County Utilities list of Approved Products (Appendix D of the Orange County Utilities Standards and Construction Specifications Manual).

3.06 CLEAN-UP

- A. Remove from the site all debris resulting from the demolition operations as it accumulates. Upon completion of the work, all materials, equipment, waste and debris of every sort shall be removed and premises shall be left, clean, neat and orderly.

END OF SECTION

SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials and equipment required and perform all site preparation, complete as shown on the Drawings and as specified herein.
- B. Obtain all permits required for site preparation work prior to proceeding with the work.
- C. Unless otherwise shown on the Drawings or directed by the Engineer, the areas to be cleared, grubbed and stripped shall generally consist of the entire project site, with the exception of those areas specifically designated to remain in an undisturbed, natural condition.

1.02 RELATED WORK

- A. Environmental Protection is included in Section 01110.
- B. Demolition and Modifications is included in Section 02050.
- C. Earthwork is included in Section 02200.
- D. Loaming and Seeding is included in Section 02930.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, copies of all permits required prior to clearing, grubbing, and stripping work.

PART 2 EXECUTION

2.01 CLEARING

- A. 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. Preserve and protect trees and other vegetation designated on the Drawings or directed by the Engineer or Owner to remain.

2.02 GRUBBING

- A. Grub and remove all stumps, roots in excess of 1-1/2-in in diameter, matted roots, brush, timber, logs, concrete rubble and other debris encountered to a depth of 18-in below original grade or 18-in beneath the bottom of foundations and roadway subbase.

- B. 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 Section 02200.

2.03 STRIPPING

- A. Strip topsoil from all areas to be occupied by the building, structures, and roadway 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. Stockpile and protect topsoil until it is used in landscaping, loaming and seeding operations. Dispose of surplus topsoil after all work is completed.

2.04 DISPOSAL

- A. Cut tree trunks and limbs exceeding 4-in in diameter shall be cut into 4-ft lengths and stockpiled on site in the area designated by the Owner.
- B. 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.
- C. On-site disposal of cleared and grubbed materials by open-air burning may be permitted only with the expressed written consent of the Owner. Burning operations and ash disposal shall be conducted in strict accordance with local and state requirements, subject to applicable permit requirements.

2.05 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. Conduct clearing operations in a manner to prevent falling trees from damaging trees and vegetation designated to remain and to the work being constructed and so as to provide for the safety of employees and others.
- B. Maintain protection until all work in the vicinity of the work being protected has been completed.
- C. Do not operate heavy equipment or stockpile materials within the branch spread of existing trees.
- D. 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.
- E. When work is completed, 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.

- F. 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 thereon, 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. Existing utilities, conduits, and structures are shown in their approximate locations. It shall be the Contractor's responsibility to locate and protect all utilities whether shown on Drawings or not.
- H. Existing buried utilities, conduits and structures that are to remain shall be protected until all work in the vicinity of the work has been completed.

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SECTION 02117

CONTAMINATED SOIL EXCAVATION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. It is not known whether the 2,500-gallon underground storage tank has leaked. However, provisions have been included in this Section to address contaminated soil and floating product in the event that a release has occurred.
- B. Furnish all labor, material, tools and equipment necessary for excavating, handling, stockpiling, sampling and analysis of contaminated soil and collection of floating product, if encountered.

1.02 RELATED WORK

- A. Underground Storage Tank Removal is included in Section 02215.
- B. Transportation and Disposal of Contaminated Material is included in Section 02125.

1.03 SUBMITTALS

- A. Submit work plan providing details of contaminated soil excavation and floating oil product collection.
- B. Submit analytical data by facsimile to Engineer and Orange County Risk Department directly from laboratory.
- C. Submit data summary tables within one week of receipt of data.

1.04 REGULATORY REQUIREMENTS

- A. State of Florida, Chapter 62-777, F.A.C., Petroleum Contamination Site Cleanup Criteria

PART 2 PRODUCTS

2.01 GENERAL

- A. The Contractor shall provide all employees and Subcontractor(s) with personal protective equipment and protective clothing consistent with the levels of protection for this Work as indicated in the Contractor's Site Health and Safety Plan.

2.02 HIGH DENSITY POLYETHYLENE (HDPE) LINING

- A. The high density polyethylene shall be manufactured of new, first-quality product designed and manufactured specifically for the intended use and have the following properties:

1. The material shall be 3-ply polyethylene reinforced with a nonwoven grid of high strength nylon cord.
2. The material shall be U.V. resistant (black in color) and cold crack resistant to minus 40 degrees F.
3. The material shall be manufactured in a minimum 12-ft seamless width. Labels on the rolls shall identify the thickness, length, width and manufacturer's mark number. Material thickness shall be as specified in Paragraph 3.03.

PART 3 EXECUTION

3.01 GENERAL

- A. Excavate soil to the limits necessary to achieve the required cleanup as directed by the Engineer.
- B. All site health and safety controls shall be fully established and in operation prior to beginning any contaminated soil excavation. Site controls shall include but not be limited to work zones properly barricaded, decontamination facilities, and all support equipment and supplies including personal protective equipment. All site controls shall be reviewed by the Engineer in the field. All health and safety requirements for the removal of the underground storage tank and contaminated soil is the responsibility of the Contractor.
- C. The Contractor shall be responsible for the removal, transportation, and disposal of floating product directed by the Engineer if encountered in the excavation. Methods to remove free product shall be governed by the quantity of free product. Absorptive pads shall be used for smaller amounts of free product and if substantial quantities are encountered and Owner and the Engineer approve, a vacuum truck or similar equipment shall be utilized for free product removal.
- D. Install a vertical perforated pipe in the excavation if free product is encountered in the excavation. The location of the pipe will be determined by the Engineer. The Contractor shall have on-site a 12-in diameter, 25-ft long, corrugated polyethylene pipe with appropriate quantities of filter fabric and gravel.

3.02 EXCAVATION OF CONTAMINATED MATERIAL

- A. Work and decontamination procedures in areas containing contaminated material shall be performed in accordance with standard industry practices including use of decontamination facilities, barriers, liners, and other means to control cross-contamination.
- B. Contractor shall employ methods necessary to isolate contaminated soils from non-contaminated soils, including benching. Impacted soils shall be removed based on visual, olfactory, on-site screening or laboratory confirmation results.

3.03 STORAGE OF EXCAVATED MATERIAL

- A. Temporarily stock-pile excavated contaminated soil on-site in stockpiles not exceeding a volume of 100 cubic yards pending soil characterization and analytical results. Soil shall be stockpiled in accordance with this Section. Blending of soil to attain composition thresholds by dilution is not allowed.

- B. Excavated contaminated materials shall be stockpiled on-site in accordance with the most recent version of FDEP guidance policies while samples are analyzed for chemical constituents. Excavated materials shall be placed on a base lined with 20 mil (or higher gauge) polyethylene and be completely and securely covered with 6 mil (or higher gauge) polyethylene.
 - 1. The stockpiles shall be tracked to provide complete data necessary to locate any stockpile within the site. All Work necessary to coordinate stockpiling from placement to disposal shall be included. The Contractor shall provide Engineer with duplicate copies of all documentation at the time of stockpiling.
 - 2. The temporarily stockpiled soil must be removed from the site in accordance with applicable regulatory deadlines or no later than the completion date of this Contract, whichever is less.
 - 3. The polyethylene shall be bermed around the edges to prevent any infiltration of stormwater or exfiltration of leachate. The berm height shall be a minimum of 12-in.
 - 4. The polyethylene shall be adequately secured to prevent damage or loss by wind or other weather elements.
- C. Stockpiles shall be securely barricaded and clearly labeled.
- D. Soils shall be suitably dewatered prior to their leaving the site, to prevent free water from developing during transport to the disposal facility.
- E. Hay bales shall be placed around the stockpiles.

3.04 SOIL TRACKING, STOCKPILE SAMPLING, AND ANALYSIS

- A. Provide to the Engineer and Owner, on a daily basis, copies of field records documenting the location of stockpiled material in the grid system, and stockpile identification data.
- B. Track all contaminated soils from excavation to final disposition.
- C. Take samples from the tank grave in such a manner as not to cause any cross-contamination. All sampling equipment shall be decontaminated between collection of samples from each stockpile. A minimum of 10 discrete samples shall be collected and composited from each stockpile. Discrete samples shall be collected at even spacing from within and around the stockpile. One composite sample shall be collected from each stockpile.
- D. Samples shall be analyzed for the constituents described in the Chapter 62-770 F.A.C. as required by the disposal facility and approved by FDEP. These analyses shall be performed by a laboratory certified for such analyses. Sampling of the tank grave shall be completed by a licensed environmental consultant in accordance with FDEP regulations.
- E. Submit a copy of all analyses to the Engineer within 2 days of receipt of the laboratory report. Analytical data shall be kept confidential, distributed only to Owner and the disposal facilities. A review period of one week should be anticipated for Engineer's review of analytical data.

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SECTION 02125

TRANSPORTATION AND DISPOSAL OF CONTAMINATED MATERIAL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, material, tools and equipment necessary for the transportation and disposal of contaminated materials generated from activities specified in Sections 02215 and 02117. Contaminated materials include, but are not limited to: underground storage tank (UST) contents, cleaning fluids and residue; contaminated soil; and floating product.
- B. The Contractor shall be responsible for determining the appropriate disposal location based on stockpile sampling and analysis results from Section 02117 and disposal facility testing results from this Section. Disposal determination will be subject to the Engineer's review.
- C. The Owner will be the generator and will sign all waste profiles, bills of lading and hazardous waste manifests. Owner information is as follows:

Owner's Name: Orange County

Owner's Contact: Tisha Pence

Owner's Address: 109 East Church Street, Suite 200, Orlando, FL 32802

Owner's Telephone Number: (407) 836-9638

Project Name: Lake Eve Pump Station No. 3541 Rehabilitation

Site Address: 11899 S. International Drive, Orlando, FL

Facility Identification Number: 489410270

1.02 RELATED WORK

- A. Underground Storage Tank Removal is included in Section 02215.
- B. Contaminated Soil Excavation is included in Section 02117.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, all pertinent information relating to the transport and disposal of materials specified herein. The information submitted shall include the following:
 1. Transporter Information:
 - a. Name and address of common carrier transporters to be used on project.
 - b. Name and address of licensed hazardous waste transporters to be used on project. Provide current licenses and permits to operate in all states affected by transport. Provide current EPA transporter license.

2. Facility Information

a. General Information

- 1) Facility Name
- 2) Facility Address
- 3) Name of Contact Person
- 4) Title of Contact Person
- 5) Telephone Number of Contact Person
- 6) Permit Number

- b. The facility shall provide written confirmation that they are permitted to accept and will accept material of the general quality and quantity described by these Specifications.
- c. The facility shall provide a listing of all current and valid permits, licenses, letters of approval, and other authorizations to operate that they hold, pertaining to the receipt and management of materials specified in this Contract.
- d. Submit a complete list of the disposal facility's permitted allowable contaminant levels and physical characteristic requirements for contaminated material, and list any required regulatory approvals for individual waste streams.

- B. Provide the Engineer and Orange County Risk Management Division with originals of all hazardous waste manifests, non-hazardous waste manifests and bills of lading, and material shipping records, no less than 7 days in advance of shipping material off site.
- C. Submit to the Engineer and Orange County Risk Management Division, copies of all analytical data. Analytical data shall be kept confidential, and distributed to the Engineer only.
- D. Submit to the Engineer and Orange County Risk Management Division, within 48 hours of receipt of wastes at accepting disposal, recycling and reuse facilities, copies of facility-signed hazardous waste manifests, non-hazardous waste manifests, bills of lading and material shipping records.
- E. Submit, prior to commencing Work on the underground storage tank removal, to the Engineer and Orange County Risk Management Division a complete detailed schedule of all field activities associated with the removal of the underground storage tank for approval.

1.04 DEFINITIONS

- A. In-State Landfill - This type of landfill shall be approved by the State of Florida to accept soil that meets land disposal restrictions in 40 CFR 268 and 40 CFR 261.
- B. In-State Recycling Facility - This type of facility shall be approved by the State of Florida to accept soil for reuse with concentration levels that meet the facility standards.

- C. Out-of-State Landfill - This type of landfill shall be state approved or permitted to accept soil that is not classified as either a RCRA characteristic waste or RCRA listed waste as defined in 40 CFR Part 261 or PCB waste as defined in 40 CFR 761. This type of landfill shall accept soil for disposal and reuse purposes.
- D. Out-of-State Recycling Facility - This type of facility shall be state approved or permitted to accept soil that is not classified as either a RCRA characteristic waste or RCRA listed waste as defined in 40 CFR Part 261 or PCB waste as defined in 40 CFR 761.
- E. RCRA Landfill – This type of landfill shall be state and federally approved to accept soil that is classified as either a RCRA characteristic waste or RCRA listed waste as defined in 40 CFR 261.
- F. RCRA TSD Facility – This type of facility shall be state and federally approved to accept soil that is classified as either a RCRA characteristic waste or RCRA listed waste as defined in 40 CFR 261.
- G. TCLP Material – Soil, through TCLP analysis, that exceeds the regulatory limit established for any one or more RCRA metals set forth in Table 1 of 40 CFR 261.24.
- H. Listed Waste Material – Soil, through VOC analysis, that indicates the presence of any of F-code wastes set forth in 40 CFR 261.31 or U-code wastes set forth in 40 CFR 261.33.
- I. Disposal Facility – In-state Landfill, In-State Recycling Facility, Out-of-State Landfill, Out-of-State Recycling Facility, RCRA Landfill or RCRA TSD Facility.
- J. TSD – Treatment, storage and disposal.
- K. Underlying Hazardous Constituent (UHC) – As defined in 40 CFR 268.2, “Any constituent listed in 40 CFR 268.48, Table UTS – Universal Treatment Standards, except fluoride, selenium, sulfides, vanadium and zinc which can be reasonably expected to be present at the point of generations of the hazardous waste, at a concentration above the constituent-specific UTS treatment standard.” For this project, metals and PAHs are the UHCs, “reasonably expected” to be present above applicable UTS.
- L. Universal Treatment Standard (UTS) – Numerical standards set forth in 40 CFR 268.48, Table UTS – Universal Treatment Standards. Non-wastewater and wastewater treatment standard levels that are used to regulate most prohibited hazardous wastes. Applicable UTS for soils are defined in 40 CFR 268.49(c).

1.05 REGULATORY REQUIREMENTS

- A. Florida Department of Environmental Protection
- B. United States Department of Environmental Protection (EPA)
 - 1. Federal Hazardous Waste Regulations, 40 CFR 261-268.
- C. Disposal of TCLP material at RCRA Landfills is subject to all applicable provisions of the Phase IV Land Disposal Restrictions (LDR) of 40 CFR 268. The Work of this Section shall include all necessary supplemental treatment required to reduce concentrations of all Underlying Hazardous

Constituents (UHCs) to levels below applicable Universal Treatment Standards (UTS) prior to landfill disposal.

PART 2 PRODUCTS

2.01 GENERAL

- A. All Contractor personnel shall wear personal protective equipment and protective clothing consistent with the levels of protection for this Work.

PART 3 EXECUTION

3.01 GENERAL

- A. The Owner will be the generator and will sign waste profiles, hazardous waste manifests, non-hazardous waste manifests, bills of lading and material shipping records.
- B. The Contractor shall identify appropriate disposal facilities and make all necessary arrangements for disposal of materials.

3.02 DISPOSAL FACILITY TESTING

- A. The Contractor shall be responsible for characterizing the soil for the purpose of obtaining approvals for final disposal of contaminated, surplus and unsuitable soil. The Contractor shall collect soil samples to perform testing required by the disposal facility.
 - 1. Submit a copy of all analytical results to the Engineer within 2 days of receipt of the laboratory report. Analytical data shall be kept confidential, and distributed to the Owner and Engineer only. Engineer's review of data will be 5 days.
 - 2. Disposal facility testing can be integrated into the stockpile testing specified in Section 02117.
- B. Sampling of contaminated soil shall be done at sufficient and adequately distributed locations so that the concentrations of the chemical constituents are adequately characterized.
- C. Coordinate schedule so that Engineer may observe sample collection.

3.03 WASTE PROFILES AND SHIPPING DOCUMENTS

- A. Prepare and submit to the Engineer for review all waste profiles.
- B. Prepare all manifests and if necessary, land ban certifications. Submit these to the Engineer for review at least 7 days before transport. Engineer will be responsible for obtaining Owner's signature prior to said use.
- C. Prepare bill of lading forms and material shipping records. Submit these to the Engineer for review at least 7 days before transport. Engineer will be responsible for obtaining Owner's signature prior to said use.

- D. Submit to Owner and the Engineer, prior to receiving progress payment, documentation certifying that all materials were transported to, accepted, and disposed of, at the selected receiving facility.
 - 1. Facility signed manifests - Uniform Hazardous Waste Manifest (EPA Form 8700-22 and 8700-22a) for hazardous waste shipments and material shipping records.
 - 2. Certified tare and gross weights for each load.

3.04 TRANSPORT AND DISPOSAL

- A. The Contractor shall not be permitted to transport materials off-site until all disposal facility documentation has been received, reviewed, and accepted by Owner and the Engineer.
- B. Transport and dispose in accordance with all United States Department of Transportation (DOT), USEPA, FDEP regulations and other regulations of all affected states.
- C. The Contractor shall be responsible for ensuring that free-liquid does not develop during transport. "Wet soils" shall not be loaded for transport. The Contractor shall be responsible to properly dispose of any free liquids that may result during transportation.
- D. The Contractor shall coordinate with Orange County Risk Department for preferred disposal location prior to disposal. Dispose of hazardous waste within 90 days.

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SECTION 02140

DEWATERING AND DRAINAGE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Design, furnish, install, operate, monitor, maintain, and remove a temporary dewatering system as required to lower and control water levels at least 2-ft below subgrades of excavations and to permit construction to proceed in-the-dry.
- B. Furnish, maintain and remove temporary surface water control measures adequate to drain and remove surface water entering excavations.
- C. Retain the services of a professional engineer registered in the State of Florida to prepare dewatering and drainage system designs and submittals described herein.
- D. Work shall include the design, equipment, materials, installation, protection, and monitoring of geotechnical instrumentation required to monitor the performance of the dewatering and drainage system as required herein.
- E. Collect and properly dispose of all discharge water from the dewatering and drainage systems in accordance with the provisions of Section 01110. Under no circumstances shall water from dewatering systems be discharged into the existing or new sanitary sewer systems.
- F. Obtain and pay for all permits required for dewatering and drainage systems.
- G. Repair damage caused by dewatering and drainage system operations.

1.02 RELATED WORK

- A. Submittals are included in Section 01300
- B. Testing and Laboratory Services is included in Section 01410
- C. Site Preparation is included in Section 02100
- D. Earthwork is included in Section 02200
- E. Trenching, Backfilling and Compaction is included in Section 02221
- F. Fill and Backfill Materials are included in Section 02230
- G. Support of Excavation and Protection is included in Section 02311
- H. Sedimentation and Erosion Control are included in Section 02270
- I. Paving is included in Sections 02500 and 02520

- J. Loaming and Seeding are included in Section 02930

1.03 SUBMITTALS

- A. Dewatering and drainage system designs shall be prepared by a licensed professional engineer retained by the Contractor. The Contractor shall submit an original and three copies of the licensed professional engineer's certification on the PE form specified in Section 01300. The Contractor shall also submit qualifications as required herein.
- B. The Contractor shall submit a dewatering and drainage system design plan. The plan shall include a description of the proposed dewatering system and include the proposed installation methods to be used for dewatering and drainage system elements and for observation wells. The plan shall include equipment, drilling methods, holes sizes, filter sand placement techniques, sealing materials, development techniques, the number and location of dewatering points and observations wells, etc. Include the dewatering system design calculations in the plan.
- C. The plan shall identify the anticipated area influenced by the dewatering system and address impacts to adjacent existing and proposed structures. The report shall also include detailed plans for pre-construction surveys of existing structures in the vicinity of the dewatering system, settlement monitoring of existing structures before and during construction, and provisions to address settlement of existing structures resulting from dewatering activities.
- D. Coordinate dewatering and drainage submittals with the excavation and support of excavation submittals. The submittal shall show the areas and depths of excavation to be dewatered. Sheet piles may be used for the advantage for reducing groundwater flow into the excavation if they can be embedded in confining or semi-confining layer(s).
- E. Do not proceed with any excavation or dewatering activities until the dewatering submittals has been accepted by the Engineer.

1.04 QUALITY ASSURANCE

- A. Regulations: Perform all work in accordance with current applicable regulations and codes of all Federal, State and local agencies.
- B. The Contractor shall have at least 5 years of experience with work compatible to the Work shown and specified, employing labor and supervisory personnel who are similarly experienced in this type of Work.
- C. The Contractor's design engineer shall be registered in the State of Florida and have a minimum of 5 years of professional experience in the design and construction of dewatering and drainage systems and shall have completed not less than 5 successful dewatering and drainage projects of equal type, size, and complexity to that require for the work.

1.05 DESIGN REQUIREMENTS

- A. The Contractor is responsible for the proper design and implementation of methods for controlling surface water and groundwater.

- B. The primary purpose of the groundwater control system is to preserve the natural undisturbed condition of the subgrade soils in the areas of the proposed excavations. Prior to excavation, the Contractor shall lower the groundwater to at least 2-ft below the lowest excavation subgrade elevation. Additional groundwater lowering may be necessary beyond the 2-ft requirement, depending on construction methods and equipment used and the prevailing groundwater and soil conditions. The Contractor is responsible for lowering the groundwater as necessary to complete construction in accordance with the plans and specifications at no additional cost to the Owner.
- C. Design deep wells, well points and sumps, and all other groundwater control system components to prevent loss of fines from surrounding soils. Sand filters shall be used with all dewatering installations unless screens are properly sized by the Contractor's design engineer to prevent passage of fines from surrounding soils.
- D. The Contractor shall be responsible for damage to properties, buildings or structures, sewers and other utility installations, pavements and work that may result from dewatering or surface water control operations.
- E. Design review and field monitoring activities by the Owner or by the Engineer shall not relieve the Contractor of his/her responsibilities for the work.

1.06 DEFINITIONS

- A. Where the phrase "in-the-dry" is used in this Section, it shall be defined as an excavation subgrade where the groundwater level has been lowered to at least 2-ft below the lowest level of the excavation, is stable with no ponded water, mud, or muck, is able to support construction equipment without rutting or disturbance and is suitable for the placement and compaction of fill material, pipe or concrete foundations.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Pipe for observation wells shall consist of minimum 2-in I.D., Schedule 40 PVC pipe and machine slotted PVC well points, maximum slot size 0.010-in.
- B. Piping, pumping equipment, and all other materials required to provide control of surface water and groundwater in excavations shall be suitable for the intended purpose.
- C. Standby pumping systems and a source of standby power shall be maintained on site at all times.

PART 3 EXECUTION

3.01 GENERAL

- A. Control surface water and groundwater such that excavation to final grade is made in-the-dry, the natural undisturbed condition of the subgrade soils are maintained, and softening and/or instability or disturbance due to the presence or seepage of water does not occur. All construction and backfilling shall proceed in-the-dry and flotation of completed portions of work shall be prohibited.

- B. Methods of groundwater control may include but are not limited to perimeter trenches and sump pumping, perimeter groundwater cutoff, well points, ejectors, deep wells and combinations thereof.
- C. Where groundwater levels are above the proposed bottom of excavation level, a pumped dewatering system will be required for pre-drainage of the soils prior to excavation, and for maintaining the lowered groundwater level until construction has been completed to such an extent that the structure, pipeline or fill will not be floated or otherwise damaged.
- D. It is expected that the type of system, spacing of dewatering units and other details of the work will have to be varied depending on soil/water conditions at a particular location.
- E. All work included in this Section shall be done in a manner which will protect adjacent structures and utilities and shall not cause loss of ground or disturbance to the pipe bearing soils or to soils which support overlying or adjacent structures.
- F. Install, monitor and report data from observation wells. Evaluate the collected data relative to groundwater control system performance and modify systems as necessary to dewater the site in accordance with the Contract requirements.
- G. Locate groundwater control system components where they will not interfere with construction activities adjacent to the work area or interfere with the installation and monitoring of geotechnical instrumentation including observation wells. Excavations for sumps or drainage ditches shall not be made within or below 1H:1V slopes extending downward and out from the edges of existing or proposed foundation elements or from the downward vertical footprint of the pipe.

3.02 SURFACE WATER CONTROL

- A. Construct surface water control measures, including dikes, ditches, sumps, and other methods to prevent, as necessary, flow of surface water into excavations and to allow construction to proceed without delay.

3.03 EXCAVATION DEWATERING

- A. At all times during construction, provide and maintain proper equipment and facilities to promptly remove and properly dispose of all water entering excavations. Excavations shall be maintained in-the-dry. Groundwater levels shall be kept at least 2-ft below the lowest excavation level.
- B. Excavation dewatering shall maintain the subgrade in a natural undisturbed condition and until the fill, structure or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
- C. Pipe, masonry, and concrete shall not be placed in water or be submerged within 24 hours after being installed. Water shall not flow over new masonry or concrete within four days after placement.
- D. In no event shall water rise to cause unbalanced pressure on structures until the concrete or mortar has set at least 24 hours. Prevent flotation of pipes and structures by promptly placing backfill.

- E. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed condition of the subgrade soils at the proposed bottom of excavation.
- F. If the subgrade of the trench or excavation bottom becomes disturbed due to inadequate dewatering or drainage, excavate below normal grade as directed by the Engineer and refill with structural fill, screened gravel or other material as approved by the Engineer at the Contractor's expense.
- G. It is expected that the initial dewatering plan may have to be modified to suit the variable soil/water conditions to be encountered during construction. Dewater and excavate, at all times, in a manner which does not cause loss of ground or disturbance to the pipe bearing soil or soil which supports overlying or adjacent structures.
- H. If the method of dewatering does not properly dewater the excavation as specified, install additional groundwater observation wells as directed by the Engineer and do not place any pipe or structure until the readings obtained from the observation wells indicate that the groundwater has been lowered a minimum of 2-ft below the bottom of the final excavation within the excavation limits.
- I. Dewatering units used in the work shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from the dewatering system shall be continuous until pipe or structure is adequately backfilled. Stand-by pumps shall be provided.
- J. Water entering the excavation from precipitation or surface runoff shall be collected in shallow ditches around the perimeter of the excavation, drained to a sump and pumped from the excavation to maintain a bottom free from standing water.
- K. Drainage shall be disposed of in an approved area as specified in Section 01110. Existing or new sanitary sewers shall not be used to dispose of drainage.

3.04 WELL POINT SYSTEMS

- A. Where necessary, install a vacuum well point system around the excavation to dewater the excavation. Each well point and riser pipe shall be surrounded by a sand [or gravel] filter. Sand shall be of such a gradation that, after initial development of the well points, the quantity and size of soil particles discharged shall be negligible. Well point systems shall be capable of operating continuously under the highest possible vacuum.
- B. Installation of well point systems shall be in accordance with the approved submittal in the presence of the Engineer.

3.05 DEEP WELLS

- A. Where necessary, install a deep well system around the excavation to dewater the excavation. Each well shall be surrounded by a sand or gravel filter with adequate gradation such that after development, the quantity and size of soil particles discharged are negligible. Sufficient number of wells shall be installed to lower or depressurize the groundwater level to allow excavation to proceed in-the-dry.

- B. Installation of deep well shall be in accordance with the approved submittal in the presence of the Engineer.

3.06 OBSERVATION WELLS

- A. Install observation wells as required under this Section to monitor groundwater levels beneath and around the excavated area until adjacent structures and pipelines are completed and backfilled.
- B. Observation Well Locations and Depths:
 - 1. Observation wells required shall be installed to a depth of at least 15-ft below the deepest level of excavation, unless otherwise approved by the Engineer, and to whatever depth is necessary to indicate that the groundwater control system designed by the Contractor's Engineer is performing as intended. Additional observation wells may be required by the Engineer if deemed necessary to monitor the performance of the Contractor's groundwater control system.
 - 2. Locations and depths of observation wells are subject to approval by the Engineer.
- C. Protect the observation wells at ground surface by providing a lockable box or outer protective casing with lockable top and padlock. Design the surface protection to prevent damage by vandalism or construction operations and to prevent surface water from infiltrating.
 - 1. Provide two copies of keys for each padlock to the Engineer for access to each well.
 - 2. Observation wells shall be developed so as to provide a reliable indication of groundwater levels. Wells shall be re-developed if well clogging is observed, in the event of apparent erroneous readings, or as directed by the Engineer.
 - 3. Submittal observation well installation logs, top of casing elevation, and well locations to the Engineer within 24 hours of completion of well installation.
- D. Observation Well Maintenance
 - 1. The Contractor shall maintain each observation well until adjacent structures and pipelines are completed and backfilled. Clean out or replace any observation well which ceases to be operable before adjacent work is completed.
 - 2. It is the Contractor's obligation to maintain observation wells and repair or replace them at no additional cost to the Owner, whether or not the observation wells are damaged by the Contractor's operations or by third parties.
- E. Monitoring and Reporting of Observation Well Data
 - 1. The Contractor shall begin daily monitoring of groundwater levels in work areas prior to initial operation of drainage and dewatering system. Daily monitoring in areas where groundwater control is in operation shall continue until the time that adjacent structures and pipelines are completed and backfilled and until the time that groundwater control systems are turned off.

2. The Contractor is responsible for processing and reporting observation well data to the Engineer on a weekly basis. Data is to be provided to the Engineer on a form, which shall include the following information: observation well number, depth to groundwater, total depth of well, top of casing elevation, groundwater level elevation and date and time of reading.

F. The groundwater level shall be kept at a minimum of 2-ft below the lowest subgrade level for a given excavation.

3.07 REMOVAL OF SYSTEMS

A. At the completion of the excavation and backfilling work, and when approved by the Engineer, all pipe, deep wells, well points, pumps, generators, observation wells, other equipment and accessories used for the groundwater and surface water control systems shall be removed from the site. All materials and equipment shall become the property of the Contractor. All areas disturbed by the installation and removal of groundwater control systems and observation wells shall be restored to their original condition.

B. Leave in place any casings for deep wells, well points or observation wells located within the plan limits of structures or pipelines or within the zone below 1H:1V planes extending downward and out from the edges of foundation elements or from the downward vertical footprint of the pipe, or where removal would otherwise result in ground movements causing adverse settlement to adjacent ground surface, utilities or existing structures.

C. Where casings are pulled, holes shall be filled with sand. Where left in place, casings should be filled with cement grout and cut off a minimum of 3-ft below finished ground level or 1-ft below foundation level so as not to interfere with finished structures or pipelines.

D. When directed by the Engineer, observation wells should be left in place for continued monitoring. When so directed, cut casings flush with final ground level and provide protective lockable boxes with locking devices. The protective boxes shall be suitable for the traffic and for any other conditions to which the observation wells will be exposed.

END OF SECTION

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SECTION 02200

EARTHWORK

PART 1 - GENERAL

1.01 STATUTORY REQUIREMENTS

- A. All excavation, trenching, sheeting, shoring, bracing, etc. shall conform to the requirements of the Florida "Trench Safety Act" (CS/SB 2626) which incorporates, by reference, OSHA excavation safety standards, 29 CFR 1926.650 Subpart P.

1.02 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and perform all excavation work and grading; place and compact backfill and fill; and dispose of unsuitable, waste and surplus materials as shown on the Drawings and as specified herein.
- B. Furnish and install temporary excavation support systems, including sheeting, shoring and bracing, to ensure the safety of personnel and protect adjacent structures, piping, etc, in accordance with Federal, State and local laws, regulations and requirements. Temporary excavation support systems shall be in accordance with Section 02311.
- C. Furnish and install temporary dewatering and surface water control systems and operate to dewater and maintain excavations in a dry condition. Control drainage into excavations and remove seepage water and rainwater. Dewatering and surface water control shall be in accordance with Section 02140.
- D. Protection of existing structure and utilities to remain the responsibility of the Contractor.

1.03 RELATED WORK

- A. Site Preparation is included in Section 02100.
- B. Dewatering and Drainage is included in Section 02140.
- C. Trenching, Backfilling and Compaction is included in Section 02221.
- D. Excavation Support and Protection is included in Section 02311.
- E. Granular Materials is included in Section 02230.
- E. Sedimentation and Erosion Control are included in Section 02270.
- F. Loaming and Seeding is included in Section 02930.

1.04 SUBMITTALS

- A. Submit, in accordance with Section 01300, the proposed methods of construction, including excavation, excavation support systems designs, backfilling and filling and compaction for the various portions of the work. Excavation support system designs shall be prepared by a licensed professional engineer, registered in the State of Florida, having a minimum of 5 years of professional experience in the design and construction of excavation support systems. Review will be for information only. Contractor shall remain responsible for adequacy and safety of construction means, methods, and techniques.

1.05 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D 1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft (2,700kN-m/cu m)).
 - 2. ASTM D 2487 – Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
- B. 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. At all structures, prior to the placement of bedding material, concrete work mats, structural fill or structural concrete, coordinate with the soils testing laboratory to verify the suitability of existing subgrade soils and to perform in-place soil density tests as required to verify that the subgrade soils have been compacted to achieve the specified degree of compaction.
- B. Prior to and during the placement of backfill and fill coordinate with the soils testing laboratory to perform in-place soil density tests to verify that the backfill/fill material has been compacted in accordance with the compaction requirements specified elsewhere. The Engineer, or owner's representative, may designate areas to be tested.

1.07 DEFINITIONS

- A. Where the phrase "in-the-dry" is used in this Section, it shall be defined as an excavation subgrade where the groundwater level has been lowered to at least 2-ft below the lowest level of the excavation, is stable with no ponded water, mud, or muck, is able to support construction equipment without rutting or disturbance and is suitable for the placement and compaction of fill material, pipe or concrete foundations.
- B. Where used in this Section "structures" refers to all buildings, wet wells, manholes and below grade vaults. Stormwater structures and duct banks are not considered structures in this context.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Materials designated for use in this Section are specified under Section 02230.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Test Pits

1. Perform exploratory excavation work (test pits) for the purpose of verifying the location of underground utilities and structures and to check for unknown utilities and structures, prior to commencing excavation work.
2. Test pits shall be backfilled as soon as the desired information has been obtained. Backfilled surfaces shall be stabilized in accordance with approved erosion and sedimentation control plans.

- B. Dewatering and Drainage Systems

1. Temporary dewatering and drainage systems, if required, shall be in place and operational prior to beginning excavation work and shall be in conformance with Section 02140.

3.02 EXCAVATION SUPPORT

- A. Furnish, install, monitor and maintain excavation support (e.g., sheeting, shoring, bracing, trench boxes, etc) as required by Federal, State or local laws, ordinances, regulations and safety requirements. Support the sides of excavations to prevent any movement which could in any way reduce the width of the excavation below that necessary for proper construction and to protect adjacent structures from undermining, settlement or other damage. Take care to prevent the formation of voids outside of sheeting. If voids occur behind sheeting, immediately backfill and compact the voids with common fill material. Voids in locations that cannot be properly compacted upon backfilling shall be filled with lean concrete.

- B. Install excavation supports outside the neat lines of foundations. Supports shall be plumb and securely braced and tied in position. Excavation support shall be adequate to withstand all pressures to which the supports will be subjected. Any movement or bulging of supports shall be corrected to provide the necessary clearances, dimensions and structural integrity.

- C. Excavation Supports Left in Place

1. Excavation supports that are required to remain in place, if applicable, are indicated on the Drawings.

2. The Engineer may direct that certain excavation supports remain in place, or be cut off at any specific elevation. Supports directed by the Engineer to be left in place or otherwise specified herein to remain in place, will be paid for in accordance with the signed contract. If the Contractor believes that such a directive increases Contractor's cost and would thereby entitle Contractor to a change in contract cost, Contractor shall notify the Engineer in accordance with the applicable documentation pertaining to changes in the work.
 3. The right of the Engineer to direct that certain excavation supports remain in place shall not be construed as creating any obligation on the Engineer to give such direction, nor shall failure to give such direction relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise, growing out of a failure on the part of the Contractor to leave in place sufficient excavation supports to prevent any movement of the ground or damage to adjacent structures.
- D. Excavation supports shall be carefully removed in such manner so as not to endanger the Work or other adjacent structures, utilities, or property. All voids left or caused by withdrawal of supports shall be immediately filled with sand and compacted.

3.03 STRUCTURAL EXCAVATION PROCEDURES

- A. Excavations for structures shall be suitably wide for construction of the structures, including excavation supports, dewatering and drainage systems and working clearances. No excavation shall extend within the zone of influence of other existing structures.
- B. Excavation shall be performed in-the-dry and shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Drainage and dewatering systems shall be in place and operational prior to beginning excavation work. Groundwater levels shall be lowered to target levels prior to excavation. In no case shall the earth be plowed, scraped or excavated by any means so near to the finished subgrade that would disturb the finished subgrade. Hand excavation of the final 3 to 6-in may be required to obtain a satisfactory, undisturbed subgrade. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory for support of structures as a result of inadequate excavation, dewatering, or other construction methods shall be removed and replaced with compacted structural fill or suitable crushed rock, subject to prior approval by the Engineer, at no additional cost to the Engineer.
- C. Subgrade Preparation
 1. All structures unless otherwise shown on the Drawings or otherwise specified herein:
 - a. Compact the top 12-in of subgrade to a density of at least 95 percent modified Proctor maximum dry density (ASTM D1557).
- D. When excavations have reached the required subgrade, including any allowances for working mats or base materials, prior to the placement of working mats or base materials, coordinate with the soils testing laboratory to verify the suitability of existing subgrade soils and to perform in-place soil density tests as required to verify that the subgrade soils have been compacted to achieve the specified degree of compaction. If the existing subgrade soils are determined to be unsuitable, direction will be provided by the Engineer regarding removal and replacement with suitable materials. If Contractor believes that such direction would increase Contractor's cost

and would thereby entitle Contractor to a change in Contract cost, Contractor shall notify the Engineer in accordance with the applicable article(s) in the General Conditions pertaining to changes in the work.

- E. Over-excavation beyond the limits and depths required by the Contract Documents shall be replaced with structural fill or other approved material subject to the prior approval of the Engineer at no additional cost to the Engineer.

3.04 GENERAL FILLING AND BACKFILLING PROCEDURES

- A. Lift thicknesses of fill and backfill materials shall be adjusted to suit the specified compaction requirements to the lines and grades required, making allowances for settlement and placement of cover materials (i.e. topsoil, sod, etc). Soft spots or uncompacted areas shall be corrected.
- B. Compaction in open areas may be accomplished by any of the following methods: compaction equipment, fully loaded ten-wheel trucks, tractor dozers weighing at least 30,000 lbs and operated at full speed, or heavy vibratory rollers. Compaction in confined areas (including areas within a 45 degree angle extending upward and outward from the base of a wall) and in areas where the use of large equipment is impractical, shall be accomplished by hand operated vibratory equipment or mechanical tampers. Lift thickness shall not exceed 4-in (measured after compaction) when hand operated equipment is used.
- C. Fill and backfill shall not be placed and compacted when the materials are too wet to properly compact (i.e. the in-place moisture content of the soil at that time shall be no more than three percentage points above the optimum moisture content of that soil as determined by the laboratory test of the moisture-density relation appropriate to the specified level of compaction).

3.05 FILL AND BACKFILL PROCEDURES

- A. Fill required beneath foundations or slabs on grade shall be structural fill. Place and compact structural fill in even lifts having a maximum thickness (measured before compaction) of 8-in.
- B. Fill and backfill material placed immediately adjacent to and within 10-ft of all structures shall be structural fill. All structure water-tightness tests and dampproofing/waterproofing shall be completed prior to placing fill or backfill around structures. Place and compact structural fill in even lifts having a maximum thickness (measured before compaction) of 8-in uniformly around the structure.
- C. Common fill may be used in below roadways, parking lots, landscape areas and areas beyond those designated for select fill unless shown or specified otherwise. Common fill shall be placed in even lifts having a maximum thickness (measured before compaction) of 12-in.

3.07 COMPACTION REQUIREMENTS

- A. Beneath foundations and slabs on grade: Compact the top 24-in of existing subgrade (and each layer of fill if applicable) to a density of at least 95 percent modified Proctor maximum dry density (ASTM D1557) at or near optimum moisture content (minus 2 to plus 3 percent).

- B. Ten feet around structures: Compact the top 24-in of existing subgrade and each layer of fill or backfill to at least 95 percent modified Proctor maximum dry density (ASTM D1557) at or near optimum moisture content (minus 2 to plus 3 percent).
- C. Roads, paved areas and roadway embankments: Compact the top 12-in of existing subgrade and each layer of fill or backfill to at least 95 percent modified Proctor maximum dry density (ASTM D1557) at or near optimum moisture content (minus 2 to plus 3 percent).

3.08 DISPOSAL OF SURPLUS MATERIAL

- A. No excavated materials shall be removed from the site of the work or disposed of, except as specified by the Engineer. Materials shall be neatly stockpiled until used or otherwise disposed of as specified below.
- B. Suitable excavated material shall be used for fill or backfill on the different parts of the work as required.
- C. Surplus fill shall become the property of the Contractor and shall be removed and disposed off site.

3.09 GRADING

- A. Grading shall be performed to the lines and grades shown on the Drawings. All objectionable material encountered within the limits indicated shall be removed and disposed offsite. Subgrades shall be completely and continuously drained and dewatered throughout the grading process. Install temporary drains, drainage ditches, etc, to intercept or divert surface water which may affect the execution or condition of grading work.
- B. If at the time of grading it is not possible to place any material in its proper section of the Work, it shall be stockpiled in areas approved by the Engineer for later use. No extra payment will be made for the stockpiling or double handling of excavated material.
- C. Stones or rock fragments larger than 3-in in their greatest dimensions will not be permitted within the top 6-in of the finished grade of fills and embankments.
- D. In cut areas, all loose or protruding rocks in slopes shall be removed to line or finished grade of the slope. All cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings unless otherwise directed by the Engineer.
- E. Final grading of the retention area should be done following over excavation of accumulated fines at the conclusion of dewatering activities.

END OF SECTION

SECTION 02215

UNDERGROUND STORAGE TANK REMOVAL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, tools, and equipment necessary to remove and dispose of an existing 2,500-gallon diesel fuel oil storage tank. The work also includes the removal and disposal of fluids and sludges remaining in the tank.
- B. The underground storage tank is located south of the existing 800 kW Generator. The exact nature and quantity of remaining contents is unknown. The Contractor will be required to conduct test pits to determine exact location and conditions.
- C. Handling and disposal of contaminated soil and groundwater and floating product, if encountered in the tank grave, are specified in Sections 02117 and 02125.
- D. Confirmatory sampling of tank grave is included in Section 02117.
- E. Remediation requirements associated with the removal of the underground storage tank, and any testing procedures, shall be coordinated with the Orange County Risk Management Department.

1.02 RELATED WORK

- A. Contaminated Soil Excavation is included in Section 02117.
- B. Transportation and Disposal of Contaminated Material is included in Section 02125.

1.03 SUBMITTALS

- A. Submit the following to the Engineer and Orange County Risk Management Division for review:
 - 1. The name and address of the company that will accept the remaining liquid phase contents, tank sludge, and all contaminated water collected during tank and piping cleaning.
 - 2. The name and address of the Florida licensed tank disposal facility (tank yard) that will accept the decommissioned tank and piping.
 - 3. Local Fire Department permits to remove the tank(s).
- B. Submit to the Engineer and Orange County Risk Management Division, copies of all analytical data. Analytical data shall be kept confidential, and distributed to the Engineer and Orange County Risk Management Division only.
- C. Within 7 days of tank removal, submit to the Engineer and Orange County Risk Management Division, Receipt of Disposal of Underground Storage Tank from the approved disposal facility.

- D. Within 7 days of tank removal, submit to the Engineer and Orange County Risk Management Division, fully completed and signed forms for Removal or Closure of Storage Tanks.

1.04 QUALITY ASSURANCE

- A. Materials shall be disposed at the same locations indicated on the Contractor's approved submittals throughout the Project.

1.05 REGULATORY REQUIREMENTS

- A. Tank closure shall be carried out in accordance with the requirements identified in 40 CFR Part 280 as well as the applicable Federal, State and local regulations.
- B. Obtain and pay for all local permits and make necessary arrangements with the local Fire Department prior to the removal of tanks.
- C. Keep the local Fire Department informed of all activities throughout the performance of the work.
- D. Obtain all Federal, State and local permits required for the transport and disposal of all waste materials resulting from the performance of this work.
- E. Document to the satisfaction of Owner and the Engineer that the disposal facility(ies) proposed have all certifications and permits required by Federal, State and local regulatory agencies to receive and dispose of the liquid and the solid wastes resulting from performance of the work.
- F. Provide a copy of all permits, completed manifests, and bills of lading to the Owner.
- G. Florida Department of Environmental Protection (FDEP) Chapter 62-761, FAC – Petroleum Storage Tank Systems.
- H. Florida Department of Environmental Protection (FDEP) Chapter 62-770, FAC – Petroleum Site Cleanup Criteria.
- I. Florida Department of Environmental Protection (FDEP) Guidelines for “Pollutant Storage Tank Closure Assessment Requirements”, dated April 1998.
- J. Florida Trench Safety Act and related OSHA requirements.
- K. Contractor shall comply with all reporting and notification requirements of the above State regulations including but not limited to FDEP Closure Assessment Report within 60 days of completion of each tank removal in accordance with Chapter 62-761, FAC.
- L. All tank removal work specified by this Section shall be performed by a Pollutant Storage Tank System Specialty Contractor certified by the Florida Department of Professional Regulation to meet the requirements of Section 489.113, Florida Statutes.

- M. Contractor shall comply with all reporting and notification requirements of the state regulations including but not limited to, FDEP Underground Storage System Installation and Removal Form for Certified Contractors, FDEP Form No. 62-761.900(5).

1.06 TITLE TO MATERIALS

- A. Tank and piping removed, shall become the property of the Contractor, and shall be removed from the site.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 GENERAL

- A. All work shall be done by skilled and experienced craftsmen, working under the supervision of a Pollutant Storage Tank System Specialty Contractor. All workmanship shall be of the highest quality and to the complete satisfaction of the Engineer. All materials shall be applied in accordance with the manufacturer's directions and shall be changed only at the written direction of the Engineer.

3.02 TANK AND PIPING REMOVAL

- A. Inspect the tank prior to excavation, decontamination and removal activities to the extent required to safely perform the work.
- B. Assure that any electrical power connected to the tank or its ancillary equipment (pumps) has been deactivated and the actual wiring properly dismantled at the circuit breaker(s).
- C. Tanks and process piping shall have interiors steam cleaned followed by three rinses. The steam discharge nozzle and all conductive insulated objects subject to impingement or condensation should be bonded to the tank or be grounded. Surfaces shall be steam cleaned using a commercial-scale steam cleaner. The Contractor shall be required to use a detergent and provide a steam generator capable of supplying steam at 15 psig. Liquid waste generated as a result of steam cleaning and rinsing operations shall be collected and removed by the Contractor. The Contractor shall dispose of the liquids, tank sludges and residues per Federal, State and Local regulatory requirements.
- D. After the above operation, all flammable vapors shall be removed from the tank by displacement with inert gas. The vapors shall be made inert by adding solid carbon dioxide, (dry ice), in the amount of 1.5 pounds per 100 gallons of tank capacity. The dry ice shall be crushed and distributed evenly over the greatest possible area to ensure rapid sublimation. All available tank openings shall be open to the atmosphere during this procedure to ensure rapid dissipation of the dry ice.

- E. To evaluate the effectiveness of the dry ice procedure, the Contractor shall use an explosimeter to determine if the resultant vapor mixture within the tank exceeds ten percent of the Lower Explosive Limit (LEL). Readings shall be taken throughout the tank's depth wherever access is possible. If the vapors within the tank exceed ten percent of the LEL, the displacement procedure shall be repeated followed by a recheck of the LEL until the vapors are less than 10 percent of the LEL.
- F. After acceptable LEL levels have been reached, excavation or removal of tank and piping may begin.
 - 1. Excavation around the perimeter of the tank shall be performed in a manner that will limit the amount of excavated soil. Visibly contaminated soil shall be segregated and handled in accordance with Section 02117.
 - 2. Surface water shall be diverted to prevent direct entry into the excavation.
 - 3. Excavation shall be sufficiently dewatered to allow excavation and removal to occur "in the dry".
- G. If contaminated soil and/or free product is encountered during excavation or tank removal, the Contractor shall immediately notify the Engineer and Owner.
- H. The tank shall be removed from the excavation and the exterior cleaned to remove all soil and inspected for signs of corrosion, structural damage, or leakage. All materials coming into contact with the tanks, or in the vicinity of the excavation such as shovels, slings and tools shall be of the non-sparking type.
- I. When the tank has been removed from the ground, the underlying soils shall be examined and sampled for contamination by a professional that has a minimum of three years of experience in the petroleum soil and groundwater testing profession.
- J. If contaminated soil is suspected through visual or olfactory evidence during excavation and tank removal, or based on the Engineer's review of the confirmatory soil sample data, the Engineer may direct the Contractor to perform Work to perform additional excavation as specified in Sections 02117 and 02125.
- K. All vent lines and product lines associated with the tank shall be completely removed.

3.03 DISPOSAL

- A. Dispose of all residue, sludges, process chemicals, cleaning materials, and fluids from the tank at an approved disposal/recycling facility as specified in Section 02125.
- B. Tank and piping shall be delivered for disposal in an acceptable manner to an approved disposal yard following decontamination.

3.04 SAFETY

- A. Personnel working inside and in the general vicinity of the tank shall be trained and thoroughly familiar with the safety precautions, procedures and equipment required for controlling the potential hazards associated with this work. Personnel shall use proper protection and safety equipment during work in and around the tank.
- B. Warning signs and devices shall be placed at regular intervals along the work area perimeter.
- C. Prior to ending operations on any working day or at any time the Contractor is not on site, the Contractor shall secure all areas of work in a safe manner to the satisfaction of the Owner.
- D. Cutting of steel or other metals by thermal methods shall, at all times, occur in a non-explosive environment. During such work, explosivity in the tank, piping and of the surrounding atmosphere shall be continuously monitored. The Contractor shall note that residual pockets of oils or residues may exist in some of the pipelines and the Contractor shall exercise care to prevent release to the environment and harm to employees or other site personnel resulting from potential explosive nature of the contained materials.
- E. Provide and maintain an adequate supply of fire extinguishers and other required safety equipment in proximity to all demolition activity.

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SECTION 02221

TRENCHING, BACKFILLING AND COMPACTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and perform all trenching for pipelines and appurtenances, including drainage, filling, backfilling, disposal of surplus material and restoration of trench surfaces and easements.
- B. Excavation shall extend to the width and depth shown on the Drawings or as specified herein and shall provide suitable room for installing pipe, structures and appurtenances.
- C. Furnish and place all sheeting, bracing and supports and remove from the excavation all materials which the Engineer may deem unsuitable for backfilling. The bottom of the excavation shall be firm, dry and in all respects, acceptable. If conditions warrant, deposit gravel for pipe bedding, or gravel refill for excavation below grade, directly on the bottom of the trench immediately after excavation has reached the proper depth and before the bottom of the trench has become softened or disturbed by any cause whatever. The length of open trench shall be related closely to the rate of pipe laying. All excavation shall be made in open trenches.
- D. All excavation, trenching and related sheeting, bracing, etc, shall conform to the requirements of the Florida "State Safety Act" (CS/SB 2626) which incorporates, by reference, OSHA's excavation safety standards, 29 CFR 1926.650 Subpart P.
- E. Wherever the requirement for 95 percent compaction is referred to herein it shall mean "at least 95 percent of maximum dry density as determined by ASTM D 1557.
- F. Prior to the start of work submit the proposed method of backfilling and compaction to the Engineer for review.

1.02 RELATED WORK

- A. Dewatering and Drainage is specified in Section 02140.
- B. Earthwork is included in Section 02200.
- C. Granular Materials is included in Section 02230.

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D 1557 – Standard Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft (2,700kN-m/cu m)).

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 TRENCH EXCAVATION

- A. Trench excavation shall include material of every description and of whatever substance encountered, except rock and boulders. Pavement shall be cut with a saw, wheel or pneumatic chisel along straight lines before excavating.
- B. Strip and stockpile topsoil from grassed areas crossed by trenches. At the Contractor's option, topsoil may be otherwise disposed of and replaced, when required, with approved topsoil of equal quality.
- C. While excavating and backfilling is in progress, traffic shall be maintained, and all utilities and other property protected as provided in the General Conditions and General Requirements.
- D. Trenches shall be excavated to the depth indicated on the Drawings and in widths sufficient for laying the pipe, bracing and for pumping and drainage facilities. The bottom of the excavations shall be firm and dry and in all respects acceptable to the Engineer. Trench width shall be practical minimum.
- E. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. The trench may be excavated by machinery to, or just below the designated subgrade, provided that material remaining in the bottom of the trench is no more than slightly disturbed. Subgrade soils which become soft, loose, "quick", or otherwise unsatisfactory as a result of inadequate excavation, dewatering or other construction methods shall be removed and replaced by screened gravel fill or structural fill as required by the Engineer at the Contractor's expense.
- F. Where pipe is to be laid in screened gravel bedding, the trench may be excavated by machinery to the normal depth of the pipe provided that the material remaining in the bottom of the trench is no more than slightly disturbed.
- G. Where pipe is to be laid directly on the trench bottom, final excavation at the bottom of the trench shall be performed manually, providing a flat-bottom true to grade upon undisturbed material. Bell holes shall be made as required.

3.02 DISPOSAL OF MATERIALS

- A. Excavated material shall be stacked without excessive surcharge on the trench bank or obstructing free access to hydrants and gate valves. Inconvenience to traffic and abutters shall be avoided as much as possible. Excavated material shall be segregated for use in backfilling as specified below.
- B. It is expressly understood that no excavated material shall be removed from the site of the work or disposed of, except as directed by the Engineer. When removal of surplus materials has been approved by the Engineer, dispose of such surplus material in approved designated areas.

- C. Should conditions make it impracticable or unsafe to stack material adjacent to the trench, the material shall be hauled and stored at a location provided. When required, it shall be re-handled and used in backfilling the trench.

3.03 SHEETING AND BRACING

- A. Furnish, put in place and maintain sheeting and bracing required by Federal, State or local safety requirements to support the sides of the excavation and prevent loss of ground which could endanger personnel, damage or delay the work or endanger adjacent structures. If the Engineer is of the opinion that at any point sufficient or proper supports have not been provided, he/she may order additional supports placed at the expense of the Contractor. Compliance with such order shall not relieve the Contractor from his/her responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.
- B. Where sheeting and bracing is required to support the sides of trenches, engage a professional Engineer, registered in the State of Florida, to design the sheeting and bracing. The sheeting and bracing installed shall be in conformity with the design and certification of this shall be provided by the professional Engineer.
- C. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the screened gravel backfill.
 - 1. When installing rigid pipe (R.C., V.C., A.C., etc), any portion of the box extending below mid diameter shall be raised above this point prior to moving the box ahead to install the next pipe. This is to prevent the separation of installed pipe joints due to movement of the box.
 - 2. When installing flexible pipe (PVC, etc), trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below mid-diameter of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, screened gravel shall be placed to fill any voids created and the screened gravel and backfill shall be recomacted to provide uniform side support for the pipe.
- D. Permission will be given to use steel sheeting in lieu of wood sheeting for the entire job wherever the use of sheeting is necessary. The cost for use of sheeting will be included in the bid items for pipe and shall include full compensation for driving, bracing and later removal of sheeting.
- E. All sheeting and bracing shall be carefully removed in such manner as not to endanger the construction of other structures, utilities, or property, whether public or private. All voids left after withdrawal of sheeting shall be immediately refilled with sand by ramming with tools especially adapted to that purpose, by watering or otherwise as directed.
- F. No payment will be given for sheeting, bracing, etc, during the progress of the work. No payment will be given for sheeting which has actually been left in the trench for the convenience of the Contractor.

- G. Sheeting driven below mid-diameter of any pipe shall remain in place from the driven elevation to at least 1-ft above the top of the pipe.

3.04 TEST PITS

- A. Excavation of test pits may be required for the purpose of locating underground utilities or structures as an aid in establishing the precise location of new work.
- B. Test pits shall be backfilled as soon as the desired information has been obtained. The backfilled surface shall be maintained in a satisfactory condition for travel until resurfaced as specified.

3.05 EXCAVATION BELOW GRADE AND REFILL

- A. Whatever the nature of unstable material encountered or the groundwater conditions, trench drainage shall be complete and effective.
- B. If the Contractor excavates below grade through error or for the Contractor's own convenience, or through failure to properly dewater the trench, or disturbs the subgrade before dewatering is sufficiently complete, he may be directed by the Engineer to excavate below grade as set forth in the following paragraph, in which case the work of excavating below grade and furnishing and placing the refill shall be performed at his own expense.
- C. If the material at the level of trench bottom consists of fine sand, sand and silt or soft earth which may work into the crushed stone or screened gravel not withstanding effective drainage, the subgrade material shall be removed to the extent directed and the excavation refilled with a 6-in layer of coarse sand, or a mixture graded from coarse sand to the fine gravel, as approved by the Engineer, to form a filter layer preserving the voids in the gravel bed of the pipe. The composition and gradation of gravel shall be approved by the Engineer prior to placement. Screened gravel shall then be placed in 6-in layers thoroughly compacted up to the normal grade of the pipe.
- D. Geotextile filter fabric may be substituted for filter layer if approved by the Engineer.

3.06 BACKFILLING

- A. The pipe shall be placed on a bedding of at least 8 inches of compacted Structural Fill. Pipe bedding material shall be pre-shaped by means of a template prior to placing the pipe. Blocking shall not be used to raise the pipe to grade. Bell holes shall be provided at each joint to allow the joints to be assembled.
- B. As soon as practicable after the pipe has been laid and jointed, backfilling shall begin and thereafter be prosecuted expeditiously. The excavation shall be backfilled to 12 inches above the top of the pipe with compacted Structural Fill.

- C. Where the pipes are laid cross-country, the remainder of the trench shall be filled with common fill material in layers not to exceed 1-ft and mounded 6-in above the existing grade or as directed. Where a loam or gravel surface exists prior to cross-country excavations, it shall be removed, conserved and replaced to the full original depth as part of the work under the pipe items. In some areas it may be necessary to remove excess material during the clean-up process, so that the ground may be restored to its original level and condition.
- D. Where the pipes are laid in streets, the remainder of the trench shall be backfilled with compacted Structural Fill material in layers not to exceed 1-ft and thoroughly compacted.
- E. To prevent longitudinal movement of the pipe, dumping backfill material into the trench and then spreading will not be permitted until selected material has been placed and compacted to a level 1-ft over the pipe.
- F. Backfill shall be placed and compacted evenly on all sides. Each layer of backfill material shall be thoroughly compacted by rolling, tamping, or vibrating with mechanical compacting equipment or hand tamping to 95 percent compaction. If rolling is employed, it shall be by use of a suitable roller or tractor, being careful to compact the backfill throughout the full width of the trench.
- G. Where other methods are not practicable, compaction shall be by use of hand or pneumatic ramming with tools weighing at least 20 lbs. The material being spread and compacted in layers not over 6-in thick. If necessary, sprinkling shall be employed in conjunction with rolling or ramming.
- H. Subject to the approval of the Engineer, fragments of ledge and boulders smaller than 6-in may be used in trench backfill providing that the quantity in the opinion of the Engineer is not excessive. Rock fragments shall not be placed until the pipe has at least 2-ft of earth cover. Small stones and rocks shall be placed in thin layers to ensure that all voids are completely filled. Fill shall not be dropped into the trench in a manner to endanger the pipe.

3.07 RESTORING TRENCH SURFACE

- A. Where the trench occurs adjacent to paved streets, in shoulders, sidewalks, or in cross-country areas, thoroughly consolidate the backfill and maintain the surface as the work progresses. If settlement takes place, immediately deposit additional fill to restore the level of the ground.
- B. In and adjacent to streets, the 12-in layer of trench backfill below the specified initial pavement shall consist of compacted structural fill. Should the Contractor wish to use material excavated from the trench as gravel subbase for pavement replacement, the Contractor, at his/her own expense, shall have samples of the material tested by an independent testing laboratory at intervals not to exceed 100-ft, in order to establish its compliance with the specifications. Only material which has been tested and approved by the Engineer shall be allowed to be incorporated into the work.
- C. The surface of any driveway or any other area which is disturbed by the trench excavation and which is not a part of the paved road shall be restored to a condition at least equal to that existing before work began.

- D. In sections where the pipeline passes through grassed areas, and at the Contractor's own expense, remove and replace the sod, or loam and seed the surface to the satisfaction of the Engineer.

3.06 COMPACTION

- A. The Contractor shall control soil compaction during construction to provide the percentage of maximum density specified. The Contractor shall provide the Engineer copies of all soil testing reports, prepared by a professional Geotechnical Engineer licensed in the State of Florida, demonstrating compliance with these specifications.
- B. When existing trench bottom has a density less than that specified, the Contractor shall break up the trench bottom surface, pulverize, moisture-condition to the optimum moisture content and compact to required depth and percentage of maximum density.
- C. Percentage of Maximum Density Requirements
 - 1. Structural fill or undisturbed soil from the bottom of the pipe trench to 1 foot above the pipe shall be densified to a minimum density of 95% of the soil's maximum dry density as determined by ASTM D 1557, Method D.
 - 2. Common fill from 1 foot above the utility pipes to grade shall be densified to a minimum density of 95% of the maximum dry density as determined by ASTM D 1557, Method D.
 - 3. Structural fill under and around structures, and to the extent of excavation shall be densified to a minimum density of 95% of the maximum dry density as determined by ASTM D 1557, Method D.
- D. Compaction Tests
 - 1. As a minimum, one compaction test location shall be required for each 300 linear feet of pipe and every 100 square feet of backfill around structures. The Engineer may determine that more compaction tests are required to certify the installation depending on field conditions. The locations of compaction tests within the trench shall be in conformance with the following schedule:
 - a. One test at the spring line of the pipe.
 - b. At least one test for each 12-inch layer of backfill within the pipe bedding zone.
 - c. One test at an elevation of one foot above the top of the pipe.
 - d. One test for each one foot of backfill placed from one foot above the top of the pipe to finished grade elevation.
 - 2. Density testing for foundation bearing surfaces shall be required at a frequency of one test per foot depth to a depth of at least two feet below bearing surface of each foundation.

3. Density testing for general grading surface shall be required at a frequency of one test every lift per 5,000 square feet, or at a minimum of one test location per lift, whichever is greater.
4. Backfill shall be tested at a frequency of one test per foot of material.
5. If based on Geotechnical testing reports and inspection, fill, which has been placed, is below specified density, the Contractor shall, at his own expense, provide additional compaction and testing prior to commencing further construction.

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SECTION 02230

GRANULAR MATERIALS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and obtain materials for filling and backfilling, grading and miscellaneous sitework, for the uses shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Site Preparation is included in Section 02100.
- B. Dewatering and Drainage is included in Section 02140.
- C. Earthwork is included in Section 02200.
- D. Trenching, Backfilling and Compaction is included in Section 02221.
- E. Sedimentation and Erosion Control is included in Section 02270.
- F. Asphaltic Concrete Pavement is included in Section 02500.
- G. Loaming and Seeding is included in Section 02930.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, complete product data for materials specified in this Section.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C33 - Standard Specification for Concrete Aggregates.
 - 2. ASTM D 1557 – Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft³ (2,700kN-m/m³)).
 - 3. ASTM D 422 – Standard Test Method for Particle-Size Analysis of Soils.
 - 4. ASTM D 4318 – Standard test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.

5. Florida Department of Transportation (FDOT) Standard Specifications for Road and Bridge Construction, latest edition.

B. Where reference is made to one of the above standards, the revision in effect at the time of contract award shall apply.

1.05 QUALITY ASSURANCE

A. Laboratory Testing

1. Deliver representative samples of the proposed fill or backfill soils weighing at least 50 lbs to the soils testing laboratory at least seven (7) days prior to the placement of any fill or backfill materials.
2. Engage the soils testing laboratory to perform:
 - a. Grain size analyses and Atterberg limits determinations of the samples to determine their suitability for use as backfill or fill material in conformance to the materials requirements specified herein.
 - b. The appropriate Proctor analyses to determine the maximum dry densities and optimum moisture contents required for compaction testing as specified elsewhere in the Contract Documents.
3. Delivered to the ENGINEER test results and determinations of suitability of fill or backfill soils no later than 3 days prior to the placement of fill or backfill soils.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Backfill and Fill materials shall be suitable excavated materials, natural or processed mineral soils obtained from off-site sources, or graded crushed stone. Backfill and Fill materials shall consist of mineral soil free of organic material, trash, loam, debris, or other objectionable or deleterious materials which may be compressible or which cannot be properly moisture conditioned and compacted. Backfill and Fill materials shall be non-plastic (ASTM D 4318) and shall contain no more than 3 percent by weight of fibrous organic materials (as determined by ASTM D 2974 Method C).
- B. Structural Fill shall not contain cobbles and boulders, broken concrete, masonry rubble, or asphalt pavement. Structural Fill shall be non-plastic (ASTM D 4318) and shall conform to the following gradation requirements, as determined by ASTM D 422:

<u>Sieve Size</u>	<u>Percent Finer By Weight</u>
3-in	100
No. 4	70 to 100
No. 40	5 to 100
No. 200	0 to 12

- C. Common fill shall consist of granular soil free of organic material, topsoil, debris, or other deleterious material that cannot be properly compacted. Common fill shall contain stones no larger than 6 inches and shall have no more than 20 percent of material passing the No. 200 sieve. Common Fill shall not contain stones larger than 6 inches in any dimension and shall have a maximum of 70 percent passing the No. 40 sieve and a maximum of 20 percent passing No. 200 sieve. Common fill shall not contain broken concrete, masonry rubble or other similar materials. It shall have physical properties such that it can be readily spread and compacted during filling.
- D. Select Common Fill shall meet the requirements of Common Fill except that the material shall not contain any materials larger than 2 inches in largest dimension.
- E. Crushed stone shall be sound, durable stone, angular in shape, and free of any foreign material, structural defects and chemical decay. The material shall conform to the physical and gradation requirements provided by the Florida Department of Transportation (FDOT) for No. 57 Stone. Filter fabric in accordance with FDOT Index 199 between the subgrade soils and the gravel/stone shall be required. Crushed stone shall be compacted by mechanical means and vibratory action during construction.
- F. Sand for concrete, grout, and masonry shall conform to ASTM C33 for fine aggregate. General purpose sand shall be Select Common Fill.
- G. Lean Concrete shall be ready-mix, cast-in-place concrete conforming to the requirements in Division 3. Minimum compressive strength shall be 2,000 psi after 7 days and 2,500 psi after 28 days.
- H. Filter fabric shall conform to the requirements of FDOT Index 199, Type D-3.
- I. Staples for installing Erosion Control Blanket shall be made of wire, 0.091-in in diameter or greater, "U" shaped, with legs 6-in in length and a 1-in crown.
- J. Controlled Low-Strength Material (CLSM) used as backfill and fill shall be comprised of a mixture of Portland cement, coarse aggregate, fine aggregate and water. Materials, methods of preparation, and placement techniques shall comply with the requirements of Section 03300 for concrete. Design mix shall result in a flowable material with a 28 day compressive strength of approximately 60 psi. Recommended mix shall be as follows:

Portland Cement	40 lbs/cu yd
Coarse Aggregate	1700 lbs/cu yd
Fine Aggregate	1900 lbs/cu yd
Water	325 lbs/cu yd, or as needed

PART 3 - EXECUTION (NOT USED)

END OF SECTION

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SECTION 02234

SOIL-CEMENT BASE

PART 1 - GENERAL

1.01 WORK INCLUDED

- A. The work specified in this Section consists of the construction of a base course composed of a combination of soil and Portland cement, uniformly mixed, moistened, compacted, finished, and cured, in accordance with these specifications, and shaped to reasonably close conformance with the lines, grades, thickness, and typical cross sections shown on the Drawings or established by the Owner's representative.
- B. Related Work Described Elsewhere:
 - 1. Submittals: Section 01300.
 - 2. Site Preparation: Section 02100.
 - 3. Stabilized Subgrade: Section 02240.
 - 4. Asphaltic Concrete Pavement: Section 02500.
- C. Applicable Codes, Standard and Specifications: The road construction under this contract shall be in strict accordance with the applicable provisions of the following:
 - 1. The Florida Department of Transportation (FDOT) "Standard Specifications for Road and Bridge Construction" Latest Edition
 - 2. American Association of State Highway and Transportation Officials (AASHTO)
 - 3. American Society for Testing and Materials (ASTM)
 - 4. County and City Codes

1.02 QUALITY ASSURANCE

- A. Laboratory analysis shall be complete, and the material accepted by the Owner's representative prior to use.
- B. The storage building, bin or silo for cement shall be weatherproof and shall be located convenient to the work to be performed.
- C. Cement which has been damaged, which is partially set, or which is lumpy or caked, shall not be used, and the entire contents of the sack of cement or the container of bulk cement, which contains damaged, partially set, or lumps of caked cement, will be rejected for use. Cement salvaged from discarded or used sacks shall not be used.

1.03 SEQUENCES AND SCHEDULING

- A. Sequence soil cement construction after all underground utilities have been placed and tested so that base would not require subsequent excavation and patching.
- B. Schedule construction to facilitate maintenance of traffic during the construction including the curing period.
 - 1. Maintenance of traffic requirements may result in construction of a soil cement base one-half the pavement width at a time.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cement: The cement used in the work shall be domestic Portland cement that conforms to the requirements of AASHTO Designation M-85, Type 1. The cement may be delivered in bags or in bulk.
- B. Water:
 - 1. Water for use with cement shall be clean and practically free of oil, acid, alkali, chlorides, organic matter, and other deleterious substances.
 - 2. Water from city water supplies or other sources that are approved by a public health department may be accepted without being tested.
 - 3. Water from all other sources shall be tested and approved before use and shall not contain impurities in excess of the following limits:

Acidity or alkalinity calculated in terms of calcium carbonate:	0.05 percent
Total organic solids:	0.05 percent
Total inorganic solids:	0.05 percent
Total chlorides as sodium chloride:	0.05 percent
- C. Cut-Back Asphalt, Grade RC-70: Rapid-curing cut-back asphalt shall conform with the requirements of AASHTO Designation M-81 except that the penetration range shall be from 60-120 instead of 70-120.
- D. Emulsified Asphalt, Grade SS-1: Emulsified asphalt shall meet the requirements of AASHTO Designation M-140.
- E. Soil: The soil for the base course shall consist of the natural material in the roadway or select soil placed in the roadbed, as shown on the Drawings, or a combination of these materials, proportioned as directed. On-site, borrow or a combination of materials which will meet the following:

1. Suitably viable with not more than 5% organic material that will not harm the soil cement performance.
2. Limiting values:
 - a. Total clay and silt content (minus 200 sieve): Maximum 25%
 - b. Plasticity Index (liquid limit minus plastic limit): Maximum 10%
3. Gradation:

<u>Passing</u>	<u>Percent</u>
2-inch sieve	100%
No. 4 sieve	55%
No. 10 sieve	37

PART 3 - EXECUTION

3.01 GENERAL

- A. Equipment: For performing the work specified in this Section the Contractor may use any vibratory machine, combination of machines, or equipment that are in good, safe working condition and that will produce results meeting the requirements for cement application, soil pulverization, mixing water application, compaction, finishing, and curing, as required herein.
- B. Limits of Construction: The Contractor shall construct the base to the full width shown on the Drawings.

3.02 COMPOSITION AND PROPORTIONING

- A. Cement: Portland cement shall be applied at the rate for the particular soil used to obtain a minimum 7-day compressive strength of 300 psi cement; no processing of the soil-cement mixture shall be started until all tests of the soil to be used to construct the base have been completed and the specified rate of application of Portland cement for the particular soil has been determined. In general, a period of approximately three (3) weeks, subsequent to the time that a particular section of the roadbed has been constructed substantially to grade, is required for such testing. The rate of application will be specified in terms of either pounds of Portland cement per square yard for the area to be mixed or pounds of cement per cubic yard of soil-cement mixture. The design soil cement shall be proportioned in accordance with strength design of Florida Test Method FM 5-520 Laboratory Design of Soil-Cement Mixtures.
- B. Water: The quantity of water required will be the amount necessary to comply with Paragraph 3.04, herein.

3.03 PREPARATION

A. Subgrade:

1. Before base construction operations are begun, the subgrade shall have been completed. The subgrade shall be firm enough to support the equipment used in the soil-cement base operations without appreciable distortion or displacement. Any unsuitable material shall have been removed and replaced with suitable material.
2. As the base is to be constructed of central plant-mix soil-cement, the subgrade shall be moist for a depth of at least one inch at the time the mixed base course material is placed thereon.

- #### B. Base Soil:
- Grade stakes shall be placed and maintained at 50 foot intervals along both sides of the proposed roadway. The area over which base is to be constructed shall be graded and shaped to an elevation which will provide a base in conformance with the grades, lines, thickness, and typical cross-section shown on the Drawings. The Contractor shall demonstrate the specified grade to Owner's representative prior to base placement and after compaction. All roots, sticks, and other deleterious matter shall be removed during processing.

3.04 PERFORMANCE

A. Mixing:

1. General:

- a. Mixing of the soil, cement, and water shall be accomplished by the central plant-mix method.
- b. The percentage of moisture in the soil at the time of cement application shall not exceed the quantity that will permit a uniform and intimate mixture of soil and cement during mixing operations.
- c. At completion of moist-mixing, the soil shall be so pulverized that 100 percent passes a 1-inch sieve and a minimum of 80 percent passes a No. 4 sieve, exclusive of gravel or stone retained on the No. 4 sieve.
- d. The operations specified in this Subparagraph and in the Paragraphs 3.04B. and 3.04C., herein, shall be continuous and shall be completed within a period of 4 hours starting from the time mixing commences.

2. Central Plant-Mix:

- a. The soil, cement and water shall be mixed in a pugmill, of either the batch or continuous-flow type. The plant shall be equipped with feeding and metering devices which will accurately proportion the soil, cement, and water in the quantities specified. Soil and cement shall be mixed sufficiently to prevent cement balls forming when additional water is added. Mixing shall continue until a uniform and intimate mixture of soil, cement and water is obtained. The materials shall be mixed a minimum of 30 seconds.

- b. The mixture shall be hauled to the roadway in trucks equipped with protective covers. The mixture shall be placed on the moistened subgrade in a uniform layer by an approved spreader. Not more than 60 minutes shall elapse between the placements of soil-cement in adjacent passes of the spread at any location, except at longitudinal construction joints. The layer of soil-cement shall be uniform in thickness and surface contour, and in such quantity that the completed base will conform to the required grade and cross-section. Dumping of the mixture in piles or windrows upon the subgrade will not be permitted.

B. Compaction:

1. Compaction of the soil-cement mixture shall begin immediately after mixing is completed. In no case shall more than 30 minutes elapse between the last pass of moist-mixing and the start of compaction of the soil-cement mixture at a particular location.
2. At the start of the final compaction operation, the percentage of moisture in the mixture and in unpulverized soil lumps, based on dry weights, shall not be more than two percentage points above or below the optimum moisture content.
3. The optimum moisture content and maximum density shall be determined in the field by the methods prescribed in ASTM D2487, on representative samples of the soil-cement mixture obtained from the area being processed.
4. The loose mixture shall be uniformly compacted to not less than 95 percent of the maximum density as determined by modified Proctor ASTM D1557. During compaction operations, shaping may be required to obtain uniform compaction and required grade and cross-section. Compaction shall be continued until the required density is achieved and rut marks disappear.

C. Finishing:

1. After compaction, the surface of the soil-cement shall be shaped to the required lines, grades, and cross-section. In all cases where soil-cement mixture is added to any portion of the surface, the surface shall be lightly scarified with a spring tooth harrow, spike, drag, or other approved device, such that the surface is uniformly loosened prior to addition of material and prior to initial set of the soil-cement mixture. The resulting surface shall then be compacted to the specified density. Rolling shall continue until all rutting ceases and until the entire base conforms to the density requirements. With certain granular soils the Owner's representative may determine that minor tire marks are acceptable.
2. The moisture content of the surface material shall be maintained at not less than two percentage points below its specified optimum moisture content, during finishing operations. Surface compaction and finishing shall be done in such manner as to produce a smooth, dense surface, free of compaction planes, cracks, ridges, and loose material.
3. If the time limits set forth herein are exceeded, the base shall be left undisturbed for a period of seven days, after which it will be examined by the Owner's representative to determine its suitability. If it is found suitable the Contractor shall be fully compensated providing the base meets all other requirements specified herein. If found unsuitable the base shall be removed and replaced by the Contractor without additional compensation. The Contractor may, at his option, remove and replace the deficient base rather than wait the seven-day test cure.

- D. Construction Joints: At the end of each day's construction a straight transverse construction joint shall be formed by cutting back into the completed work to form a true vertical face. The construction joint shall be located such as to exclude all of that part of the base at the end of the run that does not meet the requirements of the Specifications and the typical section.
- E. Curing:
1. Surface Requirements (Scalping or Hardplaning): After compacting and finishing have been completed, and not later than the beginning of the next calendar day after the construction of any section of base, the surface shall be tested with a template cut to the required crown and with a 15 foot straightedge laid parallel to the centerline, and all irregularities greater than 1/4 inch shall be immediately corrected with a blade adjusted to the lightest cut which will insure a surface that does not contain depressions greater than 1/4 inch under the template or the straightedge. If the required thickness cannot be maintained, the base shall be replaced. In the testing of the surface, the measurements shall not be taken in small holes caused by individual rocks having been pulled out by the blade. The material removed shall be wasted.
 2. Protection Against Drying:
 - a. During the period when finishing and surface correction operations are being accomplished, the surface of the base shall be kept continuously moist by sprinkling as necessary. Subsequent to this period, it shall be protected from drying for 7 days, by application of either cut-back asphalt, Grade RC-70, applied at the rate of 0.15 to 0.20 gallon per square yard; or a mixture containing equal parts of emulsified asphalt, Grade SS-1, and water, applied at the rate of 0.20 to 0.25 gallon of the diluted mixture per square yard. The actual rate of application shall be as directed and shall provide complete coverage without excessive runoff. At the time the bituminous material is applied, the soil-cement surface shall be dense and free of all loose and extraneous material, and shall contain sufficient moisture to prevent excessive penetration of the bituminous materials.
 - b. Should it be necessary to allow construction equipment or other traffic to use the completed base before the bituminous material has cured sufficiently to prevent pickup or displacement, the bituminous material shall be sanded, using approximately 10 pounds of clean sand per yard.
 - c. The curing material shall be maintained by the Contractor during the seven-day protection period.
- F. Opening to Traffic: No traffic shall be permitted on the base subsequent to completion of the finishing operations specified in Paragraph 3.04C., herein, for a period of 72 hours. As an exception to this requirement, the equipment necessary for correction of surface irregularities, application of water and application of curing materials will be allowed provided that the tire contact pressures of such equipment do not exceed 45 pounds per square inch (psi). After the 72 hours curing period the base may be opened to traffic provided that it either is protected or has hardened sufficiently to prevent marring or distorting of the surface by equipment or traffic.
- G. Maintenance: The Contractor shall maintain the base to a true and satisfactory surface until the wearing surface is constructed. Should any repairs or patching be necessary, they shall extend to the full depth of the base and shall be made in a manner that will assure restoration of a uniform base course conforming to the requirements of these specifications. In no case shall

repairs be made by adding a thin layer of soil-cement to the completed work. The Contractor may, at his option, make full depth repairs to small or minor areas, such as at manholes, inlets, or the like, with Class C concrete.

- H. Density Requirements: As soon as proper conditions are attained, the material shall be compacted to a density of not less than 97 percent of the maximum dry density obtainable under AASHTO Designation T-134. The maximum density determination shall be determined by sampling the blended soil cement base material immediately after the initial mixing for each day's run.
1. Density tests:
 - a. During final compacting operations, if blading of any areas is necessary to obtain the true grade and cross section, the compacting operations for such areas shall be completed prior to making the density determinations on the finished base.
 - b. Density determinations for intervals not to exceed 300 feet (three tests minimum) shall be made on each day's final operations. The density determinations shall be made at more frequent intervals if deemed necessary by the Owner's representative.
 - I. Contamination of base:
 1. If at any time the subgrade material should become mixed with the base course material, the Contractor shall dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean base material, which shall be shaped and compacted as specified above.
 - J. Testing surface: The finished surface of the base course shall be checked for conformance to the required crown and grade with a template cut to the required cross-section and 15-foot straight edge. All irregularities greater than 1/4-inch shall be corrected by replacing base as required, after which the entire area shall be recompacted as specified hereinbefore.
 - K. Thickness:
 1. During various stages of construction, test holes shall be dug in the mixture to determine the thickness. After the base is completed at intervals of not more than 300 feet, test holes shall be dug or drilled and the thickness of the base shall be determined from measurements made in these test holes.
 2. Where the base is deficient in thickness by more than 1/2 inch, the area of deficient base shall be removed and replaced by base of the required thickness, at the Contractor's expense.
 3. As an exception to the above, if the deficiency is considered to not be sufficient to seriously impair the required strength of the base, the deficient area may be left in place. No payment will be made for the base or the theoretical amount of cement used in areas left in place without correction.

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SECTION 02240

STABILIZED SUBGRADE

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The work specified in this section consists of the construction of a stabilized roadway subgrade where indicated on the Drawings. Construction shall be to the uniformity, density and bearing ratio specified hereinafter. Paved areas shall be stabilized to a minimum depth of 12 inches below the bottom grade of the base material and to a width 12 inches outside of pavement or concrete curb edge.

B. Related Work Described Elsewhere:

1. Site Preparation: Section 02100
2. Soil-Cement Base: Section 02234
3. Asphaltic Concrete Pavement: Section 02500

C. Definitions: The stabilizing shall be FDOT Type B as described hereinafter. The required bearing ratio value shall be obtained either by constructing the subgrade or selected materials from the roadway and borrow area(s), or by stabilizing the subgrade material by the addition and mixing in of suitable stabilizing material. Such work shall be done in accordance with these specifications, lines, grades, thicknesses and notes shown on the Drawings.

D. Applicable Codes, Standard and Specifications: The road construction under this contract shall be in strict accordance with the applicable provisions of the following:

1. The Florida Department of Transportation (FDOT) "Standard Specifications for Road and Bridge Construction" (Latest Edition).
2. American Association of State Highway and Transportation Officials (AASHTO).
3. American Society for Testing and Materials (ASTM).
4. County and City codes and Standards.

PART 2 - PRODUCTS

2.01 MATERIALS

- ###### A. General: The particular type of stabilizing material to be used shall be in accordance with Paragraph 2.01.E hereinafter and shall meet the following requirements.

B. Use Of Materials From Existing Base:

1. Removal of any section of existing base shall not be done until the need for it in maintaining traffic is fulfilled.
2. Existing shell or limerock base material may be reutilized as an admixture for stabilized subgrade.

C. Commercial Materials

1. General: Materials which are designated as Commercial- Materials which are to be used for this stabilizing may be commercial limerock, limerock overburden or shell approved by Owner's Representative.
2. Limerock: Specific requirements for limerock and limerock overburden: For limerock and limerock overburden, the percentage of carbonates of calcium and magnesium shall be at least 70, and the plasticity index shall not exceed 10. The gradation of both commercial limerock and limerock overburden shall be such that 97 percent of these materials will pass a 1 1/2 inch sieve.
3. Crushed Shell: Crushed shell for this use shall be mollusk shell (i.e. oysters, mussels, clams, cemented coquina, etc.). Steamed shell will not be permitted. The shell shall meet the following requirements: at least 97% by weight of the total material shall pass a 3 1/2-inch screen and at least 50% by weight of the total material shall be retained on the No. 4 sieve. Not more than 20% by weight of the total material shall pass the No. 200 sieve. The determination of the percentage passing the No. 200 sieve shall be made by washing the material over the sieve.

D. Local Material:

1. General: Local materials used for this stabilizing may be high bearing value soils or sand-clay material. The material passing the 40-mesh sieve shall have a liquid limit not greater than 30 and a plasticity index not greater than 10.
2. Blending: No blending of materials to meet these requirements will be permitted unless authorized by the Owner's Representative. When blending is permitted, the blended material shall be tested and approved before being spread on the roadway.

E. Type B Stabilization:

1. The type of materials, Commercial or Local, shall be at the Contractor's option.
2. No separate payment for stabilizing materials will be made.
3. Bearing Value determinations will be made by the Limerock Bearing Ratio Method.

4. Under this method, it shall be the Contractor's responsibility that the finished roadbed section meets the bearing value requirements, regardless of the quantity of stabilizing materials necessary to be added. Also under this method, full payment will be made for any areas where the existing sub-grade materials meet the design bearing value requirements without the addition of stabilizing additives, as well as areas where the Contractor may elect to place select high-bearing materials from other sources, within the limits of the stabilizing.
5. After the roadbed grading operations have been substantially completed, the Contractor shall make his own determination as to the quantity (if any) of stabilizing material, of the type selected by him, necessary for compliance with the bearing value requirements. The Contractor shall notify the Owner's Representative of the approximate quantity to be added.

PART 3 - EXECUTION

3.01 PREPARATION

A. General

1. Equipment: All equipment necessary for the proper construction of the work shall be on the project, in first-class working condition, and shall have been approved by the Owner's Representative prior to its use.
2. Clear, grub and strip within limits of roadway. See Section 02100, Site Preparation.
3. Grade stakes shall be placed and maintained at 50 foot intervals along both sides of the proposed roadway. The Contractor shall demonstrate the specified grade to the Owner's Representative prior to placement of stabilizer. Prior to the beginning of stabilizing operations, the area to be stabilized shall have been constructed to an elevation such that upon completion of stabilizing operations the completed stabilized subgrade will conform to the lines, grades and cross sections shown in the plans. Prior to the spreading of any additive stabilizing material, the surface of the roadbed shall be brought to a plane approximately parallel to the plane of the proposed finished surface.
4. The subgrade to be stabilized shall be processed in one course, unless the equipment and methods being used do not provide the required uniformity, particle size limitation, compaction and other desired results, in which case, the Owner's Representative will direct that the processing be done in more than one course.
5. All manhole castings, valve boxes or other utility castings within the area to be surfaced shall be adjusted to the proposed surface elevation by the Contractor. The work shall be accomplished in such manner as to leave the casting fixed permanently in its correct position.

3.02 APPLICATION

A. Stabilizing Material:

1. When additive stabilizing materials are required, the designated quantity shall be spread uniformly over the area to be stabilized.

2. When materials from an existing base are to be utilized in the stabilizing at a particular location, all of such materials shall be placed and spread prior to the addition of other stabilizing additives.
 3. Commercial stabilizing material shall be spread by the use of mechanical material spreaders except that where use of such equipment is not practicable other means of spreading may be used, but only upon written approval of the proposed alternate method.
- B. Mixing:
1. The mixing shall be done with rotary tillers, or other equipment meeting the approval of the Owner's Representative. The area to be stabilized shall be thoroughly mixed throughout the entire depth and width of the stabilizing limits.
 2. The mixing operations, as specified, will be required regardless of whether the existing soils, or any select soils placed within the limits of the stabilized sections, have the required bearing value without the addition of stabilizing materials.
 3. As an exception to the above mixing requirements, where the subgrade is of rock, the Owner's Representative may direct that the mixing operations (and the work of stabilizing) be waived and no payment for stabilization will be made for such sections of the roadway.
- C. Maximum Particle Size of Mixed Materials: At the completion of mixing, all particles of material within the limits of the area to be stabilized shall pass a 3 1/2-inch ring. Any particles not meeting this requirement shall be removed from the stabilized area or shall be broken down so as to meet this requirement.
- D. Compaction: After the mixing operations have been completed and requirements for bearing value, uniformity and particle size have been satisfied, the stabilized area shall be compacted, in accordance with Paragraph 3.03.B hereinafter. The materials shall be compacted at a moisture content permitting the specified compaction. If the moisture content of the material is improper for attaining the specified density, either water shall be added or the material shall be permitted to dry until the proper moisture content for the specified compaction is reached.
- E. Finish Grading: The completed stabilized subgrade shall be shaped to conform with the finished lines, grades and cross-section indicated in the Drawings to a tolerance of 0.05 feet. The subgrade shall be checked by the use of grade stakes and demonstrated to the Owner's Representative.
- F. Requirements For Condition Of Completed Subgrade:
1. After the stabilizing and compacting operations have been completed, the subgrade shall be firm and substantially unyielding, to the extent that it will support construction equipment and will have the bearing value required by the Drawings.
 2. All safe and yielding material, and any other portions of the subgrade which will not compact readily, shall be removed and replaced with suitable material and the whole subgrade brought to line and grade, with proper allowance for subsequent compaction.

- G. Maintenance Of Completed Subgrade: After the subgrade has been completed as specified above, the Contractor shall maintain it free from ruts, depressions and any damage resulting from the hauling or handling of materials, equipment, tools, etc. It shall be the Contractor's responsibility to maintain the required density until the subsequent base or pavement is in place. Such responsibility shall include any repairs, replacement, etc., of curb and gutter, sidewalk, etc., which might become necessary in order to recompact the subgrade in the event of underwash or other damage occurring to the previously compacted subgrade. Any such work required for recompaction shall be at the Contractor's expense. Ditches and drains shall be constructed and maintained along the completed subgrade section.

3.03 FIELD QUALITY CONTROL

A. Bearing Value Requirements:

1. General: Bearing value samples will be obtained and tested by a testing firm approved by the Owner's Representative at completion of satisfactory mixing of the stabilized area. For any area where the bearing value obtained is deficient from the value indicated in the Drawings, in excess of the tolerances established herein, additional stabilizing material shall be spread and mixed in accordance with 3.02.B.1 and 3.02.B.2. This reprocessing shall be done for the full width of the roadway being stabilized and longitudinally for a distance of 50 feet beyond the limits of the area in which the bearing value is deficient.
2. Tolerances In Bearing Value Requirements: The following under-tolerances from the specified bearing value will be allowed as based on tests performed on samples obtained after mixing operations have been completed:

Specified Bearing Value

Under-tolerances

LBR 40

0

- B. Density Requirements - General: Within the entire limits of the width and depth of the areas to be stabilized, the minimum density acceptable at any location will be 98 percent of the maximum density as determined by AASHTO T 180, Test Method D (ASTM D1557). Tests for the subgrade compaction shall be spaced at a maximum of 300 feet apart and shall be staggered to the left, right, and on the centerline of the roadway or as directed by the Owner's Representative. The Owner's Representative may direct additional tests when in his opinion conditions warrant additional testing to assure compliance with specifications.

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SECTION 02251

TERMITE CONTROL

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Work Included: Soil treatment below slabs-on-grade and at interior and exterior foundation perimeters, for subterranean insects.

1.02 QUALITY ASSURANCE

- A. Applicator: Company specializing in soil treatment for termite control and Licensed as a professional Pest Control Contractor in the State of Florida.
- B. Materials: Provide certification that toxicant's conform to specified requirements.
- C. Conform to State of Florida requirements for application licensing and authority to use toxicant chemicals.
- D. Conform to Florida Building Code Section 1816 – Termite Protection.

1.03 ENVIRONMENTAL HAZARDS:

- A. Do not apply directly to water. Drift and runoff from treated areas may be hazardous to aquatic organisms in adjacent aquatic sites. Do not contaminate water by cleaning of equipment or disposal of waste.

1.04 INSPECTION AND WARRANTY:

- A. Provide five year warranty for material and installation. Cover against invasion or propagation of subterranean termites. Provide yearly inspections and warranty to replace any wood damage through subterranean infestation without cost to the Owner for a period of five years from date of acceptance by means of a five year repair and replacement bond, which shall be signed by Applicator and Contractor.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Characteristics: Provide chemicals specially formulated to prevent long term termite infestation, unless forbidden by governing authority. Other solutions may be used if approved by governing authorities and the Engineer. Use only chemicals and concentrations which do not injure plants and grass.

- B. Product shall meet the requirements for registration as a pesticide product as required by Chapter 487, Florida Statutes, and the registered label shall contain directions for use on new construction.

PART 3 EXECUTION

3.01 GENERAL

- A. Installer/Applicator must examine areas and conditions under which Termite Control is to be installed/applied, and notify Contractor in writing of conditions detrimental to proper/timely completion of the work.
- B. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to Installer/Applicator.
- C. Beginning of installation/application means acceptance of existing conditions.

3.02 EXTENT, SEQUENCE

- A. Do not apply soil treatment solution until excavating, filling and grading operations are completed, except as otherwise required in construction operations.
- B. Remove foreign matter which could decrease effectiveness of treatment on areas to be treated. Loosen, rake, and level soil to be treated, except previously compacted areas under slab and foundations. Toxicant's may be applied before placement of porous fill under slabs, if recommended by chemical manufacturer.

3.03 APPLICATION

- A. Apply soil treatment solution at rates recommended by soil chemical manufacturer. Comply with chemical manufacturer's printed/written instructions and recommendations for this work where they are the same as or greater than what is specified here.
- B. Allow not less than 12 hours for drying after application before beginning concrete placement or other construction activities.
- C. Post signs in areas of application warning workers that soil poisoning has been applied. Remove signs when areas are covered by other construction.
- D. Reapply soil treatment solution to areas disturbed by subsequent excavation or other construction activities following application.
- E. Apply toxicant immediately prior to placement of vapor barrier under slab-on-grade or finish grading outside foundation walls. Do not apply soil poison when surface water is present.
- F. Apply toxicant to soil at the following minimum rates, using metered applicator:

1. Under floor slabs-on-grade: One gallon per 10 square feet; if fill is washed gravel or other coarse material, apply at rate of 1 1/2 gallons per 10 square feet.
 2. Both sides of foundation wall: Four gallons per 10 linear feet per foot of depth. Mix emulsion with the soil as it is being replaced in the trench.
 3. Immediately below expansion joists, control joints: Four gallons per 10 linear feet.
- G. Apply extra treatment to structure penetrations, pipe ducts, and other soil penetrations.
- H. Apply as coarse spray to ensure uniform distribution.
- I. Coordinate soil treatment at foundation perimeter with finish grading and landscaping work to avoid disturbance of treated soil. Retreat disturbed treated soil.

3.04 RETREATMENT

- A. If inspection identifies the presence of termites, retreat soil and retest.
- B. Use same toxicant as for original treatment.

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SECTION 02270

EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and perform all installation, maintenance, removal and area cleanup related to erosion and sedimentation control work as shown on the Drawings and as specified herein. The work shall include, but not necessarily be limited to; installation of temporary access ways and staging areas, silt fences, sediment removal and disposal, device maintenance, removal of temporary devices, temporary mulching, and final cleanup.

1.02 RELATED WORK

- A. Earthwork is included in Section 02200.
- B. Granular fill materials are included in Section 02230.
- C. Loaming and seeding is included in Section 02930.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, within 10 days after award of Contract, technical product literature for all commercial products, including straw mulch tackifier, to be used for erosion and sedimentation control.

1.04 QUALITY ASSURANCE

- A. Be responsible for the timely installation and maintenance of all sedimentation control devices necessary to prevent the movement of sediment from the construction site to off-site areas or into the wetland. Measures in addition to those shown on the Drawings necessary to prevent the movement of sediment off site shall be installed, maintained, removed, and cleaned up at the expense of the Contractor. No additional charges to the Owner will be considered.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Crushed stone for soil tracking prevention device, access ways, and staging areas shall conform to Florida Department of Transportation Standards Specifications for Road and Bridge Construction latest edition.

B. Sediment Fence

1. Sediment fence shall be a prefabricated commercial product made of a woven, polypropylene, ultraviolet resistant material such as TenCate Mirafi® silt fence, or equal.
- C. Straw mulch shall be utilized on all newly graded areas to protect areas against washouts and erosion. Straw mulch shall be comprised of threshed straw of oats, wheat, barley, or rye that is free from noxious weeds, mold or other objectionable material. The straw mulch shall contain at least 50 percent by weight of material to be 10-in or longer. Straw shall be in an air-dry condition and suitable for placement with blower equipment.
- D. Latex acrylic copolymer or organic tackifier shall be a commercial product specifically manufactured for use as straw mulch tackifier.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Sediment Fence Installation

1. Sediment fences shall be positioned as indicated on the Drawings and as necessary to prevent off site movement of sediment produced by construction activities as directed by the Engineer.
 2. Dig trench approximately 6-in wide and 6-in deep along proposed fence lines.
 3. Drive stakes, 8-ft on center (maximum) at back edge of trenches. Stakes shall be driven 2-ft (minimum) into ground.
 4. Hang filter fabric on posts carrying to bottom of trench with about 4-in of fabric laid across bottom of trench. Stretch fabric fairly taut along fence length and maintain secure both ways.
 5. Backfill trench with excavated material and tamp.
 6. Install pre-fabricated silt fence according to manufacturer's instructions.
- B. Staging areas and access ways shall be surfaced with a minimum depth of 4-in of crushed stone.

3.02 MAINTENANCE AND INSPECTIONS

A. Inspections

1. Make a visual inspection of all erosion and sedimentation control devices once per week and promptly after every rainstorm. If such inspection reveals that additional measures are needed to prevent movement of sediment to offsite areas, promptly install additional devices as needed. Sediment controls in need of maintenance shall be repaired promptly.

B. Device Maintenance

1. Sediment Fences

- a. Remove accumulated sediment once it builds up to 1/2 of the height of the fabric.
- b. Replace damaged fabric, or patch with a 2-ft minimum overlap.
- c. Make other repairs as necessary to ensure that the fence is filtering all runoff directed to the fence.

2. Soil Tracking Prevention Device

- a. Rinse, or replace as needed, crushed stone when it becomes saturated with silt to prevent off-site tracking.

3. Add crushed stone to access ways and staging area as necessary to maintain a firm surface free of ruts and mudholes.

3.03 TEMPORARY MULCHING

- A. Apply temporary mulch to areas where rough grading has been completed but final grading is not anticipated to begin within 30 days of the completion of rough grading.
- B. Straw mulch shall be applied at rate of 100 lbs/1000 sq ft and tackified with latex acrylic copolymer at a rate and diluted in a ratio per manufacturer's instructions.

3.05 REMOVAL AND FINAL CLEANUP

- A. Once the site has been fully stabilized against erosion, remove sediment control devices and all accumulated silt. Dispose of silt and waste materials in proper manner. Regrade all areas disturbed during this process and stabilize against erosion with surfacing materials as indicated on the Drawings.

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SECTION 02311

EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. The work specified in this Section includes requirements for excavation and support of temporary excavations at the proposed Lake Eve Pump Station and pipelines as shown in the Drawings. The Contractor shall design, furnish, install, and maintain a system of supports, including all bracing and associated items, to retain excavations in a safe manner and to control ground movements. Upon completion of the required construction the system of supports shall be completely removed and the excavation and staging area sites restored as discussed herein.
- B. The work shall include site grading; fencing and signing; construction staging areas; design and construction of excavation support systems; disposal of excavated material, surface water, and ground water; backfilling; and site restoration. Work shall include all labor, materials, and equipment required to complete excavation support.
- C. Retain the services of a professional engineer registered in the State of Florida to prepare excavation support and protection system designs and submittals described herein.
- D. Work shall include the design, equipment, materials, installation, protection, and monitoring of geotechnical instrumentation required to monitor the performance of the excavation support system as required herein.
- E. All excavations and support systems shall conform to applicable OSHA excavation, trenching, and shoring standards which are contained in the U.S. Code of Federal Regulations 29 (C.F.R.) 1926.650-1926.653, other federal, state or local requirements. In the event of a conflict, comply with the more restrictive applicable requirements.

1.02 RELATED WORK

- A. Submittals are included in Section 01300.
- B. Testing and Laboratory Services is included in Section 01410.
- C. Site Preparation is included in Section 02100.
- D. Dewatering and Drainage is included in Section 02140.
- E. Earthwork is included in Section 02200.
- F. Trenching, Backfilling and Compacting is included in Section 02221.
- G. Granular Materials is included in Section 02230.

1.03 SUBMITTALS

- A. Submit to the Engineer in accordance with Section 01300, Shop Drawings and design calculations for the Contractor-designed excavation support system stamped by a Professional Engineer registered in the State of Florida. Submittals shall indicate the following, as a minimum:
 - B. Shop Drawings shall include:
 - 1. Provide overall plan layout of the system, indicating clearances, dimensions, material properties, member sizes, locations, spacing and penetrations depth of all members, locations of various types of lateral supports. Indicate existing and proposed utilities, structures or other obstruction, location and type of instrumentation and monitoring points within the area of influence of the excavation.
 - 2. Provide wall elevations and locations of all bracing.
 - 3. Show the overall sequence of installation and removal of bracing, indicating levels to which the work will be carried out before bracing is installed or removed.
 - 4. Method of preloading bracing (if required) and the preload for each member, and the method of locking-off the preload. Include detailed drawings of the connections, jacking supports and method of shimming.
 - 5. Details, layout, arrangement, equipment requirements, and method of construction of the proposed excavation support system.
 - 6. Procedures for resolving difficulties arising from misalignment of members exposed during excavation, and criteria for implementing those procedures.
 - 7. Coordinate Excavation Support and Protection submittals with the excavation and dewatering submittals. The submittal shall show the areas and depths of excavation to be dewatered and the zone of influence from dewatering efforts.
 - C. Design calculations shall include:
 - 1. Loads on the excavation support system for all stages of excavation, bracing removal, and concrete placement, including material and equipment loads on adjacent ground during construction.
 - 2. Design of wall and all bracing members including all details for all stages of construction. Design shall account for water pressures associated with flood conditions.
 - 3. Theoretical deflections of excavation support system and deformation of structures, pipelines, tanks, and other improvements located within the area of influence of the excavation.

4. Provide threshold values for movement of the excavation support system and deformation of structures, pipelines, tanks, and other improvements located within the area of influence of the excavation. Movement beyond the threshold values will require the Contractor to take positive measures to limit further movement.
 5. Submit to the Engineer for review and acceptance, a plan of action to be implemented in the event any threshold value for deformation is reached. The plan of actions shall be positive measures by the Contractor to limit further movement of the wall including but not limited to trenching for struts and wales, placement of granular earth berms against the wall, installation of additional struts, or combinations thereof. The details of the mitigating measures shall include a schedule of implementation, location and/or availability of materials, structural details for all connections to the wall and support elements, and a detailed description of the method of implementation. The Contractor shall be prepared to work 24 hours per day to implement such measures. The remedial work/mitigating measures shall be at no additional cost to the Owner.
- D. Submit quality control measures as required to ensure that the performance of the excavation support system is consistent with the approved shop drawings and the requirements herein.
 - E. Submit welder qualifications and weld procedures in accordance with AWS D1.1.
 - F. Submit Contractor's and Design Engineer's qualifications as described in herein
 - G. At least one copy of the design shall be maintained at the job site during excavation that includes a plan indicating the sizes, types, and configurations of the materials to be used in the protective system, and the identity of the registered engineer who approved the design.
 - H. Do not proceed with any support of excavation or protection activities until the submittal has been reviewed and accepted by the Engineer.
 - I. Design Engineer's documentation shall include:
 1. On-site inspections of excavation support system as the systems are constructed.
 2. Review of quality control measures and performance data.
 3. Certification that the excavation support system is constructed per the applicable design following completion of each support system and following any modifications by Contractor during construction.

1.04 QUALITY ASSURANCE

- A. Regulations: Perform all work in accordance with current applicable regulations and codes of all Federal, State and local agencies.
- B. The Contractor shall have at least 5 years of experience with work compatible to the Work shown and specified, employing labor and supervisory personnel who are similarly experienced in this type of Work.

- C. The Contractor's Design Engineer shall be a Registered Professional Structural and/or Geotechnical Engineer in the State Florida with at least 5 years professional experience in the design and construction of support of excavation systems and shall have completed not less than 5 successful excavation support projects of equal type, size, and complexity to that required for the work.

1.05 DESIGN REQUIREMENTS

- A. The design of temporary excavation support systems is the responsibility of the Contractor. The design calculations and drawings shall be prepared, stamped and signed by a Professional Structural and/or Geotechnical registered in the State of Florida, who is experienced in designing similar excavation support systems.
- B. Design temporary excavation support systems in accordance with requirements of this Section. These criteria are the minimum acceptable standards.
- C. All underground utility lines shall be identified, located, and protected from damage or displacement. Utility companies and other responsible authorities shall be contacted to locate and mark the locations and, if they so desire, direct or assist with protecting the underground installation. When required, the Contractor shall obtain an excavation permit from the local authority having jurisdiction prior to the initiation of any excavation work.
- D. Design excavation support systems in accordance with all OSHA requirements and other local and agency requirements.
- E. Design the support system to minimize horizontal and vertical movements and to protect adjacent structures and utilities from damage.
- F. Excavations below the level of the base of any adjacent foundation or retaining wall shall not be permitted unless the design of the excavation and bracing includes an analysis of the stability of the structure supported by the foundation and as necessary, incorporates required bracing/underpinning of the foundation.
- G. For support systems in which bracing is installed between opposite sides of the excavation, design the excavation support of both sides to be nearly the same as feasible.
- H. Design, install, operate, and maintain ground water control system to control ground water inflows, prevent quick condition, prevent piping or loss of ground, heave or uplift, and maintain stability of the excavation. Refer to the requirements of Section 02140.
- I. Design review and field monitoring activities by the Owner or by the Engineer shall not relieve the Contractor of his/her responsibilities for the work.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Steel sheet piling shall conform to ASTM A572, unless approved otherwise. All steel sheet piling conforming to ASTM A 572 shall be Grade 50 or better.

PART 3 - EXECUTION

3.01 GENERAL

- A. Commence installation of support system and excavations only after shop drawings have been reviewed and accepted by the Engineer.
- B. All instrumentation for monitoring settlement or horizontal movement of adjacent structures, required per the approved excavation support submittal shall be installed and initialized prior to the start of work.
- C. Methods of construction for excavations shall be such as to ensure the safety of the Work, Contractor's employees, Engineer, and Owner's employees and inspectors, the public and adjacent property and improvements, whether public or private.
- D. Before beginning construction at any location of this project, adequately protect existing structures, utilities, trees, shrubs, and other existing facilities. The repair of or compensation for damage to existing facilities shall be at no additional cost to the Owner.
- E. As a minimum, place fencing, gates, lights, and signs as necessary around the excavations and staging areas to provide for public safety.
- F. Install excavation support systems in accordance with the approved shop drawings and applicable permits.
- G. All voids between excavation support system and earth shall be filled with materials acceptable to the Engineer.
- H. Previously placed material with construction debris can be expected at the site. All necessary measures shall be taken immediately to contain it in place and prevent ground displacement.
- I. If settlement or deflections of supports indicate that support system requires modification to prevent excessive movements, redesign and resubmit revised shop drawings and calculations to the Engineer at no additional cost to the Owner.
- J. Sufficient quantity of material shall be maintained on site for protection of work and for use in case of accident or emergency.
- K. All welding shall conform to the applicable provisions of ANSI/AWS D1.1.

3.02 PORTABLE TRENCH BOXES

- A. Portable trench boxes or sliding trench shields may be used for the protection of workers only.
- B. Trench boxes may be used for pipeline installation provided the area to be excavated is dewatered in accordance with Section 02140.
- C. Additional excavation, backfilling, and surface restoration required as the result of trench box use shall be at no additional cost to the Owner.
- D. Trench boxes or shields shall be designed, constructed, and maintained to meet acceptable engineering and industry standards.
- E. Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.
- F. A copy of the trench box manufacturer's specifications, recommendations, and limitations shall be in written form and maintained at the job site during all excavation work.

3.03 STEEL SHEET PILING

- A. Install steel sheet piling with the minimum embedment depths as shown on the approved shop drawings.
- B. Drive sheeting in plumb position with each sheet pile interlocked with adjoining piles for its entire length so as to form a continuous diaphragm throughout the length of each run of wall, bearing tightly against original ground. Exercise care in driving so that interlocking members can be extracted without damaging adjacent structures or utilities. The methods of driving, cutting, and splicing shall conform to the approved shop drawings.
- C. Use templates or other temporary alignment facilities to maintain piling line.
- D. Prior to installation, the sheet piles shall be thoroughly cleaned and inspected for defects and for proper interlock dimensions. The Contractor shall provide a tool for checking the interlock dimensions.
- E. Each sheet pile shall have sufficient clearance in the interlocks to slide, under its own weight, into the interlock of the sheet pile previously placed.
- F. Excavation shall not be carried in advance of steel sheet piling installation.
- G. Obstructions due to previous placed material with construction debris are anticipated. When encountered, pre-excavation or pre-drilling along the sheet pile wall alignment shall be conducted in accordance with Section 02360 Steel Sheet Piling.
- H. Obstructions encountered before the specified embedment for piles shall be removed. Where obstructions cannot be removed, the sheet pile system shall be re-evaluated by the Contractor's Design Engineer for the resulted reduced embedment and additional toe stability measure implemented, as required or for realignment of the sheet pile wall. A submittal of the proposed measures shall be provided.

- I. Damaged piling or piling with faulty alignment shall be withdrawn and new piling driven properly in its place. The cost of such additional work shall be considered as part of the pile driving and shall be borne by the Contractor.

3.04 INTERNAL BRACING

- A. Provide internal bracing to carry maximum design load without distortion or buckling.
- B. Include web stiffeners, plates, or angles as needed to prevent rotation, crippling, or buckling of connections and points of bearing between structural steel members. Allow for eccentricities caused by field fabrication and assembly.
- C. Install and maintain all bracing support members in tight contact with each other and with the surface being supported. Wood shims shall not be used.
- D. Coordinate excavation work with installation of bracing. Excavation shall extend no more than 2 feet below any brace level prior to installation of the bracing.
- E. Use procedures that produce uniform loading of bracing member without eccentricities or overstressing and distortion of members of system.

3.05 REMOVAL OF EXCAVATION SUPPORT

- A. Do not remove internal bracing and transfer loads to the permanent structure without prior acceptance of the Engineer.
- B. Removal shall begin at and progress from the bottom of the excavation. Members shall be released slowly as to note any indication of possible failure of the remaining members or possible cave-in of the sides of the excavation.
- C. Backfilling shall progress together with the removal of support systems from excavations.
- D. As indicated in the drawings, sheet piles shall be remain in-place. Otherwise remove all portions of excavation support.
- E. Do not remove vertical support members that were installed within the zone of influence of new or existing structures. The zone of influence is defined as a zone extending down and away from the outer edge of the structure at 1 horizontal to 1 vertical. Support members installed within this zone shall be cut off at 5 ft below finished grade and abandoned in place.
- F. No untreated wood shall remain as part of the abandoned portion of the work.
- G. When removing the excavation support system, do not disturb or damage adjacent buildings, structures, waterproofing material, or utilities. Fill voids immediately with lean concrete or well-graded cohesionless sand, as indicated in approved shop drawings or as directed by the Engineer.

H. Remove material of the excavation support system from the site immediately.

END OF SECTION

SECTION 02380

SINKING CAISSON ALTERNATE PROCEDURE FOR PUMP STATION CONSTRUCTION

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Install Pump Station structure using sinking caisson construction method.
- B. All design and construction will conform to the contract documents and the following specifications.
 - 1. Earthwork per Section 02200.
 - 2. Concrete formwork per Section 03100.
 - 3. Concrete Reinforcement per Section 03200.
 - 4. Concrete Joints and Joint Accessories per Section 03250.
 - 5. Cast-in-Place Concrete per Section 03300.
 - 6. Grout per in Section 03600.

1.02 RELATED WORK

- A. Electrical work is included in Division 16. CONTRACTOR shall coordinate location and attachment of all equipment, conduit, etc. to the caisson structure. CONTRACTOR shall coordinate size and location of all required conduit penetrations of the caisson structure.

1.03 SUBMITTALS

- A. Make submittals in accordance with Section 01300 - Submittals.
- B. Submit sinking caisson drawings and procedures prepared by CONTRACTOR's Engineer showing:
 - 1. Include any special design required by CONTRACTOR's selected method of installation such as water jet, bentonite and grout pipes, and injection ports, and dimensions of annular space for bentonite lubrication.
 - 2. Procedure to show that the water height inside caisson will be kept within 12" of the ground water monitoring piezometers until the plug slab has completely cured. This level should be checked at a minimum of every 24 hours or every 4 feet of sinking the caisson, whichever is smaller.

3. Soil grouting plans and procedures, signed and sealed by a FL Professional Engineer. See Section 3.10.
- C. Submit safety plan to meet OSHA requirements. Submit these procedures for record purpose only and not for approval by the ENGINEER. Address in the plan, as a minimum but not limited to the following:
1. Protection against caisson instability, soil instability, and ground water inflow.
 2. Safety for caisson access and exit, including ladders and hoists.
 3. Protection against equipment operations, and for lifting and hoisting equipment and materials.
 4. Protection of workers and the public, including barriers, accidental or unauthorized entry, and falling objects.
 5. Safety supervising responsibilities.
- D. Submit concrete mix designs and placement procedure for seal slab tremie concrete plug slab to be used in wet construction in accordance with specification Section 03300. Tremie plug slab mix design shall include an anti-washout admixture in accordance with specification Section 03300.
- E. Submit progress report and other monitoring observations to the ENGINEER each week.

1.04 DEFINITION

- A. Caisson is defined as the external walls of a concrete structure, together with any excavation cell partition walls, erected at-grade or in a starter pit, and sunk by gravity to the final position through excavation inside the structure under dry or wet conditions. The complete caisson includes the structural base slab and interior slabs below top of caisson as shown on drawings. The caisson walls provide ground support during construction and for the permanent installation.
- B. Dry construction means that the CONTRACTOR operates sufficient external ground water control system to maintain the ground water level and the piezometric head safely below the excavation bottom within the caisson.
- C. Wet construction means that the external hydrostatic ground water pressure is counteracted by water or a slurry within the caisson.

1.05 REFERENCE STANDARDS

- A. ACI 318 - Building Code Requirements for Reinforced Concrete and Commentary.
- B. ACI 350R - Environmental Engineering Concrete Structures.

- C. Additional geotechnical information which may be applicable to the caisson design is provided in the geotechnical report made available to the CONTRACTOR. In the event of conflict between the geotechnical report and these specifications, the most conservative shall govern.

1.06 QUALITY ASSURANCE

- A. Caisson CONTRACTOR shall be capable of demonstrating successful completion for design and construction of a minimum of three similar projects within the seven previous years.

PART 2 PRODUCTS

2.01 CONCRETE

- A. Provide concrete in accordance with Section 03300 - Cast-in-Place concrete. Concrete for seal slabs placed by tremie method shall be in accordance with CONTRACTOR's mix design as approved by the ENGINEER.

2.02 REINFORCEMENT

- A. Provide reinforcement in accordance with Section 03200 - Concrete Reinforcement.

2.03 EMBEDDED ITEMS

- A. Provide embedded items in accordance with Section 05500 Miscellaneous Metals and Division 15.
- B. Materials and schedule for embedded jet, bentonite or grout piping required for caisson construction shall be defined in the construction drawings prepared by the CONTRACTOR's Engineer.

2.04 BACKFILL

- A. Backfill starter pit, or other excavations requiring grade restorations adjacent to the caisson with select fill.
- B. Provide select fill in accordance with Section 02200 - Earthwork.

PART 3 EXECUTION

3.01 SITE PREPARATION

- A. Perform site preparation for site clearing and to grade the site to required elevation. Provide for site drainage.
- B. Relocate and protect utilities to be maintained that may be affected by the caisson construction area, including starter pit.

- C. Install security fencing around caisson construction areas to prevent accidental or unauthorized entry.
- D. Provide for control of ground water and surface water according to Section 02140 – Dewatering and Drainage.
 - 1. For wet construction, maintain the fluid level within the caisson above the piezometric level within the soils surrounding the caisson, and above the piezometric level in the soils below the excavation bottom.
- E. Remove hard surface or subsurface materials or other obstructions that may prevent caisson sinking before caisson construction starts.
- F. Compact disturbed soils in accordance with geotechnical engineer recommendations.
- G. Provide soil grouting in accordance with Section 3.10.

3.02 CAISSON WALL CONSTRUCTION

- A. Place concrete as specified in Section 03300 - Cast-in-Place Concrete.
- B. Install 9-inch PVC waterstops centered in construction joints as specified in Section 03250 - Concrete Joints and Joint Accessories.
- C. Allow concrete of the first lift to achieve sufficient strength for a minimum curing period of 21 days before launching the caisson, to prevent structural damage unless a high early strength mix design is used.
- D. Inspect the concrete surfaces after form removal and repair defects before the wall section is sunk into the ground.

3.03 CAISSON EXCAVATION

- A. Excavation is unclassified and includes, without exception, removal of materials encountered. Properly dispose excavated soils or other materials, including soils mixed with bentonite or other slurries.
- B. Sink the caisson to a depth at least equal to the design depth shown on the Drawings.
- C. Remove soft or otherwise disturbed soil from the excavation bottom before placement of the seal slab. For wet conditions, determine the conditions of the excavation bottom by probing, witnessed by the ENGINEER.

3.04 BASE SLAB CONSTRUCTION

- A. Place a concrete tremie slab in the caisson bottom within 4 hours after verification that stable, undisturbed bottom conditions have been achieved. Place the seal slab by tremie method for wet construction.

- B. Place the structural base slab in the dry.
- C. As soon as practical after placement of the seal slab and clean-up, place the base slab reinforcement and place reinforcement steel and dowel connections between the base slab and caisson wall. Place expansive waterstop continuously around the joint between the base slab and the wall as specified in Section 03250 - Concrete Joints and Joint Accessories. Locate the waterstop as shown on the construction drawings. Immediately pour the concrete for the base slab.
- D. Maintain dewatering and other measures to prevent bottom heave until the structural base slab has been cast and reached the design strength determined by the CONTRACTOR's Engineer for the caisson design, but not less than 7 days after the structural base slab has been cast.

3.05 CAISSON CLEAN UP AND INSPECTION

- A. Clean the interior of the caisson after the seal slab has been poured. Remove soil, mud, slurries, spilled grout or concrete, or other materials not part of the structure from the caisson and clean the surfaces.
- B. Inspect the caisson for possible structural damage or damage to any embedded items occurring during excavation and caisson sinking. Notify and allow the ENGINEER to witness caisson inspection. Repair and replace any damage before proceeding with construction.

3.06 CAISSON CONSTRUCTION TOLERANCES

- A. Maximum acceptable deviation of the caisson from the vertical at all levels and locations is 1 inch in 10 feet. The maximum total tilt of the caisson from the horizontal, as measured at or near the top of each concrete placement lift in two perpendicular directions, shall not exceed 2", at any time during caisson sinking.
- B. Maximum acceptable horizontal deviation from the design location of the center of the caisson at the ground surface level is 2 inches.
- C. The installed elevation of the base of the caisson structure shall be equal to or lower than the elevation shown in the Drawings. The top of the caisson structure shall be at the elevation shown on the Drawings.
- D. Provide block-outs with allowance for pipe entry deviations of not less than plus or minus 1.5 inches vertically and plus or minus 6 inches horizontally, plus caisson construction tolerance.
- E. The tolerances defined above are only acceptable provided that the CONTRACTOR can adjust pipe connections, structural, mechanical and electrical components to resolve any deviation from plumbness, horizontal or vertical location as approved by the ENGINEER. Adjustments must be made without adversely affecting operation or maintenance of the pump station. Functionality must be met as designed and shown, without modification. Required changes to systems due to out of tolerance conditions are subject to removal of the entire structure, redesign of the affected systems, or monetary compensation, as approved by the ENGINEER.

- F. Monitor the caisson installation to verify that no settlement or heave is observed for 10 consecutive days starting not later than the 50 days after structural completion.

3.07 BACKFILL

- A. Remove any starter pit shoring if applicable to a depth of at least 4 feet below the ground surface.
- B. Compact backfill material in accordance with Section 02200 - Earthwork.

3.08 MONITORING

- A. Groundwater. Monitor the ground water conditions and piezometric levels around the caisson and in the strata below the excavation bottom by daily observations while ground water control installations are in operation.
- B. Caisson
 - 1. During caisson sinking operations until the caisson is secured by grout and the base slab hardened, determine and record the plumbness of the caisson at least once checked at a minimum of every 24 hours or every 4 feet of sinking the caisson, whichever is smaller. at two locations, 90 degrees apart.
 - 2. During caisson sinking operations place or mark horizontal control lines at or near the top of each lift on two perpendicular sides. Determine and record deviations from the horizontal at least once each shift. The tilt measured on different lifts shall be added to determine the total tilt of the caisson.
 - 3. As soon as the caisson has been secured, install 4 benchmarks, 90 degrees apart, on the top concrete placement for settlement monitoring of the installed caisson. The benchmarks shall be transferred to higher elevation on the structure as required due to continued lift station construction. Continue weekly monitoring of settlement points until 60 days after completed construction of the structure.
 - 4. Install and monitor borehole heave points in the caisson for dry construction as defined on the Drawings. Survey heave points before excavation starts and upon retrieval when the final excavation bottom has been reached.

3.09 CAISSON SURVEY

- A. When the caisson has been secured, the seal slab poured, and, in the case of wet construction, when the fluid has been pumped out, survey the installed caisson for compliance with the tolerances defined in Paragraph 3.06, Caisson Construction Tolerances. The survey shall include:
 - 1. Location of center of caisson at ground level.
 - 2. Elevation of top and bottom of caisson and structural slab connection.

3. Elevation and locations of penetrations and embedded items and any other support points for lift station installation completion.
4. Deviation from plumb from the caisson top to structural slab at two locations 90 degrees apart.

3.10 SOIL GROUTING

- A. A soil grouting procedure shall be submitted to ensure that the soil around the perimeter of the pump station is adequately densified after the sinking caisson has been installed.
 1. Area of soil to be treated is for a distance of 5 ft beyond the outside walls of the pump station, from the finished exterior grade to the bottom of the plug slab elevation, which will be at a depth of about 27 feet.
 2. Investigation, Planning, Grouting and Validation phases shall be under the direction of a FL Professional Engineer, who specializes in ground remediation procedures.
- B. Investigative Phase:
 1. Four standard soil penetration test (SPT) borings shall be performed after the structure top slab has been cast. The test borings (ASTM D1586) will be drilled in the area that is to be grouted around the perimeter, at a distance of about 3 feet from the exterior walls. The borings will be drilled to a depth of 30 feet below the finished exterior grade. The proposed boring locations will be submitted by the CONTRACTOR to the ENGINEER for approval.
 2. The results of the soil test borings will be signed and sealed by the FL Professional Engineer and submitted to the ENGINEER for review prior to mobilizing to the site for soil grouting.
- C. Planning Phase:
 1. Based on a review of the investigation phase soil test boring results, the proposed pattern of grout injection holes will be verified. The grout injection holes will be drilled to the bottom elevation of the plug slab. It is anticipated that one line of grout holes that are spaced at approximately 5 feet, will be required.
 2. The CONTRACTOR shall provide a grout mix design that will achieve the desired soil densification to the ENGINEER for approval. It is assumed that a cement based grout mix will provide the desired level of consolidation of soils that are disturbed by the sinking caisson construction process.
 3. The CONTRACTOR will provide a grout injection procedure that will adequately densify the soils in the specified zone to the ENGINEER for approval.

D. Grouting Phase:

1. Grouting at the selected injection points will begin at the bottom of the plug slab (approximately 27 feet below finished grade) and continue to a depth of approximately 3 feet below the finished exterior grade.

E. Validation Phase:

1. Four soil test borings (ASTM D1586) will be drilled to a depth of 30 feet after grouting is completed to verify that loose soil zones have been adequately compacted. These borings locations will be selected by the CONTRACTOR and approved by the ENGINEER.
2. The validation phase test results shall be signed and sealed by the FL Professional Engineer and submitted to the ENGINEER for approval. Verification that loose soil zones have been adequately densified will require that SPT blow counts of at least 8 blows per foot be achieved in the treated areas.

3.11 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 03300 - Cast-in-Place Concrete and Section 01410 - Testing and Testing Laboratory Services.

3.12 DISPOSAL OF EXCESS MATERIAL

- A. Remove excavated material from the job site and dispose of material in accordance with governing agencies.

END OF SECTION

SECTION 02500

ASPHALTIC CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work:

1. The work specified in this section consists of the construction of asphaltic concrete surface course composed of a mixture of aggregates, mineral filler and asphalt cement properly laid upon a prepared base, or a newly constructed binder course, in accordance with these Specifications and in conformity with the lines, grades, thickness and typical cross-section shown on the Drawings. The Contractor shall furnish Type S-III asphaltic concrete where indicated on the Drawing. Asphaltic concrete pavement for around drain inlets and catch basins shall conform to the following provisions, except placing material may be by hand methods.

B. Related Work Described Elsewhere:

1. Earthwork: Section 02200.
2. Soil Cement Base: Section 02234.

C. Applicable Codes, Standard and Specifications: The road construction under this contract shall be in strict accordance with the applicable provisions of the following:

1. The Florida Department of Transportation (FDOT) "Standard Specifications for Road and Bridge Construction" (Latest Edition).
2. American Association of State Highway and Transportation Officials (AASHTO).
3. American Society for Testing and Materials (ASTM).
4. County and City Codes and Standards.

1.02 QUALITY ASSURANCE

- ###### A. Laboratory analysis by a Certified Testing Laboratory on all materials shall be complete and the materials accepted by the Owner's Representative prior to placement.

PART 2 - PRODUCTS

2.01 MATERIALS

- ###### A. Prime Coat: Unless otherwise indicated, the material used for the prime coat shall be cutback asphalt, Grade RC-70 or RC-250 and shall conform with the requirements specified in AASHTO Designation M 81-75 (1982). Unless otherwise indicated, the use of either RC-70 or RC-250 shall be at the Contractor's option.

- B. Tack Coat: The material used for the tack coat shall be emulsified asphalt, Grade RS-2 and shall conform with the requirements specified in AASHTO Designation M 140-82.
- C. Type S-III Asphaltic Concrete: Materials used in the type S-III asphaltic concrete pavement mix shall conform to the applicable FDOT requirements. No construction of this type shall be started until the Contractor has submitted and the Owner's Representative has approved, a job mix formula prepared by the approved testing agency. In general, the mix proportions shall be in the following range by weight:

<u>Material</u>	<u>Percent of Total</u>
Total Mineral Aggregate	91-95.5
Asphaltic Cement (Bitumen)	4.5-9
Total Mix	100

1. The bituminous material shall be asphalt cement, viscosity grade AC-20. The aggregate shall be clean and shall contain no deleterious substances. Coarse or fine aggregate containing any appreciable amount of phosphate shall not be used.
2. For the purpose of proportioning the paving mixture, all material passing the No. 10 sieve and retained on the No. 200 sieve shall be considered as fine aggregate and the material passing the No. 200 sieve shall be considered as mineral filler.
3. Any screenings used in the combination of aggregates shall contain not more than 15 percent of material passing the No. 200 sieve. When 2 screenings are blended to produce the screening component of the aggregate, the combined total of material passing the No. 200 sieve must not exceed 15 percent. Screenings may be washed to meet these requirements.
4. Mineral filler, if needed, shall consist, in general, of limerock dust, portland cement, slag dust, hydrated lime, or any other inert mineral matter from sources approved by the Owner's Representative. The mineral filler shall be thoroughly dry and free from lumps consisting of aggregations of fine particles. Ground phosphate will not be allowed as a mineral filler.
5. The laboratory compacted mixture shall have a density of not less than 95 nor more than 98 percent of the calculated theoretical density of a voidless mixture composed of the same materials in like proportions.
6. Samples of the mixture in use shall be taken as many times daily as is necessary and the mixture shall be maintained uniform throughout the project.

2.02 EQUIPMENT FOR PRIME AND TACK COATING

- A. The pressure distributor for placing the tack or prime coat shall be equipped with pneumatic tires having sufficient width of rubber in contact with the road surface to avoid breaking the bond of or forming a rut in the surface.
- B. The distance between the centers of openings of the outside nozzles of the spray bar shall be equal to the width of the application required, within an allowable variation of 2 inches.

- C. The outside nozzle at each end of the spray bar shall have an area of opening of not less than 25 percent, nor more than 75 percent in excess of the other nozzles which shall have uniform openings.
- D. When the application covers less than the full width, the normal opening of the end nozzle at the junction line may remain the same as those of the interior nozzle.

PART 3 - EXECUTION

3.01 PREPARATION AND PRIMING

- A. **Cleaning the Base:** Before any bituminous material is applied, remove to the shoulders all loose material, dust, caked clay, and foreign material which might prevent proper bond with existing surface. Take particular care to clean the outer edges of the strip to be treated to insure that tack coat will adhere. Where the prime or tack coat is applied adjacent to curb and gutter or valley gutter, such concrete surfaces are to be protected and kept free of bituminous material.

3.02 WEATHER LIMITATIONS

- A. **Prime and Tack Coats:** No bituminous material shall be applied when the air temperature is less than 50°F in the shade, or when the weather conditions or the condition of the existing surface is unsuitable. In no case shall bituminous material be applied while rain is falling or when there is water on the surface to be covered.
- B. **Asphaltic Concrete Type S-III:**
 - 1. The mixture shall be spread only when the surface upon which it is to be laid has been previously prepared, is intact, firm and properly cured, and is dry. Unless otherwise approved by the Owner's Representative, no mixture shall be spread that cannot be finished and compacted during daylight hours.
 - 2. The mixture shall not be spread when the wind is blowing to such an extent that proper and adequate compaction cannot be maintained or when sand, dust, etc. are being deposited on the surface being paved, to the extent that the bond between layers will be diminished.

3.03 APPLICATION OF TACK COAT

- A. In general, a tack coat will not be used on primed bases except in areas which have become excessively dirty and cannot be cleaned or where the prime has cured and lost all of its bonding effect.
- B. No tack coat shall be applied until the primed base or leveling course has been cleaned and is free from sand, dust or other objectionable material.
- C. The tack coat shall be applied with a pressure distributor as specified above. It shall be heated to a suitable consistency and applied in a thin uniform layer at the rate of between 0.02 gallons and 0.08 gallons per square yard.
- D. The tack coat shall be applied sufficiently in advance of the laying of the wearing surface to permit drying, but shall not be applied so far in advance or over such an area as to lose its adhesiveness as a result of being covered with dust or other foreign material. Suitable

precautions shall be taken by the Contractor to protect the surface while the tack coat is drying and until the wearing surface is applied.

3.04 GENERAL CONSTRUCTION REQUIREMENTS - HOT BITUMINOUS MIXTURES

- A. This section specifies the general construction requirements for the plant-mixed hot bituminous pavements and bases.
1. The mixture shall be transported in tight vehicles previously cleaned of all foreign material and, if necessary, each load shall be covered. The cover shall be used during cool and cloudy weather and at any time where there is probability of rain. The inside surface of the truck bodies shall be thinly coated with soapy water or an approved emulsion containing not over 5 percent oil, but no excess of either shall be used. Kerosene, gasoline or similar products shall not be used. After the truck bodies are coated and before any mixture is placed therein, they shall be raised so that all excess liquids will be drained out.
 2. A tack coat will be required on the following surfaces:
 - a. Between successive surface courses;
 - b. Between successive leveling courses;
 - c. Between leveling and surface courses Tack coat shall also be applied where specified above.
 3. All hot bituminous plant mixed material other than adjacent to curb and gutter or other true edges, shall be laid by the stringline method, to assure the obtaining of an accurate, uniform alignment of the pavement edge. The temperature of the mixture at the time of spreading shall be within 25°F of the temperature set by the Owner's Representative.
 - a. Any mixture caught in transit by a sudden rain may be laid only at the Contractor's risk. Should such mixture prove unsatisfactory, it shall be removed and replaced with satisfactory mixture. In no case shall the mixture be laid while rain is falling or when there is water on the surface to be covered.
 - b. In limited areas where the use of the spreader is impossible or impracticable, the mixture may be spread and finished by hand. Straight-edging and back-patching shall be done after initial compaction has been obtained and while the material is still hot.
 4. Surface course materials upon arrival shall be dumped into the approved mechanical spreader and immediately spread and struck-off to the full width required and to such loose depth for each course that, when the work is completed, the required weight of mixture per square yard, or specified thickness, will be secured.
 - a. An excess amount of mixture shall be carried ahead of the screen at all times. Hand raking shall be done behind the machine as required.
 - b. Where a surface course is constructed to a thickness greater than 2 inches, it shall be constructed in approximately equal layers and no layer shall be more than 2 inches in thickness when compacted.

- c. Before any rolling is started, the surface shall be checked, any irregularities adjusted and all drippings, fat sandy accumulations from the screen and fat spots from any source shall be removed and replaced with satisfactory material. No skin patching shall be done. When a depression is to be corrected while the mixture is hot, the surface shall be well scarified before the addition of fresh mixture.
5. For each paving train in operation, the Contractor shall furnish a separate set of rollers and operators. The rolling shall be done in the following sequence, with the equipment as shown, unless otherwise permitted by the Owner's Representative.
 - a. Seal rolling, using tandem steel rollers weighing 8 to 12 tons, and following as close behind the spreaders as possible without pick-up, undue displacement or blistering of the material.
 - b. Rolling with self-propelled, pneumatic-tired rollers, following as close behind the seal rolling as the mix will permit. The roller shall cover every portion of the surface with at last 5 passes.
 - c. Final rolling with the 8 to 12 ton tandem steel roller, to be done after the seal rolling and pneumatic-tired rolling have been completed, but before the pavement temperature has dropped below 140°F.

Areas which are inaccessible to a roller shall be compacted by the use of hand tamps or other satisfactory means.
6. The roller shall not be allowed to deposit gasoline, oil, or grease onto the pavement and any areas damaged by such deposits shall be removed and replaced as directed by the Owner's Representative. While the rolling is in progress, the surface shall be tested continuously and all discrepancies corrected to comply with the surface requirements.
 - a. All drippings, fat or lean areas and defective construction of any description shall be removed and replaced. Depressions which develop before the completion of the rolling shall be remedied by loosening the mixture and adding new mixture to bring the depressions to a true surface. Should any depression remain after the final compaction has been replaced with sufficient new mixture to form a true and even surface. All high spots, high joints and honeycomb shall be corrected as directed by the Owner's Representative.
 - b. Any mixture remaining unbonded after rolling shall be removed and replaced. Any mixture which becomes loose or broken, mixed or coated with dirt or in any way defective, prior to laying the wearing course shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with the surrounding area.
 - c. Areas of defective surface may be repaired by the use of indirect heat. No method of repair involving open-flame heaters shall be used.
7. After final compaction, the density required for Type S-III asphaltic concrete shall be at least 95 percent of the laboratory compacted density of the, paving mixture. Density tests shall be taken at intervals not to exceed 300 feet.

8. When the traffic roller begins to rut the sand-asphalt base course, the Contractor may reduce the weight by removing ballast or substitute a lighter traffic roller that will not distort the surface.
9. The final surface course will be required to be checked by the use of a rolling or manual straightedge. As soon as the rolling has been completed and the surface has hardened sufficiently to be walked on the entire surface shall be checked. The finished surface shall not vary more than 1/4 inch from the templet cut to the cross-section of the road nor more than 3/16 inch from the straightedge applied parallel to the center line of pavement. Any surface irregularities exceeding these limits shall be corrected. Unless shown otherwise on the drawings, the pavement shall crown at the centerline of the roadway and the cross section shall have a slope of 1/4 in/ft.
10. The finished surface shall be of uniform texture and compaction. The surface shall have no pulled, torn or loosened portions and shall be free of sand streaks, sand spots or ripples. (These requirements shall also apply to any areas where it is necessary to apply hand work.)
11. The thickness of the pavement shall be determined from the length of cores at least two inches in diameter, taken at random points on the cross-section and along the roadway. Each core shall represent a section not longer than 250 feet. The average thickness shall be determined from the measured thickness. The maximum deviation allowed between the average measured thickness and the design thickness shall be 1/4 inch. The minimum thickness allowed at random locations shall be 1/4" less than the required average thickness.
12. Extraction stability and gradation of combined aggregate - 1 test per 500 tons or part with a minimum of one per day. Bitumen content, stability and gradation of aggregates to conform to intent of job mix formula.
13. Any areas which the surface does not meet above requirements for texture, sand streaks, ripples, pulled or loosened portions, or for uniformity of compaction; or does not meet the straightedging requirements, shall be corrected.
 - a. Such corrections may be made either by replacing the surface course (to full depth) or by overlaying with, the type of asphaltic concrete mixture being placed. An overlay will not be allowed adjacent to a concrete curb section.
 - b. Within the longitudinal limits where such defective areas occur, such corrections shall be made for the full width of the roadway and for longitudinal distances in both directions beyond such defective areas in accordance with the following:
 - 1) If the correction is made by replacing of the full thickness, it shall extend to at least 50 feet each side of the defective area.
 - 2) If the Contractor elects to effect the correction by overlaying, the overlay shall consist of at least 100 pounds of mixture per square yard, at the defective section and shall taper uniformly down from the full thickness of such weight, to zero thickness at the end of a minimum length of 50 feet each side of the defective area.
 - 3) The transverse thickness at any section shall be such as to provide the design cross section.

- 4) Sections of newly compacted asphalt concrete which are to be covered by additional courses shall be kept clean until the successive course is laid.
14. Upon completion of the finished pavement, no dumping of any material directly on the pavement will be permitted. When shoulders are constructed after completion of the final surface, blade graders operating adjacent to the pavement during shoulder construction shall have a two inch by eight inch (or larger) board (or other attachment providing essentially the same results) attached to their blades in such manner that it extends below the blade edge, in order to protect the pavement surface from damage by the grader blade. Vehicular traffic shall not be permitted on any pavement which has not set sufficiently to prevent rutting or other distortion.

END OF SECTION

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SECTION 02520
CONCRETE PAVING

PART 1 - GENERAL

1.01 DESCRIPTION

- A. Scope of Work: The work included in this Section consists of furnishing all labor, material equipment and transportation for the construction of the concrete pavement to the lines and grades as shown on the Drawings.
- B. Related Work Described Elsewhere:
 - 1. Site Preparation: Section 02100.
 - 2. Stabilized Subgrade: Section 02240.

1.02 SUBMITTALS

- A. All materials specified shall be certified by the producer or manufacturer that the furnished material meets the specific requirements of the specifications.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Concrete: Concrete shall be Class B that conforms to the requirements of Section 03300.
- B. Reinforcing and Welded Wire Fabric: Joint reinforcing and welded wire fabric shall be as shown on the Drawings.
- C. Joint Sealer for Pavement:
 - 1. Hot Poured Type: Joint sealer shall conform to the requirements of AASHTO Designation M 173.
 - 2. Cold Applied Type: In lieu of the hot poured type, joint sealer shall be a one or two part polysulfide base self leveling sealant for horizontal surfaces that has been developed for foot and vehicular traffic. The sealant shall be listed on the Thiokol approved product list.
- D. Preformed Joint Filler: Preformed joint filler shall be nonextruding and resilient bituminous type and shall conform to the requirements of ASTM Designation D 1751.
- E. Membrane Curing Compound: Membrane curing compound shall be clear fugitive dye and conform to the requirements of AASHTO Designation M 148, Type 1-D.

PART 3 - EXECUTION

3.01 PREPARATION

A. Subgrade Condition:

1. The finished subgrade shall be maintained in a smooth, compact condition and any areas which are disturbed prior to placing of the concrete shall be restored at the Contractor's expense. The subgrade shall be moist at the time the concrete is placed. Water shall be uniformly applied ahead of the paving operations as directed by the Owner's Representative. If the Contractor does not maintain the subgrade in the required condition, a vapor barrier sheet will be required between the subgrade and the concrete.
2. The subgrade shall be accurately trimmed to the required elevation with a 1/4-inch tolerance. High areas shall be trimmed to proper elevation. Low areas may be filled with suitable material and compacted to the specified density or filled with concrete integrally with the placing of the pavement.

B. Setting Forms: The forms shall be accurately set to line and grade such that they rest firmly, throughout their entire length upon the compacted subgrade surface. Forms shall be joined neatly and tightly and braced to resist the pressure of the concrete and the finished operations. The alignment and grade of all forms shall be approved before and immediately prior to the placing of concrete.

C. Mixing Concrete: Concrete shall be mixed in accordance with the requirements of Section 03300.

3.02 EXECUTION

A. Placing Concrete:

1. The concrete shall be distributed on the subgrade to such depth that, when it is consolidated and finished, the slab thickness required by the Drawings will be obtained at all points and the surface will at no point be below the grade specified for the finished surface, after application of the allowable tolerance. The concrete shall be deposited on the subgrade in a manner which will require as little rehandling as possible. Placing of the concrete shall be continuous between transverse joints, without the use of intermediate bulkheads.
2. Concrete shall be deposited a near to expansion and contraction joint assemblies as possible without disturbing them, but shall not be dumped from the discharge bucket or hopper onto an assembly unless the bucket or hopper is centered directly over the assembly.
3. Fabric reinforcement shall be placed at midslab depth and the fabric shall be maintained at this location during the placing and finishing operations.

4. Concrete shall be thoroughly consolidated against and along the faces of all forms, and along the full length and on both sides of all joint assemblies, by means of hand-operated, vibrators. Vibrators shall not be permitted to come in contact with a joint assembly, the subgrade or a side form. Vibration at any one location shall not continue so long as to produce puddling or the accumulation of excessive grout on the surface. In no case shall the vibrator be operated longer than 15 seconds in any one location.
- B. Striking-off, Consolidating and Finishing Concrete: Immediately after the placing, the concrete shall be struck off, consolidated and finished, to produce a finished pavement conforming to the cross section, width and surface finished required by the Drawings and Specifications. The sequence of operations shall be as follows: strike-off; vibratory consolidation; screeding; floating; removal of laitance; straightedging; and final surface finish. Strike-off, consolidation and finishing shall be accomplished in a manner such as to avoid damage to, or misalignment of, joint assemblies, dowels, and other embedded items.
- C. Straightedging and Surface Corrections:
1. After floating has been completed and the excess water removed, but while the concrete is still in a plastic state, the surface of the concrete shall be tested for trueness with an accurate 12-foot straightedge. The straightedge shall be furnished by the Contractor. The straightedge shall be held in successive positions parallel to the road or driveway center line, in contact with the surface, and the whole area tested from one side of the slab to the other as necessary. The advance along the road shall be in successive stages of not more than one-half the length of the straightedge. Any depressions shall be immediately filled with freshly mixed concrete and struck-off, consolidated and refinished. High areas shall be cut down and refinished. Straightedge testing and surface correction shall continue until the entire surface appears to conform to the required grade and cross section.
 2. As soon as the concrete has hardened sufficiently to be walked on, straightedging shall again be done. All surface irregularities exceeding 1/4 inch in 10-foot shall be corrected by grinding as directed by the Owner's Representative.
- D. Final Finish: As soon as the water sheen has disappeared from the surface of the pavement and just before the concrete becomes non-plastic, a light broom finish shall be given to the surface.
- E. Edging:
1. After the final finish has been applied, but before the concrete has become non-plastic, the edges of the pavement along each side of the strip being placed, on each side of transverse expansion joints and construction joints and along any structure extending into the pavement, shall be carefully rounded to a 1/4 inch radius except as otherwise indicated. A well-defined and continuous radius shall be produced and a smooth, dense mortar finish obtained. All concrete shall be completely removed from the top of the joint filler.
 2. All joints shall be checked with a straightedge before the concrete has become non-plastic and, if one side of the joint is higher than the other or the entire joint is higher or lower than the adjacent slabs, corrections shall be made as necessary.

F. Joints:

1. **Transverse Construction Joints:** Transverse construction joints shall be constructed at the end of all pours and at other locations where the paving operations are stopped for as long as 30 minutes. Construction joints, however, shall not be placed within ten feet of any other transverse joint or of either end of a section of pavement. If sufficient concrete has not been placed to form a slab at least ten feet long, the excess concrete, back to the last preceding joint, shall be removed. The joints shall be formed by placing a wood or metal bulkhead accurately and securely in place, in a plane perpendicular to the profile and center line of the pavement. Dowel bars shall be installed at the construction joints, in accordance with the details shown or the Drawings for contraction joints. Construction joints shall be sawed, in a manner similar to contraction joints, so that a groove will be formed for holding the joint sealing compound.
2. **Transverse Contraction Joints:** Transverse contraction joints shall be constructed at the interval indicated on the plans and shall consist of planes of weakness created by sawing a groove in the surface of the hardened concrete. The groove shall be perpendicular to the surface of the pavement. Load-transfer devices shall be installed in transverse contraction joints as indicated on the Drawings.
 - a. It shall be the Contractor's responsibility to see that the sawing equipment does not damage the pavement and to saw the transverse contraction joints as soon as the pavement has hardened to the degree that tearing and raveling are not excessive and before uncontrolled shrinkage cracking begins. If, at any time, uncontrolled cracking occurs, the Contractor will be required to modify his methods, and remove damaged slabs.
 - b. The joint sawing shall be accomplished in two steps. The initial cut shall be 1/8-inch wide by a depth of not less than 20 percent nor more than 25 percent of the pavement thickness, and in general will be made when the concrete is between four and twelve hours old. A second saw cut, to provide the joint dimensions indicated on the Drawings shall be made as soon as there is no danger of raveling.
 - c. After the final sawing, the joint shall be cleaned, the bond breaker shall be installed and the joint sealed.
3. **Longitudinal Joints:** The plane of weakness shall be constructed either by sawing a groove in the hardened concrete or by forming a groove by depressing a tool or by insertion of an approved plastic device into the plastic concrete. Sawing shall be done within 15 calendar days after the placing of the concrete, and prior to opening of the pavement to any type of traffic.
 - a. Deformed steel tie bars shall be placed at the required depth, parallel to the finished surface, at right angles to the joint and at the uniform spacing. The bars shall not be painted or coated with any material before placement in the concrete. They shall be placed in the plastic concrete by use of approved equipment, or shall be rigidly supported on the subgrade by approved devices capable of preventing displacement prior to placing of the concrete.

4. Expansion Joints Around Structures: Expansion joints shall be formed by placing premolded expansion joint material about all structures and features projecting through, into or against the pavement. Unless otherwise indicated, such joints shall be 1/2 inch in width.
5. Transverse Expansion Joints: Transverse expansion joints shall be formed using preformed joint filler and shall be provided with dowel load transfer bars in accordance with the details shown on the Drawings. Joint sealer shall be provided as shown in the Drawings.
6. Cleaning and Sealing Joints: Joints which are to be sealed, shall be filled with joint sealing material before the pavement is opened to traffic and as soon after completion of the curing period as is feasible. Just prior to sealing, each joint shall be thoroughly cleaned of all foreign material (including any membrane curing compound) and the joint faces shall be clean and surface-dry when the sealer is applied.
 - a. The sealing material shall be applied to each joint to conform to the details shown on the Drawings and in accordance with the manufacturer's recommendation. The pouring shall be done in such manner that the material will not be spilled on the exposed surfaces of the concrete. Any excess material on the surface of the concrete pavement shall be removed immediately and the pavement surface cleaned.
 - b. All cracks occurring in the pavement prior to its acceptance shall be cleaned out and sealed as specified above, except that the cracks and fractures shall be completely filled with joint sealer and any excess filler material cut down level with the pavement surface.

G. Curing:

1. After the finishing operations have been completed and as soon as the concrete has hardened sufficiently that marring of the surface will not occur, the entire surface and the edges of the newly placed concrete shall be covered and cured with membrane curing compound.
2. Curing compound shall be uniformly applied to the surfaces to be cured, in a single coat, continuous film, at the rate of one gallon to not more than 200 square feet, by a mechanical sprayer.
3. Curing compound shall not be applied during periods of rainfall. Curing compound shall not be applied to the inside faces of joints to be sealed. Should the film become damaged from any cause within the required curing period, the damaged portions shall be repaired immediately with additional compound. Upon removal of side forms the sides of the slabs exposed shall immediately be coated to provide a curing treatment equal to that provided for the surface.

END OF SECTION

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SECTION 02525

CONCRETE CURBS AND GUTTERS

PART 1 - GENERAL

1.01 DESCRIPTION

- A. This section includes materials, testing and construction of curbs, valley gutters, and curb and gutter.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete - Division 3

1.03 STANDARDS

- A. Determine the density of soil in place by the sand cone method, ASTM D1556; by nuclear methods, ASTM D2922 or D3017; by the rubber balloon method, ASTM D2167; or by the dry sleeve method, ASTM D2937.
- B. Determine laboratory moisture-density relations of soils by ASTM D1557 (modified Proctor).
- C. Determine the relative density of cohesionless soils by ASTM D2049.
- D. Sample backfill material by ASTM D75.
- E. "Relative density" is the ratio, expressed as a percentage, of the in-place dry density to the laboratory maximum dry density as determined by ASTM D1557 (modified Proctor).
- F. Testing: An independent testing laboratory will make density tests for determination of specific compaction and concrete cylinder tests.

PART 2 - PRODUCTS

2.01 CONCRETE

- A. Make all concrete curbs with Class B concrete, minimum 28-day compressive strength of 3,000 psi, in accordance with the applicable sections of these specifications.
- B. Concrete shall comply with the requirements of these specifications.

2.02 REINFORCEMENT, JOINT MATERIALS, AND FORMS

- A. Comply with applicable sections of these specifications.

PART 3 - EXECUTION

3.01 FOUNDATION

- A. Excavate or backfill to the required depth. Compact the foundation material upon which the curb is to be set to at least 98 percent relative density to a depth of 12 inches, with an even surface, true to line, grade and cross section, and soaking wet at the time that the concrete is placed.

3.02 FORMS

- A. Place forms straight, free from warp or bends, and set to the line and grades shown on the drawings.

3.03 PLACING CONCRETE

- A. Place concrete in the forms. Tamp and spade until mortar entirely covers its surface. Float the top of the concrete smooth and round the edges to the radius shown in the plans.

3.04 JOINTS

- A. Except for machine-placed items, at the option of the Contractor, contraction joints may be formed by the use of dummy joints (either formed or sawed) or by the use of sheet metal templates. If sheet metal templates are used, make them 1/4 inch thick and other dimensions same as cross section of form. Hold templates firmly during the placing of the concrete and leave in place until the concrete has set sufficiently to hold its shape, but remove while the forms are still in place.
- B. For machine-placed items, unless otherwise approved, saw contraction joints approximately 3/16 inch wide and 1-1/2 inches deep in curb and gutter as soon as the concrete has hardened to the degree that excessive raveling will not occur and before uncontrolled shrinkage cracking begins. Space contraction joints at intervals of 10 feet, except where lesser interval is required for closure, but make no section less than 4 feet in length.
- C. Construct expansion joints at all inlets, at all radius points, in other locations indicated in the plans at intervals of 500 feet between other expansion joints or ends of a run. The joints shall be 1/2 inch in width.
- D. Saw joints before the formation of uncontrolled cracking (i.e., cracking that occurs at locations other than construction, control or contraction joints) and as soon as the concrete has hardened sufficiently to permit cutting without chipping, spalling or tearing. Saw joints both during the day and night as required.

3.05 FINISHING

- A. Finish all exposed surfaces while the concrete is still green. In general, only a brush finish will be required. For any surface areas, however, which are too rough or have other surface defects which make additional finishing necessary, rub the curb to a smooth surface with a soft brick or wood block, with water used liberally.

3.06 CURING

- A. Continuously cure the concrete for a period of at least 72 hours. Commence curing after finishing has been completed and as soon as the concrete has hardened sufficiently to permit application of the curing material without marring the surface. Replace immediately any curing material removed or damaged during the 72-hour period. Curing will be done by the membrane curing compound method.
- B. To cure by the membrane curing compound method, apply clear membrane curing compound or white pigmented curing compound by a hand sprayer in a single coat continuous film and uniform coverage of at least one gallon to each 200 square feet. Thoroughly agitate the curing compound in the drum prior to application and during application as necessary to prevent settlement of pigment. Re-coat immediately any cracks, chips or other defects appearing in the coating.

3.07 BACKFILLING AND COMPACTING

- A. After the concrete has set sufficiently, fill the spaces in back of the curb to the required elevation with suitable material and compact to 90 percent relative density.

3.08 MACHINE LAID CURB

- A. Concrete curbs may be installed by machines without forming, provided that the finished product is straight, free from warp or bends, and does not deviate from the design line and grade or cross section.

3.09 DRIVEWAYS

- A. When construction is through areas previously "built up", construct drop curbs for driveway aprons at all existing driveways and as shown on the plans. When construction is in "new" areas, construct drop curbs as shown in the plans.

3.10 TESTING

- A. Sample and cure the concrete in accordance with ASTM C31, except take not less than three 6-inch by 12-inch cylinders for each 75 cubic yards poured or each day's pour less than 75 cubic yards. A slump test may be taken in conformity with ASTM C143, and the cylinders shall be tested in accordance with ASTM C39.
- B. The finished curbs, valley gutters, and curb and gutters shall be within 0.02 feet of the lines and grades shown on the plans. The finished concrete shall be smooth to within 1/4 inch in ten feet, without cracks (other than contraction joints) and without puddled or trapped water deeper than 1/4 inch.
- C. Remove and replace all work that does not meet above requirements.

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SECTION 02550

ARCHITECTURAL PRECAST CONCRETE SCREEN WALL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Anti-Graffiti paint is included in Section 09902.

1.02 SUMMARY

- A. This Section includes architectural precast concrete wall including its design and installation per Orange County Utilities Standard Drawing A407-1.

1.03 REFERENCES

- A. PCI Design Standard: Comply with recommendations of PCPs MNL-120 "PCI Design Handbook—Precast and Prestressed Concrete" applicable to types of architectural precast concrete units indicated.
- B. PCI Quality-Control Standard: Comply with requirements of PCPs MNL-117 "Manual for Quality Control for Plants and Production of Architectural Precast Concrete Products," including manufacturing procedures and testing requirements, quality-control recommendations, and dimensional tolerances for types of units required.
- C. ACI 318 (ACI 318M) "Building Code Requirements for Reinforced Concrete."
- D. Florida Building Code

1.04 PERFORMANCE REQUIREMENTS

- A. Structural Performance: Engineer; fabricate, and install architectural precast concrete units to withstand design loads within limits and under conditions indicated.
- B. Engineering Responsibility: Engage a fabricator who utilizes a professional engineer licensed in the State of Florida to prepare signed and sealed design calculations, Shop Drawings, and other structural data for architectural precast concrete wall. Panels and columns to be designed in accordance with the Florida Building Code, see Structural Drawings for requirements.

1.05 SUBMITTALS

- A. General: Submit each item in this Article according to the Conditions of the Contract and Division 1 Specification Sections.

- B. Product Data and instructions for manufactured materials and products.
- C. Shop Drawings prepared by or under the supervision of a professional engineer detailing fabrication and installation of architectural precast concrete wall. Indicate member locations, plans, elevations, dimensions, shapes, cross sections, foundation design, subsurface preparation and reinforcement details. Include locations and details of hoisting points and lifting devices for handling and erection.
 - 1. For architectural precast concrete units indicated to comply with performance requirements, include engineering analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
 - 2. For foundation design, include engineering analysis signed and sealed by the professional engineer responsible for their preparation.
 - 3. For the subgrade preparation, include the geotechnical engineering calculations and design or report, signed and sealed by the professional engineer responsible for their preparation.
 - 4. All engineering design, drawings, and reports shall be performed in accordance with the Florida Building Code latest edition.
- D. Samples for verification, approximately 12 by 12 by 2 inches (300 by 300 by 50 mm), to illustrate quality of finishes, colors, and textures of exposed surfaces of architectural precast concrete units.
- E. VOC compliance certificates signed by manufacturers certifying compliance of their products with regulations of authorities having jurisdiction over volatile organic compounds (VOCs).
- F. Design mixes for each concrete mix.
 - 1. Concrete materials.
 - 2. Reinforcing materials.
 - 3. Admixtures.
 - 4. Water-absorption test reports.
- G. Material certificates in lieu of agency test reports, when permitted by Engineer, signed by fabricator certifying that each material item complies with requirements.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: Engage an experienced Installer who has completed architectural precast concrete work similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

- B. Fabricator Qualifications: Engage a firm experienced in producing architectural precast concrete units similar to those indicated for this Project and with a record of successful In-service performance, as well as sufficient production capacity to produce required units without delaying the Work
 - 1. Fabricator must participate in the Precast/Prestressed Concrete Institute's (PCI) Plait Certification Program and be designated a PCI Certified Plant for Group A1 - Architectural Concrete.
 - 2. Fabricator shall be registered and approved by authorities having jurisdiction.
- C. Testing Agency Qualifications: To qualify for approval, an independent testing agency must demonstrate to Engineer's satisfaction, based on evaluation of agency-submitted criteria conforming to ASTM C 1077 and ASTM E 329, that it has the experience and capability to satisfactorily conduct the testing indicated without delaying the Work.
- D. Professional Engineer Qualifications: A professional engineer who is legally authorized to practice in the State of Florida and who is experienced in providing engineering services of the kind indicated.
 - 1. Test each variety of stone for compliance with physical property requirements specified in referenced ASTM standard specifications. Conduct tests using specimens and assemblies representative of proposed materials and construction.
- E. Field samples, approximately 36 by 46 inches, of architectural precast concrete; in sets of 3 for each finish, color, and texture required, demonstrating the range of variations expected in these characteristics.
 - 1. In presence of Engineer, damage part of an exposed-face surface and demonstrate materials and methods proposed for repair of surface blemishes.
- F. Design modifications may be made as necessary to meet field conditions and to ensure proper fitting of the Work as acceptable to Engineer. Maintain general design concept shown without increasing or decreasing sizes of architectural precast concrete units or altering profiles and alignments shown. Revise and submit complete design calculations and Drawings prepared by a qualified professional engineer when design modifications are required.
- G. Pre-installation Conference: Conduct conference at Project site to comply with requirements of Division 1 Section "Project Meetings."

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Deliver precast concrete units to Project site in such quantities and at such times to ensure continuity of installation. Store units at Project site to prevent cracking, distorting, warping, staining, or other physical damage, and so that markings are visible.
- B. Lift and support units only at designated lifting or supporting points shown on Shop Drawings.

1.08 SEQUENCING

- A. Supply anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURER: Available Manufacturers: Subject to compliance with requirements,

- A. PremierCrete Products, Justin, TX, T: (940) 648-5602.
- B. Superior Concrete Products, Arlington, TX, T: (817) 277-9255.
- C. Designer Concrete Fence, Sherman Oaks, CA, T: (818) 990-3362.
- D. Wall Way, Ft Lauderdale, FL, T: (954) 484-7600.

2.02 MOLD MATERIALS

- A. Forms: Provide forms and, where required, form-facing materials of metal, plastic, wood, or another acceptable material that is nonreactive with concrete and will produce required finish surfaces.

2.03 REINFORCING MATERIALS

- A. Reinforcing Bars: ASTM A 615, Grade 60 (ASTM A 615M, Grade 400), deformed.
- B. Steel reinforcement wire: ASTM – A 82, $f_y = 70,000$ psi min. Galvanized.
- C. Accessories: Provide ties and stirrups to conform to the requirements of ASTM - A 615, grade 40.

2.04 CONCRETE MATERIALS

- A. Portland Cement ASTM C 150, Type I or Type III.
 - 1. Use only one brand, type, and color of cement from the same mill throughout Project.
- B. Normal-Weight Aggregates: ASTM C 33, with coarse aggregates meeting Class 5S and MNL-117 requirements.
 - 1. Face-Mix Coarse Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining.
 - a. Gradation: Uniformly graded.

- C. Coloring Agent ASTM C 979, synthetic mineral oxide pigments or colored water-reducing admixtures, color stable, nonfading, resistant to lime and other alkalis.
 - 1. Color shall be as selected by the Engineer and Owner.
- D. Water. Potable; free from deleterious material that may affect color stability, setting, or strength of concrete.
- E. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

2.05 CONCRETE MIXES

- A. Prepare design mixes for each type of concrete required.
- B. Design mixes may be prepared by a qualified independent testing agency or by qualified architectural precast manufacturing plant personnel at architectural precast fabricator's option.
- C. Limit water-soluble chloride ions to the maximum percentage by weight of cement permitted by ACI 318 (ACI 318M).

2.06 MOLDS

- A. Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placing operations, temperature changes, and for pretensioning and detensioning operations.
- B. Maintain molds to provide completed architectural precast concrete units of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

2.07 FABRICATION

- A. Accurately position cast-in anchors, inserts, plates, angles, and other anchorage hardware for attachment of loose hardware and secure in place during precasting operations. Locate anchorage hardware where it does not affect the position of the main reinforcement or the placing of concrete.
- B. Cast-in reglets, slots, holes, and other accessories in architectural precast concrete units to receive dowels, reglets, waterstops, flashings, and other similar work as indicated. Coordinate with other trades for installation of cast-in items.
- C. Reinforcement Comply with the recommendations of CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.
- D. Reinforce architectural precast concrete units to resist handling, transportation, and erection stresses.
- E. Mix concrete according to MNL-117 and requirements of this Section. Following concrete batching, no additional water may be added.

- F. Place concrete in a continuous operation to prevent seams or planes of weakness from developing in precast units. Comply with requirements of MNL-117 for measuring, mixing, transporting, and placing concrete.
 - 1. Place back-up concrete to ensure bond with face concrete.
- G. Thoroughly consolidate placed concrete by internal and external vibration without dislocating or damaging reinforcement and built-in items. Use equipment and procedures complying with MNL-117.
 - 1. Comply with ACI 306R procedures for cold-weather concrete placement.
 - 2. Comply with ACI 305R procedures for hot-weather concrete placement.
- H. Identify pickup points of architectural precast concrete units and orientation in structure with permanent markings, complying with markings indicated on Shop Drawings. Imprint casting date on each architectural precast concrete unit on a surface that will not show in the finished structure.
- I. Cure concrete according to the requirements of MNL-117 by moisture retention without heat or by accelerated heat curing, using low-pressure live steam or radiant heat and moisture.
- J. Fabricate architectural precast concrete units straight and true to size and shape with exposed edges and corners precise and true.
 - 1. Edge and Corner Treatment Uniformly chamfered.
- K. Discard architectural precast concrete units that are warped, cracked, broken, spalled, stained, or otherwise defective unless repairs are permitted by Engineer and meet requirements.

2.08 FABRICATION TOLERANCES

- A. Comply with the following overall height and width dimensional tolerances of finished units measured at face adjacent to mold at time of casting:
 - 1. 10 Feet Or Less: Plus or minus 1/16 inch.
- B. Angular Deviation of Plane of Side Mold: Plus or minus 1/32 per 3-inch depth or plus or minus 1/15-inch total, whichever is greater.
- C. Out of Square: Difference in length of two diagonal measurements of 1/16 inch per 72 inches or 1/2-inch total, whichever is greater.
- D. Thickness: Minus 1/16 inch, plus 1/4 inch.
- E. Locations of Reveals and Architectural Features: Plus or minus 1/16 inch.

2.09 FINISHES

- A. Finish exposed-face surfaces of architectural precast concrete units as follows to match Engineer's design reference sample.
 - 1. Textured-surface finish shall have a stacked stone appearance imparted by form liners or inserts to provide surfaces free of pockets, streaks, and honeycombs, with uniform color and texture.
- B. Finish exposed-back surfaces of architectural precast concrete units to match face-surface finish.
- C. Finish unexposed surfaces of architectural precast concrete units by float finish.

2.10 SOURCE QUALITY CONTROL

- A. The Owner may employ an independent testing agency to evaluate architectural precast concrete fabricator's quality control and testing methods.
 - 1. Allow Owner's testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with Owner's testing agency and provide samples of materials and concrete mixes as may be requested for additional testing and evaluation.
- B. Quality-Control Testing: Test and inspect architectural precast concrete according to MNL-117 requirements.
- C. Strength of architectural precast concrete units will be considered deficient when they fail to comply with ACI 318 (ACI 318M) requirements.
- D. Testing: When there is evidence that the strength of architectural precast concrete units may be deficient or may not meet ACI 318 (ACI 318M) requirements, the CONTRACTOR will employ an independent testing agency to obtain, prepare, and test cores drilled from hardened concrete to determine compressive strength according to ASTM C 42.
 - 1. A minimum of 3 representative cores will be taken from architectural precast concrete units of suspect strength, from locations directed by Engineer.
 - 2. Cores will be tested in an air-dry condition.
 - a. Strength of concrete for each series of 3 cores will be considered satisfactory if the average compressive strength is equal to at least 85 percent of the 28-day design compressive strength and no single core is less than 75 percent of the 28-day design compressive strength.

3. Test results will be made in writing on the same day that tests are made, with copies to Engineer, Contractor, and precast fabricator. Test reports will include the Project identification name and number, date, name of precast concrete fabricator, name of concrete testing agency, identification letter, name, and type of architectural precast concrete unit or units represented by core tests; design compressive strength, compressive strength at break and type of break, corrected for length-diameter ratio, and direction of applied load to core with respect to horizontal plane of concrete as placed.

E. Patching: Where core test results are satisfactory and architectural precast concrete units meet requirements, solidly fill core holes with patching mortar and finish to match adjacent concrete surfaces.

F. Defective Work: Discard architectural precast concrete units that do not conform to requirements, including strength, manufacturing tolerances, and finishes. Replace with architectural precast concrete units that meet requirements.

2.11 STORMWATER RUNOFF

A. Openings shall be fabricated in the pre-cast panels to allow the passage of stormwater through the lower portion of the wall. The opening dimensions, locations, and accessories shall be determined by the Architectural Precast Screen Wall manufacturer based on the Site Grading Plan in the Drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances, true and level bearing surfaces, and other conditions affecting performance of architectural precast concrete units. Do not proceed with installation until all unsatisfactory conditions have been corrected.

B. Do not install architectural precast units until supporting concrete has attained minimum allowable design compressive strength.

3.02 INSTALLATION

A. Install clips, hangers, and other accessories required for connecting architectural precast concrete units to supporting members and back-up materials.

B. Install architectural precast concrete units plumb, level, and in alignment. Provide temporary supports and bracing as required to maintain position, stability, and alignment as units are being permanently connected.

1. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses.

2. Remove projecting hoisting devices and cement grout fill recessed hoisting devices.

- C. Anchor architectural precast concrete units in position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring and grouting are completed.
- D. At bolted connections use lock washers or other acceptable means to prevent loosening of nuts.

3.03 ERECTION AND LOCATION TOLERANCES

- A. Install architectural precast concrete units level, plumb, square, and true, without exceeding the recommended erection and location tolerances of MNL-117.
- B. Tolerances for Location of Architectural Precast Units: Fabricate and erect architectural precast concrete units so that joints between units do not exceed the following. Alignment for exterior units is outside face.
 - 1. Face Width of Joints: Plus or minus 1/4 Inch
 - 2. Joint Taper: 1/40 inch per 12-inch length, with maximum length of taper over 10 feet of 1/4 inch
 - 3. Step in Face: 1/4 inch
 - 4. Jog in Alignment of Edges: 1/4 inch
 - 5. Jog in Alignment of Reveals: 1/4 inch
 - 6. Plumb in Any 10 Feet of Element Height: 1/4 inch
 - 7. Variation from Level: Plus or minus 1/2 inch in any 40-foot run
 - 8. Top Elevation from Nominal Top Elevation: Plus or minus 1/4 Inch for exposed individual panel; 1/4 inch exposed relative to adjacent panel

3.04 REPAIRS

- A. Repair exposed exterior surfaces of architectural precast concrete units to match color, texture, and uniformity of surrounding concrete when permitted by Engineer.
- B. Remove and replace damaged architectural precast concrete units when repairs do not meet requirements.

3.05 CLEANING

- A. Clean exposed surfaces of architectural precast concrete units after erection to remove weld marks, other markings, dirt, and stains.
 - 1. Wash and rinse according to architectural precast concrete fabricators recommendations. Protect other work from staining or damage due to cleaning operations.

2. Do not use cleaning materials or processes that could change the appearance of exposed architectural precast concrete finishes.

END OF SECTION

SECTION 02604

CHEMICAL RESISTANT THERMOPLASTIC LINING FOR CONCRETE STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. This Section covers extruded thermoplastic concrete protective liner with integral anchors to be applied to the following interior surfaces of new cast-in-place reinforced concrete structures and concrete structures being rehabilitated:
 - 1. All wall surfaces on the interior of the structure, underside of top slab.

1.02 RELATED WORK

- A. Cast-in-Place Concrete is included in Section 03300.

1.03 SUBMITTALS

- A. Complete specifications and data covering the materials to be furnished and detailed drawings covering the installation thereof, including but not limited to, the attachment of the linings to the forms and the arrangement and sealing or welding of the butt and corner joints, shall be submitted in accordance with Section 01300.
- B. The Contractor shall furnish data certifying that the lining is of the materials specified. No lining materials will be accepted for use in the Work on this project until certificates have been submitted and approved by the Engineer.

1.04 QUALITY ASSURANCE

- A. The manufacturer of the sheet lining shall furnish an affidavit attesting to the successful and completely satisfactory use of the materials as a lining for the service intended before shipment thereof.
- B. The accepted plastic sheet manufacturer's standard printed specifications covering the installation of the lining in concrete structures shall be considered as being incorporated herein and all work for and in connection with said lining installation shall be strictly in accordance therewith. Such manufacturer's specifications shall include and cover application of sheets to concrete forms, including preparation of forms, joint welding, and removal of forms; miscellaneous requirements covering transportation, handling, storing, and inspection; and necessary precautions with respect to ventilation and protection of workmen.
- C. All work for and in connection with the installation of sheet lining, the preparation of surfaces, and the sealing and welding of joints shall be performed by the manufacturer of the lining or by a firm or individual who has been trained and certified by said manufacturer.

- D. Training certification shall be submitted by manufacturer in writing.

1.05 WARRANTY

- A. 5 Year, material and labor warranty shall be furnished in writing to the Owner.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All liner furnished shall be composed of chemically inert synthetic resin, pigments, and plasticizers suitably compounded and processed; extruded under pressure into permanently flexible sheets; black in color and shall conform to the following:
 - 1. Extruded Chemical Resistant Thermoplastic Sheet Lining System shall be High Density Polyethylene (HDPE) Sure Grip Concrete Protective Liner, as manufactured by AGRU America, Inc., Kingwood, Texas; Anchor Lok as manufactured by Atlas Minerals & Chemicals Inc, Mertztown, PA; or approved equal. The minimum thickness for the liner shall be 5mm.
- B. Separate sections of the liner will be extrusion welded into integral sheets.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Cast-in-Place Concrete Structures
 - 1. Sheets shall be set and properly secured to the concrete contact faces of the forms that form the surfaces to be lined. The sheets shall be placed with the smooth face next to the form. The sheets shall be butt jointed without more than 3/8-inch opening in any joint between adjacent sheets and the sheets held in place with small-headed finishing nails placed within 1/4-in of the edge of the sheets; the number of nails used shall be kept to the minimum needed to secure the liner onto the form. All welded joints shall be T-intersections. The seams will be extrusion welded.
 - 2. Where possible, the form to be lined shall be set in place, the lining attached, and all lining joints covered before the reinforcing steel is installed. The outer form shall then be set in place and the form ties installed through the liner in the normal manner. The number of form ties used shall be held to the minimum.
 - 3. The lining installation and sealing shall be such that a continuous plastic lining is provided and that entrance of concrete or mortar between the lining and the form is prevented.
 - 4. Forms shall be removed in a careful manner and not before the concrete has attained sufficient strength and has been properly cured. Finishing nails used to hold the liners in place on the forms may pull out with the forms but if not, shall be removed afterwards. The small nail heads should come through the plastic liner sheet easily.

5. After the forms have been removed, the exposed butt joints in the liner, including nail and form tie holes, shall be extrusion welded. Sealing shall be such that a continuous watertight/gastight, homogeneous plastic liner is provided. Workmanship shall be neat and of the highest quality.
6. Application of liner to any surface by means of adhesive shall be used only where approved by the Engineer and shown on approved shop drawings and shall be performed in accordance with the manufacturer's recommended procedures.

B. Repairs

1. All repairs to damaged portions of the linings shall be made and all holes in the linings sealed before final acceptance of the work, in conformity with the lining manufacturer's instructions and recommendations. The requirement for neat, high quality work is emphasized.

C. Testing

1. All surfaces covered with the lining shall be tested with an acceptable electrical holiday or flaw detector after installation and any imperfections discovered thereby shall be repaired as specified above. All necessary equipment and material for testing shall be provided by Contractor. A factory trained and certified advisor/manufacturer's representative shall be on site during and approve the spark testing procedure.

END OF SECTION

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SECTION 02605

PRECAST CONCRETE MANHOLES (AND STRUCTURES)

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install precast concrete manholes, structures, frames and covers, access hatches, manhole rungs, ladders and appurtenances all as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Trenching, Backfilling and Compaction is included in Section 02221.
- B. Cast-in-place concrete is included in Section 03300.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings showing details of construction, reinforcing, joints, pipe connection to manhole, manhole rungs, manhole platforms (if applicable), manhole frames and covers, access hatches and ladders.
- B. Submit for review, structural calculations and drawings for all precast structures.
- C. Concrete design mix data and concrete test cylinder reports from an approved concrete testing laboratory certifying that the concrete used in the precast structures conforms with the strength requirements specified herein.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A48 - Standard Specification for Gray Iron Castings
 - 2. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement
 - 3. ASTM C32 - Standard Specification for Sewer and Manhole Brick (Made from Clay or Shale)
 - 4. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made from Clay or Shale)
 - 5. ASTM C150 - Standard Specification for Portland Cement
 - 6. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes

7. ASTM C443 - Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets
 8. ASTM C478 - Standard Specification for Precast Reinforced Concrete Manhole Sections
 9. ASTM D4101 - Standard Specification for Propylene Plastic Injection and Extrusion Materials
- B. American Concrete Institute (ACI)
1. ACI 318 - Building Code Requirement for Structural Concrete
- C. American Association of State Highway and Transportation Officials (AASHTO)
- D. Occupational Safety and Health Administration (OSHA)
- E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. The quality of all materials, the process of manufacture, and the finished sections shall be subject to inspection and approval by the Engineer, or other representative of the Owner. Such inspection may be made at the place of manufacture, or on the work after delivery, or at both places and the materials shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein; even though samples may have been accepted as satisfactory at the place of manufacture. Material rejected after delivery to the job shall be marked for identification and shall be removed from the job at once. All materials which have been damaged after delivery will be rejected, and if already installed, shall be acceptably repaired, if permitted, or removed and replaced, entirely at the Contractor's expense.
- B. At the time of inspection, the materials will be carefully examined for compliance with the ASTM standard specified below and this Section and with the approved manufacturer's drawings. All manhole sections shall be inspected for general appearance, dimension, "scratch-strength", blisters, cracks, roughness, soundness, etc. The surface shall be dense and close-textured.
- C. Imperfections in manhole sections may be repaired, subject to the approval of the Engineer, after demonstration by the manufacturer that strong and permanent repairs result. Repairs shall be carefully inspected before final approval. Cement mortar used for repairs shall have a minimum compressive strength of 4,000 psi at 7 days and 5,000 psi at 28 days, when tested in 3-in by 6-in cylinders stored in the standard manner. Epoxy mortar may be utilized for repairs subject to the approval of the Engineer.

PART 2 - PRODUCTS

2.01 PRECAST CONCRETE MANHOLE SECTIONS

- A. Precast concrete barrel sections and transition top sections, shall conform to ASTM C478 and meet the following requirements:
1. The wall thickness shall not be less than 8-in for 96-in diameter reinforced barrel sections.
 2. Top sections shall be eccentric except that barrel sections shall be used where shallow pipe cover requires a top section less than 4-ft as shown on the Drawings.
 3. Barrel sections shall have tongue and groove joints.
 4. All sections shall be cured by an approved method and shall not be shipped nor subjected to loading until the concrete compressive strength has attained 3,000 psi and not before 5 days after fabrication and/or repair, whichever is longer.
 5. Precast concrete barrel sections with precast top slabs and precast concrete transition sections shall be designed for a minimum of H-20 loading plus the weight of the soil above at 120 pcf.
 6. The date of manufacture and the name and trademark of the manufacturer shall be clearly marked on the inside of each precast section.
 7. Precast concrete bases shall be constructed and installed as shown on the Drawings. The thickness of the bottom slab of the precast bases shall not be less than the manhole barrel sections or top slab whichever is greater.
 8. Knock out panels shall be provided in precast manhole sections at the locations shown on the Drawings. They shall be integrally cast with the section, 2-1/2-in thick and shall be sized as shown on the Drawings. There shall be no steel reinforcing in knock out panels.

2.02 PRECAST CONCRETE STRUCTURES

- A. The precast reinforced concrete structures shall be manufactured by Oldcastle Precast, Atlantic Concrete Products Inc., Delzotto Products Inc., or equal. The inside dimensions, headroom requirements and minimum thickness of concrete shall be as indicated on the Drawings. The manufacturer shall notify the Engineer at least 5 working days prior to placing concrete during the manufacturing process. The Engineer may inspect the reinforcing steel placement and/or require the manufacturer to provide photographs of each section showing the location of all reinforcing steel prior to the placing of concrete. Should it be found that the placement of steel is not as detailed in the shop drawing submittals, the section in question shall be rejected and a replacement section shall be manufactured at the Contractor's expense. Failure to properly notify the Engineer prior to placing concrete shall require the precast sections to be rejected and replacement sections to be manufactured at the Contractor's expense.
- B. Structural design calculations and Drawings shall be prepared and stamped by a professional engineer registered in the State of Florida.

- C. All precast concrete shall have a minimum compressive strength of 5000 psi at 28 days. Water shall be kept to a minimum to obtain concrete which is as dense and watertight as possible. The maximum water-to-cement ratio shall be 0.40 by weight and the minimum cement content shall be 600 lbs of cement per cubic yard of concrete. The above ratios shall be revised for sacks of cement weighing different from 94 pounds per sack.
- D. Design Criteria
1. All precast concrete members shall conform to ACI 318.
 2. When the design yield strength "fy" for tension reinforcement exceeds 40,000 psi, the "z" values referred to in ACI 318 shall not exceed 95 kips/in. The flexural stress in reinforcement under service loads "fs" shall be calculated and shall not be greater than 50 percent of the specified yield strength "fy."
 3. The precast concrete structure's elements shall be designed to support their own weight, the weight of soil above at 120 pcf and shall be capable of withstanding a live load equal to an AASHTO HS-20 highway loading applied to the top slab.
 4. The base slab and walls shall be cast together to form a monolithic base section.
 5. All exterior walls shall be designed for an equivalent fluid pressure of 90 lbs/sq ft. The top of the pressure diagram shall be assumed to originate at finished ground level. Additional lateral pressure from approaching truck wheels shall be considered in accordance with AASHTO.
 6. The structural design shall take into account discontinuities in the structure produced by openings and joints in the structure.
 7. The structures shall be designed to prevent flotation without the benefit of skin friction when the ground water level is at finished ground surface. Flotation forces shall be resisted by the dead load of the structure and soil directly above the structure. Weight of equipment and piping within the structure and soil frictional forces shall not be considered as being effective in resisting flotation forces.
 8. If the design of the box structure requires a concrete pad to prevent flotation, the cost of designing, furnishing and installing a reinforced concrete pad shall be included in the price for the structure. Details of the design of the concrete pad (if required) shall be submitted to the Engineer for review.
 9. All walls and slabs shall be analyzed by accepted engineering principles. Openings shall be completely framed as required to carry the full design loads to support walls. All slabs and walls shall be fully reinforced on both faces and the minimum reinforcing shall be No. 5 at 12-in E.F.E.W. Additional reinforcing shall be provided around all openings.
 10. The horizontal wall joints shall not be located within 18-in of the horizontal centerline of wall penetrations.

- E. The structure shall be built by the manufacturer in no more than four major sections including the top slab if required.
- F. Where top slabs are used or required, lifting hooks shall be provided.
- G. As required, access openings and pipe penetrations shall be formed openings and located as shown on the Drawings.
- H. Wall sleeves as shown on the Drawings, shall be provided to the precast concrete manufacturer for inclusion in the manufacture of the structure.

2.03 MANHOLE FRAME AND COVER

- A. Manhole frames and covers shall be of good quality, strong, tough, even grained cast iron smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which they are intended. Manhole covers and frame seats shall be machined to a true surface. Castings shall be thoroughly cleaned and subject to hammer inspection. Cast iron shall conform to ASTM A48, Class 30.
- B. Manhole covers shall be per Orange County Standards. Manhole frame and covers shall be USF Fabrication Inc., or equal.

2.04 JOINTING PRECAST MANHOLE SECTIONS AND STRUCTURES

- A. Tongue and groove joints of precast manhole sections shall be sealed with either a round rubber O-ring gasket or a preformed flexible joint sealant. The O-ring shall conform to ASTM C443. The preformed flexible joint sealant shall be Kent Seal No. 2 by Hamilton-Kent; Ram-Nek by K.T. Snyder Company or equal.
- B. Joints shall be designed and manufactured so that the completed joint will withstand an internal water pressure of 15 psi without leakage or displacement of the gasket or sealant.

2.05 MANHOLE RUNGS

- A. Manhole rungs shall be either of the following types:
 - 1. Manhole rungs shall be of cast aluminum alloy 6061-T6, drop front design, 12-in wide with an abrasive step surface. The manhole rungs shall conform to the requirements of OSHA.

2.06 PIPE CONNECTIONS TO MANHOLE

- A. Manhole pipe connections may be accomplished in the following ways:
 - 1. A tapered hole filled with non-shrink waterproof grout, Hallemite; Waterplug; Embecco or equal, after the pipe is inserted is acceptable, providing the grout is placed carefully to completely fill around the pipe. If this method is used, place concrete encasement to assure a total 12-in of concrete including manhole thickness around the pipe stub.

2. The "Lock Joint Flexible Manhole Sleeve" shall be cast in the precast manhole base. The stainless steel strap shall be protected from corrosion with a bituminous coat.
3. "A-Lok" shall be a rubber like gasket cast in the precast manhole base. The rubber gasket shall be cast into a formed opening in the manhole.
4. "KOR-N-SEAL" joint shall be installed as recommended by the manufacturer. The stainless steel clamp shall be protected from corrosion with a bituminous coat.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Manhole and Structure Installation

1. Manhole and structure shall be constructed to the dimensions shown on the Drawings and as specified herein. All work shall be protected against flooding and flotation.
2. The bases of manholes shall be placed on a bed of 12-in screened gravel as shown on the Drawings. The bases shall be set at a grade to assure that a maximum of 8-in thickness of brickwork will bring the manhole frame and cover to final grade. Cast-in-place bases shall be constructed in accordance with the requirements of Division 3 and the details shown on the Drawings.
3. Precast concrete barrel sections [and structures] shall be set plumb and with sections in true alignment with a 1/4-in maximum tolerance to be allowed. The joints of precast barrel sections shall be sealed with either a rubber O-ring set in a recess or the preformed flexible joint sealant used in sufficient quantity to fill 75 percent of the joint cavity. The outside and inside joint shall be filled with non-shrink mortar and finished flush with the adjoining surfaces. Allow joints to set for 24-hours before backfilling. Backfilling shall be done in a careful manner, bringing the fill up evenly on all sides. If any leaks appear in the manholes, the inside joints shall be caulked with lead wool to the satisfaction of the Engineer. Install the precast sections in a manner that will result in a watertight joint.
4. Holes in the concrete barrel sections required for handling or other purposes shall be plugged with a non-shrinking grout or non-shrinking grout in combination with concrete plugs and finished flush on the inside.
5. Where holes must be cut in the precast sections to accommodate pipes, cutting shall be done prior to setting manhole sections in place to prevent any subsequent jarring which may loosen the mortar joints.

B. Manhole Pipe Connections

1. Manhole pipe connections shall be accomplished in the ways specified herein. Pipe stubs for future extensions shall also be connected and the stub end closed by a suitable watertight plug.

3.02 LEAKAGE TESTS

- A. Leakage tests shall be made and observed by the Engineer on each manhole. The test shall be the exfiltration test made as described below:
- B. After the manhole has been assembled in place, all lifting holes and those exterior joints within 6-ft of the ground surface shall be filled and pointed with an approved non-shrinking mortar. The test shall be made prior to placing the shelf and invert and before filling and pointing the horizontal joints below the 6-ft depth line. If the groundwater table has been allowed to rise above the bottom of the manhole, it shall be lowered for the duration of the test. All pipes and other openings into the manhole shall be suitably plugged and the plugs braced to prevent blow out.
- C. The manhole shall then be filled with water to the top of the cone section. If the excavation has not been backfilled and observation indicates no visible leakage, that is, no water visibly moving down the surface of the manhole, the manhole may be considered to be satisfactorily water-tight. If the test, as described above is unsatisfactory as determined by the Engineer, or if the manhole excavation has been backfilled, the test shall be continued. A period of time may be permitted if the Contractor so wishes, to allow for absorption. At the end of this period, the manhole shall be refilled to the top of the cone, if necessary and the measuring time of at least 8 hours begun. At the end of the test period, the manhole shall be refilled to the top of the cone, measuring the volume of water added. This amount shall be extrapolated to a 24-hour rate and the leakage determined on the basis of depth. The leakage for each manhole shall not exceed 1 gallon per vertical foot for a 24-hour period. If the manhole fails this requirement, but the leakage does not exceed 3 gallons per vertical foot per day, repairs by approved methods may be made as directed by the Engineer to bring the leakage within the allowable rate of 1 gallon per foot per day. Leakage due to a defective section or joint or exceeding the 3 gallon per vertical foot per day shall be the cause for the rejection of the manhole. It shall be the Contractor's responsibility to uncover the manhole as necessary and to disassemble, reconstruct or replace it as directed by the Engineer. The manhole shall then be retested and, if satisfactory, interior joints shall be filled and pointed.
- D. No adjustment in the leakage allowance will be made for unknown causes such as leaking plugs, absorptions, etc, i.e. it will be assumed that all loss of water during the test is a result of leaks through the joints or through the concrete. Furthermore, take any steps necessary to assure the Engineer that the water table is below the bottom of the manhole throughout the test.
- E. If the groundwater table is above the highest joint in the manhole, and if there is no leakage into the manhole as determined by the Engineer, such a test can be used to evaluate the water-tightness of the manhole. However, if the Engineer is not satisfied, lower the water table and carry out the test as described hereinbefore.
- F. Leakage Tests for Structures
 1. The Engineer will visually inspect structure(s) for possible leaks before backfilling of structures is allowed. All joints shall be sealed to the satisfaction of the Engineer.
 2. The Engineer may require an exfiltration test as described for manholes on any structure for which he/she deems the test appropriate.

3.03 CLEANING

- A. All new manholes shall be thoroughly cleaned of all silt, debris and foreign matter of any kind, prior to final inspection.

END OF SECTION

SECTION 02616

DUCTILE IRON PIPE AND FITTINGS

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required, install, and test ductile iron pipe and fittings for piping as shown on the Drawings and as specified herein.
- B. Piping shall be located substantially as shown on the Drawings. The Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference between pipes or for other reasons. Pipe fitting notation is for the Contractor's convenience and does not relieve him/her from installing and jointing different or additional items where required to achieve a complete piping system.
- C. Where the word "pipe" is used it shall refer to pipe, fittings, or appurtenances unless otherwise noted.

1.02 RELATED WORK

- A. Delivery, Storage and Handling is included in Section 01600.
- B. Trenching, Backfilling and Compaction is included in Section 02221.
- D. Granular Fill Material is included in Section 02230.
- E. Sedimentation and Erosion Control is included in Section 02270.
- F. Piping Specialties are included in Section 15121.

1.03 SUBMITTALS

- A. Submit shop drawings and product data, including piping layouts, design calculations, warranty information, test reports, in accordance with Section 01300 and the referenced standards.
- B. Submit design calculations in accordance with Paragraph 2.02 below signed by a Professional Engineer, as noted in Section 01300.
- C. Submit the name of the pipe and fitting suppliers and a list of materials to be furnished.
- D. Prior to shipment of pipe, certified copies of mill tests confirming the type of materials used in the pipe, and shop testing of pipe to show compliance with the requirements of the applicable standards, along with a sworn affidavit of compliance that the pipe complies with the referenced standards, shall be submitted.
- E. Submit copies of all shop tests, including hydrostatic tests.

- F. Submit information on all warranties per Section 01740.
- G. Submit shop drawings with a tabulated laying schedule which references stations and invert elevations as shown on the Drawings as well as all fittings, bends, outlets, restrained joints, tees, special deflection bells, adapters, solid sleeves and specials, along with the manufacturer's drawings and specifications providing complete details of all items. The laying schedule shall show pipe class, class coding, station limits and transition stations for various pipe classes. The above shall be submitted to the Engineer for approval before manufacture and shipment. The location of all pipes shall conform to the locations indicated on the Drawings. Full length pipe may be supplied from inventory provided that all specification requirements are met. Shop drawings shall include but not be limited to:
1. Complete and dimensional working drawings of all pipe layouts, including pipe stationing, invert elevation at changes in grade or horizontal alignment, all elements of curves and bends both in horizontal alignment and vertical position.
 2. The grade of material; size, wall thickness, of the pipe and fittings and appurtenances, type and location of fittings, specials, and valves; and the type and limits of the lining, lining reinforcing and coating systems of the pipe and fittings. Methods and procedures recommended by the coating manufacturer will be documented.
 3. Joint details; methods and locations of supports, and complete information concerning type, size and location of all welds. Shop welds (no field welding will be allowed) will be clearly differentiated and welds will be clearly detailed with preparation procedures for all pipe and parent material comprising each weld. Critical welding procedures will be identified along with methods for controlling welding stresses and distortions. Locations and proposed joint details will also be clearly identified.
 4. Method of manufacture of pipe; joint details; fittings; and any specials.
 5. All other pertinent information for all items to be furnished; product data to show compliance of all couplings, supports, fittings, coatings and related items.
- H. Submit anticipated production and delivery schedule.
- I. Prior to shipment of pipe, submit a certified affidavit of compliance from the manufacturer stating that the pipe, fittings, gaskets, linings and exterior coatings for this project have been manufactured and tested in accordance with AWWA and ASTM standards and requirements specified herein.
- J. Submit handling procedures for all phases from finished fabrication through delivery including storage, transportation, loading, and unloading. This will include storage at the project site and required protection following installation prior to startup.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A242 – Standard Specification for High-Strength Low-Allow Structural Steel
 - 2. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 PSI Tesile Strength.
 - 3. ASTM A674 – Standard Practice for Polyethylene Encasement for Ductile Iron Pipe for Water or Other Liquids.
 - 4. ASTM C150 - Standard Specification for Portland Cement.

- B. American Water Works Association (AWWA)
 - 1. AWWA C104 – Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water.
 - 2. AWWA C105 – Polyethylene Encasement for Ductile-Iron Pipe Systems.
 - 3. AWWA C110 – Ductile-Iron and Gray-Iron Fittings, 3-in through 48-in (75mm Through 1219mm) for Water.
 - 4. AWWA C111 – Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 - 5. AWWA C150 – Thickness Design of Ductile-Iron Pipe.
 - 6. AWWA C151 – Ductile-Iron Pipe, Centrifugally Cast, for Water.
 - 7. AWWA C115 – Flanged Ductile Iron Pipe with Ductile Iron or Grey Iron Threaded Flanges.
 - 8. AWWA C116 – Protective Fusion-Bonded Epoxy Coatings for the Interior and Exterior surfaces of Ductile Iron and Grey Iron Fittings for Water Supply Service.
 - 9. AWWA C153 – Ductile- Iron Compact Fittings, 3-in through 24-in and 54-in through 64-in, for Water.
 - 10. AWWA C550 – Protective Interior Coatings for Valves and Hydrants
 - 11. AWWA C600 – Installation of Ductile-Iron Water Mains and Their Appurtenances.
 - 12. AWWA C606 – Grooved and Shouldered Joints.
 - 13. AWWA C651 - Disinfecting Water Mains.
 - 14. AWWA M41 – Ductile Iron Pipe and Fittings Manual of Water Supply Practices

C. National Sanitation Foundation (NSF)

1. NSF 61 – Drinking Water System Components Health Effects.

- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. It is a requirement of these Contract Documents to have all of the ductile iron pipe under this section designed and supplied by a single manufacturer rather than have selection and supply of these items by a number of different manufacturers. Similarly, it is a requirement of these Contract Documents to have all of the ductile iron fittings under this section designed and supplied by a single manufacturer rather than have selection and supply of these items by a number of different manufacturers. All connections between the pipe and fittings shall be compatible, as detailed in Section 1.06.
- B. Each length of ductile iron pipe supplied for the project shall be hydrostatically tested at the point of manufacture to 500 psi for a duration of 10 seconds per AWWA C151. Testing may be performed prior to machining bell and spigot. Failure of ductile iron pipe shall be defined as any leak or rupture of the pipe wall. Certified test results shall be furnished in duplicate to the Engineer prior to time of shipment.
- D. All ductile-iron pipe and fittings to be installed under this project shall be inspected and tested at the foundry as required by the standard specifications to which the material is manufactured. Furnish in duplicate to the Engineer sworn certificates of such tests and their results at least 5 days prior to the shipment of the goods.
- E. Inspection of the pipe and fittings will also be made by the Engineer or representative of the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the Specification requirements even though pipe may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery (including defects from manufacturing or delivery/transport) shall be marked for identification and shall immediately be removed from the job at the Contractors expense.
- F. A manufacturer's representative shall be made available to the Owner and owner's representative during the manufacturing furnishing, transporting, and unloading of the pipe during installation and testing of the pipe to assist in insuring that the pipe is properly fabricated, transported, unloaded, stored in the field, joined and tested. Manufacturer's responsibilities relate only to the proper care and treatment of the pipe during these procedures and not the techniques or procedures used during installation and testing.
1. The designated factory representative shall be made available at any time the owner may request. The field or site representative shall be made available a minimum of 10 working days during the project when requested by the owner.
 2. The cost for the services of the factory representative, including expenses, shall be considered incidental to the project and will not be paid separately.

- G. The manufacturer shall meet the following criteria and furnish the necessary project information which demonstrates the required experience:
1. Experience that includes successful fabrication (followed by installation, acceptance and service) to AWWA C151 standards of at least 30,000 lineal feet of the largest specified diameter or larger ductile iron pipe with similar linings/coatings within the past 5 years.
 2. Experience shall include the successful fabrication of at least 50- fittings in compliance with AWWA C110 or C153 of the largest specified diameter or larger with similar lining/coatings within the past 5 years.
 3. Experience that includes the successful fabrication (followed by installation, acceptance and service) of at least 10,000 lineal feet of the largest specified diameter or larger push-on style, boltless restrained joint for ductile iron pipe within the last 5 years.
- H. All pipe and fittings shall be marked in accordance with all applicable AWWA standards. Legibly and permanently mark all pipe, fittings, specials and appurtenances to be consistent with the laying schedule and marking drawings (if required) with the following information:
1. Manufacturer, date
 2. Size, type, class, or wall thickness
 3. AWWA Standard(s) produced to

1.06 DESCRIPTION OF SYSTEMS

- A. Pipe shall be made in the United States. Fittings may be made outside the United States, but shall be supplied by one of the named pipe manufacturers or engineer approved equal. Pipe and fittings shall be as supplied by the American Cast Iron Pipe Co., Sigma Corporation, Star Pipe Products, Tyler Union & Clow or an approved equal who is a member of the Ductile Iron Pipe Research Association (DIPRA). All ductile iron pipe shall be supplied by a single manufacturer and all ductile iron fittings shall be supplied by a single manufacturer. The fittings supplier shall certify in writing that their fittings are compatible with the supplied brand of pipe.
- B. Pipe is to be installed in those locations shown on the Drawings, and only where specifically indicated.
- C. Contractor is responsible for compatibility between joints of all items they supply.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe, pipe linings and pipe coatings. See AWWA C600 and the referenced AWWA Standards for Shipping, handling and storage procedures. All pipe and fittings shall be examined as noted in Division 1. Any damage to linings or coatings discovered during the examination shall be repaired to the satisfaction of the Engineer at the cost of the Contractor, before proceeding with the work.

- B. Pipe shall be transported to the job site on padded bunks or oak timbers and secured with steel banding or nylon tie down straps to adequately protect the pipe and coating. Slings, hooks, or pipe tongs or other devices acceptable to the Engineer shall be used in pipe handling. No uncushioned ropes, chairs, wedges, cables or levers shall be used in handling finished pipe, fittings or couplings. Under no circumstances shall the pipe or fittings be dropped or skidded against each other. Care shall be taken to preventing marring the pipe coating. Padded wooden pipe cradles, or chocks suitable for the protection of coatings shall be used between finished pipes and beneath them when pipes are placed upon rough surfaces. Pipe shall not be stored on bare ground unless soft sand berms are used to support the pipe and is approved by the Engineer.
- C. Materials, if stored, shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt, excessive corrosion or foreign matter at all times.
- D. Pipe shall not be stacked higher than the limits recommended by its manufacturer. The bottom tier shall be kept off the ground on timbers, rails, or concrete. Stacking shall conform to manufacturer's recommendations and/or AWWA C600.
- E. Gaskets for mechanical and push-on joints to be stored shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.
- F. Lined and/or coated pipe shall be suitably protected from exposure and heating of the sun at all times following procedures recommended by the coating/lining system manufacturer. Exposure will not be allowed (except for short periods such as installation, assembly and repairs).
- G. No metal tools or heavy objects shall be permitted to come in contact unnecessarily with the finished coating. Workers will be permitted to walk upon the coated pipe only when necessary, in which case they shall wear footwear with rubber or composition soles and heels that are sufficiently free of dirt and mud that coating remains undamaged.
- H. It shall be the responsibility of the Contractor to prevent damage to the linings and coatings that might be caused by handling and/or onsite storage of the finished pipe at low temperatures (due to embrittlement), high temperatures or direct sunlight.

1.08 WARRANTIES

- A. Provide warranties as required in Section 01740.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Ductile iron pipe shall conform to AWWA C151. Pipe shall be supplied in standard lengths as much as possible.

- B. Thickness design shall be per AWWA C150, except provide minimum Class 350 for piping 12-in and smaller, provide minimum Class 350 for piping from 14 to 20-in and provide minimum Class 250 for piping larger than 24-in. The pipe supplier shall perform thickness analysis as referenced in Paragraph 2.02. All ductile iron pipe supplied shall meet the minimum wall thickness and pressure class indicated on the drawings.

2.02 DUCTILE IRON PIPE DESIGN

- A. Ductile iron pipe shall have a minimum tensile strength of 60,000 psi with minimum yield strength of 42,000 psi (per AWWA M-41). Design shall be done for external and internal pressures separately using the larger of the two for the net design thickness. Additional allowances shall be made for service allowance and casting tolerance per AWWA C150. The pipe classes determined for various sizes and conditions shall provide the total calculated thickness at a minimum or conform to minimum pipe class specified in Paragraph 2.01A above, or as shown on the Drawings, whichever is greater.
- B. Design for the net thickness for external loading shall be taken as the greater of the following conditions:
 - 1. 2-1/2-ft of cover with AASHTO H-20 wheel loads, with an impact factor of 1.5.
 - 2. Depth from existing ground level of future proposed grade (whichever is greater) to top of pipe as shown on the Drawings, with truck load.
 - 3. Soil Density: 125 lbs/cu ft
 - 4. Laying Conditions; AWWA C150, Type 2.
- C. Design for the net thickness shall be based upon the following internal pressure conditions:
 - 1. Design pressure: 150 psi
 - 2. Surge allowance: 100 psi
 - 3. Safety factor: 2
 - 4. Total internal pressure design: $2 (150 + 100) = 500$ psi
 - 5. E': 300 psi
- D. Copies of design calculations showing that the pipe meets all of the requirements specified herein shall be furnished to the Engineer for approval during shop drawing review in accordance with Section 01300. A yield strength of 42,000 psi shall be used during design calculations.

2.03 END TREATMENTS/JOINTS

- A. Ductile iron pipe/fitting joints shall be push-on rubber gasket type per AWWA C111 in unrestrained areas, except where flanged joints are required as shown on the drawings. In restrained areas, both pipe and fitting joints shall be push on rubber gasket, locking ring type restrained joints per the manufacturer' standard described in Paragraph C except where flange joints are shown on the Drawings. All gasket materials shall comply with Table 5-1 of AWWA M-41. Rubber-gasket joints shall conform to AWWA C111. Gasket shall be of styrene butadiene rubber (SBR).
- B. Unless otherwise noted, all ductile iron pipe/fitting joints shall be push-on rubber gasket type per AWWA C111 in unrestrained areas.
- C. Restraint for push on joint pipe shall be positive locking "Locked-type" joints manufactured by the pipe and fitting manufacturer that utilize restraint independent of the joint gasket. All restrained joints shall be suitable for the specified 150 psig test pressure. Joints shall be fabricated of heavy section ductile iron casting. Bolts and nuts shall be low carbon steel conforming to ASTM A193, Grade B7. Restraint for mechanical joint pipe shall use retainer glands for restraining joint. Restrained push on joints shall be by one of the following or an approved equal:
- "TR Flex" by US Pipe and Foundary Company
 - "Lok-Ring," "Flex Ring (positive locking style)" by the American Cast Iron Pipe Company
 - "Snap Lok" by Griffin Pipe Products Company
 - "Superlok" by Clow Water Systems Company
1. All buried pipe shall be restrained joint.
 2. Restrained pipe joints that achieve restraint by incorporating cut out sections in the wall of the pipe shall have a minimum wall thickness at the point of the cut out that corresponds with the minimum specified wall thickness for the rest of the pipe.
 3. For up through 48-inch diameter ductile iron pipe only, the following may be used as an alternative restraint system
 - a. The optional mechanical joint restraint shall be incorporated in the design of a follower gland. The gland shall be manufactured of ductile iron conforming to ASTM A536. Dimensions of the gland shall be such that it can be used with the standard mechanical joint bell and tee-headed bolts, as specified with the pipe.
 - b. The restraint mechanism shall consist of numerous individually activated gripping surfaces to maximize restraint capability. The gripping surfaces shall be wedges designed to spread the bearing surfaces on the pipe. Actuation of the gripping wedges shall be by torque limiting twist-off nuts sized same as T bolts for mechanical joints. When the nut is sheared off, standard hex nut shall remain.

- c. The restraint device for ductile iron pipe shall have a working pressure of at least 250 psi and a safety factor of 2:1.
 - d. Pipe manufacturer proprietary mechanical joint restraint systems that utilize a wedge style gripping systems or a gland/ring positive restraint system will be considered acceptable on a case by case basis as determined by the ENGINEER.
 - e. The restraint device shall be EBAA Iron Megalug Series 1100, or approved equal.
- D. Threaded ductile iron flanges for ductile iron pipe shall be fabricated per AWWA C115 and sealed during installation with a special high pressure, full face gasket per AWWA C111. At the pipe manufacturer's option, the use of 250 lb pattern flanges, which are faced and drilled in accordance with ANSI B16.1 may be substituted in order to match valves or other equipment and/or to meet the required working pressure requirements. All flanges shall be rated for the same pressure as the adjacent pipe in all cases. Compatibility of the flanges with the 250 lb class and higher special class AWWA valves will be the responsibility of the Contractor.
1. Flanges shall be pre drilled and then faced after being screwed onto the pipe, with flanges true to 90 degrees of the pipe axis and shall be flush with the end of the pipe.
 2. Gaskets shall be full face rubber, 1/8" thick SBR material. Such as American Torseal Gasket, or approved equal.
 3. Flanged joints shall be supplied with bolts and nuts on one end, bolt studs with a nut at each end, or studs with nuts on one end where the flange is tapped. The number and size of bolts shall comply with the same standard as the flange. Bolts and nuts shall, except as otherwise specified or noted in the Specifications or on the Drawings, comply with ASTM A193, grade B7.
 4. Blind flanges shall mate with regular flanges.
 5. Filler flanges and beveled flange fillers shall be furnished faced and drilled complete with extra length bolts.
- E. Couplings and Adapters
1. Sleeve type couplings shall be Dresser Style 38, 138 or equal.
 - a. Buried sleeve-type couplings shall have a protective wrapping of "Denso" material by DENSO Inc. of Texas or equal. Where "Denso" material is used, the joint shall be packed up with "Densyl mastic" to give an even contour for wrapping with "Densopol" tape. A 1.5 mm thick coating of "Denso" paste shall be applied following by 100 mm or more wide "Densopol" tape wound spirally round the joint with at least 50 percent overlap.
 2. Split Sleeve type flexible couplings shall be Victaulic Depend-O-Lok Style E x E (unrestrained) or F x F (self-restrained) or equal.

3. Grooved flexible joints for ductile iron pipe sizes 36-in and smaller must be in accordance with AWWA C606 and shall be Victaulic Style 31 or equal.
4. Shouldered flexible joints for ductile iron pipe larger than 36-in shall be Victaulic Style 44 or equal.

2.04 FITTINGS

- A. Pipe fittings shall be ductile iron with pressure rating of 350 psi for 24-in and smaller piping and 250 psi for 30-in and larger piping. Fittings shall meet the requirements of AWWA C110 or AWWA C153 as applicable. Fittings shall have the same pressure rating, as a minimum, of the connecting pipe.
- B. Closures shall be made with mechanical joint ductile iron solid sleeves unless alternate approved coupling systems as described in paragraph 2.03E are used and shall be located in straight runs of pipe at minimum cover outside the limits of restrained joint sections. Location of closures shall be subject to approval of the Engineer.

2.05 INTERIOR LINING

- A. Ductile iron pipe and fittings shall have the same type of lining as specified herein.
- B. Ductile iron pipe and fittings for raw wastewater shall be lined with a ceramic-filled amine-cured epoxy, Protecto 401 by Induron. The lining thickness shall be 40 mils nominal with a minimum thickness of 35 mils. Application shall be performed by an applicator approved by the coating manufacturer, in accordance with manufacturer's instructions and under controlled conditions at the applicators shop or the pipe manufacturer's plant. Applicator shall submit a certified affidavit of compliance with manufacturer's instructions and requirements specified herein.

2.06 EXTERIOR COATING

- A. Buried pipe shall be installed with a bituminous coating in accordance with AWWA C151 and C110 respectively.

PART 3 - EXECUTION

3.01 GENERAL

- A. Care shall be taken in loading, transporting and unloading to prevent injury to the pipe, lining or coatings. Pipe and fittings shall not be dropped or skidded against each other. Slings, hooks or pipe tongs shall be used for pipe handling. All pipe and fittings shall be examined before laying and no piece shall be installed which is found to be defective. Any damage to the pipe, lining or coatings shall be repaired per manufacturer's recommendations. Handling and laying of pipe and fittings shall be in accordance with manufacturer's instruction and as specified herein.
- B. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner. All pipe and fittings shall be thoroughly cleaned before

laying, shall be kept clean until they are used in the work and when installed or laid, shall conform to the lines and grades required.

- C. Materials, if stored, shall be kept safe from damage. The interior of all pipe, fittings and other appurtenances shall be kept free from dirt, excessive corrosion or foreign matter at all times.
- D. Pipe shall not be stacked higher than the limits recommended by its manufacturer. The bottom tier shall be kept off the ground on timbers, rails, or concrete. Stacking shall conform to manufacturer's recommendations and/or AWWA C600.
- E. Gaskets for mechanical and push-on joints to be stored shall be placed in a cool location out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

3.02 INSTALLING DUCTILE IRON PIPE AND FITTINGS

- A. Ductile iron pipe and fittings shall be installed in accordance with requirements of AWWA C600, except as otherwise specified herein. A firm, even bearing throughout the length of the pipe shall be provided by digging bell holes at each joint and by tamping backfill materials at the side of the pipe to the springline per details shown on the Drawings. Blocking will not be permitted. If any defective pipe or fitting is discovered after it has been laid, it shall be removed and replaced with a sound pipe or fitting in a satisfactory manner by the Contractor, at his/her own expense.

All pipe and fittings shall be kept clean until they are used in the work and shall be sound and thoroughly cleaned before laying. When laid, the pipe and fittings shall perform to the lines and grades required. When laying is not in progress, including lunch breaks, open ends of the pipe shall be closed by a watertight plug or other approved means. Sufficient backfill shall be placed to prevent flotation. The deflection at joints shall not exceed that recommended by the manufacturer.

All ductile iron pipe laid underground shall have a minimum of 3 of feet of cover unless otherwise shown on the Drawings or as specified herein. Pipe shall be laid such that the invert elevations shown on the Drawings are not exceeded.

Fittings, in addition to those shown on the Drawings shall be provided, where required, in crossing utilities which may be encountered upon opening the trench. Solid sleeve closures shall be installed at locations approved by the Engineer.

The pipe interior shall be maintained dry and broom clean throughout the construction period.

When field cutting the pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. The end of the cut pipe shall be beveled to conform to the manufacture's recommendations for the spigot end. Any coating removed from the cut end shall be repaired according to manufacturer's recommendation and/or Section 2.06 (whichever method is more stringent in the opinion of the Engineer). Lining shall be undamaged. Cutting of restrained joint pipe will not be allowed, unless approved at specific joints in conjunction with the use of restrainer glands by EBAA Iron or field adaptable restrained joints. Where field cuts are permitted, the pipe to be cut shall be supplied by the factory as "gauged full length". Should full length gauged pipe be unavailable, the pipe to be cut shall be field gauged at the location of

the new spigot using a measuring tape, or other means approved by the manufacturer, to verify that the diameter is within the tolerances permitted in Table 1 of AWWA C151.

B. Jointing Ductile-Iron Pipe

1. Push-on joints shall be made in strict accordance with manufacturer's instructions, AWWA C600 and Appendix B of AWWA C111. If there is conflict, the manufacturer's instructions shall take precedence. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe. The joint surfaces shall be cleaned and lubricated and the plain end of the pipe shall be aligned with the bell of the pipe to which it is to be joined and pushed home. After joining the pipe, a metal feeler shall be used to make certain that the rubber gasket is properly seated.
2. Mechanical joints shall be assembled in strict accordance with the manufacturer's instructions, AWWA C600 and Appendix A of AWWA C111. If there is conflict, the manufacturer's instructions shall take precedence. Pipe shall be laid with bell ends looking ahead. To assemble the joints in the field, thoroughly clean and lubricate the joint surfaces and rubber gasket. Bolts shall be tightened to the specified torques. Under no condition shall extension wrenches or pipe over handle of ordinary ratchet wrench be used to secure greater leverage. After installation, apply a bitumastic coating to bolts and nuts and install polyethylene encasement as specified.
3. Bolts in mechanical or restrained joints shall be tightened alternately and evenly. Restraint for mechanical joint pipe shall use retainer glands for restraining joint. All restrained mechanical joints shall be suitable for the specified test pressure.
4. Restrained joints shall be installed according to pipe manufacturer's instructions.
5. Flanged joints shall be assembled in strict accordance with the manufacturer's instructions and Appendix C of AWWA C111. If there is conflict, the manufacturer's instructions shall take precedence. Extreme care shall be taken to ensure that there is no restraint on opposite ends of pipe or fitting, which would prevent uniform gasket compression, cause unnecessary stress, bending or torsional strains, or distortion of flanges or flanged fittings. Adjoining push on joints shall not be assembled until flanged joints have been tightened. Flange bolts shall be tightened uniformly to compress the gasket uniformly and obtain a seal. Flange bolts shall be left with approximately 1/2-inch projection beyond the face of the nut after tightening. After installation apply a bitumastic coating to the bolts and nuts as specified.
6. Sleeve couplings shall only be installed for closure or as shown on the Drawings. Couplings shall not be assembled until adjoining joints have been assembled. After installation, apply a heavy bitumastic coating to the bolts and nuts and install protective wrap recommended by the manufacturer or as required herein. Care shall be exercised to insure that the insulating properties of insulating and dielectric couplings are maintained.

- C. All blowoffs, outlets, valves, fittings and other appurtenances required shall be set and jointed as indicated on the Drawings in accordance with manufacturer's instructions.

3.03 CONNECTIONS TO STRUCTURES

- A. Wherever a pipe 3-in in diameter or larger passes from concrete to earth horizontally, two flexible joints spaced from 2 to 4-ft apart depending on pipe size shall be installed, within 2-ft of the exterior face of the wall, whether or not shown on the Drawings.
- B. Unless otherwise specified, all pipes passing through a wall will utilize a wall sleeve designed to pass the thrust through the wall via restrained piping.
- C. Piping underneath structures shall be concrete encased.

3.04 FILLING AND TESTING

- A. After installation, the pipe shall be tested for compliance as specified herein. Furnish all necessary equipment and labor for the hydrostatic pressure test on the pipelines.
- B. Submit detailed test procedures and method for Engineer's review. In general, testing shall be conducted in accordance with AWWA C600. The method and procedures for performing the hydrostatic pressure test shall be approved by the Engineer. Submit the plan for testing to the Engineer at least 10 days before starting a test.
- C. Pressure pipelines shall be subjected to a hydrostatic pressure of 1.25 times the working pressure at the highest point along the test segment. This test pressure shall be maintained for a minimum of 2 hours. The hydrostatic testing allowances shall not exceed those indicated in AWWA C600. Provide suitable restrained bulkheads as required to complete the hydrostatic testing specified.
- D. Contractor shall make any taps and furnish all necessary caps, plugs etc, as may be required in conjunction with performing the testing.
- E. Gravity pipelines shall be subjected to hydrostatic pressure test as specified in AWWA C600.
- F. All valves and valve boxes shall be properly located and installed and operable prior to testing. Bulkheads shall be provided with a sufficient number of outlets for filling and draining the line and for venting air.
- G. Hydrostatic pressure tests shall conform to Section 5.2 of AWWA C600. Furnish gauges, meters, pressure pumps and other equipment needed to fill the line slowly and perform the required hydrostatic pressure tests.
- H. The Owner will provide a source of supply from the existing treated water distribution system for 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 makeup water required to maintain this pressure.
- I. Duration of pressure test shall not be less than 2 hours. All leaks evident at the surface shall be repaired and leakage eliminated regardless of the total leakage as shown by test. Lines which fail

to meet tests shall be repaired and retested as necessary until test requirements are complied with. Defective materials, pipes, valves and accessories shall be removed and replaced.

3.06 CLEANING

- A. At the conclusion of the work, thoroughly clean all of the pipe by flushing with water or other means to remove all dirt, stones, pieces of wood, or other material which may have entered during the construction period. All debris shall be removed from the pipeline. The lowest segment outlet shall be flushed last to assure debris removal.
- B. After the pipe has been cleaned and if the groundwater level is above the pipe or water in the pipe trench is above the pipe following a heavy rain, the Engineer will examine the pipe for leaks. If defective pipes, fittings or joints are discovered at this time, they shall be repaired or replaced by the Contractor.

END OF SECTION

SECTION 02622

POLYVINYL CHLORIDE (PVC) PRESSURE PIPE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install and test polyvinyl chloride (PVC) pipe and fittings, complete as shown on the Drawings and as specified herein.
- B. Pipe or piping refers to all pipe, fittings, material and appurtenances required to construct PVC pipe complete, in place.

1.02 RELATED WORK

- A. Pipeline testing is included in Sections 01445.
- B. Trenching, backfilling and compacting is included in Section 02221.
- C. Fill materials, including granular bedding materials, are included in Section 02230.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, and within 30 days of the effective date of the Contract, the name of the pipe and fitting manufacturers and a list of materials to be furnished by each manufacturer. Also, include information on local representative for each manufacturer, if product is sold through a distributor.
- B. Shop Drawings including piping layouts and schedules shall include dimensioning, fittings, types and locations of valves and appurtenances, joint details, methods and location of supports, anchorage, gasket material, grade of material and all other pertinent technical information for all items to be furnished.
- C. Prior to each shipment of pipe, certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM and AWWA Standards specified herein shall be submitted.

1.04 REFERENCE STANDARDS

- 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 and 80.

3. ASTM D2241 – Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).
 4. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 5. ASTM D2467 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 80.
 6. ASTM D2564 – Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems.
 7. ASTM D2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 8. ASTM F438 – Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
 9. ASTM D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals.
 10. ASTM F477 - Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
- B. American Water Works Association (AWWA)
1. AWWA C110 - Ductile-Iron and Gray-Iron Fittings, 3-in Through 48-in (75mm Through 1219mm) for Water.
 2. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings.
 3. AWWA C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances.
 4. AWWA C-605 – Underground Installation of Polyvinyl Chloride (PVC) Pressure Pipe and Fittings for Water.
 5. AWWA C651 - Disinfecting Water Mains.
 6. AWWA C900 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4-in through 12-in for Water Distribution.
 7. AWWA C905 - Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings 14-in through 48-in for Water Transmission and Distribution.
 8. AWWA M-23 – Manual of Water Supply Practices PVC Pipe, Design and Installation.
- C. National Sanitation Foundation (NSF)
1. Standard No. 14 - Plastic Piping Components and Related Materials.

2. Standard No. 61 – Drinking Water System Components - Health Effects.

- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. PVC pipe supplier shall be responsible for the provisions of all test requirements specified in ASTM D3034 and NSF Standard No. 14 as applicable. In addition, all PVC pipe to be installed under this Contract may be inspected at the plant for compliance with this Section by an independent testing laboratory provided by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of plant inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe, will be borne by the Owner. Final payment will be reduced by excessive costs of plant inspection of pipe, Contractor shall have no claim thereto. Excessive inspection costs are defined as the costs of inspection of that amount of pipe which exceeds 125 percent of the aggregate length of each type installed.
- B. Inspections of the pipe may also be made by the Engineer or other representatives of the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though sample pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

1.06 SYSTEM DESCRIPTION

- A. The equipment and materials specified herein are intended to be of standard types for use in transporting potable water, reclaimed water, and sewage.
- B. Note information in pipe schedule on Drawings, if any and in this Section, especially concerning pressures, minimum thickness, etc. In case of a conflict, information given in the pipe schedule shall govern.
- C. Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.
- D. Unless otherwise noted, PVC pipe systems shall be designed for the following condition(s).
1. System: Potable Water
 - a. Class: 150
 - b. Operating pressure: 60 psi
 - c. Temperature Range: 50F-110F
 2. System: Reclaimed Water
 - a. Class: 150

- b. Operating pressure: 80 psi
- c. Temperature Range: 50F-110F
- 3. System: Sanitary Sewer
 - a. Class: 100
 - b. Operating pressure: 50 psi
 - c. Temperature Range: 50F-110F

1.07 DELIVERY, STORAGE AND HANDLING

- A. All items shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Engineer.
- B. PVC items deteriorate in sunlight and are slightly brittle, especially at lower temperatures, so care shall be taken in loading, transporting and unloading items to prevent injury to the items. All items shall be examined before installation and no piece shall be installed which is found to be defective. Handling and installation of pipe and fittings shall be in accordance with the manufacturer's instructions, referenced standards and as specified herein.
- C. Any pipe or fitting showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
- D. Any gouges or scratches that extend 10 percent or more into the pipe wall shall be cause for rejection of that pipe. The undamaged portion may cut off and used. Rejected materials shall be clearly marked as rejected, segregated and removed from the site.
- E. While stored, pipe shall be adequately supported from below at not more than 3-ft intervals to prevent deformation. The pipe shall be stored in stacks no higher than that given in the following table:

<u>Pipe Diameter (inches)</u>	<u>Max. No. of Rows Stacked</u>
8 or less	5
12 to 21	4
24 to 30	3
33 to 48	2

- F. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of the sunlight or delivered to the site so that no pipe is exposed to sunlight for more than 60 days. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup or direct or indirect sunlight will not be permitted.

- G. If any defective item is discovered after it has been installed, it shall be removed and replaced with an exact replacement item in a satisfactory manner by the Contractor, at the Contractor's own expense. All pipe and fittings shall be thoroughly cleaned before installation and the interior shall be kept clean until testing
- H. In handling the items, use special devices and methods as required to achieve the results specified herein. No uncushioned devices shall be used in handling the item.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. PVC pressure pipe sized 4 through 12-in shall conform to the requirements of AWWA C900. All piping shall be Class 150 with a Dimension Ratio of 18. The pipe shall be PVC 1120 made from PVC compounds Class 12454-A or 12454-B as defined in ASTM D1784. Each pipe length shall be marked with the manufacturer's name or trademark, size, material code, pressure class, AWWA designation number and seal of test agency that verified pipe material for potable-water service.
- B. PVC pressure pipe sizes 14 through 48-in shall conform to the requirements of AWWA C905. The pipe shall be made from PVC compounds Class 12454-A or 12454-B as defined in ASTM D1784. Each pipe length shall be marked with the manufacturer's name or trademark, size, material code, and pressure class.
- C. PVC pipe and fittings shall have bell and spigot push-on joints. The bell shall consist of an integral wall section with a solid cross-section elastomeric gasket securely locked in place to prevent displacement during assembly. Installation of elastomeric gasketed joints and performance of the joint shall conform to ASTM F477, ASTM D3139. Joint lubricants shall be as recommended by the manufacturer and meet all requirements of NSF61 for potable water pipes.
- D. All fittings and accessories for waterlines and sewers shall have bell and/or spigot configurations compatible with the pipe.
- E. PVC fittings shall meet the requirements of AWWA C900 for piping less than 12-inches and C905 for piping larger than 12 inches and be of the same (or higher) pressure rating as the pipeline.
- F. Force mains shall be green in color. Water lines shall be blue in color. Reclaimed water shall be purple in color.
- G. Where restrained joints are shown on the Drawings restraining glands shall be installed. Restraining glands for PVC pipe shall conform to AWWA C111 and be Megalug Series 200 PV by EBAA Iron Sales Inc or equal.
- H. PVC piping exposed to sunlight (ultraviolet light) after installation shall be painted with a latex paint.

- I. All PVC pipe and fittings shall be installed using IPS Weld-On 724 cement and P-70 primer only.

PART 3 - EXECUTION

3.01 INSTALLATION OF PVC PIPE AND FITTINGS

- A. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-in per foot of length. If a piece of pipe fails to meet this requirement, check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.
- B. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required. PVC pipe and fittings shall be installed in accordance with requirements of the manufacturer, AWWA C605 or as otherwise provided herein.
- C. As soon as the excavation is complete to normal grade of the bottom of the trench, bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Drawings. Blocking under the pipe will not be permitted. Bedding shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Bedding shall then be placed to 12-in above the top of the pipe. The initial 3-ft of backfill above the bedding shall be placed in 1-ft layers and carefully compacted. Generally the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the initial 3-ft of backfill shall be approved by the pipe manufacturer's representative prior to use.
- D. All piping shall be sound and clean before installation. When installation is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved during installation. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the Drawings, shall be provided, if required, in crossing utilities that may be encountered upon opening the trench.
- E. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a bell shall be beveled to conform to the manufactured spigot end and a reference mark made at the same distance from the pipe end as measured from a factory marked end from the same manufacturer.
- F. The Engineer, or Owner's representative may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected, marked as such and immediately removed from the job site.

- G. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be "pulled" or "cramped".
- H. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.
- I. Precautions shall be taken to prevent flotation of the pipe in the trench.
- J. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be recompact to provide uniform side support for the pipe.

3.02 JOINTING PVC PIPE (Push-on type)

- A. Joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe and the joint surfaces cleaned and an approved lubricant applied in accordance with the manufacturer's recommendations. The plain end of the pipe to be installed shall then be inserted into the bell of the pipe to which it is to be joined and when in alignment pushed home with a come-along or by other means. Check that the reference mark on the spigot end is flush with the end of the bell.

3.03 JOINTING MECHANICAL JOINT FITTINGS

- A. For potable and reclaimed water service, mechanical joints at valves, fittings and where designated shall be in accordance with the AWWA C111 and the instructions of the manufacturer. For sewer service, PVC sewer pipe and fittings shall be jointed in accordance with the recommendations of the latest ASTM Standards and detailed instructions of the manufacturer. Suitable PVC to cast iron adaptors shall be installed prior to installing fittings. PVC beveled spigot shall be cut flush prior to insertion in mechanical joint pipe. To assemble the joints in the field, thoroughly clean the joint surfaces and rubber gasket with soapy water before tightening the bolts. Bolts shall be tight to the specified torques. Under no condition shall extension wrenches or pipe over handle of ordinary ratchet wrench be used to secure greater leverage.

3.04 FILLING AND TESTING

- A. Testing is located in Sections 01445.

3.05 FLUSHING AND CHLORINATION OF PIPELINES

- A. Before being placed in service and prior to hydrostatic testing, all new water pipelines shall be chlorinated in accordance with AWWA C651. The procedure shall be approved by the Engineer in advance.
- B. The location of the chlorination and sampling points will be determined by the Engineer, Owner's representative in the field. Taps for chlorination and sampling shall be installed by the Contractor. Uncover and backfill the taps as required.
- C. The general procedure for chlorination shall be first to flush all dirty or discolored water from the pipeline. The flushing velocity shall be a minimum of 3 ft/sec and continue until at least three changes of water have passed through the segment being flushed. Flushing operations shall be conducted without causing erosion, damage, nuisance or interruption of traffic and comply with all regulatory requirements. Then introduce chlorine in approved dosages through a tap at one end, while water is being withdrawn at the other end of the line. The concentration and residence time of the chlorine solution in the pipeline will depend on the type of disinfection method used, as described in AWWA 651.
- D. Following the chlorination period, all treated water shall be flushed from the lines at their extremities and replaced with water from the distribution system. All treated water flushed from the lines shall be disposed by discharging to the nearest sanitary sewer or other approved means. No discharge to any storm sewer or natural water courses will be allowed. Bacteriological sampling and analysis of the replacement water may then be made by the Engineer in full accordance with AWWA C651. Rechlorination will be required, if necessary and the line shall not be placed in service until the requirements of the Orange County Public Health Department are met.
- E. Special disinfecting procedures shall be used in connections to existing mains and where the method outlined above is not practical.

END OF SECTION

SECTION 02623

POLYVINYL CHLORIDE (PVC) GRAVITY PIPE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required to install and test polyvinyl chloride (PVC) sewer pipe and fittings, complete as shown on the Drawings and as specified herein.
- B. Pipe or piping refers to all pipe, fittings, material and appurtenances required to construct PVC sewer pipe complete, in place.

1.02 RELATED WORK

- A. Pipeline Testing and Cleaning is included in Sections 01445.
- B. Trenching, Backfilling and Compacting is included in Section 02221.
- C. Granular bedding materials are included in Sections 02230.

1.03 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300, the name of the pipe and fitting manufacturers and a list of materials to be furnished by each manufacturer.
- B. Shop Drawings including piping layouts and schedules shall include dimensioning, fittings, types and locations of valves and appurtenances, joint details, methods and location of supports, anchorage, gasket material, grade of material and all other pertinent technical information for all items to be furnished.
- C. Prior to each shipment of pipe, certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM Standards specified herein shall be submitted.

1.04 REFERENCE STANDARDS

- 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 D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

3. ASTM D3034 – Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings.
 4. ASTM D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
 5. ASTM F477 – Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe.
 6. ASTM F1760 – Standard Specification for Co-extruded Poly (Vinyl Chloride) (PVC) Non-Pressure Plastic Pipe Having Reprocessed-Recycled Content.
 7. ASTM F679 - Standard Specification for Poly (Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings.
- B. National Sanitation Foundation (NSF)
1. Standard No. 14 – Plastic Piping Components and Related Materials.
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. All PVC sewer pipe and fittings of a similar type (e.g. solid wall or profile wall) shall be from a single manufacturer. The supplier shall be responsible for the provisions of all test requirements specified in ASTM D3034, ASTM F1760 or ASTM F789 as applicable. In addition, all PVC pipe to be installed under this Contract may be inspected at the plant for compliance with this Section by an independent testing laboratory provided by the Owner. The Contractor shall require the manufacturer's cooperation in these inspections. The cost of plant inspection of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe, will be borne by the Owner. Final payment will be reduced by excessive costs of plant inspection of pipe, Contractor shall have no claim thereto. Excessive inspection costs are defined as the costs of inspection of that amount of pipe which exceeds 125 percent of the aggregate length of each type installed.
- B. Inspections of the pipe may also be made by the Engineer or other representatives of the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though sample pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall be removed from the job at once.

1.06 SYSTEM DESCRIPTION

- A. The equipment and materials specified herein are intended to be of standard types for use in transporting sanitary sewage and for use as drain pipe.

- B. Note information in pipe schedule on Drawings, if any and in this Section, especially concerning pressures, minimum thickness, etc. In case of a conflict, information given in the pipe schedule shall govern.
- C. Contractor is responsible for compatibility between pipe materials, fittings and appurtenances.

1.07 DELIVERY, STORAGE AND HANDLING

- A. All items shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Any pipe damaged in shipment shall be replaced as directed by the Engineer.
- B. PVC items deteriorate in sunlight and are slightly brittle, especially at lower temperatures, so care shall be taken in loading, transporting and unloading items to prevent injury to the items. All items shall be examined before installation and no piece shall be installed which is found to be defective. Handling and installation of pipe and fittings shall be in accordance with the manufacturer's instructions, referenced standards and as specified herein.
- C. Any pipe or fitting showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.
- D. While stored, pipe shall be adequately supported from below at not more than 3-ft intervals to prevent deformation. The pipe shall be stored in stacks no higher than that given in the following table:

<u>Pipe Diameter (inches)</u>	<u>Max. No. of Rows Stacked</u>
8 or less	5
12 to 21	4
24 to 30	3

- E. Pipe and fittings shall be stored in a manner which will keep them at ambient outdoor temperatures and out of the sunlight or delivered to the site so that no pipe is exposed to sunlight for more than 60 days. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings which allows temperature buildup or direct or indirect sunlight will not be permitted.
- F. If any defective item is discovered after it has been installed, it shall be removed and replaced with an exact replacement item in a satisfactory manner by the Contractor, at the Contractor's own expense. All pipe and fittings shall be thoroughly cleaned before installation and the interior shall be kept clean until testing.
- G. In handling the items, use special devices and methods as required to achieve the results specified herein. No uncushioned devices shall be used in handling the item.

PART 2 - PRODUCTS

2.01 POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS

- A. PVC solid wall gravity pipe and fittings shall be Type PSM, PVC SDR 26 with full diameter dimensions and shall conform to ASTM D3034 or ASTM F1760, for sizes 4 through 15-in and shall conform to ASTM F679 for sizes 18 through 27-in. Straight pipe shall be furnished in lengths according to ASTM D3034 and wyes shall be furnished in lengths of not more than 3-ft. Saddle wyes will not be allowed.
- B. PVC ribbed wall gravity pipe and fittings shall be Type PS-46 PVC conforming to ASTM F794. The pipe shall be manufactured from PVC having cell classification of 12454-C or 12364-C. Straight pipe shall be furnished in lengths according to ASTM D3034. Saddle wyes will not be allowed.
- C. PVC pipe and fittings shall have bell and spigot push-on joints. The bell shall consist of an integral wall section with a solid cross-section elastomeric gasket securely locked in place to prevent displacement during assembly. Installation of elastomeric gasketed joints and performance of the joint shall conform to ASTM F477, ASTM D3139 or ASTM D3212.
- D. All fittings and accessories for sewers shall have bell and/or spigot configurations compatible with the pipe.
- E. Sewer lines shall be green in color.
- F. PVC piping exposed to sunlight (ultraviolet light) after installation shall be painted with a latex paint.
- G. All PVC pipe and fittings shall be installed using IPS Weld-On 724 cement and P-70 primer only.

PART 3 - EXECUTION

3.01 INSTALLATION OF PVC PIPE AND FITTINGS

- A. No single piece of pipe shall be laid unless it is straight. The centerline of the pipe shall not deviate from a straight line drawn between the centers of the openings at the ends of the pipe by more than 1/16-in per foot of length. If a piece of pipe fails to meet this requirement check for straightness, it shall be rejected and removed from the site. Laying instructions of the manufacturer shall be explicitly followed.
- B. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required. PVC pipe and fittings shall be installed in accordance with requirements of the manufacturer, ASTM D2321 or as otherwise provided herein.

- C. As soon as the excavation is complete to normal grade of the bottom of the trench, bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. Bell holes shall be excavated so that only the barrel of the pipe bears upon the bedding. The pipe shall be laid accurately to the lines and grades indicated on the Drawings. Blocking under the pipe will not be permitted. Bedding shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the bedding under the haunches of the pipe and into the bell holes to give firm continuous support for the pipe. Bedding shall then be placed to 12-in above the top of the pipe. The initial 3-ft of backfill above the bedding shall be placed in 1-ft layers and carefully compacted. Generally the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compacting the initial 3-ft of backfill shall be approved by the pipe manufacturer's representative prior to use.
- D. All piping shall be sound and clean before installation. When installation is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plug or other approved means. Good alignment shall be preserved during installation. The deflection at joints shall not exceed that recommended by manufacturer. Fittings, in addition to those shown on the Drawings, shall be provided, if required, in crossing utilities which may be encountered upon opening the trench.
- E. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe. Cut ends of pipe to be used with a bell shall be beveled to conform to the manufactured spigot end.
- F. The Engineer may examine each bell and spigot end to determine whether any preformed joint has been damaged prior to installation. Any pipe having defective joint surfaces shall be rejected, marked as such and immediately removed from the job site.
- G. Each length of the pipe shall have the assembly mark aligned with the pipe previously laid and held securely until enough backfill has been placed to hold the pipe in place. Joints shall not be "pulled" or "cramped".
- H. Before any joint is made, the pipe shall be checked to assure that a close joint with the next adjoining pipe has been maintained and that the inverts are matched and conform to the required grade. The pipe shall not be driven down to grade by striking it.
- I. Precautions shall be taken to prevent flotation of the pipe in the trench.
- J. When moveable trench bracing such as trench boxes, moveable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken in placing and moving the boxes or supporting bracing to prevent movement of the pipe, or disturbance of the pipe bedding and the backfill. Trench boxes, moveable sheeting, shoring or plates shall not be allowed to extend below top of the pipe. As trench boxes, moveable sheeting, shoring or plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be recompacted to provide uniform side support for the pipe.

3.02 JOINTING PVC PIPE (Push-on type)

- A. Joints shall be made in strict accordance with the manufacturer's instructions. Pipe shall be laid with bell ends looking ahead. A rubber gasket shall be inserted in the groove of the bell end of the pipe and the joint surfaces cleaned and lubricated. The plain end of the pipe to be entered shall then be inserted in alignment with the bell of the pipe to which it is to be joined and pushed home with a come-along or by other means. Check that the reference mark on the spigot end is flush with the end of the bell.

3.03 JOINTING POLYVINYL CHLORIDE (PVC) SEWER PIPE AND FITTINGS

- A. PVC sewer pipe and fittings shall be jointed in accordance with the recommendations of the latest ASTM Standards and detailed instructions of the manufacturer. The pipe manufacturer shall furnish information and supervise the installation of at least the first five joints. The pipe manufacturer shall be available on site for 5 days to supervise and inspect installation.
- B. All manhole connections shall be as shown on the Drawings except that concrete and mortared connections shall be equipped with an integral O-ring or other sealant such that a positive watertight seal is established.

3.04 TESTING (GRAVITY PIPELINES)

- A. Leakage testing is specified in Sections 01445.
- B. Allowable Deflection Test
 - 1. Pipe deflection measured not less than 90 days after the backfill has been completed as specified shall not exceed 5 percent. Deflection shall be computed by multiplying the amount of deflection (nominal diameter less minimum diameter when measured) by 100 and dividing by the nominal diameter of the pipe.
 - 2. Deflection shall be measured with a rigid mandrel (Go/No Go) device cylindrical in shape and constructed with a minimum of nine evenly spaced arms or prongs. Drawings of the mandrel with complete dimensions shall be submitted to the Engineer for each diameter of pipe to be tested. The mandrel shall be hand pulled through all sewer lines.
 - 3. Any section of sewer not passing the mandrel shall be uncovered at no additional cost to the Owner and the bedding and backfill replaced to prevent excessive deflection. Repaired pipe shall be retested at no additional cost to the Owner. Retested pipe shall not deflect more than 4 percent.

END OF SECTION

SECTION 02624

HIGH DENSITY POLYETHYLENE GRAVITY PIPE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install high density polyethylene (HDPE) pipe complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Pipeline testing and cleaning are included in Section 01445.
- B. Dewatering and drainage are included in Section 02140.
- C. Trenching, backfilling and compaction are included in Section 02221.
- D. Granular materials are included in Section 02230.
- E. Precast Concrete Manholes and Structures are included in Section 02605.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, completely detailed working drawings and schedules of all high density polyethylene (HDPE) pipe and fittings required.
- B. Submit a sample of the pipe wall section for use in determining the acceptability of the pipe finish and pipe structure.
- C. Submit a sample of the gasket and a sample of a spliced gasket, if applicable.
- D. Submit a drawing of the mandrel with complete dimensions for each pipe size.
- E. Prior to each shipment of pipe, submit certified test reports that the pipe for this Contract was manufactured and tested in accordance with the ASTM Standards specified herein.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes.
 - 2. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

3. ASTM D1557 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Methods (56,000 ft-lbf/ft³ (2,700 kN-m/m³))
4. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Application.
5. ASTM D3212 – Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals.
6. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
7. ASTM F477 – Standard Specification (Gaskets) for Joining Plastic Pipe.
8. ASTM F894 – Standard Specification for Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe.

B. AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI)

1. ANSI B16.1 – Cast Iron Pipe Flanges and Flanged Fittings Classes 25, 125 and 250.

- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. All high density polyethylene (HDPE) pipe and fittings shall be from a single manufacturer. All HDPE pipe to be installed under this Contract may be inspected at the factory for compliance with this Section by an independent testing laboratory provided by the Owner. The manufacturer's cooperation shall be required in these inspections. The cost of these plant inspections of all pipe approved for this Contract, plus the cost of inspection of a reasonable amount of disapproved pipe, will be borne by the Owner.
- B. Inspection of the pipe may also be made by the Engineer or other representatives of the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the requirements specified herein, even though pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job.

1.06 WARRANTY

- A. The pipe manufacturer shall provide a warranty against manufacturing defects of material and workmanship for a period of ten years after the final acceptance of the project by the Owner. The manufacturer shall replace, at no additional cost to the Owner, any defective pipe material within the warranty period.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. The pipe and fittings shall be free from all defects including indentations, delaminations, cracks, bubbles, and pinholes which, due to their nature, degree, or extent, detrimentally affect the strength and serviceability of the pipe. Any pipe or fittings with such defects which, in the judgment of the Engineer, will affect the strength and serviceability shall be repaired or rejected.
2. HDPE pipe shall be corrosion-resistant to sewer gas and will not support bacteriological growth. HDPE pipe is a flexible conduit and shall be designed to transfer imposed loads to the surrounding embedment medium. Pipe shall be applicable for conveying raw wastewater which has been determined by the pipe manufacturer to be suitable for this particular design.

B. Pipe

1. The HDPE pipe and fittings shall be manufactured in accordance with ASTM F894 and shall have a minimum ring stiffness class RSC of 160. The pipe shall be manufactured by the continuous winding of a special profile onto suitably sized mandrels.
2. Pipe and Fittings: The pipe shall be made of high density, high molecular weight polyethylene pipe material meeting the requirements of cell classification 334433C (or E) or higher cell classification as defined in ASTM D3350.
3. Joining system: The joining system shall be bell and spigot using a gasket. The joint shall be designed in accordance with ASTM D3212. The pipe ends shall consist of integrally formed bell and spigot, one of which is designed to accommodate a gasket. When assembled, the joint forms a watertight seal by the radial compression of the gasket. The use of externally supplied couplings in combination with a gasket shall not be allowed unless specifically approved by the Engineer.
4. Flanged connections shall be drilled to meet ANSI B16.1, 125 lbs. Gaskets shall be full faced, 3/8-in thick rubber, of Shore 60 durometer value.
5. Mechanical couplings (Dresser Industries, Style 38 or equal) may be used as a field joining technique. Pipe ends to be joined shall be prepared by the pipe manufacturer for the type and exact diameter of coupling to be used.
6. Bolts, nuts and washers shall be Type 316 stainless steel conforming to ASTM A276 and ASTM A307. Bolt torque shall be as recommended by the manufacturer.

7. Gaskets: Rubber gaskets shall comply in all respects with the physical requirements specified in the low-head application requirements of ASTM F477. They shall be molded or produced from an extruded shape approved by the manufacturer and spliced into circular form. Where gaskets require a splice, the manufacturer shall submit a sample of the gasket with splice for approval of the Engineer. The approval of the splice will be based on the ability of the gasket to compress in the area of the splice.
8. Lubricant: The lubricant used for assembly shall have no detrimental effect on the gasket or on the pipe.
9. The pipes shall have the nominal dimensions shown on the Drawings, and shall conform to the dimension requirements of the DIPS Sizing System (ASTM F714-12). Pipe shall meet the requirements of Dimension Ratio (DR) 17.
10. HDPE pipe shall be supplied by JM Eagle Manufacturing Co., Performance Pipe a Division of Chevron Phillips Chemical Company, or PolyPipe, Inc.

PART 3 - EXECUTION

3.01 LAYING PIPE

- A. All pipes shall be installed in accordance with Practice D 2321, the pipe manufacturer's instructions and this specification.
- B. Care shall be taken in loading, transporting, and unloading to prevent injury to the pipe. Pipe shall not be dropped. All pipe shall be examined before laying and no piece shall be installed which is found to be defective. Any pipe found to be defective shall be marked and removed from the site immediately. If any defective pipe is discovered after it has been laid, it shall be removed and replaced with a sound pipe in a satisfactory manner, at the Contractor's own expense.
- C. All pipes shall be sound and clean before installing. When laying of the pipe is not in progress, including lunchtime, the open ends of the pipe shall be closed by watertight plugs or other approved means. Good alignment shall be preserved in laying. The deflection at joints shall not exceed one-half of that recommended by manufacturer.
- D. Pipes shall not be laid in standing or running water. All trenches shall be properly dewatered and provisions shall be included to prevent surface and water from other sources from entering the trench.
- E. As soon as the excavation is completed to the normal grade of the bottom of the trench, the Engineer shall inspect the bottom of the excavation. In all cases, the bottom of the trench shall be firm and stable and shall provide uniform support for the pipe. The trench bottom shall be smooth, dry and free of all sloughed material and hard spots. Immediately after acceptance by the Engineer, screened gravel bedding shall be placed and thoroughly compacted to conform to the line and grade of the pipe as indicated on the Drawings. Compaction shall be by the use of hand tampers, hand-held power tampers or hand held vibrating compaction equipment. The use of water shall be restricted to the amount necessary to achieve optimum moisture content for compaction. Flooding, water jetting and/or water tamping is not permitted.

- F. For the purposes of this specification section, thorough compaction shall be defined as minimum 92 percent of maximum density as determined by ASTM D1557, Method D. The Contractor shall provide field density tests periodically at the direction of the Engineer to ensure compliance with this requirement.
- G. Before the pipe is lowered into the trench, the spigot and bell shall be cleaned and free from dirt. Gasket and bell shall be lubricated furnished by the pipe manufacturer. The pipe shall be properly aligned in the trench to avoid any possibility of contact with the side of the trench and fouling the gasket. If the pipe has deformed under its own weight during storage or transportation, place the pipe with the maximum height in the vertical position. As soon as the spigot is centered in the bell of the previously laid pipe, it shall be engaged by approved methods.
- H. For pipes greater than or equal to 27-inch in diameter, wood or plastic struts shall be used to ensure that the pipe does not deflect during joining and initial backfill operations. The struts shall be removed prior to placing any backfill above the pipe's mid-diameter.
- I. After the gasket is compressed, but before the pipe is brought home, each gasket shall be checked for proper position, and to stress-relieve the gasket, slip a feeler gauge or other smooth object around the full circumference of the joint. Re-seat the gasket if required.
- J. As soon as the pipe is in place and the gasket checked, backfill shall be placed evenly on each side of the pipe to the haunch of the pipe. Backfill shall be placed in 4-in to 6-in lifts and shall be hand tamped using approved methods to compact the material to provide firm continuous support for the pipe. After the bedding material has been fully compacted to the haunch, backfill material shall than be placed to mid-diameter of the pipe in lifts not exceeding 6-in. Each lift shall be compacted evenly on both sides of the pipe before the next lift is added. The use of hand tampers or hand-held power tampers weighing less than twenty pounds may be used in the initial backfilling compaction efforts provided the compaction is parallel to the pipe.
- K. After backfill material has been placed and thoroughly compacted on both sides of the pipe to mid-diameter and the alignment to checked to ensure that the pipe did not move during backfilling, backfill shall be placed to one-foot over the top of the pipe. The backfill shall be placed in lifts not to exceed 9-inches and thoroughly compacted. Each lift shall be compacted evenly on both sides of the pipe before the next lift is added. The use of hand tampers or hand-held power tampers weighing less than twenty pounds may be used in the initial backfilling compaction efforts provided the compaction is parallel to the pipe and not directly above any portion of the pipe. The use of any static and or vibrating mechanical compactors shall not be used until there is a minimum of 12-in of compacted backfill material above the pipe, and then, only with the approval of the Engineer. Backfilling and compaction of the remainder of the trench shall be as specified in Section 02221.
- L. The use of water jetting or the use of water under pressure for compaction shall not be used.
- M. Regulate the equipment and construction operations such that the loading of the pipe does not exceed the loads for which the pipe is designed and manufactured. Any pipe damaged during construction operations shall promptly and satisfactorily be repaired or replaced at the Contractor's expense.

- N. Precautions shall be taken to prevent flotation of the pipe in the trench.
- O. When moveable trench bracing such as trench boxes, movable sheeting, shoring or plates are used to support the sides of the trench, care shall be taken to prevent movement of the pipe or disturbance of the bedding and backfill material during the movement of the moveable trench bracing equipment. Trench boxes, moveable sheeting, shoring and plates shall not extend below the top of the pipe. As trench boxes, moveable sheeting, shoring and plates are moved, pipe bedding shall be placed to fill any voids created and the backfill shall be re-compacted to provide uniform side support for the pipe. Any moveable trench bracing, sheeting, shoring or plates placed below the top of the pipe shall be left in place and cut off at an elevation to be determined by the Engineer. The cost of any moveable trench bracing, sheeting, shoring or plates left in place, plus the cost of cutting-off material, shall be solely at the contractor's expense.

3.02 MANHOLE AND CATCH BASIN CONNECTIONS

- A. Connections shall be made as detailed on the Drawings and as recommended by the manufacturer.
- B. Connections can be made in the following manner.
 - 1. The use of a flexible neoprene sleeve or boot. This method shall be permitted on smooth exterior pipe only.
 - 2. The use of an integrally placed gasket within the opening to the manhole such as A-Lok or equivalent. This method shall be permitted on smooth exterior pipe only and shall require the use of a flexible rope gasket/ sealant material to fill any annular space between the A-Lok and the concrete encasement.
 - 3. Concrete encasement as detailed.
- C. The connection pipe to the manhole and/or catch basin shall have a foundation as detailed on the Drawings. This foundation shall be screened gravel, placed and compacted in 6-inch lifts from the bottom of the trench under the manhole and/or catch basin structure to the pipe bedding of the connection pipe. This foundation shall extend the width of the trench and a minimum length of five pipe diameters, or 6-feet, whichever is more.
- D. Whenever concrete is being poured around an HDPE pipe, wood or plastic struts shall be used to protect the pipe against deformation.

3.03 VERTICAL PIPE DEFLECTION

- A. Vertical pipe deflections shall be checked as soon as practicable after backfill has reached ground elevation. The Contractor shall immediately check the first section of pipe for deflection. The first section of pipe shall be defined as the length of pipe between two adjacent manholes or structures. The contractor shall check every section of pipe for the next five sections until the Contractor and Engineer can determine the relationship between the installation methods and the resulting initial deflection. A maximum five percent initial deflection is allowed.

- B. Deflection shall be measured with a rigid mandrel (Go/No Go) device cylindrical in shape and constructed with a minimum of 9 evenly spaced arms. The mandrel shall be hand pulled through the pipelines.
- C. Any section of pipe not passing the mandrel shall be uncovered and replaced at no additional cost to the Owner. Repairing the deflection by re-bedding and re-compacting the backfill shall be approved by the Engineer after the pipe has been exposed and the damage to the pipe observed. If re-bedding and re-compacting is approved, the pipe shall be retested after repair.

3.04 TESTING AND CLEANING

- A. Testing and Cleaning of the pipe shall be as specified in Section 01445.

END OF SECTION

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SECTION 02625

HIGH DENSITY POLYETHYLENE PIPE AND FITTINGS (PRESSURE PIPE)

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install high density polyethylene (HDPE) pipe and fittings complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Testing and cleaning of pipe are included in Section 01445.
- B. Dewatering and drainage are included in Section 02140.
- C. Trenching, backfilling and compaction are included in Section 02221.
- D. Granular fill materials are included in Section 02230.
- E. Buried valves and appurtenances are included in Section 02640.
- F. Concrete for thrust blocks in included in Division 3.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, completely detailed working drawings and schedules of all high density polyethylene (HDPE) pipe and fittings required.
- B. Submit the name and address of pipe manufacturer.
- C. Submit complete description of method of pipe installation.
- D. Submit description of the method of testing the pipe and fittings including a complete drawing of mandrel with dimensions for each pipe size.
- E. Submit the manufacturer's recommendations for handling, storing and installing the pipe and fittings.
- F. Submit certification that the stress regression testing has been performed on the specific polyethylene resin being utilized in the manufacturing of the pipe for this contract in accordance with ASTM D2837.
- G. Prior to each shipment, submit certified test reports that the pipe and fittings for this contract were manufactured and tested in accordance with the ASTM and AWWA Standards specified herein.

- H. Submit the name and qualifications of the technician proposed to perform the heat fusion of the pipe joints.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A276 – Standard Specification for Stainless Steel Bars and Shapes.
2. ASTM A307 – Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.
3. ASTM D2321 – Standard Practice for Underground Installation of Thermoplastic Pipe for Sewer and Other Gravity-Flow Applications.
4. ASTM D2774 – Standard Practice for Underground Installation of Thermoplastic Pressure Piping.
5. ASTM D2657 – Standard Practice for Heat Fusion Joining of Polyolefin Pipe and Fittings.
6. ASTM D2837 – Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
7. ASTM D3350 – Standard Specification for Polyethylene Plastics Pipe and Fittings Materials.
8. ASTM F714 – Standard Specification for Polyethylene (PE) Plastic Pipe (SDR-PR) Based on Outside Diameter.

B. American Water Works Association (AWWA)

1. AWWA C600 – Installation of Ductile Iron Water Mains and Their Appurtenances.
2. AWWA C906 – Polyethylene (PE) Pressure Pipe and Fittings, 4-in Through 63-in, for Water Distribution and Transmission.

C. American National Standards Institute (ANSI)

1. ANSI B16.1 – Cast Iron Flanges and Flanged Fittings.
2. ANSI B16.21 – Nonmetallic Flat Gaskets for Pipe Flanges.
3. ANSI/NSF 61- Drinking Water System Components-Health Effects

- D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 DELIVERY, STORAGE AND HANDLING

- A. The delivery, storage and handling of the pipe and fittings shall be done in accordance with the manufacturer's recommendations.
- B. Pipe shall be stored on clean, level ground to prevent any scratching or gouging of the pipe. The handling of the pipe shall be done in a manner to avoid dragging the pipe over any hard or sharp objects to avoid cutting of the pipe's exterior. Any cut or gouge deeper than 5 percent of the pipe's wall thickness shall be removed from the site.
- C. Handling of the pipe shall be done in a manner to avoid all undue stress in the pipe caused by bending of the pipe.
- D. The interior of the pipe shall be free of cuts, gouges and scratches.

1.06 QUALITY ASSURANCE

- A. All HDPE pipe and fittings shall be manufactured in strict accordance with ASTM F714, and shall be from a single manufacturer who is fully experienced, reputable and qualified in the manufacture of the polyethylene pipe and fittings to be furnished. All HDPE pipe and fittings shall be supplied by a single distributor who is fully experienced, reputable, and qualified with the distribution of the pipe and fittings to be furnished. The pipe shall be designed, constructed, and installed in accordance with the best practices and methods and shall comply with these specifications. All pipe and fittings shall be NSF 61 approved.
- B. All pipes under this contract shall be manufactured from a polyethylene resin that has been specifically stress regression tested to provide a product supplying a minimum Hydrostatic Design Basis (HDB) of 1600 psi, as determined in accordance with ASTM D2837.
- C. All HDPE pipe to be installed under this Contract may be inspected at the factory for compliance with this Section by an independent testing laboratory provided by the Owner. The manufacturer's cooperation shall be required in these inspections. The cost of these plant inspections of all pipe approved for this Contract will be borne by the Owner.
- D. Inspection of the pipe may also be made by the Engineer or other representatives of the Owner after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the specified requirements, even though pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job.

1.07 WARRANTY

- A. The pipe manufacturer shall provide a warranty against manufacturing defects of material and workmanship for a period of ten years after the final acceptance of the project by the Owner. The manufacturer shall replace, at no additional cost to the Owner, any defective pipe material within the warranty period.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General

1. HDPE pipe is a flexible conduit and shall be designed to transfer raw wastewater or odor control process air to the location(s) shown on the Drawings. The pipe and fittings shall be free from all defects including indentations, delaminations, cracks, bubbles and pinholes, which due to their nature, degree, or extent, detrimentally affect the strength and serviceability of the pipe. Any pipe or fittings with such defects which, in the judgment of the Engineer, will affect the strength and serviceability shall be repaired or rejected.
2. HDPE pipe resins shall be high molecular weight, high density polyethylene with a cell classification number of 345464C (or E) or higher cell classification in accordance with ASTM D3350.

B. Pipe and Fittings

1. The pipes shall have the nominal dimensions shown on the Drawings, and shall conform to the dimension requirements of the DIPS Sizing System (ASTM F714-12). Pipe shall meet the requirements of Dimension Ratio (DR) 17.
2. Pipe shall be furnished in standard laying lengths not exceeding 20-ft.
3. Joining system: The pipe shall be joined with butt, heat fusion joints. All joints shall be made in strict compliance with the manufacturer's recommendations and ASTM 2657. Where required, flange connections, mechanical joint connections and butt connections using bolted mechanical couplers shall be provided from a pipe stub with a polyethylene and steel stiffener. Flanged connections shall be provided from a pipe stub and a steel back-up flanged. Back-up flanges shall be primed and painted in a corrosion protected paint recommended and supplied by the manufacturer. All bolts, nuts and hardware shall be Type 316 stainless steel.
4. HDPE fittings shall be fully pressure rated to match the pipe DR pressure rating. All fittings shall be molded or fabricated by the same manufacturer as the pipe. HDPE fittings shall be joined using butt, heat fusion and/or electrofusion. Adhesives and solvent cements shall not be permitted.
5. HDPE pipe shall be supplied by JM Eagle Manufacturing Co., Performance Pipe a Division of Chevron Phillips Chemical Company, or PolyPipe, Inc.

2.02 PIPE IDENTIFICATION

- A. At 5-ft intervals along the pipe, the pipe shall be marked with the name of the manufacturer, size and class (pressure and DR), and manufacturing reference to ASTM F714.
- B. A color coded strip(s) shall be marked along the entire length of the pipe.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. All pipe and fittings shall be installed in accordance with the manufacturer's instructions and Section 02221.
- B. The contractor performing the joining shall be by a distributor of the pipe material supplied. All fusion joints shall be done by a factory qualified technician as designated by the manufacturer with a minimum of five years experience with the fusion equipment to be used.
- C. Joining of the pipe by heat fusion shall be done in accordance with ASTM D2657. Prior to the start of pipe installation, one test joint shall be made and tested. Test shall be done in accordance with CPChem Co. Bulletin No. 106. No joints shall be made until a successful test joint has been made.
- D. When cutting pipe is required, the cutting shall be done by machine specifically designed for the cutting of HDPE pipe. The cut shall leave a smooth cut at right angles to the axis of the pipe.
- E. Fittings shall be connected to HDPE pipe in accordance with manufacturer's recommendations.
- F. Flanged and mechanical connections shall consist of the following:
 - 1. A high density polyethylene flange adapter, made by the manufacturer from the same resin as the pipe, and fully pressure rated to match the pipe DR pressure rating, thermally butt-fused to the stub end of the pipe.
 - 2. A ductile iron or steel back-up ring conforming to ANSI B16.1 fitted to the polyethylene flange adapter and shaped as necessary to suit the outside dimension of the pipe.
 - 3. A full face neoprene gasket, conforming to ANSI B16.21.
 - 4. Corrosion resistant bolts and nuts of Type 316 stainless steel as specified in ASTM A276 and ASTM A307. Bolts shall be tightened alternately and evenly to the manufacturer's specified torques. After installation a bitumastic coating shall be applied to bolts and nuts.

3.04 CLEANING, TESTING AND DISINFECTION

- A. Cleaning, testing and disinfection of the pipe shall be in accordance with Section 01445.

END OF SECTION

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SECTION 02626

DOUBLE WALL CHEMICAL PIPE SYSTEM

PART 1 - GENERAL

1:01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install and test buried, double walled plastic chemical pipe system as shown on the Contract Drawings and as specified herein.
- B. Pipe system refers to all primary carrier and containment pipe, fittings, material and appurtenances required to construct the chemical pipe complete, in place.

1.02 RELATED WORK

- A. Testing of pipe is included in Section 01445.
- B. Trenching, backfilling and compaction is included in Section 02221.
- C. Granular bedding materials are included in Section 02230.
- D. Loaming and seeding is included in Section 02930.
- E. Plastic pipe and fittings for non-buried process pipe are included in Section 15070.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and product data including the following:
 - 1. Shop drawings including piping layouts and schedules shall be submitted to the Engineer and shall include dimensioning, fittings, types and locations of valves and appurtenances, joint details, methods and locations of supports, anchorage, grade of material and all other pertinent technical information for all items to be furnished.
 - 2. Shop drawing submittals for piping under this Section shall include all data and information required for the complete piping systems. All dimensions shall be based on the actual equipment to be furnished.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D1784 – Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds.

2. ASTM D1785 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40 and 80.
 3. ASTM D2466 – Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40.
 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 D2855 – Standard Practice for Making Solvent-Cemented Joints with Poly (Vinyl Chloride) (PVC) Pipe and Fittings.
 7. ASTM F438 – Standard Specification for Socket-Type Chlorinated Poly (Vinyl Chloride) (CPVC) Plastic Pipe Fittings, Schedule 40.
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. All double walled plastic pipe and fittings shall be a prefabricated system furnished by a single manufacturer who is experienced in the manufacture of the items to be furnished. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall be suitable for the intended service.
- B. Any personnel installing PVC shall be card certified to ASTM D2855 installation practices.

1.06 SYSTEM DESCRIPTION

- A. Double walled piping systems shall be installed in those locations as shown on the Contract Drawings.
- B. The equipment and materials specified herein are intended to be standard types of plastic pipe and fittings for use in transporting chemicals.
- C. Double walled piping systems shall be designed for the following chemical systems:

1. System: Bioxide
- Carrier Pipe and Fittings Material: Schedule 80 PVC
- Containment Pipe and Fittings Material: Schedule 40 PVC Pipe and Fittings
- Gaskets: Viton
- Fluids: Bioxide® as Provided by Siemens Water Technologies or Approved Equal

Pressure:	Atmosphere to 100 psig
Flow Velocity:	Up to 5 fps
Temperature:	35 to 100 degrees F
Special Conditions:	Gravity feed from Bioxide Tank

1.07 DELIVERY, STORAGE AND HANDLING

- A. All items shall be bundled or packaged in such a manner as to provide adequate protection of the ends during transportation to the site. Pipes and fittings damaged in shipment shall be replaced as directed by the Engineer.
- B. PVC items deteriorate in sunlight and are slightly brittle, especially at lower temperatures, so care shall be taken in loading, transporting and unloading items to prevent injury to the items. All items shall be examined before installation and no piece shall be installed which is found to be defective. Handling and installation of pipe and fittings shall be in accordance with the manufacturer's instructions, referenced standards and as specified herein.
- C. Pipe and fittings shall be stored in a manner that will keep them at ambient outdoor temperatures and out of sunlight. Temporary shading as required to meet this requirement shall be provided. Simple covering of the pipe and fittings that allows temperature buildup or direct or indirect sunlight will not be permitted.
- D. Any pipe or fitting showing a crack or which has received a blow that may have caused an incident fracture, even though no such fracture can be seen, shall be marked as rejected and removed at once from the work.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All buried chemical piping, fittings, and valves shall be a prefabricated double wall containment piping system.
- B. All PVC pipe and fittings shall be installed using IPS Weld-On 724 cement and P-70 primer only.
- C. The Bioxide® double wall piping system shall consist of Schedule 80 PVC primary piping system supported within the Schedule 40 PVC secondary containment housing. Pipe and fittings shall be centralized at the factory with the correct amount of centralizers. Pipe centralizers shall be 3 leg PP. Fitting centralizers shall be a solvent cemented, non wetted joints.

2.02 MATERIALS

- A. Primary Carrier Pipe and Fittings
 - 1. The PVC primary carrier pipe and fittings shall be manufactured from PVC compounds meeting ASTM D1784, Class 12454-B.

2. The pipe shall be manufactured in accordance with ASTM D1785, PVC 1120. The pipe shall have a minimum hydrostatic design stress of 2000 psi at 73 degrees F and shall be suitable for field cutting and solvent welding. Pipe shall be of the sizes indicated above and shall be Schedule 80.
3. The burst pressure of fittings shall be not less than the burst pressure of the size and thickness of the pipe with which it is to be used in accordance with ASTM D2467.

B. Secondary Containment Pipe and Fittings

1. The PVC secondary containment pipe and fittings for all buried chemical piping systems shall be manufactured from PVC compounds meeting ASTM D1784, Class 12454-B.
2. The pipe shall be manufactured in accordance with ASTM D1785, PVC 1120. The pipe shall have a minimum hydrostatic design stress of 2000 psi at 73 degrees F and shall be suitable for field cutting and solvent welding. Pipe shall be of the sizes indicated above and shall be Schedule 40 unless otherwise specified. Solvent cement shall be as specified in ASTM D2564.
3. PVC containment pipe shall be used to encase buried carrier piping for chemical systems as defined in Paragraph 1.06 above and as shown on the Contract Drawings.
4. The burst pressure of fittings shall be not less than the burst pressure of the size and thickness of the pipe with which it is to be used in accordance with ASTM D2467.
5. Containment pipe size shall be based on the size of the primary carrier pipe as follows:

<u>Carrier Pipe Diameter</u>	<u>Containment Pipe Diameter</u>
1/2-in	2-in
3/4-in	3-in
1-in	3-in
1-1/2-in	4-in
2-in	4-in

- C. The double walled PVC chemical piping system shall be Centra-lok as manufactured by IPEX, or approved equal.

PART 3 - EXECUTION

3.01 INSTALLATION OF DOUBLE WALLED CHEMICAL PIPE SYSTEM

- A. Double walled chemical pipe systems shall be installed in accordance with the manufacturer's technical data, printed instructions and field instruction.

- B. If any defective pipe is discovered after it has been installed, it shall be removed and replaced with a sound pipe in a satisfactory manner at no additional cost to the Owner. All pipe and fittings shall be thoroughly cleaned before installation, shall be kept clean until they are used in the work and when laid, shall conform to the lines and grades required.
- C. As soon as the excavation is complete to normal grade of the bottom of the trench, screened gravel bedding shall be placed, compacted and graded to provide firm, uniform and continuous support for the pipe. The pipe shall be laid accurately to the lines and grades indicated on the Contract Drawings. Blocking under the pipe will not be permitted. Screened gravel shall be placed evenly on each side of the pipe to mid-diameter and hand tools shall be used to force the screened gravel under the haunches of the pipe to give firm continuous support for the pipe. Screened gravel shall then be placed to 12-in above the top of the pipe. The initial 3-ft of backfill above the screened gravel backfill shall be placed in 1-ft layers and carefully compacted. Generally the compaction shall be done evenly on each side of the pipe and compaction equipment shall not be operated directly over the pipe until sufficient backfill has been placed to ensure that such compaction equipment will not have a damaging effect on the pipe. Equipment used in compaction of the initial 3-ft of backfill shall be approved by the pipe manufacturer's representative prior to use.
- D. All piping shall be sound and clean before installation. When installation is not in progress, including lunchtime, the open ends of the double walled chemical pipe systems shall be closed by watertight plug or other approved means. Good alignment shall be preserved during installation.
- E. When cutting pipe is required, the cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe.
- F. Joints for PVC pipe shall be solvent welded. In making solvent welded connections, clean dirt and moisture from the pipe, bevel pipe ends slightly with emery cloth to remove any shoulder or burrs created by the cutting of the pipe. Solvent welded joints shall be made in accordance with ASTM D2855 except that solvent cement formulated especially for and as specified above shall be used for joining PVC pipe. Primer and primer application shall be in accordance with ASTM D2855 standards.
- G. Precautions shall be taken to prevent flotation of the pipe in the trench.
- H. Where plastic pipe passes through wall sleeves, the space between the pipe and sleeve shall be sealed with a mechanical sealing element.
- I. The entire length of buried chemical piping systems shall slope to the piping gallery terminal points to allow any chemical leaks to be detected. At the terminal points, the containment piping shall extend through the building wall a distance of at least 2-in. The terminal ends of the pipe shall be equipped with end seals consisting of a bulkhead plate of the same material as the containment pipe, solvent welded to the containment and carrier pipes. As a means of checking for and draining chemical leaks in the pipes, end seals shall be equipped with drain and vent openings with ball valves located diametrically opposite on the vertical centerline of the plate.

3.02 FIELD TESTING

- A. All pipelines shall remain undisturbed for the minimum curing time specified for each type of pipe material but no less than 24 hours to develop full curing and complete strength at all joints. Primary carrier pipe systems shall be flushed clean and then subjected to a hydrostatic pressure test for 4 hours at 150 psi. The system pressure shall be maintained to within 5 psi of the test pressure over the entire duration of the test.
- B. After testing of the carrier pipe, the containment system shall be tested pneumatically at 5 psi for 2 hour duration prior to backfilling. All containment piping joints shall be checked for leaks by applying a soapy solution to the joints. Furnish all necessary equipment and labor to perform the air test, including air compressor, gauges, conduit caps, temporary pipe and connections, etc and complete the test to the satisfaction of the Engineer.
- C. After backfilling is completed, a 5 psig air test of the containment pipe shall be conducted to the satisfaction of the Engineer.
- D. All leaks detected during the pressure test shall be repaired and the pressure/temperature test rerun.
- E. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during the tests.

END OF SECTION

SECTION 02640

VALVES, HYDRANTS AND APPURTENANCES

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and provide all buried valves, valves in manholes and underground vaults, hydrants and appurtenances complete with actuators and all accessories as shown on the Drawings and as specified herein.
- B. Valves specifically excluded from this Section are as follows:
 - 1. All interior valves for process piping
 - 2. All valves for plumbing work.
 - 3. All valves for heating and ventilation work.
 - 4. All valves for fuel piping.

1.02 RELATED WORK

- A. Earthwork is included in Section 02200.
- B. Concrete is included in Division 3
- C. Miscellaneous metal fabrication is included in Division 5.
- D. Field painting is included in Section 09902.
- E. Interior process valves and appurtenances are included in Section 15100 respectively.
- F. Electric valve actuators are included in Division 15.
- G. Electrical work is included in Division 16.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, materials required to establish compliance with this Section for shop drawings. Submittals shall include the following:
 - 1. Manufacturer's literature, illustrations, specifications and engineering data including:
 - a. Dimensions
 - b. Size

- c. Materials of construction
- d. Weight
- e. Protection coating
- f. Actuator weight
- g. Calculations for actuator torque where applicable
- h. Wiring diagram including:
 - 1) Ladder diagrams
 - 2) Point-to-point wiring

B. Test Reports

- 1. Four copies of all certified shop test results specified herein.

C. Operation and Maintenance Manuals

- 1. Submit complete operation and maintenance manuals including copies of all approved Shop Drawings.

D. Certificates

- 1. Certificates of compliance where required by referenced standards: For each valve specified to be manufactured and/or installed in accordance with AWWA and other standards, submit an affidavit of compliance with the appropriate standards, including certified results of required tests and certification of proper installation.

1.04 REFERENCE STANDARDS

- A. Comply with applicable provisions and recommendations of the following, except as otherwise shown or specified.

B. American Water Works Association (AWWA)

- 1. AWWA C111 - Rubber-Gasket Joints for Ductile-Iron and Pressure Pipe and Fittings.
- 2. AWWA C500 - Metal-Seated Gate Valves for Water Supply Service.
- 3. AWWA C502 - Dry-Barrel Fire Hydrants.
- 4. AWWA C504 - Rubber-Seated Butterfly Valves.
- 5. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service.

6. AWWA C515 – Reduced Wall, Resilient-Seated Gate Valves for Water Supply Service
7. AWWA C517 – Resilient-Seated Cast Iron Eccentric Plug Valves
8. AWWA C800 – Underground Service Lines and Fittings

C. American National Standards Institute (ANSI)

1. ANSI B16.1 – Cast Iron Pipe Flanges and Flanged Fittings.

D. American Society for Testing and Materials (ASTM)

1. ASTM A48 - Standard Specification for Gray Iron Castings.
2. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges and Pipe Fittings
3. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
4. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
5. ASTM A536 - Standard Specification for Ductile Iron Castings.

E. The Society for Protective Coatings (SSPC)

1. SSPC SP-6 - Joint Surface Standard Commercial Blast Cleaning

F. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Manufacturer's Qualifications

1. Valves and appurtenances provided under this Section shall be the standard product in regular production by manufacturers whose products have proven reliable in similar service for at least 10 years. If required, the manufacturer shall furnish evidence of installation in satisfactory operation.
2. All units of the same type shall be the product of one manufacturer.

B. Design Criteria

1. All valves and appurtenances shall be new and in perfect working condition. Valves shall be designed for continuous use with a minimum of maintenance and service required and shall perform the required function without exceeding the safe limits for stress, strain or vibration. In no case will used or damaged valves be acceptable. The selection of equipment to meet the specified design conditions is the responsibility of the Contractor.

Both workmanship and material shall be of the very best quality and shall be entirely suitable for the service conditions specified.

C. Source Quality Control

1. Valves shall be shop tested in accordance with the following:
 - a. Metal-seated gate valves: AWWA C500.
 - b. Rubber-seated butterfly valves: AWWA C504.
 - c. Resilient-seated gate valves: AWWA C509.
 - d. Reduced-wall, resilient-seated gate valves: AWWA C515.
2. Obtain each type of valve from no more than one manufacturer.
3. Plug valves shall be hydrostatically tested for 30 minutes at two times the maximum working pressure, with no evidence of distress, leakage or weeping. Plug valves shall be capable of providing drop-tight shut-off up to the full pressure rating.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the site to ensure uninterrupted progress of the work.
- B. Protect threads and seats from corrosion and damage. Rising stems and exposed stem valves shall be coated with a protective oil film which shall be maintained until time of use.
- C. Furnish covers for all openings.
 1. All valves 3-in and larger shall be shipped and stored on site until time of use with wood or plywood covers on each valve end.
 2. All valves smaller than 3-in shall be shipped and stored as above except that heavy card board covers may be furnished instead of wood.
 3. All butterfly valves shall be delivered with blind flanges bolted in place until valve is pressure-tested on site, before installation and burial.
- D. Store equipment to permit easy access for inspection and identification. Any corrosion in evidence at the time of Owner acceptance shall be removed, or the valve shall be removed from the job.
- E. Store all equipment in covered storage off the ground.

1.07 COORDINATION

- A. Review installation procedures under other Sections and coordinate with the work which is related to this Section including buried piping installation, site utilities, piping insulation, heating, ventilating and air conditioning, plumbing and chemical feed facilities.
- B. Coordinate the location and placement of concrete thrust blocks when required.

PART 2 - PRODUCTS

2.01 GENERAL

- A. All buried valves shall open counter-clockwise.
- B. The use of a manufacturer's name and/or model or catalog number is for the purpose of establishing the standard of quality and general configuration desired.
- C. Valves shall be of the size shown on the Drawings or as noted and as far as possible equipment of the same type shall be identical and from one manufacturer.
- D. Valves shall have the name of the maker, nominal size, flow directional arrows, working pressure for which they are designed and standard to which they are manufactured cast in raised letters on some appropriate part of the body.
- E. Unless otherwise noted, valves shall have a minimum working pressure of 150 psi or be of the same working pressure as the pipe they connect to, whichever is higher, and suitable for the pressures noted where they are installed.
- F. Valves shall be of the same nominal diameter as the pipe or fittings they are connected to. Except as otherwise noted, joints shall be mechanical joints, with joint restraint where the adjacent piping is required to be restrained.
- G. Valves shall be especially constructed for buried service.

2.02 VALVE BOXES

- A. All gate, butterfly and plug valves shall be provided with extension shafts, operating nuts and valve boxes as follows:
 - 1. Extension shafts shall be Type 304 stainless steel and the operating nut shall be [2-in] square. Shafts shall be designed to provide a factor of safety of not less than four. Operating nuts shall be pinned to the shafts.
 - 2. Top of the operating nut shall be located 2-in below the rim of the valve box.

3. Valve boxes shall be as manufactured by American Flow Control; Mueller; or equal and shall be a heavy-pattern cast iron, three-piece, telescoping type box with dome base suitable for installation on the buried valves. Inside diameter shall be at least 4-1/2-in. Barrel length shall be adapted to the depth of cover, with a lap of at least 6-in when in the most extended position. Covers shall be cast iron with integrally-cast direction-to- open arrow, and the word. Covers for water service shall say "WATER", integrally cast, painted blue on top. Covers for reclaimed water service shall say "RECLAIM WATER", integrally cast, painted lavender on top. Valves for sewer services shall say "SEWER", integrally cast. Aluminum or plastic are not acceptable. A means of lateral support for the valve extension shafts shall be provided in the top portion of the valve box.
4. The upper section of each box shall have a top flange of sufficient bearing area to prevent settling. The bottom of the lower section shall enclose the stuffing box and operating nut of the valve and shall be oval.
5. An approved operating key or wrench shall be furnished.
6. All fasteners shall be Type 316 stainless steel.

2.03 TAPPING SLEEVES AND TAPPING VALVES

- A. Tapping sleeves shall be of ductile iron, designated for working pressure not less than 200 psi. Armored end gaskets shall be provided for the full area of the sleeve flanges. Sleeves shall be as manufactured by American Flow Control; Mueller; Clow or equal. Nuts and bolts shall be Type 304 stainless steel.
- B. Tapping valves shall conform to the requirements specified above for gate valves except that one end shall be flanged and one mechanical. Tapping valves shall be provided with an oversized opening to permit the use of full size cutters.
- C. See Section 13500 for requirements on Hot Tapping and Plugging at the Pump Station.

2.04 PLUG VALVES

- A. Plug valves specified herein shall be suitable for buried service, and shall be Series PEC by DeZurik Water Controls of Sartell, Minnesota; the Cam-Centric® by Val-Matic Valve and Manufacturing Corporation of Elmhurst, Illinois, or Model F5413 by Clow Valve Company (A Division of McWane Inc.) of Oskaloosa, Iowa. Plug valves shall conform to the minimum requirements of AWWA C517, in addition to the requirements specified herein.
- B. All plug valves shall be of the non-lubricated, eccentric type with bodies and plugs of semi-steel construction. Valves shall be rated for a minimum working pressure of 175 psig for 3-in through 12-in and 150 psig for 14-in through 72-in valves. The area at the valve port shall be at least 80 percent of the full pipe area. All valves shall open by turning the wrench nut counter-clockwise.
- C. All plug valves for what ever service, shall be capable of passing "pigging" cleaning equipment (using a Girard or similar cleaning pig of full nominal pipeline diameter) in either direction and manufacturer shall so certify that this may be done without the use of special equipment.

- D. Valves shall have balanced plugs with a resilient facing of Nitrile (Buna-N) solidly bonded thereto to assure bubble-tight shutoff low torque requirements.
- E. Seats shall have a welded-in overlay of 90 percent pure nickel on all surfaces contacting the plug face.
- F. Valves shall be furnished with bolted bonnets and self-adjusting chevron-type packing. Packing shall be replaceable without disassembling the valve or removing the bonnet from the valve.
- G. Corrosion-resistant, permanently-lubricated bearings shall be provided at both ends of the valve shafts.
- H. All valves shall be supplied with mechanical joint ends conforming to AWWA C111, unless otherwise noted herein.
- I. All exterior hardware on valves shall be of Type 316 stainless steel.

2.05 FIRE HYDRANTS

- A. Fire hydrants shall be the Eddy Type Clow Corp. Fig. F-2640 "Break Flange", or similar model by Mueller Industries or American Flow Control and shall conform to the "Standard Specification for Fire Hydrants for Ordinary Water Works Service", AWWA C502, and shall in addition meet the specific requirements and exceptions which follows:
- B. Hydrants shall be according to manufacturer's standard pattern and of standard size and shall have one 4-1/2-in steamer nozzle and two 2-1/2-in hose nozzles.
- C. Hydrant inlet connections shall have mechanical joints for 6-in ductile-iron pipe, or 6-in asbestos cement pipe.
- D. Hydrant valve opening shall have an area at least equal to that area of a 5-1/4-in minimum diameter circle and be obstructed only by the valve rod. Each hydrant shall be able to deliver 500 gallons minimum through its two 2-1/2-in hose nozzles when opened together with a loss of not more than 2 psi in the hydrant.
- E. Each hydrant shall be designed for installation in a trench that will provide 5-ft minimum cover. Hydrant extensions shall be as manufactured by the company furnishing the hydrants and of a style appropriate for the hydrants as furnished.
- F. Hydrants shall be hydrostatically tested as specified in AWWA C502.
- G. All nozzle threads shall be National (American) Standard.
- H. Hydrant operating nut shall be AWWA Standard pentagonal type measuring 1-1/2-in point to flat.
- I. Hydrants shall be equipped with O-ring packing.
- J. Each nozzle cap shall be provided with a Buna N rubber washer.

- K. Hydrants shall be so arranged that the direction of outlets may be turned 90 degrees without interference with the drip mechanism obstructing the discharge from any outlet.
- L. A bronze or rustproof steel nut and check nut shall be provided to hold the main hydrant valve on its stem.
- M. Hydrants must open by turning operating nut to right (clockwise) and must be marked with an arrow and word "open" to indicate the direction to turn stem to open hydrant.
- N. All iron work to be set below ground, after being thoroughly cleaned, shall be painted with two coats of asphalt varnish specified in AWWA C502 and iron work to be left above ground shall be shop painted with two coats of paint of quality and color to correspond to the present standard of the Owner.
- O. Each hydrant shall be designed such that the hydrant valve closes with line pressure preventing loss of water and consequent flooding in the event of traffic damage.
- P. Each hydrant shall be furnished with a steel chain holder, double steel hose cap chain, steel steamer cap chain and any other hooks and/or appurtenances required for proper use.

2.06 YARD HYDRANTS

- A. Yard hydrants shall be 2-1/8-in non-freezing type Post Type A-411 by Mueller Company of Decatur, IL or equal. Yard hydrants shall have two 1-1/2-in hose nozzles with a 3-in mechanical joint inlet connection. Operating nuts shall be standard AWWA 2-in square and caps shall have attachment chains. Six operating wrenches (Type A-312) of suitable size shall be furnished to operate all yard hydrants. Each hydrant shall have one of the two 1-1/2-in hose nozzles fitted with a special adapter fitting to reduce the nozzle to 1-in male hose connection.
- B. Caution sign shall be provided on each yard hydrant connected to the reclaimed water system. Signs shall be of the plastic laminate type, suitable for outdoor application. The signs shall be a minimum of 1/8-in thickness. Laminate shall be red in white. Signs shall be mounted to the yard hydrants using stainless steel No.16 single jack chain. Signs shall be square cornered, approximately 3-in by 8-in with the following engraved text in 3/4-in high letters:
RECLAIMED WATER – DO NOT DRINK.

2.07 CORPORATION STOPS

- A. Corporation stops shall be compliant with AWWA C800, and shall brass with Mueller-type threads, not less than 1-in in diameter and shall be installed where shown, specified or required.
- B. Corporation stops shall be rated at 100 psig maximum working pressure for 1/2, 3/4, and 1-in sizes, and at 80 psig maximum working pressure for 1-1/4, 1-1/2, and 2-in sizes. Furnish machined/ground key type corporation stops, as manufactured by the following:
 - 1. The Figure P-25008 by Mueller Company of Decatur, Illinois; Model F1000-Q by Ford Meter Box Company Inc. of Wabash, Indiana; Model 4701-22 by A.Y. McDonald Manufacturing Company of Dubuque, Iowa; or equal.

2.08 SURFACE PREPARATION AND SHOP COATINGS

- A. The interior ferrous metal surfaces, except finished or bearing surfaces, shall be blast cleaned in accordance with SSPC SP-10 and painted with two coats of an approved two-component epoxy coating specifically formulated for potable water use. The coating shall be NSF certified to Standard 61.
- B. Exterior ferrous metal surfaces of all buried valves and hydrants shall be blast cleaned in accordance with SSPC SP-6 and given two shop coats of an approved two-component coal tar epoxy paint.
- C. Exterior ferrous metal surfaces of all non-buried valves shall be shop painted with one coat of primer in accordance with the requirements of Section 09901.

PART 3 - EXECUTION

3.01 INSPECTION AND PREPARATION

- A. During installation of all valves and appurtenances, verify that all items are clean, free of defects in material and workmanship and function properly.
- B. All valves shall be closed and kept closed until otherwise directed by the Engineer.

3.02 INSTALLATION OF BURIED VALVES AND VALVE BOXES

- A. Buried valves shall be cleaned and manually operated before installation. Buried valves and valve boxes shall be set with the stem vertically aligned in the center of the valve box. Valves shall be set on a firm foundation and supported by tamping pipe bedding material under the sides of the valve. The valve box shall be supported during backfilling and maintained in vertical alignment with the top flush with finish grade. The valve box shall be set so as not to transmit traffic loads to the valve.
- B. Before backfilling, all exposed portions of any bolts shall be coated with two coats of bituminous paint.
- C. Install valve floor stand operators with stainless steel bolts.

3.03 INSTALLATION OF TAPPING SLEEVES AND VALVES

- A. The proper authority shall be contacted and their permission granted prior to tapping a "live" line. The required procedures and time table shall be followed exactly.
- B. Installation shall be made under pressure and flow shall be maintained. The diameters of the tap shall be not less than 1/4-in less than the inside diameter of the branch line.
- C. The entire operation shall be conducted by workers experienced in the installation of tapping sleeves and valves. The tapping machine shall be furnished by the Contractor.

- D. Determine the location of the line to be tapped to confirm that the proposed location will be satisfactory and that no interference will be encountered such as joints or fittings. No tap or sleeve will be made closer than three feet from a pipe joint.
- E. Tapping sleeve and valve with boxes shall be set squarely centered on the line to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Thrust blocks or other permanent restraint acceptable to the Engineer shall be provided behind all tapping sleeves. Proper tamping of supporting pipe bedding material around and under the valve and sleeve is mandatory for buried installations.
- F. After completing the tap, the valve shall be flushed to ensure that the valve seat is clean. All proper regulatory procedures (including disinfection) shall be followed exactly.

3.04 FIELD TESTS AND ADJUSTMENTS

- A. Conduct a functional field test of each valve, including actuators and valve control equipment, in presence of Engineer to demonstrate that each part and all components together function correctly. All testing equipment required shall be furnished by the Contractor.

3.05 MANUFACTURER'S SERVICE

- A. Furnish the services of a qualified representative of the tapping equipment manufacturer to provide on-site instruction during wet tapping of the existing water mains indicated on the Drawings.
- B. Following installation of the butterfly valves, furnish the services of a qualified, factory-trained representative of the manufacturer of the respective valves, to check the installations before they are placed in operation, supervise initial operations and testing in the presence of the Engineer, instruct the plant personnel in care and maintenance of the equipment, and make all necessary field adjustments. A minimum of one 8-hour days, which may not necessarily be consecutive, shall be provided for these services. In the event of trouble with the equipment, the representative of the respective manufacturer shall revisit the site as often as necessary until all troubles are corrected and the installation is entirely satisfactory.

END OF SECTION

SECTION 02825

ORNAMENTAL SLIDE GATES AND CHAIN-LINK SWING GATE

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals necessary and install the ornamental aluminum slide gates for manual operation as shown on the Drawings and as specified herein. Ornamental slide gates shall be provided at the pump station surrounded by an architectural precast concrete screen wall.

1.02 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300, shop drawings showing details and specifications on materials, layouts and details of construction and erection of fence, gates, operator, and accessories required.
- B. Provide samples of specified finishes on proposed aluminum, stainless steel and steel sections, hardware and sheet showing materials, finish and color for approval.

PART 2 - PRODUCTS

2.01 ORNAMENTAL SLIDE GATE MATERIALS

- A. Aluminum Extrusions – All components shall be 6063-T5 and 6105-T5 alloy extrusions as approved, conforming to ASTM B221.
- B. Fasteners – All screws shall be Type 302 stainless steel, self-drilling. Provide masonry anchors and stainless steel machine screws for masonry connections as approved. All screws shall be painted to match the finish of aluminum.
- C. Accessories – Provide aluminum wall brackets and required stainless steel hardware.
- D. Bracing Cables – Stainless steel, Type 302 wire rope with stainless steel hardware. Size to provide required bracing for gate rigidity in cross-brace configuration and minimum visual impact.
- E. Finish – The gate and components shall be factory coated with Specrail Poly-Color or equal high-solids acrylic coating meeting AAMA 603.8. Application shall be by electrostatic spray. Curing shall be at a temperature of 375EF to 400EF. Color shall be black.
- F. Operator housing and base – Factory powder coated as approved. Color - black.

2.02 ORNAMENTAL SLIDE GATE FABRICATION

- A. Horizontal rails, 1-5/8-in square, open extrusions, shall be punched to allow pickets to pass through the top of the rail and into bottom rail.
- B. Pickets, 1-in square, 0.065-in wall, tubes, integral spear point finial, shall be fastened to stringers mechanically with stainless steel TEK screws on one side of stringer only.
- C. Vertical members, 2-1/2-in square, 0.075-in wall, tubes shall be prepunched to allow horizontal rails to slide in and be attached with stainless steel TEK. Gate posts, 4-in square, 0.125-in wall, tubes. Cast aluminum post caps shall be affixed to all posts and verticals.
- D. Provide in configurations shown and approved for rigidity and appearance. Cross brace on inside with stainless steel cable, each panel shown making up the gate.

2.03 BOTTOM GUIDE WHEEL ASSEMBLIES

- A. Two 4" diameter rubber wheels (one set) straddling the bottom horizontal gate rail shall be installed, one set on the gate post and one on the overhang post.

2.04 STOP BRACKET/END PLUG

- A. After gate has been installed both ends of the one-piece combination track/frame member shall be completely closed off with a 3/8" plate that shall also serve as a stop bracket. The bottom horizontal rail shall also have both ends completely closed with a piece of 3/8" aluminum plate that has been continuously welded into place at the factory.

2.05 HARDWARE

- A. Gate Hangers, latches brackets, guide assemblies and stops shall be aluminum, or steel galvanized after fabrication.
- B. Positive latch device shall be provided with provisions for padlocking.

2.06 CHAIN-LINK DOUBLE SWING GATE (COORDINATE WITH DETAIL ON SHEET CD-3)

- A. Posts, gate frames, braces, rails, stretcher bars, truss rods, and tension wire shall be made of schedule 40 galvanized steel. Gate hinges, post caps, tops, rail ends, ties, clips, stretcher bar bands, and other parts shall also be of hot dipped galvanized steel. Fencing and posts shall be black, vinyl clad.
 - 1. Intermediate posts, terminal posts, braces and rails shall be Type I round, hot dipped galvanized with a minimum average zinc (Grade E) coating of 1.8 oz/sq ft meeting ASTM F1083 for standard weight (Schedule 40) galvanized pipe. Dimensions shall conform to the following:

Use and Section	Nominal Outside Diameter Inches
End, corner and pull posts fabric height 8-ft	3.00
Rails & Post Braces	1.66
Intermediate posts fabric height 8-ft	2.375

2. Post braces shall be provided for each gate, corner, pull, and end post with fabric 8-ft or more in height, and shall consist of a round tubular brace extending to each adjacent line post at approximately mid-height of the fabric, and a truss consisting of a rod not less than 5/16-in nominal diameter from the line post back to the gate, corner, pull, or end post, with a turnbuckle or other equivalent provision for adjustment.
 3. Post tops shall consist of a hole suitable for the through passage of the top rail and shall fit over the outside of posts, excluding moisture from inside of posts.
 4. All fences shall have continuous top rails. Rails shall consist of lengths not greater than 18-ft and shall be fitted with hot dipped galvanized steel sleeves or couplings for connecting the lengths into a continuous run. Couplings shall not be less than 6-in long with 0.070-in minimum wall thickness and shall allow for expansion and contraction of the rail. Means shall be provided for attaching the top rail to each gate, corner, pull, and end post.
 5. Tension bars shall not be less than 3/4-in and not less than 2-in shorter than normal height of fabric to which they are attached. Provide one tension bar for each end and gate post and two bars for each corner and pull post.
 6. Tie fasteners shall be 6 gauge galvanized steel wire, attaching the fabric securely to all line posts at intervals not exceeding 15-in. Tie fasteners shall be attached securely to the top rail at intervals not exceeding 18-in.
 7. Bands of galvanized steel per ASTM F626 shall be provided for attaching fabric and stretcher bars to all terminal posts at intervals not exceeding 12-in. Bands shall have a minimum thickness after galvanizing of 0.078-in and minimum width of 3/4-in for posts 4-in OD or less and 0.108-in thick by 7/8-in for posts larger than 4-in. Attachment bolts shall be 5/16-in by 1-1/4-in galvanized carriage bolts with nuts.
 8. Tension wire shall be No. 7 gauge conforming to ASTM A824 with zinc-coating Class 2, 1.20 oz/sf.
- B. Swing gates shall conform to ASTM F900. Base materials of the gate frame shall be round tubular members, welded at all corners or assembled with corner fittings. Corner fittings shall have adjustable truss rods 3/8-in minimum diameter on panels 5-ft wide or wider. And constructed of the same base metal and finish as the frame. Interior bracing, when needed, shall

be the same metal and shape tubular material and finish as the frame, but need not be the same size. Leaves shall have vertical interior bracing at maximum intervals of 8-ft and shall have a horizontal interior member if the fabric height is 8-ft or more.

1. Frame shall be zinc-coated steel in accordance with ASTM F1043 and F1083 and shall match adjoining fence framework.
 2. Gate fabric shall be the same type as used in fence construction and attached securely to the frame with ties at intervals not exceeding 15-in.
 3. Size of the gate opening shall be measured from the inside face to inside face of gate posts.
 4. Outer members shall not sag in excess of the lesser of 1 percent of the gate leaf width or 2-in.
 5. Accessories shall be of the same materials as specified for the fence.
 6. Hinges shall be structurally capable of supporting the gate leaf and allow the gate to open and close without binding and designed to permit the gate to swing a full 180 degrees.
 7. Gate latch shall be a drop rod or plunger bar arranged to engage the gate stop. Locking devices shall be constructed so that the center drop rod or plunger bar cannot be raised when the gate is locked. Latching devices shall have a provision for a padlock.
 8. Gate stops shall be provided for all double gates. Keeper shall be provided for each gate leaf over 5-ft wide.
- C. Concrete: Portland cement, 1-in maximum size aggregate and potable water producing concrete with a 3-in slump and a 28-day compressive strength of at least 3000 psi. Packaged Concrete Mix: Mix dry-packaged normal-weight concrete conforming to ASTM C387 with clean water to obtain a 2-in to 3-in slump.
- D. Fabric shall be standard Heavy Industrial Grade of 6 gauge (nominal diameter 0.192-in) coated wire with a 2-in mesh with zinc-coating (Class 2) weight of not less than 2.00 oz/sf of uncoated wire surface hot-dip galvanized after fabrication.
1. Height shall be as shown on the Drawings, with overall dimension measured from ends of twists with tolerances of plus or minus 1-in.
 2. Fabric on fences 72-in high and over shall be knuckled at the bottom selvage and twisted on the top selvage. On fences less than 72-in in height, top and bottom selvages shall be knuckled.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prepare the grade and remove surface irregularities, if any, which may cause interference with the installation of gate and components.

3.02 INSTALLATION (ORNAMENTAL SLIDE GATES)

- A. Set gate posts for gate opening as shown, providing support for gate in open and closed positions.
- B. Insert rail ends into pre-punched posts and fasten with TEK screws.
- C. Center and align posts. Place concrete around posts and vibrate for consolidation. Recheck vertical and top alignment of posts, and make necessary corrections. Depth of post and full-depth concrete encasement shall be as required and approved to provide rigidity under all operating and wind conditions.
- D. Install gate plumb, level and secure for full opening without interference. Use masonry anchor system specified below where required. Install operator on a concrete pad, program as required and test to the satisfaction of the Engineer. Clean cement paste from components before it dries.
- E. Install fence sections between precast concrete columns. Drill the precast for expansion anchors and set to receive fence and gate post support hardware. Install fence sections and required gate support appurtenances plumb, level and secure as approved.

3.03 INSTALLATION (CHAIN-LINK DOUBLE SWING GATE)

- A. Install fence to comply with ASTM F567. Do not begin installation and erection before final grading is completed, unless otherwise permitted.
- B. Place fabric on the outside of the framework of the area to be enclosed. Install fencing on boundary lines inside of property line established by survey as required by Division 1.
- C. Place fabric by securing one end, applying sufficient tension to remove all slack before making attachments elsewhere. Tighten the fabric to provide a smooth uniform appearance free from sag. The fabric can be cut by untwisting a picket and attaching each span independently at all terminal posts. Use stretcher bars with tension bands at 15-in maximum intervals. Fabric shall be installed min. 2-in above finished grade. Fasten fabric with ties to line posts at intervals not exceeding 15-in. Fasten fabric to rails with ties at intervals not exceeding 18-in. Rolls of wire fabric can be joined by weaving a single picket into the ends of the rolls to form a continuous mesh.
- D. Excavation:
 - 1. Dig or drill each post hole to accommodate post and footing to the diameter and spacings indicated on the Drawings.

2. Each post foundation shall have hole diameter dug or drilled a minimum of 4 times the largest cross section of the post and a minimum depth below finished grade of 36-in. Depth of concrete footing shall be increased an additional 3-in for every 1-ft increase in the fence height over 6-ft.

E. Setting Posts:

1. Center and align posts in holes 4-in above bottom of excavation. Space posts not more than 10-ft on center. Align posts vertically and align tops. Extend center top of concrete footing 1-in above grade and trowel to a crown to shed water.
2. If solid rock is encountered where an overburden of soil is not present, set fence posts in solid rock to a depth 3 times the largest cross section of fence posts. Diameter of hole shall be 1/2-in greater than the largest cross section of the fence post. Set post in rock with non-shrink grout.
3. Gate posts shall be set in concrete footings as follows:

Gate Leaf Width	Post Size Height	Diameter (Steel)	Size of Hole		Depth	
			Earth	Rock	Earth	Rock
4-ft or <	6-ft or <	2.375-in	10-in	post o.d. + 1/2-in	30-in	post o.d. x 3
>4-10-ft	6-ft or <	2.875-in	12-in	post o.d. + 1/2-in	36-in	post o.d. x 3
6-ft or <	>6-ft	2.875-in	10-in	post o.d. + 1/2-in	36-in	post o.d. x 3
>6-12-ft	>6-ft	4.0-in	12-in	post o.d. + 1/2-in	36-in	post o.d. x 3
>12-18-ft	>6-ft	6.625-in	16-in	post o.d. + 1/2-in	42-in	post o.d. x 3
>18-24-ft	>6-ft	8.625-in	18-in	post o.d. + 1/2-in	48-in	post o.d. x 3

4. End, corner and pull post bracing with a center rail shall be required on all fencing over 6-ft in height.

F. Top Rails:

1. Run top rail on all fences continuously through line post caps with expansion couplings placed maximum 18-ft on center.

G. Brace Assemblies:

1. Install braces at end and gate posts and at both sides of corner and pull posts so posts are plumb when diagonal rod is under proper tension.

H. Bottom Tension Wire:

1. Install bottom tension wire within 6-in of bottom of fabric and weave through the stretched portion of fence running tension wire from end to end of each stretch of fence. Fasten to

fabric with 0.120-in diameter (11-gauge) hog rings spaced not more than 24-in on center. Tension wire shall be taut and free of sag.

I. Gates:

1. Install gates to meet the requirements of ASTM F567 and according to manufacturer's instructions, plumb, level and secure for full 180 degree opening without interference.
2. Hinges shall be constructed to allow the gate to open and close without binding.

J. Gate Operators:

1. Install according to the manufacturer's instructions. Adjust for smooth, trouble-free operation.

3.04 CLEANING, REPAIR AND REPLACEMENT

- A. Contractor shall clean jobsite of excess materials and excavated matter. Clean aluminum with mild household detergent and clean water rinse thoroughly.
- B. Adjust operator and all hardware for smooth operation of gate and test as ordered. Repair or replace operator components as required and retest as ordered.
- C. The Engineer will inspect all fence/gate components and finishes. Repair or replace components and finishes as order. Cement past not removed before it dried shall be carefully removed and finish repaired or component replaced as ordered.

END OF SECTION

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SECTION 02931

LOAMING AND SODDING

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and provide erosion control and place topsoil, finish grade, apply lime and fertilizer, place sod and maintain all sodded areas as shown on the Drawings and as specified herein, including all areas disturbed.

1.02 RELATED WORK

- A. Site preparation including clearing, grubbing and stripping is included in Section 02100.
- B. Earthwork including excavation, backfill, fill and grading including the stockpiling of topsoil is included in Section 02200.
- C. Erosion and sedimentation control are included in Section 02270.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, samples of all materials for inspection and acceptance. Submittals shall include the following:
 - 1. Full and complete written instructions for maintenance of the sodded areas to the Owner at the time of provisional acceptance.
 - 2. Sod grower's name and location and grass type for review and approval prior to delivery of sod to the site.
 - 3. Schedules for sodding and fertilizing to the Engineer for approval prior to performing the work.

1.04 DELIVERY

- A. Topsoil: Mix or amend topsoil, if required, prior to delivery to the site.
- B. Fertilizer: Deliver to the site in original unopened containers, each showing the manufacturer's guaranteed analysis conforming to applicable state fertilizer laws.

1.05 MAINTENANCE AND PROVISIONAL ACCEPTANCE

- A. Keep all sodded areas watered, lawn areas mowed and all areas in good condition. Maintain all sodded areas in an approved condition until provisional acceptance.

- B. The Engineer will inspect all work for provisional acceptance at the end of the 10 week maintenance period, upon the written request, received at least 10 days before the anticipated date of inspection. The maintenance period must occur during the growing season between March 15 and October 1 and shall include a minimum of three mowings.
- C. After the inspection has occurred but prior to provisional acceptance, a soil test shall be performed to determine if additional soil fertilization should occur. If necessary, apply additional fertilizer not to exceed 30 lbs/1000 sq ft of 10-20-10 as directed by the Engineer.
- D. The inspection by the Engineer will determine whether maintenance shall continue in any area or manner.
- E. After all necessary corrective work and clean-up has been completed, and maintenance instructions have been received by the Owner, the Engineer will certify in writing the provisional acceptance of the lawn areas. Maintenance of lawns or parts of lawns shall cease on receipt of provisional acceptance.

1.06 GUARANTEE PERIOD AND FINAL ACCEPTANCE

- A. Guarantee all sodded areas for not less than 1 full year from the time of provisional acceptance.
- B. At the end of the guarantee period, inspection will be made by the Engineer upon written request submitted at least 10 days before the anticipated date. Renovate, resod and maintain sodded areas not demonstrating satisfactory stands as specified herein and as determined by the Engineer.
- C. After all necessary corrective work has been completed, the Engineer will certify in writing the final acceptance of the sodded areas.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Topsoil
 - 1. The topsoil shall consist of natural topsoil, free from subsoil, obtained from an area which has never been stripped. Remove to a depth of 1-ft or less if subsoil is encountered. Topsoil shall be of uniform quality free of hard clods, stiff clay, hardpan, sods, partially disintegrated stone, lime, cement, ashes, slag, concrete, tar residues, tarred paper, boards, chips, sticks and all other undesirable material.
 - 2. The topsoil shall be classified as a sandy loam by the USDA textural classification system determined by sieve and pipette or hydrometer analysis. The topsoil shall contain 75 percent sand by weight. The fine to medium sand fraction (0.10 to 0.50 mm in diameter) shall comprise at least 90 percent of the sand fraction. No more than 3 percent of the soil shall be gravel (≥ 1 mm ≤ 1 -in in diameter).

3. The topsoil shall contain between 2 to 8 percent organic matter by weight determined by loss on ignition of moisture free samples dried at 100 degrees C. To adjust organic matter content, the soil may be amended, by the addition of composted leaf mold or peat moss. Use of organic amendments is acceptable only if random soil sampling indicates thorough incorporation.
4. The topsoil reaction (pH) shall be between 5.5 and 6.5.
5. Topsoil shall be graded within the following limits:

<u>Sieve Size</u>	<u>Percent Finer by Weight</u>
1-in	100
1/4-in	97
No. 100	40 to 60

6. Do not destroy topsoil structure through excessive and unnecessary handling and compaction. Inappropriate handling leading to the compaction or deterioration of soil structure will result in rejection of topsoil for use.
 7. Provide samples to assure topsoil fulfills specified requirements regarding textural analysis, organic matter content, pH and fertility as follows:
 - a. Provide one 20 lb sample of topsoil to Engineer from each site that will be used as a topsoil borrow area in accordance with the provisions of Section 01300). Submit samples at least 15 days prior to beginning stripping operations or 3 weeks prior to commencing topsoiling operations on the site; whichever is greater.
 - b. At least 3 weeks prior to anticipated start of topsoiling operations, a one pint sample of topsoil material for each site from which topsoil is to be stripped will be delivered by to a laboratory approved by the Owner, for analysis by test methods S1A, S2, particle size analysis and lead content. Copies of test results will be provided.
 - c. Based on test results, the topsoil shall be identified as "Acceptable", "Acceptable with certain fertilizer and limestone applications" or "Unacceptable" by the Engineer. If the topsoil is found acceptable, the fertilizer and limestone requirements will be as specified or as recommended by the Engineer. If the topsoil is found unacceptable, identify another source of topsoil and incur all expenses associated with testing additional samples. All topsoil incorporated into the site shall match the samples provided to the Engineer for testing.
 8. Topsoil stockpiled under other Sections of this Division may be used subject to the testing and approval specified above. Screen stockpiled topsoil and provide additional topsoil as required at no additional cost to the Owner.
- B. Fertilizer shall be commercial mixed free flowing granules or pelleted fertilizer, 10-20-10 (N-P2O5-K2O) grade for lawn and 5-10-10 for wetland areas. At least 40 percent of the nitrogen in the fertilizer used shall be in slowly available (organic) form.

C. Lime shall be ground agricultural limestone containing not less than 85 percent calcium and magnesium carbonates and be ground to such fineness that at least 50 percent shall pass a 100-mesh sieve and at least 90 percent shall pass a 20-mesh sieve.

D. Sod for Lawn Areas

1. Sod shall be as grown by an established sod grower, as approved by the Engineer and shall consist of either bahia grass, or bermuda grass.
2. Sod shall be vigorous, well rooted, healthy turf, free from insect pests, disease, weeds, other grasses, stones, bare spots, burned spots and any other harmful or deleterious matter. Sod shall be machine stripped at a uniform soil thickness of approximately 1-in and not less than 3/4-in. The measurement for thickness shall not include top growth and thatch and shall be determined at the time of cutting in the field.
3. Individual pieces of sod shall be cut to the supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be plus or minus 1/2-in on width and plus or minus 5 percent on length. Broken rolls or torn or uneven rolls will not be acceptable.
4. Standard size sections of sod shall be strong enough to support their own weight and retain their size and shape when suspended vertically from a firm grasp on the upper 10 percent of the section.
5. Sod shall not be harvested or transplanted when moisture content (excessively dry or wet) may adversely affect is survival.
6. Harvest, deliver and transplant sod within a period of 36 hours unless a suitable preservation method is approved by the Engineer prior to delivery. Sod not transplanted within this period shall be subject to inspection and approval by the Engineer prior to its installation.
7. Before stripping, mow sod uniformly at a height of 1-in to 2-1/2-in.

PART 3 - EXECUTION

3.01 APPLICATION OF TOPSOIL AMENDMENTS

- A. Unless otherwise shown on the Drawings, place topsoil to a minimum compacted depth of 6-in on all parts of the site not covered with structures, pavement, or existing vegetation.
- B. Do not handle or move topsoil when it is wet or frozen.
- C. For all areas to be sodded:
 1. Apply lime at the rate determined by the soil test to bring topsoil pH to a range of 6.0 to 7.0.
 2. Apply fertilizer (10-20-10) at the rate determined by the soil test or at 30 lbs/1000 sq ft.

- D. If possible, apply limestone 2 to 3 months before the application of fertilizer. Do not mix limestone with fertilizer for application and apply a minimum of 2 weeks prior to fertilizer application.
- E. After the topsoil is placed and before it is raked to true lines and rolled, spread limestone evenly over the loam surface and thoroughly incorporate by heavy raking to at least 1/2 the depth of topsoil.
- F. The application of fertilizer may be performed hydraulically. Clean all structures and paved areas of unwanted deposits of the mixture.

3.02 INSTALLATION OF TOPSOIL

- A. Maintain previously established grades, as shown on the Drawings, in a true and even condition.
- B. Prepare subgrade by tilling prior to placement of topsoil to obtain a more satisfactory bond between the two layers. Tillage operations shall be across the slope. Tillage shall not take place on slopes steeper than 2 horizontal to 1 vertical or where tillage equipment cannot be operated. Accomplish tillage by disking or harrowing to a depth of 9-in parallel to contours. Do not perform tillage when the subgrade is frozen, excessively wet, extremely dry or in other conditions which would not permit acceptable results. Rake the subgrade and remove all rubbish, sticks, roots and stones larger than 2-in. Rake subgrade surfaces, or otherwise loosen, immediately prior to covering surfaces with loam.
- C. Place topsoil over approved areas to a depth sufficiently greater than required so that, after natural settlement and light rolling, the complete work will conform to the lines, grades and elevations shown on the Drawings. Do not spread loam in water or while it is frozen or muddy.
- D. After topsoil has been spread, carefully prepare it by scarifying or harrowing and hand raking. Remove all stiff clods, lumps, roots, litter and other foreign material from the loamed area and dispose of it as approved. The areas shall also be free of smaller stones, in excessive quantities, as determined by the Engineer. Then roll the whole surface with a hand roller weighing not more than 100 lbs/ft of width. During the rolling, fill all depressions caused by settlement of rolling with additional loam, regrade the surface and roll until a smooth and even finished grade is created.

3.03 INSTALLATION OF SOD

- A. Only perform sodding and conditioning during those periods within the seasons which are normal for such work as determined by the weather, locally accepted practice and as approved by the Engineer.
- B. Perform sodding between the period of March 15 to June 1 or August 15 to October 1. Only perform sodding during the period from October 2 to March 14 upon approval of the Engineer. Only perform sodding during the period from June 1 to August 14 if irrigation is provided.
- C. Perform sodding within 10 days following soil preparation.

- D. During periods of higher than optimal temperature for species being specified and after all unevenness in the soil surface has been corrected, lightly moisten the soil immediately prior to laying the sod.
- E. Lay the first row of sod in a straight line with subsequent rows placed parallel to and butted tightly against each other. Stagger lateral joints. Exercise care to ensure that the sod is not stretched or overlapped and that all joints are butted tight to prevent voids.
- F. As sodding is completed in any one section, roll the entire section by making four passes with a hand roller weighing not more than 100 lbs/ft of width.
- G. Water sod immediately after transplanting to prevent excessive drying during progress of the work. After rolling, thoroughly water the sod to a depth sufficient that the underside of the new sod pad and soil immediately below the sod are thoroughly wet. Have adequate water available at the site prior to, during and after transplanting the sod. Keep the soil on soil pads moist at all times. In the absence of adequate rainfall, water daily or as often as necessary after installation and in sufficient quantities to maintain moist soil to a minimum depth of 4-in. Perform watering during the heat of the day to help prevent wilting.

3.04 EROSION CONTROL

- A. In order to prevent unnecessary erosion of newly topsoiled and graded slopes and unnecessary siltation of drainage ways, carry out sodding as soon as the project has been satisfactorily completed. When protection of newly loamed and graded areas is necessary at a time which is outside of the normal seeding season, protect those areas by whatever means necessary, as approved by the Owner's representative and prevent siltation in the areas beyond the Limit of Work.
- B. When newly graded subgrade areas cannot be topsoiled and sodded because of season or weather conditions and will remain exposed for more than 30 days, protect those areas against erosion and washouts by temporary mulching. Prior to application of topsoil, thoroughly incorporate any such materials applied for erosion control into the subgrade by discing. Apply fertilizer prior to spreading of topsoil.
- C. On slopes, provide against washouts by an approved method. Regrade and resod all washouts that occur until a good sod is established, at no additional cost to the Owner.

END OF SECTION

SECTION 03100

CONCRETE FORMWORK

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and design, install and remove formwork for cast-in-place concrete complete as shown on the Drawings and as specified herein.
- B. Secure to forms or set for embedment all miscellaneous metal items, sleeves, reglets, anchor bolts, inserts, waterstops, fiberglass reinforced plastic components, hatches and other items furnished under other Sections and required to be cast into concrete.

1.02 RELATED WORK

- A. Concrete reinforcement is included in Section 03200.
- B. Concrete joints and joint accessories are included in Section 03250.
- C. Cast-in-place concrete is included in Section 03300.
- D. Concrete finishes are included in Section 03350.
- E. Grout is included in Section 03600.
- F. Miscellaneous metals are furnished under Sections 05500.
- G. Anchor bolts for equipment are furnished under respective Divisions.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:
 - 1. Form release agent
 - 2. Form ties
- B. Review will be for appearance, performance and strength of the completed structure only. Approval by the Engineer will not relieve the Contractor of responsibility for the strength, safety or correctness of methods used, the adequacy of equipment, or from carrying out the work as shown on the Drawings and as specified herein.

C. Sample Substrate

1. Demonstrate to the Engineer on a designated area of the concrete substructure exterior surface that the form release agent will not impair the bond of paint, sealant, waterproofing, dampproofing, or other coatings and will not affect the forming materials.

D. Certificates

1. Submit completed PE Certification Form for design of formwork in accordance with Section 01300. The PE Certification Form shall be completed and stamped by a professional engineer registered in the State of Florida.
2. Certify that form release agent complies with Federal, State and local VOC limitations.

1.04 REFERENCE STANDARDS

A. American Concrete Institute (ACI)

1. ACI 301 - Specifications for Structural Concrete
2. ACI 318 - Building Code Requirements for Structural Concrete
3. ACI 347 – Guide to Formwork for Concrete

B. APA - The Engineered Wood Association (APA)

1. Material grades and designations as specified

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 SYSTEM DESCRIPTION

- A. Structural design responsibility: Contractor shall provide all forms and shoring designed by a professional engineer registered in the State of Florida. Design and erect formwork in accordance with the requirements of ACI 301, ACI 318 and ACI 347. Comply with all applicable regulations and codes. Consider any special requirements due to the use of plasticized and/or retarded set concrete.

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. Forms, General

1. Make forms for cast-in-place concrete of wood, steel or other approved materials, except as specified in Paragraphs 2.02B and 2.02C.2. Construct wood forms of sound lumber or plywood free from knotholes and loose knots. Construct steel forms to produce surfaces equivalent in smoothness and appearance to those produced by new plywood panels. Design and construct all forms to provide a flat, uniform concrete surface requiring no grinding, repairs, or finishing except as specified in Section 03350.

B. Forms for Exposed Concrete

1. Make forms for all exposed and non-submerged exterior and interior concrete of new and unused Plyform exterior grade plywood panels manufactured in compliance with the APA and bearing the APA trademark. Provide B grade or better veneer on all faces to be in contact with concrete. Design and construct all forms to provide a flat, uniform concrete surface requiring no grinding, repairs, or finishing except as specified in Section 03350.
2. Provide rigid forms that will not deflect, move, or leak. Design forms to withstand the high hydraulic pressures resulting from rapid filling of the forms and heavy high frequency vibration of the concrete. Limit deflection to 1/400 of each component span. Lay out form joints in a uniform pattern.
3. Dress and match boards. Sand plywood smooth and fit adjacent panels with tight joints. Tape, gasket, plug, and/or caulk all joints and gaps in forms to provide watertight joints that will withstand placing pressures without exceeding specified deflection limit or creating surface patterns.
4. Provide 3/4-inch chamfer on all corners unless otherwise indicated.
5. Provide forms for circular structures that conform to the circular shape of the structure and where applicable the existing structure below. Straight panels may be substituted for circular panels if the straight panels do not exceed two feet in width, nor deflect more than 3-1/2 degrees per joint, nor conflict with specific notes indicated and panels conform with the existing structure below.

C. Column Forms

1. Form rectangular columns as specified for exposed concrete. Provide 3/4-in chamfer on all corners unless otherwise indicated.
2. Form circular columns with steel, fiberglass reinforced plastic or seamless cardboard column forms. Provide continuous forms for the height of the column between construction joints indicated.

- D. Provide rustications as indicated. Mill and plane smooth moldings for chamfers and rustications. Provide rustications and chamfer strips of nonabsorbent material, compatible with

the form surface and fully sealed on all sides to prevent the loss of paste or water between the two surfaces.

- E. Form Release Agent. Coat all form surfaces in contact with concrete with an effective, non-staining, non-residual, water based, bond-breaking form coating unless otherwise indicated or specified. Form release agent shall not impair the bond of paint, sealant or other coatings.
- F. Form Ties
 - 1. Coil and Wire Ties: Provide ties manufactured so that, after removal of the projecting part, no metal remains within 1-1/2-in of the face of the concrete. The part of the tie to be removed shall be at least 1/2-in diameter or be provided with a plastic or wooden cone at least 1/2-in diameter and 1-1/2-in long. Provide cone washer type form ties in concrete exposed to view.
 - 2. Flat Bar Ties for Panel Forms: Provide ties that have plastic or rubber inserts with a minimum depth of 1-1/2-in and manufactured to permit patching of the tie hole.
 - 3. Provide ties for liquid retaining structures that have a steel waterstop tightly attached to each strut or that have a neoprene rubber washer on each strut.
 - 4. Do not use common wire for form ties.
 - 5. Alternate form ties consisting of tapered through-bolts at least 1-in in diameter at smallest end or through-bolts that utilize a removable tapered sleeve of the same minimum size may be used. Install in forms so that large end is, where applicable, on the liquid or backfilled side of the wall. Clean, fill and seal form tie hole with non-shrink cement grout to provide watertight form tie holes and make all repairs needed to make watertight.

PART 3 EXECUTION

3.01 GENERAL

- A. Provide forms for all cast-in-place concrete including sides of footings. Construct and place forms to provide concrete of the shape, lines, dimensions and appearance indicated.
- B. Provide removable panels at the bottom of forms for walls and columns to allow cleaning, inspection and joint surface preparation. Provide closable intermediate inspection ports in forms for walls. Provide tremies and hoppers for placing concrete and to allow concrete sampling, prevent segregation and prevent the accumulation of hardened concrete on the forms and reinforcement above the fresh concrete.
- C. Place molding, bevels, or other types of chamfer strips to produce blockouts, rustications, or chamfers as indicated on the Drawings or as specified herein. Provide chamfer strips at horizontal and vertical projecting corners to produce a 3/4-in chamfer. Provide rectangular moldings at locations requiring sealants where shown on the Drawings or specified herein.

- D. Provide rigid forms to withstand construction loads and vibration and meeting specified deflection limits and tolerances. Construct forms so that the concrete will not be damaged by form removal.
- E. Accessories which remain embedded in the concrete after formwork removal will be subject to the approval of the Engineer. Permanent embeddings shall have sufficient concrete cover or be of suitable materials for the exposure condition as approved by the Engineer. Remove unsatisfactory embedded items at no additional cost to the Owner.

3.02 FORM TOLERANCES

- A. Design, construct and surface forms in accordance with ACI 347 and meet the following additional requirements for the specified finishes.
- B. Forms for Exposed Concrete: Edges of all form panels in contact with concrete flush within 1/8-in and forms for plane surfaces plane within 1/8-in in 4-ft. Maximum deviation of the finished surface at any point not to exceed 1/4-in from the intended surface indicated. Arrange form panels symmetrically and orderly to minimize the number of seams. Provide tight forms to prevent the passage of mortar, water, and grout.
- C. Formed Surface Not Exposed to View or Buried: Class "C" Surface per ACI 347.
- D. Formed Surface Including Mass Concrete, Pipe Encasement, Electrical Raceway Encasement and Other Similar Installations: No minimum requirements for surface irregularities and surface alignment. The overall dimensions of the concrete shall be plus or minus 1-in from the intended surface indicated.
- E. Rustications Exposed to View: Straight, plumb and true with a variation of no more than 1/8-in in 10-ft measured in any direction.
- F. Formed Surfaces to be Painted: Surface irregularities limited to 1/16-in at any point. Variation in alignment not to exceed 1/16-in per 4-ft. The maximum deviation of the finish surface at any point not to exceed 1/4-in from the intended surface indicated.

3.03 FORM PREPARATION

- A. Clean, repair, remove projecting nails and fill holes, and smooth protrusions on all form surfaces to be in contact with concrete before reuse. Do not reuse forms for exposed concrete unless a "like new" condition of the form is maintained that will produce surfaces equivalent in smoothness and appearance to those produced by new plywood panels.
- B. Coat wood forms in contact with concrete using form release agent prior to form installation.
- C. Clean steel forms by sandblasting or other method to remove mill scale and other ferrous deposits from the contact surface of all forms. Coat steel forms in contact with concrete using form release agent prior to form installation.

3.04 REMOVAL OF FORMS

- A. Be responsible for all damage resulting from removal of forms and make repairs at no additional cost to the Owner. Leave in place forms and shoring for horizontal structural members in accordance with ACI 301 and ACI 347. Conform to the requirements for form removal specified in Section 03300.

3.05 INSPECTION

- A. Notify the Engineer when the forms are complete and ready for inspection, at least six working hours prior to the proposed concrete placement. The Engineer will inspect the forms to ensure overall conformance with the contract documents.
- B. Failure of the forms to comply with the requirements specified, or to produce concrete complying with requirements specified shall be grounds for rejection of that portion of the concrete work. Repair or replace rejected work as directed by the Engineer at no additional cost to the Owner. Such repair or replacement shall be subject to the requirements of these Specifications and approval of the Engineer.

END OF SECTION

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, including dowels embedded into concrete for masonry.
- B. Furnish only deformed steel reinforcement required to be entirely built into masonry construction specified in Section 04200.

1.02 RELATED WORK

- A. Concrete formwork is included in Section 03100.
- B. Concrete joints and joint accessories are included in Section 03250.
- C. Cast-in-place concrete is included in Section 03300.
- D. Grout is included in Section 03600.
- E. Masonry is included in Section 04200.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:
 - 1. Reinforcing steel. Drawings for fabrication, bending, and placement of concrete reinforcement shall conform to the recommendations of ACI 315 for placement drawings and as specified herein.
 - a. Placement drawings. For walls, show elevations from the outside, looking towards the structure, at a minimum scale of 1/4-in to one foot. For slabs, show top and bottom reinforcement on separate plan views, as needed for clarity. For beams and columns, show schedules with sections and/or elevations and stirrup/tie spacing. Show additional reinforcement around openings, at corners and at other locations indicated, diagrams of bent bars, arrangements and assemblies, all as required for the fabrication and placement of concrete reinforcement. Reference bars to the same identification marks shown on the bar bending details. Identify bars to have special coatings and/or to be of special steel or special yield strength.

- b. Bar bending details. Reference bars to the same identification marks shown on the placement drawings. Identify bars to have special coatings and/or to be of special steel or special yield strength.
 2. Fiber reinforcement. Submit manufacturer's data for synthetic reinforcing fibers. Identify all placements that are to contain synthetic reinforcing fibers. The fiber length and amount of fibers per cubic yard to be used for each placement shall be noted. Submit two samples of synthetic reinforcing fibers.
- B. Submit samples of each of the following items.
 1. Two samples of each type of mechanical reinforcing steel coupling system.
- C. Submit, in accordance with Section 01300, Test Reports of each of the following items.
 1. Certified copy of mill test on each heat of each steel proposed for use showing the physical properties of the steel and the chemical analysis.
 2. Welder's certification in accordance with AWS D1.4 when welding of reinforcement is indicated, specified, or approved.

1.04 REFERENCE STANDARDS

- A. 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 A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement.
 4. ASTM A496 - Standard Specification for Steel Wire, Deformed, for Concrete Reinforcement.
 5. ASTM A497 - Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete Reinforcement.
 6. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
 7. ASTM A704 – Standard Specification for Welded Steel Plain Bar or Rod Mats for Concrete Reinforcement.
 8. ASTM A706 - Standard Specification for Low-Alloy Steel Deformed and Plain Bars for Concrete Reinforcement.

- B. American Concrete Institute (ACI)
 - 1. ACI 301 - Specifications for Structural Concrete.
 - 2. ACI 315 - Details and Detailing of Concrete Reinforcement.
 - 3. ACI 318 - Building Code Requirements for Structural Concrete.
 - 4. SP-66 (ACI 315) ACI Detailing Manual.
- C. Concrete Reinforcing Steel Institute (CRSI)
 - 1. Manual of Standard Practice
- D. American Welding Society (AWS)
 - 1. AWS D1.4 Structural Welding Code - Reinforcing Steel
- E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. Fiber Reinforcement. Provide services of a manufacturer's representative, with at least 2 years experience in the use of the synthetic reinforcing fibers for a preconstruction meeting and assistance during the first placement of the material.

1.06 DELIVERY, HANDLING AND STORAGE

- A. Provide reinforcement free from mill scale, rust, mud, dirt, grease, oil, ice, or other foreign matter.
- B. Ship and store reinforcement 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. Tags for ASTM A706 reinforcing and for ASTM A615 reinforcing meeting the requirements of Paragraph 2.01C.1 shall indicate that the reinforcing is weldable.
- C. Store reinforcement off the ground, protect from moisture and keep free from rust, mud, dirt, grease, oil, ice, or other injurious contaminants.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Provide new materials of domestic manufacture complying with the following material specifications.

- B. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.
- C. Deformed Concrete Reinforcing Bars required on the Drawings to be Field Bent or Welded: ASTM A706.
 - 1. ASTM A615, Grade 60 may be substituted for ASTM A706 subject to the following:
 - a. The actual yield strength of the reinforcing steel based on mill tests does not exceed the specified yield strength by more than 18,000 psi. Retests not to exceed this value by more than an additional 3,000 psi.
 - b. The ratio of the actual ultimate tensile strength to the actual tensile yield strength of the reinforcement is not less than 1.25.
 - c. The carbon equivalency (CE) is 0.55 percent or less.
- D. Welded Steel Wire Fabric: ASTM A185. Provide in flat sheets.
- E. Welded Deformed Steel Wire Fabric: ASTM A497.
- 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 Wire Bar Supports: CRSI Bar Supports, Class 1 - Maximum Protection.
 - 2. Stainless Steel Protected Wire Bar Supports: CRSI Bar Supports, Class 2 - Moderate Protection with legs made wholly from stainless steel wire.
 - 3. Precast Concrete Bar Supports: CRSI Bar Supports, Precast Concrete Bar Supports. Precast concrete blocks that have equal or greater strength than the surrounding concrete.
- I. Tie Wire
 - 1. Tie Wires for Reinforcement: 16-gauge or heavier black annealed wire.
- J. Mechanical Reinforcing Steel Coupling System
 - 1. Use only where indicated. Mechanical reinforcing steel coupling system 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. Coupling system shall meet all ACI 318 requirements. Bar ends must be taper threaded with coupler manufacturer's bar threader to ensure proper taper and thread engagement. Provide with cap on female end to exclude dirt, debris and wet concrete. Couplers shall be torqued to manufacturer's recommended value.

2. Unless otherwise noted on the Drawings, mechanical reinforcing steel coupling system shall produce a splice strength in tension or compression of not less than 125 percent of the ASTM specified minimum yield strength of the reinforcing bar. Base yield strength on Grade 60 reinforcing unless otherwise indicated or specified.
3. Compression type mechanical splices shall provide concentric bearing from one bar to the other bar.

K. Fiber Reinforcement

1. Synthetic reinforcing fibers for concrete grout shall be 100 percent polypropylene collated, fibrillated fibers, Fibermesh 300 as manufactured by Propex Concrete Systems Corp, Chattanooga, TN, or equal. Fiber length and quantity for the concrete grout mix shall be in strict compliance with the manufacturer's recommendations as approved by the Engineer.

2.02 FABRICATION

- A. Comply with the CRSI Manual of Standard Practice.
- B. Bend bars cold. Do not straighten or rebend bars.
- C. Bend bars around a revolving collar having a diameter not less than that recommended by the CRSI or ACI 318.
- D. Saw cut bar ends that are to be butt spliced, placed through limited diameter holes in metal, or threaded. Terminate saw cut ends 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. Comply with the CRSI Manual of Standard Practice for surface condition, bending, spacing and tolerances of placement for reinforcement. Provide the amount of reinforcing indicated at the spacing and clearances indicated on the Drawings.
- B. Determine clear concrete cover based on exposure to the environment. Unless indicated otherwise on the Drawings, provide the following minimum clear concrete cover over reinforcement:
 1. Concrete cast against and permanently exposed to earth: 3-in
 2. Concrete exposed to soil, water, sewage, sludge and/or weather:
 - a. Slabs (top and bottom cover), walls: 2-in
 - b. Beams and columns (ties, spirals and stirrups): 2-in

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: 1-in
 - b. Beams and columns (ties, spirals and stirrups): 1-1/2-in
- C. Coat uncoated reinforcement which will be exposed for more than 60 days after placement with a heavy coat of neat cement slurry.
- D. Do not weld reinforcing steel bars either during fabrication or erection unless indicated on the Drawings or as specified herein, or unless prior written approval has been obtained from the Engineer. Remove immediately all bars that have been welded, including tack welds, without such approval. Comply with AWS D1.4 when welding of reinforcement is shown on the Drawings, specified, or approved.
- E. Reinforcing steel interfering with the location of other reinforcing steel, piping, conduits or embedded items may be moved within the specified tolerances or one bar diameter, whichever is greater. Obtain the approval of the Engineer if greater displacement of bars to avoid interference is needed. Do not cut reinforcement to install inserts, conduits, mechanical openings or other items without the prior approval of the Engineer.
- F. Secure, support and tie reinforcing steel to prevent movement during concrete placement. Secure dowels in place before placing concrete.
- G. Do not field bend reinforcing unless indicated or specifically authorized in writing by the Engineer. Cold-bend bars indicated or authorized to be field bent around the standard diameter spool specified in the CRSI. Do not heat bars. Closely inspect the reinforcing steel for breaks. Replace, repair by cutting out damaged bars and splicing new bars using coupling sleeves filled with ferrous material, or otherwise repair damaged reinforcing bars as directed by the Engineer at no additional cost to the Owner. Do not bend reinforcement after it is embedded in concrete unless indicated on the Drawings.

3.02 REINFORCEMENT AROUND OPENINGS

- A. 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 the opening unless indicated otherwise on the Drawings. Extend each end of each bar beyond the edge of the opening or penetration by the tension development length for that bar size.

3.03 SPLICING OF REINFORCEMENT

- A. Provide splices as shown on the Drawings and as specified herein.
- B. Splices Indicated as Compression Splices: Provide lap splice of 30 bar diameters, but not less than 12-in unless indicated otherwise on the Drawings. Base the lap splice length for column vertical bars on the bar size in the column above.

- C. All Other Splices: Provide tension lap splices in compliance with ACI 318. Stagger splices in adjacent bars where possible. Provide Class B tension lap splices at all locations unless otherwise indicated.
- D. Splices in Circumferential Reinforcement in Circular Walls: Provide Class B tension lap splices and stagger as indicated.
- E. Tension Members: Avoid splicing of reinforcing steel in concrete elements indicated as "tension members." However, if splices are required for constructability, splices in the reinforcement subject to direct tension shall be butted and joined with complete penetration welds to develop, in tension, at least 125 percent of the specified yield strength of the bar. Offset splices in adjacent bars the distance of a Class B splice or 30-in, whichever is greater.
- F. Lap splices in welded wire fabric in accordance with the requirements of ACI 318 but not less than 12-in. Tie the spliced fabrics together with wire ties spaced not more than 24-in on center and lace with wire of the same diameter as the welded wire fabric. Offset splices in adjacent widths to prevent continuous splices.
- G. Mechanical reinforcing steel coupling system shall be used only where shown on the Drawings. Offset splices in adjacent bars by at least 30 bar diameters. Mechanical reinforcing steel coupling system is only to be used for special splice and dowel conditions approved by the Engineer.
- H. After installation of mechanical reinforcing steel coupling system, on reinforcement, repair coating damage in accordance with the applicable ASTM standard. Coat all parts of mechanical connectors used on coated bars including steel splice sleeves, bolts and/or nuts with the same material used for the repair of damaged coating.

3.04 ACCESSORIES

- A. Determine, provide and install accessories such as chairs, chair bars and the like to support the reinforcement providing the spacing and clearances indicated on the Drawings 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. Use plastic protected bar supports or steel supports with plastic tips where the reinforcing steel is to be supported 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 stainless steel protected bar supports in walls, beams and elevated slabs. Use stainless steel supports or plastic tipped metal supports in all other locations unless otherwise noted on the Drawings or specified herein.
- D. Provide #5 minimum size support bars. Do not reposition upper bars in a bar mat for use as support bars.

- E. 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. Notify the Engineer when the reinforcing is complete and ready for inspection, at least six working hours prior to the proposed concrete placement. Do not cover reinforcing steel with concrete until the installation of the reinforcement, including the size, spacing and position of the reinforcement has been inspected by the Engineer and the Engineer's release to proceed with the concreting has been obtained. Keep forms open until the Engineer has completed inspection of the reinforcement.

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 complete as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Concrete formwork is included in Section 03100.
- B. Concrete reinforcement is included in Section 03200.
- C. Cast-in-place concrete is included in Section 03300.
- D. Concrete finishes are included in Section 03350.
- E. Grout is included in Section 03600.
- F. Miscellaneous metals are included in Section 05500.
- G. Waterproofing, dampproofing and caulking are included in Division 7.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and product data for:
 - 1. Plastic Waterstops: Product data including sample, catalogue cut, technical data, storage requirements, splicing methods and conformity to CRD standards.
 - 2. Special Waterstops: Product data including location of use, sample, catalogue cut, technical data, storage requirements, splicing methods, installation instructions, and conformity to CRD, ASTM or FS standards, as applicable.
 - 3. Premolded joint fillers: Product data including location of use, sample, catalogue cut, technical data, storage requirements, installation instructions, and conformity to ASTM standards.
 - 4. Compressible joint filler: Product data including location of use, catalogue cut, technical data, storage requirements, installation instructions, and conformity to ASTM standards.
 - 5. Bond breaker: Product data including location of use, catalogue cut, technical data, storage requirements, and application instructions.

6. Expansion joint dowels: Product data on the complete assembly including dowels, coatings, expansion dowel caps, installation instructions and conformity to ASTM standards.
7. Sealant: Product data including location of use, catalogue cut, technical data, storage requirements, mixing and application instructions, and conformity to ASTM standards.
8. Neoprene bearing pads: Product data including location of use, sample, catalogue cut, technical data, storage requirements, installation instructions, and conformity to AASHTO standards.

B. Certifications

1. Certify that all materials used within the joint system are compatible with each other.

1.04 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM)

1. ASTM A615 – Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
2. ASTM C920 - Standard Specification for Elastomeric Joint Sealants.
3. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

B. U.S. Army Corps of Engineers (CRD).

1. CRD C572 - Specification for Polyvinylchloride Waterstops.

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

1. Standard Specifications for Highway Bridges

D. Federal Specifications (FS)

1. FS SS-S-210A - Sealing Compound for Expansion Joints.

E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. Provide services of a manufacturer's field representative of the sealant who has performed at least five projects of similar size and complexity within the last 5 years. The field representative shall be present at the work site prior to any mixing of components to instruct on mixing,

application and inspection procedures and to inspect the finish of the prepared surfaces prior to application of the sealant.

- B. The manufacturer's field representative shall make at least one additional visit to the site as the work progresses and shall report on each visit to the Contractor and the Engineer, advising as to whether the application is being performed in accordance with this Section and the manufacturer's printed instructions.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in original, unopened containers displaying the manufacturer's label showing manufacturer name, product identification and batch number.
- B. Store products as recommended by the manufacturer.

PART 2 PRODUCTS

2.01 GENERAL

- A. All materials used together in a given joint shall be compatible with one another. Coordinate selection of suppliers and products to provide compatibility. Do not use asphaltic bond breakers or asphaltic joint fillers in joints receiving sealant.
- B. 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 in similar applications for more than five years.

2.02 MATERIALS

- A. Plastic Waterstops
 1. Waterstops for expansion joints: 9-in by 3/8-in ribbed type waterstops with a center bulb conforming to CRD C572 and 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 1750 psi. Waterstops shall be style CR-9380 by Paul Murphy Plastics Co., Roseville, MI; style 696 by Greenstreak Plastic Products, St. Louis, MO; style RLB9-38 by Vinylex Corp., Knoxville, TN, or equal.
 2. Waterstops for non-expansion joints and other locations shown on the Drawings: 6-in by 3/8-in ribbed type waterstops conforming to CRD C572 and 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 1750 psi. Waterstops shall be style FR-6380 by Paul Murphy Plastics Co., Roseville, MI; style 679 by Greenstreak Plastic Products, St. Louis, MO; style R6-38 by Vinylex Corp., Knoxville, TN, or equal.

B. Special Waterstops

1. PVC Retrofit Waterstops for non-expansion joints: "T" type waterstop conforming to CRD C572 and 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 1750 psi. Waterstop shall be style 609 system, complete with Type 304 stainless steel batten bars and 1/4-in diameter stainless steel expansion bolts, by Greenstreak Plastic Products, St. Louis, MO or equal.
2. Type B Expansive Waterstops for construction joints where shown on the Drawings: Preformed hydrophilic rubber seals. Installation adhesives used with the expansive waterstops shall be as recommended by the waterstop manufacturer. The waterstop shall be Adeka Ultraseal MC-2010MN as distributed by Mitsubishi of Houston, TX; Hydrotite CJ-1020-2K by Greenstreak Plastic Products, St. Louis, MO, or equal.

C. Premolded Joint Filler

1. Premolded Joint Filler – Structures: Self-expanding cork premolded joint filler conforming to ASTM D1752, Type III. Provide 1-in thickness unless otherwise indicated on the Drawings.

D. Bond Breaker

1. Bond Breaker Tape: Adhesive-backed glazed butyl or polyethylene tape which will adhere to the premolded joint filler or concrete surface. Provide tape the same width as the joint.
2. Bond breaker for concrete other than where tape is indicated on the Drawings or specified: Either bond breaker tape or a non-staining type bond prevention coating such as Crete-Lease Bond Breaker for Tilt-Up by Cresset Chemical Co.; Sure-Lift J-6 WB by Dayton Superior; Silcoseal Select by Nox-Crete, or equal.

E. Compressible Joint Filler

1. A non-extrudable watertight strip material used to fill expansion joints between structures. The material shall be capable of being compressed at least 40 percent for 70 hours at 68 degrees F and subsequently recovering at least 20 percent of its original thickness in the first 1/2 hour after unloading. Compressible joint filler shall be Evazote 380 E.S.P, by E-Poxy Industries, Inc., Ravena, NY or equal.

F. Expansion Joint Dowels

1. Smooth under-formed steel bars conforming to ASTM A615, Grade 60. Provide dowels 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-in on the diameter of the dowel and extends no more than 0.04-in from the end. Coat bars with a bond breaker on the expansion end of the dowel. Provide expansion dowel caps on the expansion end.

2. Expansion Dowel Caps: No. 87 Dowel Caps by Heckmann Building Products, Inc.; Style K-11 Dowel Caps by the Dayton Superior Corporation; Style 3070 Expansion Tube by Meadow Steel Products, Inc., or equal.

G. Sealant

1. Provide sealant for joints in horizontal surfaces conforming to ASTM C920, Type S or M, Grade P or NS, Class 25. Provide sealant for joints in sloping and vertical surfaces conforming to ASTM C920, Type S or M, Grade NS, Class 25. Provide Use T sealant in pedestrian and vehicular traffic areas and Use NT in non-traffic areas.
2. Provide sealants made for use in continuous immersion in contact with wastewater. Provide gray colored sealants unless otherwise indicated on the Drawings, specified, or approved.

H. Neoprene Bearing Pads: 50 durometer conforming to AASHTO Standard Specifications for Highway Bridges.

PART 3 EXECUTION

3.01 INSTALLATION

A. Waterstops - General

1. Install waterstops for all joints as shown on the Drawings. Provide waterstops continuous around all corners and intersections so that a continuous seal is provided.
2. Provide a minimum number of connections or splices.
3. Secure waterstops in joints before concrete is placed.
4. Install plastic waterstops so that half of the width will be embedded on each side of the joint. Provide waterstops completely embedded in void-free concrete.
5. Terminate waterstops 2-in below the exposed top of walls. Plug center bulbs in expansion joint waterstops with foam rubber, 1-in deep, at all points of termination.

B. Plastic Waterstops

1. Make splices by welding in accordance with the manufacturer's recommendations. Use only manufacturer's special approved tools for welding. The finished splices shall provide a cross-section that is dense and free of porosity. After splice has cooled, spark test all splices in accordance with manufacturer's printed instructions. If splice shows any separation or lack of fusion reject the splice, recut back at least 1-in from rejected splice each side, reweld and retest.
2. Secure waterstops in wall joints before concrete is placed. If waterstop does not incorporate an integral fastening system, drill holes in waterstops 1-in from each edge or

between the outermost ribs at each edge. Center the waterstop in the joint. Tie both edges of the waterstop to reinforcing steel with tie wire as specified for tying reinforcing steel. Secure the waterstop centered on and perpendicular to the joint and to maintain this position during concrete placement.

3. Space waterstop ties to match the spacing of the adjacent reinforcing, but ties need not be spaced closer than 12-in on center.
4. Clamp horizontal waterstops in slabs in position with the form bulkhead (unless previously set in concrete). Lift the edge of the waterstop while placing concrete below the waterstop. Manually force the waterstop against and into the placed concrete and cover with fresh concrete, to provide complete encasement of the waterstop in concrete.

C. Special Waterstops

1. Install special waterstops at joints only where specifically shown on the Drawings. Provide waterstops continuous around all corners and intersections so that a continuous seal is provided.
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. Terminate waterstops 2-in below the exposed top of walls. Plug bulbs in PVC retrofit waterstops with foam rubber, 1-in deep, at all points of termination.
4. Splice PVC retrofit waterstops and secure projecting portion to reinforcing steel as specified for plastic waterstops. Clean existing concrete of all foreign material and patch as necessary to form a smooth plane surface. Adhesives, fastening devices, and fastener spacing shall conform to the manufacturer's recommendations.
5. Clean and prepare joint surfaces, install primers or adhesives, and install Type B expansive waterstops on dry surfaces in accordance with the manufacturer's instructions including concrete cure, temperature conditions, and splices. Protect installed waterstops from moisture and keep dry until subsequent placement of concrete.

D. 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. Do not eliminate construction joints.
2. Locate additional or relocated joints 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. Unless indicated otherwise, provide joints perpendicular to main reinforcement. Continue reinforcing steel through the joint as indicated on the Drawings. Provide inclined dowels at construction joints in beams, as detailed on the Drawings.
4. At all construction joints and at concrete joints indicated on the Drawings to be "roughened", uniformly roughen the surface of the concrete to a full amplitude (distance between high and low points and side to side) of 1/4-in with chipping tools to expose a fresh face. Thoroughly clean joint surfaces of loose or weakened materials by waterblasting or sandblasting and prepare for bonding. At least two hours before and again shortly before the new concrete is deposited, saturate the joints with water. After glistening water disappears, coat joints with neat cement slurry mixed to the consistency of very heavy paste. The surfaces shall receive a coating at least 1/8-in thick, scrubbed-in by means of stiff bristle brushes. Deposit new concrete before the neat cement dries.
5. Provide waterstops in wall and slab construction joints in liquid retaining structures and at other locations shown on the Drawings.
6. Do not use keyways in construction joints unless specifically shown on the Drawings or approved by the Engineer.

E. Expansion Joints

1. Make expansion joints at locations indicated on the Drawings. Do not eliminate or relocate expansion joints.
2. Do not extend through expansion joints, reinforcement or other embedded metal items that are continuously bonded to concrete on each side of joint.
3. Position premolded joint filler material parallel to finished surfaces. Secure the joint filler against displacement during concrete placement and consolidation. Place joint filler over the face of the joint, allowing for sealant grooves as indicated. Tape all joint filler splices to prevent intrusion of mortar. Seal expansion joints as indicated on the Drawings.
4. Provide expansion joints 1-in in thickness unless otherwise indicated on the Drawings.
5. Where indicated on the Drawings install smooth dowels at right angles to expansion joints. Align dowels with finished surface. Rigidly hold in place and support during concrete placement. Unless otherwise indicated on the Drawings apply a bond breaker to one end of all dowels through expansion joints. Provide expansion dowel caps on the lubricated ends of expansion dowels.
6. Provide center bulb type waterstops, sealant grooves, and sealants in wall and slab expansion joints in liquid retaining structures and at other locations shown on the Drawings.

F. Control Joints

1. Make control joints at locations shown on the Drawings. Do not eliminate or relocate control joints.
2. Provide waterstops, sealant grooves, and sealants in wall and slab control joints in liquid retaining structures and at other locations shown on the Drawings.
3. Extend every other bar of reinforcing steel through control joints or as indicated on the Drawings. Coat the concrete surface with a bond breaker prior to placing new concrete against it as shown on the Drawings. Do not coat reinforcement or waterstops with bond breaker.

G. Sealant

1. Install sealants in clean dry recesses free of frost, oil, grease, form release agent, loose material, laitance, dirt, dust and other materials which will impair bond at the locations shown on the Drawings. Apply sealant conforming to the manufacturer's recommendations including concrete cure, temperature, moisture, mixing, primer, primer cure time, joint and recess preparation, tooling, and curing. Apply masking tape to each side of the joint prior to the installation of the sealant and remove afterwards along with any spillage to leave a sealant installation with neat straight edges.

H. Compressible Joint Filler

1. Install compressible joint filler in conformance with the manufacturer's recommendations; including surface preparation, adhesive installation, heat welding and set time.

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install cast-in-place concrete complete as shown on the Drawings and as specified herein.
- B. Furnish, as required to establish concrete mixes, all sampling and laboratory testing of products and materials performed by an independent testing laboratory engaged by and at the expense of the Contractor. Field sampling, testing, inspection and related laboratory tests will be provided by the Owner.

1.02 RELATED WORK

- A. Concrete formwork is included in Section 03100.
- B. Concrete reinforcement is included in Section 03200.
- C. Concrete joints and joint accessories are included in Section 03250.
- D. Concrete finishes are included in Section 03350.
- E. Grout is included in Section 03600.
- F. Miscellaneous metals are included in Section 05500.
- G. Waterproofing, dampproofing, and caulking are included in Division 7.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, product data for:
 - 1. Sources of cement, fly ash, aggregates, and batched concrete.
 - 2. Air-entraining admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.
 - 3. Water reducing admixture. Product data including catalogue cut, technical data, storage requirements, product life, recommended dosage, temperature considerations and conformity to ASTM standards.
 - 4. Sheet curing material. Product data including catalogue cut, technical data and conformity to ASTM standard.

5. Material Safety Data Sheets (MSDS) for all concrete components and admixtures.
6. 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.
7. 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.

B. Samples

1. Fine and coarse aggregates if requested for examination by the Engineer.

C. Test Reports

1. Aggregates: Conformance to ASTM standards, including sieve analysis, mechanical properties, deleterious substance content, and mortar bar expansion test results.
2. Cement and fly ash: Conformance to ASTM standards, including chemical analysis and physical tests.
3. Concrete mixes: For each formulation of concrete proposed for use, submit constituent quantities per cubic yard, water cementitious ratio, air content, concrete slump, type and manufacturer of cement and type and manufacturer of fly ash. Provide either Paragraph a. or b., below, for each mix proposed.
 - a. Standard deviation data for each proposed concrete mix based on statistical records.
 - 1) Provide the following for each strength data point used in the calculation of the standard deviation for determination of the minimum required average strength:
 - a) Date of sampling and name of testing laboratory.
 - b) Name of concrete batch plant.
 - c) Water cementitious ratio.
 - d) Slump of batch.
 - e) Air content of batch.
 - f) Compressive strengths of all cylinders tested at that age in that batch.
 - g) If available, temperature and unit weight of batch.

- 2) Provide data from projects not more strictly controlled than outlined in these specifications. Provide summary sheet showing all pertinent data and the computation of the standard deviation.
 - b. Water cementitious ratio curve for concrete mixes based on laboratory tests. Provide average cylinder strength test results at 7 and 28 days for laboratory concrete mix designs. Provide results of 14 day tests if available.
4. Mass Concrete Mix: shrinkage test.

D. Certifications

1. Certify that admixtures used in the same concrete mix are compatible with each other and the aggregates.
2. Certify that the Contractor is not associated with the independent testing laboratory proposed for use by the Contractor nor does the Contractor or officers of the Contractor's organization have a beneficial interest in the laboratory.
3. Certificate of conformance for concrete production facilities from the NRMCA.

1.04 REFERENCE STANDARDS

A. 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 C138 – Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
7. ASTM C143 - Standard Test Method for Slump of Hydraulic-Cement Concrete
8. ASTM C150 - Standard Specification for Portland Cement
9. ASTM C156 - Standard Test Method for Water Retention by Liquid Membrane-Forming Curing Compound for Concrete.

10. ASTM C157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
11. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete
12. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
13. ASTM C192 – Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
14. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
15. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
16. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
17. ASTM C311 – Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for use in Portland Cement Concrete.
18. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
19. ASTM C596 – Standard Test Method for Drying Shrinkage of Mortar Containing Hydraulic Cement.
20. ASTM C618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
21. ASTM C1017 – Standard Specification for Chemical Admixtures for use in Producing Flowing Concrete.
22. ASTM C1077 – Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation.
23. ASTM C1260 – Standard Test Method for Potential Alkali Reactivity of Aggregates (Mortar-Bar Method).
24. ASTM E329 – Standard Specification for Agencies Engaged in Construction Inspection and/or Testing.

B. American Concrete Institute (ACI).

1. ACI 207.1R Guide to mass concrete
2. ACI 207.4R Cooling and Insulating System for Mass Concrete

3. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete.
4. ACI 232.2R - Use of Fly Ash in Concrete.
5. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.
6. ACI 304.2R - Placing Concrete by Pumping Methods.
7. ACI 305R - Hot Weather Concreting.
8. ACI 306R - Cold Weather Concreting.
9. ACI 318 - Building Code Requirements for Structural Concrete and Commentary.
10. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary.

C. National Ready Mixed Concrete Association (NRMCA)

1. Quality Control Manual, Section 3 - Certification of Ready Mixed Concrete Production Facilities.

D. Truck Mixer Manufacturers Bureau (TMMB)

1. TMMB 100 - Truck Mixer, Agitator and Front Discharge Concrete Carrier Standards.

- E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. Comply with ACI 318 and ACI 350 and other stated specifications, codes and standards. Apply the most stringent requirements of other stated specifications, codes, standards, and this Section when conflicts exist.
- B. Independent testing laboratory shall meet the requirements of ASTM E329 and ASTM C1077 and be acceptable to the Engineer. Laboratories affiliated with the Contractor or in which the Contractor or officers of the Contractor's organization have a beneficial interest are not acceptable.
- C. Use only one source of cement and aggregates for the project. Provide concrete uniform in color and appearance.
- D. At least ten working days before the first concrete placement hold a preconstruction meeting to review the requirements for concrete placement, waterstop placement, jointing, concrete curing, hot weather concreting, cold weather concreting and finishing. Review, with the attendance of the plasticizer manufacturer, the properties and techniques of batching and placing concrete

containing high-range water-reducing admixture. Notify all parties involved, including the Engineer, of the meeting at least ten working days prior to its scheduled date. Prepare an agenda for the meeting. Take meeting minutes and distribute to all attendees.

- E. If, during the progress of the work, it is impossible to secure concrete of the specified 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 specified properties. Make all changes so ordered at no additional cost to the Owner.
- F. If, during the progress of the work, the materials from the sources originally accepted change in characteristics, make, at no additional cost to the Owner, new acceptance tests of materials and establish new concrete mixes with the assistance of an independent testing laboratory.
- G. All field testing and inspection services and related laboratory tests required will be provided by the Owner. The cost of such work will be paid for by the Owner. Methods of testing will comply with the latest applicable ASTM methods. The following items will be tested by the Owner to verify conformity with this Section.
- H. Provide field testing and inspection services and related laboratory tests. Methods of testing shall comply with the latest applicable ASTM methods. The following items shall be tested to verify conformity with this Section.
 - 1. Concrete placements - compressive strength (cylinders), compressive strength (cores), slump, and air content.
 - 2. Other materials that may require field testing.
- I. Samples of constituents and of concrete as-placed will be subjected to laboratory tests by the Owner. All materials incorporated in the work shall conform to accepted samples.
- J. Provide laboratory tests of samples of constituents and of concrete as-placed. All materials incorporated in the work shall conform to accepted samples.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Cement: Store in weathertight buildings, bins or silos to provide protection from dampness and contamination and to prevent warehouse set.
- B. Aggregate: Arrange and use stockpiles to prevent segregation or contamination with other materials or with other sizes of like aggregates. Build stockpiles in successive horizontal layers not exceeding three 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 prevent contamination. Allow sand to drain to a uniform moisture content before using. Do not use frozen or partially frozen sand.
- D. Admixtures: Store in closed containers to prevent contamination, evaporation or damage. Provide agitating equipment to uniformly disperse ingredients in admixture solutions which

tend to separate. Protect liquid admixtures from freezing and other temperature changes which could adversely affect their characteristics.

- E. Fly Ash: 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.

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. Materials shall comply with this Section and any applicable State or local requirements.
- B. Cement: Domestic portland cement conforming to ASTM C150. Cement shall be low alkali cement. Do not use air entraining cements. Cement brand must be approved by the Engineer and one brand shall be used throughout the work. Provide the following type(s) of cement:
 - 1. Concrete - Type II with the addition of fly ash resulting in C_3A being below 5 percent of total cementitious content, Type III limited to 5 percent C_3A or Type V.
- C. Aggregates:
 - 1. Fine Aggregate: Washed inert natural sand conforming to ASTM C33.
 - 2. Coarse Aggregate: Well-graded crushed stone or washed gravel conforming to ASTM C33. Grading requirements as listed in ASTM C33, Table 2 for the specified coarse aggregate size number listed in Table 1 herein. Limits of deleterious substances and physical property requirements as listed in ASTM C33, Table 3 for severe weathering regions. Do not use coarse aggregates known to be deleteriously reactive with alkalis in cement.
 - 3. The fine and coarse aggregates used shall not cause expansion of mortar bars greater than 0.1 percent in 16 days when tested in accordance with ASTM C1260 and using the cement proposed for the project. If aggregates proposed for use do not meet this requirement, then satisfy either a. or b. below.

- a. Total equivalent alkali content of the cement used shall not exceed 0.60 percent as provided in the Optional Chemical Requirements of ASTM C150.
 - b. The fine and coarse aggregates used shall not cause expansion of mortar bars greater than 0.1 percent in 16 days when tested in accordance with ASTM C1260 and using the cement and fly ash proposed for the project. The proportions of the cement-fly ash mix shall be the same as those proposed for the project.
- D. Water: Potable water free of oil, acid, alkali, salts, chlorides (except those attributable to drinking water), organic matter, or other deleterious substances.
- E. Admixtures: Use admixtures free of chlorides and alkalis (except for those attributable to drinking water). The admixtures shall be from the same manufacturer when it is required to use more than one admixture in the same concrete mix. Use admixtures compatible with the concrete mix including other admixtures.
1. Air Entraining Admixture: Conforming to ASTM C260. Proportion and mix in accordance with manufacturer's recommendations.
 2. Water Reducing Admixture: Conforming to ASTM C494, Type A. Proportion and mix in accordance with manufacturer's recommendations.
 3. High-Range Water-Reducing Admixtures (Plasticizer): Conforming to ASTM C494, Type F or ASTM C1017, Type I resulting in non-segregating plasticized concrete with little bleeding and with the physical properties of low water/cementitious ratio concrete. The treated concrete shall be capable of maintaining its plastic state in excess of 2 hours. Proportion and mix in accordance with manufacturer's recommendations.
 4. Do not use admixtures causing retarded or accelerated setting of concrete without written approval from the Engineer. Use retarding or accelerating water reducing admixtures when so approved.
 5. Tremie Mix Anti-Washout Admixture: Conforming to ASTM C494. Proportion and mix in accordance with manufacturer's recommendations. RHEOMAC UW450 by BASF Building Systems or equal.
- F. Fly Ash: Class F fly ash complying with ASTM C618, including the requirements of Table 1 but with the Loss of Ignition (LOI) limited to 3 percent maximum and the optional physical requirements of Table 3. Test in compliance with ASTM C311 with a minimum of one sample weighing four pounds taken from each 200 tons of fly ash supplied for the project.
- G. Sheet Curing Materials: Waterproof paper, polyethylene film or white burlap-polyethylene sheeting, all conforming to ASTM C171.
- H. Liquid Curing Compound. Liquid membrane-forming curing compound conforming to ASTM C309, Type 1-D (clear or translucent with fugitive dye) and containing no wax, paraffin, or oil. Curing compounds shall be non-yellowing and have a unit moisture loss no greater than 0.039 gm/cm² at 72 hours as measured by ASTM C156. Curing compound shall comply with Federal, State and local VOC limits.

2.03 MIXES

- A. An independent testing laboratory engaged by and at the expense of the Contractor shall establish concrete mixes and perform all sampling and laboratory testing of products and materials.
- B. Select proportions of ingredients to meet the design strength and materials limits specified in Table 1 and to produce placeable, durable concrete conforming to these specifications. 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 free water to collect on the surface.
- C. Base concrete mixes on standard deviation data of prior mixes with essentially the same proportions of the same constituents or, if not available, develop concrete mixes by laboratory tests using the materials proposed for the work.
 - 1. For concrete mixes based on standard deviation data of prior mixes, submit standard deviation data of prior mixes with essentially the same proportions of the same constituents in accordance with ACI 318 and ACI350 and based on the modification factors for standard deviation tests contained in ACI 318 and ACI 350.
 - 2. For concrete mixes developed by laboratory testing, base cementitious content of the concrete on curves showing the relation between water cementitious ratio and 7 and 28 day compressive strengths of concrete made using the proposed materials. Determine curves by four or more points, each representing an average value of at least three test specimens and one water-cementitious ratio at each age. Provide curves with a range of values sufficient to yield the desired data, including the compressive strengths specified, without extrapolation. The cementitious content of the concrete mixes to be used, as determined from the curve, shall correspond to the required average compressive strength in Table 5.3.2.2 of ACI 318. The resulting mix shall not conflict with the limiting values for maximum water cementitious ratio and net minimum cementitious content specified in Table 1.
- D. Test the fly ash and concrete mixture to provide test data confirming that the fly ash in combination with the cement to be used meets all strength requirements and is compatible with the other concrete additives.
- E. Test aggregates for potential alkali reactivity in accordance with ASTM C1260. If initial testing indicates aggregates are not potentially reactive repeat test at 3 month intervals.
- F. Compression Tests: Provide testing of the proposed concrete mixes to demonstrate compliance with the compression strength requirements in conformity with the provisions of ACI 318.
- G. 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 specified under Paragraph 1.03.

- H. Slump of the concrete as measured by ASTM C143, shall be as shown in Table 1. If a high-range water-reducing admixture (plasticizer) is used, the slump indicated shall be that measured before plasticizer is added. Plasticized concrete shall have a slump ranging from 7 to 10-in.
1. 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 the other admixture(s).

TABLE 1

Design Class	Strength	Cement	Fine Aggregate	Coarse Aggregate	Cementitious Content	Shrinkage Reducing & AntiWashout Admixtures
	1	2	2	3	4	10
A	2500	C150 Type II	C33	57 or 9	440	No
B	3000	C150 Type II	C33	57	480	No
C	4500	C150 Type II	C33	57	580	No
D	4500	C150 Type II	C33	57	580	Yes

Class	W/C Ratio	Fly Ash	AE Range	WR	HRWR	Slump Range Inches
	5	6	7	8	9	
A	0.62 max.	20-25% by weight	3.5 to 5	Yes	No	1-4
B	0.54 max.	20-25% by weight	3.5 to 5	Yes	No	1-3
C	0.42 max.	20-25% by weight	3.5 to 5	Yes	No	3-5
D	0.42 max.	20-25% by weight	3.5 to 5	Yes	No	3-5

NOTES:

1. Minimum compressive strength in psi at 28 days
2. ASTM designation
3. Size Number in ASTM C33
4. Minimum cementitious content in lbs per cubic yard (where fly ash is used cementitious content is defined as cement content plus fly ash content)
5. W/C is Maximum Water Cementitious ratio by weight
6. Fly ash content in the range of 20-25 percent of the total cement content plus fly ash content, by weight
7. AE is percent air entrainment
8. WR is water reducing admixture
9. HRWR is high-range water-reducing admixture
10. Concrete shall contain a shrinkage-reducing admixture. Quantity of shrinkage-reducing admixture used in the mix shall be added to the quantity of water for purposes of

determining the water/cement ratio. Shrinkage Reducing Admixture shall be Eucon SRA by Euclid Chemical or approved equal. Anti-washout Admixture shall be Eucon AWA by Euclid Chemical or approved equal.

PART 3 EXECUTION

3.01 MEASURING MATERIALS

- A. Provide concrete composed of portland cement, fly ash, fine aggregate, coarse aggregate, water and admixtures as specified and produced by a plant complying with ACI 318 and ASTM C94. Batch all constituents, including admixtures, at the plant. High-range water reducing admixtures may 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. Use scales last certified by the local Sealer of Weights and Measures within one year of use.
- C. Weigh cement and fly ash in individual weigh batchers that are separate and distinct from the weigh batchers used for other materials. When cement and fly ash are weighed in a cumulative weigh batcher, the cement shall be weighed first.
- D. Measure the amount of free water in fine aggregates within 0.5 percent with a moisture meter. Compensate for varying moisture contents of fine aggregates. Record the number of gallons of water as-batched on printed batch tickets.
- E. Dispense admixtures 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. Provide ready-mixed concrete produced by equipment complying with ACI 318 and ASTM C94 and produced by a plant certified by the NRMCA. Do not hand-mix. All truck mixers shall carry a rating plate conforming to TMMB 100. 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.
- B. Transport ready-mix concrete to the site in watertight agitator or mixer trucks loaded not in excess of their rated capacities as stated on the name plate.
- C. Keep the water tank valve on each transit truck locked at all times. Any addition of water must be directed by the Engineer. Incorporate water directed to be added by additional mixing of at

least 50 revolutions at mixing speed after the addition of all water. Meter all added water and show the amount of water added on each delivery ticket.

- D. Comply with ACI 318 and ASTM C94 for all central plant and rolling stock equipment and methods.
- E. Select equipment of size and design to provide continuous flow of concrete at the delivery end. Use metal or metal-lined non-aluminum discharge chutes with slopes not exceeding one vertical to two horizontal and not less than one vertical to three horizontal. Chutes more than 20-ft long and chutes not meeting slope requirements may be used if concrete is discharged into a hopper before distribution.
- F. Do not retemper (mix with or without additional cement, aggregate, or water) concrete or mortar which has partially hardened.
- G. Handle concrete from mixer to placement providing concrete of specified quality in the placement area and not exceeding the maximum time interval specified in Paragraph 3.02 I.4. Dispatch trucks from the batching plant so they arrive at the work site just before the concrete is required to avoid excessive mixing of concrete while waiting or delays in placing successive layers of concrete in the forms. Remix for a minimum of 5 minutes prior to discharge or testing.
- H. Furnish a delivery ticket for ready mixed concrete to the Engineer as each truck arrives. Provide a printed record of the weight of cement and each aggregate as batched individually on each ticket. Use the type of indicator that returns for zero punch or returns to zero after a batch is discharged. Indicate for each batch the weight of fine and coarse aggregate, cement, fly ash, and water, moisture content of fine and coarse aggregate at time of batching, and types, brand and quantity of each admixture, the quantity of concrete delivered, the time any water is added and the amount, 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 transit mix truck.
- I. Temperature and Mixing Time Control
 - 1. In cold weather (see Paragraph 3.07D) maintain the as-mixed temperature of the concrete and concrete temperatures at the time of placement in the forms as indicated in Table 3.
 - 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 (see Paragraph 3.07E), cool ingredients before mixing to maintain temperature of the concrete below the maximum placing temperature of 90 degrees F. Well-crushed ice may be substituted 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 final placing of concrete in the forms shall not exceed the following:

TABLE 2

<u>AIR OR CONCRETE TEMPERATURE</u> (WHICHEVER IS HIGHER)	<u>MAXIMUM TIME</u>
(27 Degree C) 80 Degree F to 90 Degree F (32 Degree C)	45 minutes
(21 Degree C) 70 Degree F to 79 Degree F (26 Degree C)	60 minutes
(5 Degree C) 40 Degree F to 69 Degree F (20 Degree C)	90 minutes

- J. If an approved high-range water-reducing admixture (plasticizer) is used to produce plasticized concrete, the maximum time interval shall not exceed 90 minutes.

3.03 INSPECTION AND COORDINATION

- A. Batching, mixing, transporting, placing and curing of concrete shall be subject to the inspection of the Engineer at all times. Advise the Engineer of readiness to proceed at least six working hours prior to each concrete placement. The Engineer will inspect the preparations for concreting including the preparation of previously placed concrete, the reinforcing and the alignment, cleanliness and tightness of formwork. Do not place concrete without the inspection and acceptance of the Engineer.

3.04 ADDITIONAL REQUIREMENTS FOR MASS CONCRETE

- A. Concrete sections 4 feet or more in the least dimension are termed mass concrete and shall conform to the special provisions of this article in addition to all applicable provisions of other articles in this specification section. Mass concrete placement, consolidation and curing shall be in accordance with ACI 304R, 309R, and 211.1.
- B. Additional requirements for heating, cooling, curing and protecting concrete sections more than 6 feet in the least dimension shall be in accordance with ACI 207.4R. Consideration shall be given to temperature rise caused by the hydration of the cement. Large differences in temperature within the concrete shall be avoided.
- C. Placement:
- Concrete with lower than usual slump may be used, provided it can be properly placed and consolidated.
- D. Temperature Control:
- Temperature Monitoring:
 - Thermocouples or thermistors shall be installed in mass concrete placements in sets of two located on a grid at a maximum spacing of 25 feet on center in each direction and no closer than 6 feet from any edge or 4 feet from any opening. One thermocouple shall be placed at mid-depth of the concrete placement and the second thermocouple shall be located directly above the first and 2 inches below the surface. Additional thermocouples shall be placed at exposed edges of concrete placements at

50 feet on center, at mid-depth, and 2 inches beneath the surface. Where cooling pipes are installed, thermocouples shall be located mid-way horizontally between the pipes.

- b. Each wire lead shall extend a minimum of 6 feet out of the concrete and shall be securely labeled with the location of the corresponding sensor and a tracking number.
- c. Placement plans showing all temperature sensors and manufacturer's installation instructions and operating manuals for all related equipment shall be submitted to the Engineer for approval prior to concrete placement.
- d. Temperature monitoring shall continue during the curing period and until the internal temperature is within 25 degrees F of the ambient air temperature following the end of the curing period.

2. Thermal Control:

- a. At mass concrete placements, the curing water added shall not be colder than 30 degrees F below the interior temperature of the concrete.
- b. For mass concrete, large differentials of temperature between the interior of the concrete and the exterior of the concrete shall be avoided. The maximum allowable temperature differential between the interior of the concrete (core) and the exterior of the concrete (surface) shall not be more than 35 degrees Fahrenheit. Thermal controls and protection shall be maintained until the interior concrete temperature is less than 35 degrees Fahrenheit greater than the average daily ambient air temperature.
- c. The rate of cooling within the interior of the concrete shall be regulated to control the temperature drop to not more than 1 degree Fahrenheit in any one hour and 10 degrees Fahrenheit in any 24 hour period.

3.05 EMBEDDED ITEMS

- A. Secure to forms as required or set for embedment as required, all miscellaneous metal items, sleeves, reglets, anchor bolts, anchors, inserts and other items furnished under other Sections and required to be embedded into concrete. Set and secure such items in the locations and alignments needed so they are not displaced by concrete placement.
- B. Clean embedded items free of rust, mud, dirt, grease, oil, ice, or other injurious contaminants.
- C. Coat or isolate all aluminum embedments to prevent aluminum-concrete reaction or electrolytic action between aluminum and steel.
- D. Do not embed piping in concrete unless shown on the Drawings.
- E. Do not embed electrical conduits in concrete unless shown on the Drawings.

- F. Pipes and conduits embedded within a slab or wall (other than those merely passing through) shall satisfy the following, unless otherwise shown on the Drawings or approved:
 - 1. Maximum outside dimension of pipe or conduit shall not be greater than one third the overall thickness of the slab or wall.
 - 2. Spacing of pipes or conduits shall be greater than or equal to three diameters or widths on center.
 - 3. Fabricate piping and conduit such that the cutting, bending, or relocation of reinforcing steel is not required.
- G. Close open ends of piping, conduits, and sleeves embedded in concrete with caps or plugs prior to placing concrete.
- H. Ensure specified tests on embedded piping are completed and satisfactory before starting concrete placement. Ensure all mechanical or electrical tests and inspections are completed and satisfactory prior to starting concrete placement.
- I. Check location, alignment, and support of piping, electrical conduits, and other items fully or partially embedded before depositing concrete. Correct mislocated and misaligned items and secure items which have become loose.
- J. Position embedded anchor bolts using templates.
- K. Correct all embedded items not installed in the location or alignment needed or displaced by concrete placement at no additional cost to the Owner.

3.06 CONCRETE APPEARANCE

- A. Remix concrete showing either poor cohesion or poor coating of the coarse aggregate with paste. Reject remixed concrete showing either poor cohesion or poor coating of the coarse aggregate with paste. Make, at no additional cost to the Owner, changes in the concrete mix design for future deliveries only by adjusting one or more of the following if the slump is within the allowable limit, but excessive bleeding, poor workability, or poor finishability are observed:
 - 1. The gradation of aggregate.
 - 2. The proportion of fine and coarse aggregate.
 - 3. The percentage of entrained air, within the allowable limits.
- B. Provide concrete having a homogeneous structure which, when hardened, will have the specified strength, durability and appearance. Provide mixtures and workmanship such that concrete surfaces, when exposed, will require no finishing except as specified in Section 03350.

3.07 PLACING AND COMPACTING

A. Placing

1. Verify that all formwork completely encloses concrete to be placed and is securely braced prior to concrete placement. Remove ice, standing water, dirt, debris, and other foreign materials from forms and exposed joint surfaces. Confirm that reinforcement and other embedded items are securely in place. Have a worker at the location of the placement who can check that reinforcement and embedded items remain in designated locations and alignments while concrete is being placed. Sprinkle semi-porous subgrades or forms to eliminate suction of water from the mix. Do not place concrete on frozen subgrade, snow, or ice.
2. Deposit concrete as near its final position as possible to prevent segregation due to rehandling or flowing. Place concrete continuously at a rate that allows the concrete previously placed to be 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 chosen for pumping and submit for approval. Do not use pipelines made of aluminum or aluminum alloy. When concrete is pumped, slump will be determined at point of truck discharge and air content will be determined at point of placement.
4. Remove temporary spreaders from forms when the spreader is no longer needed. Temporary spreaders may remain embedded in concrete only when made of galvanized steel 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 has attained design 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 to bring the full surface of the mortar against the form. Prevent the formation of surface voids.
7. Slabs
 - a. After bulkheads, screeds and jointing materials have been positioned, place concrete continuously between joints beginning at a bulkhead, edgeform, or corner. Place each batch into the edge of the previously placed concrete to avoid stone pockets and segregation.
 - b. Avoid delays in placement. If there is a delay in placement, spade and consolidate the concrete placed after the delay at the edge of the previously placed concrete to avoid cold joints. Bring concrete to correct level and strike off with a straightedge. Use bullfloats or darbies 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 one 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 to prevent cold joints.
8. Do not place concrete underwater unless approved in writing by the Engineer.

B. Compacting

1. Consolidate concrete by vibration and puddling, spading, rodding or forking so that concrete is completely worked around reinforcement, embedded items and openings and into corners of forms. Continuously perform puddling, spading, rodding and forking along with vibration of the placement to eliminate air or stone pockets which may cause honeycombing, pitting or planes of weakness.
2. Compact all concrete with mechanical vibrators unless otherwise noted. Do not order concrete until vibrators (including standby units in working order) are on the job. Where epoxy coated rebar is provided, use vibrators with rubber or non-metallic vibrator heads.
3. Use mechanical vibrators having a minimum frequency of 8000 vibrations per minute. Insert vibrators and withdraw at points from 18-in to 30-in apart. Vibrate sufficiently at each insertion to consolidate concrete, generally from 5 to 15 seconds. Do not over vibrate so as to segregate. Keep standby vibrators on the site during concrete placing operations.
4. Concrete Slabs: Vibration for concrete slabs less than 8-in thick shall be by vibrating screeds. Vibration for concrete slabs 8-in and thicker shall be by internal vibrators and (optionally) with vibrating screeds. Place vibrators into concrete vertically. Do not lay vibrators horizontally or lay over.
5. Walls and Columns: Use internal vibrators (rather than form vibrators) unless otherwise approved by the Engineer. In general, for each vibrator needed to melt down (level) the batch at the point of discharge, one or more additional vibrators must be used to densify, homogenize and perfect the surface. Insert vibrators vertically at regular intervals, through the fresh concrete and slightly into the previous lift, if any.
6. Amount of Vibration: Use vibrators to consolidate properly placed concrete. Do not use vibrators to move or transport concrete in the forms. Continue vibration until:
 - a. Frequency of vibrator 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.

3.08 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 a temperature of at least 50 Degrees F at the concrete surface for a minimum of seven days after placement. Use the following curing methods as specified:
 - a. Water Curing: Keep entire concrete surface wet by ponding, continuous sprinkling or covered with saturated burlap. Begin water curing as soon as concrete attains an initial set and maintain water curing 24 hours a day. Do not permit the surface of the concrete to dry out at any time during the curing period. Temperature of curing water shall be within 20 Degrees F of the concrete temperature.
 - b. Sheet Material Curing: Cover entire surface with sheet material. 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 as follows. Curing compound shall NOT be placed on any concrete surface where additional concrete or grout is to be placed, where concrete sealers or surface coatings are to be used, or where the concrete finish requires an integral floor product. Apply curing compound 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. Apply in compliance with the manufacturer's recommendations.
 - 2. Specified applications of curing methods:
 - a. Slabs for Liquid Retaining Structures: Water curing only.
 - b. Slabs on Grade and Footings (not used to retain liquids): Water curing or sheet material curing or liquid membrane curing.
 - c. Structural Slabs (other than Liquid Retaining Structures): 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 seven days. Water curing if absorbent forms are used. Water curing if forms are removed prior to seven days. Sheet cure or liquid membrane cure if forms are removed prior to seven days. Exposed horizontal surfaces of formed walls or columns shall be water cured for seven days or until next placement of concrete is made.

- f. Surfaces of Concrete Joints: Water curing or sheet material curing.
- 3. Curing time may be reduced to 3 days for concrete placement using Type III cement when approved by the Engineer.
- C. Protect finished surfaces and slabs from the direct rays of the sun to prevent checking and crazing.
- D. Cold Weather Concreting
 - 1. For this Specification, "cold weather" is defined as a period when for more than three successive days, the average daily outdoor temperature drops below 40 degrees F. Calculate average daily temperature as the average of the highest and the lowest temperature during the period from midnight to midnight.
 - 2. Batch, deliver, place, cure and protect concrete during cold weather in compliance with the recommendations of ACI 306R and the additional requirements of this Section.
 - 3. Review the cold weather concreting plan at the preconstruction meeting. Include the methods and procedures for use during cold weather including the production, transportation, placement, protection, curing and temperature monitoring of the concrete and the procedures to be implemented upon abrupt changes in weather conditions or equipment failures.
 - 4. The minimum temperature of concrete immediately after placement and during the protection period shall be as indicated in Table 3. The temperature of the concrete in place and during the protection period shall not exceed these values by more than 20 degrees F. Prevent overheating and non-uniform heating of the concrete.

TABLE 3

Concrete Temperatures
Minimum Dimension of Section

	<u>< 12-in</u>	<u>12 to 36-in</u>
Min. conc temp:	55 Degree F	50 Degree F

- 5. Protect concrete during periods of cold weather to provide continuous warm, moist curing (with supplementary heat when required by weather conditions) 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 (e.g., 7 days at an average 50 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.

6. Do not use salt, manure or other chemicals for protection.
7. At the end of the protection period, allow the concrete to cool gradually to the ambient temperature. If water curing has been used, do not expose concrete to temperatures below those shown in Table 3 until at least 24 hours after water curing has been terminated and air dry concrete for at least 3 days prior to first exposure to freezing temperatures.
8. During periods not defined as cold weather, but when freezing temperatures are expected or occur, protect concrete surfaces from freezing for the first 24 hours after placing.

E. Hot Weather Concreting

1. For this Specification, "hot weather" is defined as any combination of high air temperatures, low relative humidity and wind velocity which produces a rate of evaporation as estimated in ACI 305R, approaching or exceeding 0.2 pounds per square foot per hour (lb/sq ft/hr).
2. Batch, deliver, place, cure and protect concrete during hot weather in compliance with the recommendations of ACI 305R and the additional requirements of this Section.
 - a. Temperature of concrete being placed shall not exceed 90 degrees F. Maintain a uniform concrete mix temperature below this level. The temperature of the concrete shall not cause loss of slump, flash set or cold joints.
 - b. Promptly deliver concrete to the site and promptly place the concrete upon its arrival at the site, not exceeding the maximum time interval specified in Paragraph 3.02I.4. Provide vibration immediately after placement.
 - c. The Engineer may direct the Contractor to immediately cover concrete with sheet curing material.
3. Review the hot weather concreting plan at the preconstruction meeting. Include the methods and procedures for use during hot weather including production, placement, and curing.

3.09 REMOVAL OF FORMS

- A. Do not remove forms before the concrete has attained a strength of at least 70 percent of its specified design strength for beams and slabs and at least 30 percent 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 4

<u>Forms for</u>	<u>Degree Days</u>
Beams and slabs	500
Walls and vertical surfaces	100

(See definition of degree-days in Paragraph 3.08D).

- B. Do not remove shores until the concrete has attained at least 70 percent of its specified design strength and also sufficient strength to support safely its own weight and the construction live loads upon it.
- C. In cold weather, when temperature of concrete exceeds ambient air temperature by 20 Degrees F at the end of the protection period, loosen forms and leave in place for at least 24 hours to allow concrete to cool gradually to ambient air temperature.

3.10 FIELD AND LABORATORY TESTS

- A. Sets of field control cylinder specimens will be taken by the Engineer (or Owner's testing laboratory 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 100 cu yds of concrete nor less than one set for each 5,000 sq ft of surface area for slabs or walls. Specimens shall be formed in 6-in diameter by 12-in long non-absorbent cylindrical molds.
 - 1. A "set" of test cylinders shall consist of four cylinders: one to be tested at seven 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 28 day test results are low.
 - 2. When the average 28 day compressive strength of the cylinders in any set falls below the required compressive strength or below proportional minimum seven-day strengths (where proper relation between seven and 28 day strengths have been established by tests), change proportions, cementitious content, or temperature conditions to achieve the required strengths at no additional cost to the Owner.
- B. Cooperate in the making of tests by allowing free access to the work for the selection of samples. Provide four firmly braced, insulated, heated, closed wooden curing boxes, each sized to hold eight specimens, complete with cold weather temperature and hot weather temperature control thermostat for initial curing and storage from time of fabrication until shipment to the testing lab. Protect the specimens against injury or loss through construction operations.
- C. Slump tests will be made in the field by the Engineer (or Owner's testing laboratory inspector) immediately prior to placing the concrete. Such tests will be made in accordance with ASTM C143. When concrete is pumped, slump will be determined at point of truck discharge. If the slump is outside the specified range, the concrete will be rejected.

- D. Air Content: Test for air content will be made by the Engineer (or Owner's testing laboratory inspector) on a fresh concrete sample. 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. If aggregates with high absorptions are used, the latter test method shall be used. When concrete is pumped, air content will be determined at point of placement.

3.11 FIELD CONTROL

- A. 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. The right of the Engineer to take such cores shall not be construed as creating any obligation to take such cores, and not exercising this right to do so shall not relieve the Contractor from meeting the requirements of these Specifications.
- B. 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 with non-shrink grout as specified in Section 03600. The work of cutting, testing and repairing the cores will be at the expense of the Contractor if defective work is uncovered. If no defective work is found, such cost will be at the expense of the Owner.

3.12 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 may require changes in proportions or materials, or both, to apply to the remainder of the work in accordance with Paragraph 1.05E. Furthermore, the Engineer may require additional curing on those portions of the structure represented by the test specimens, which fall below the values given in Table 1. The cost of such additional curing shall be at no additional cost to the Owner. In the event that such additional curing does not give the strength required, as evidenced by core and/or load tests, the Engineer may require strengthening or replacement of those portions of the structure which fail to develop the required strength. Coring and testing and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be at no additional cost to the Owner. In such cases of failure to meet strength requirements the Contractor and Owner 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 C94 is the Contractor.
- B. When the tests on control specimens of concrete fall below the required 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 cases where tests of cores fall below the values given in Table 1, the Engineer, in addition to other recourses, may require load tests on any one of the slabs, walls, beams, columns, piles and pile caps in which such concrete was used. Test need not be made until concrete has aged 60 days. The Engineer may require strengthening or replacement of those portions of the structure, which fail to develop the required strength. All coring and testing and/or load tests and any strengthening or concrete replacement required because strengths of test specimens are below that specified, shall be at no additional cost to the Owner.

- C. Should the strength of test cylinders fall below 60 percent of the required minimum 28 day strength, the concrete shall be rejected and shall be removed and replaced at no additional cost to the Owner.

3.13 PATCHING AND REPAIRS

- A. It is the intent of these Specifications to require quality work including forming, mixture and placement of concrete and curing so completed concrete surfaces will require no patching or repairs.
- B. As soon as the forms have been stripped and the concrete surfaces exposed: remove fins and other projections; fill recesses left by the removal of form ties; and repair surface defects which do not impair structural strength. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.
- C. Immediately after removal of forms remove tie cones and metal portions of ties as specified in Section 03100. Fill holes promptly upon stripping as follows: Moisten the hole with water, followed by a 1/16-in 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 spider web. Trowel smooth with heavy pressure. Avoid burnishing.
- D. When filling tie cone holes and patching or repairing exposed surfaces use the same source of cement and sand as used in the parent concrete. Adjust color to match by addition of white cement. Rub lightly with a fine carborundum stone at an age of one to five days if necessary to bring the surface down with the parent concrete. Do not damage or stain the virgin skin of the surrounding parent concrete. Wash thoroughly to remove all rubbed matter.
- E. Defective concrete and honeycombed areas: Chip down square and at least 1-in deep to sound concrete with hand chisels or pneumatic chipping hammers. Irregular voids or surface stones need not be removed if they are sound, free of laitance, and firmly embedded in the parent concrete. If honeycomb exists around reinforcement, chip to provide a clear space at least 3/8-in wide all around the steel. For areas less than 1-1/2-in deep, the patch may be made in the same manner as described above for filling form tie holes, care being exercised to use adequately dry (non-trowelable) mixtures and to avoid sagging. Thicker repairs will require build-up in successive 1-1/2-in layers on successive days, each layer being applied (with slurry, etc.) as described above.
- F. For very heavy (generally formed) patches, the Engineer may order the addition of pea gravel to the mixture and the proportions modified as follows:

<u>Material</u>	<u>Volumes</u>	<u>Weights</u>
Cement	1.0	1.0
Sand	1.0	1.0
Pea Gravel	1.5	1.5

- G. The Contractor may use a packaged patching compound, such as: Poly-Patch by Euclid Chemical Company; Emaco R310 by BASF Chemical Company; Sikatop 122 Plus by Sika Chemical Corporation or equal only if approved by the Engineer for use and for color match.

3.14 SCHEDULE

- A. The following (Table 5) are the general applications for the various concrete classes and design strengths:

TABLE 5

	Design Strength	
A	2,500	Concrete fill, concrete fill for bollards, electrical raceway encasement, pipe encasement, and where specified or noted.
B	3,000	Concrete grout and where specified or noted.
C	4,500	Structural concrete including walls, slabs on grade, elevated slab and beam systems, columns, grade beams, and all other structural concrete.
D	4,500	Tremie Plug Slab

END OF SECTION

SECTION 03350
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 specified herein.

1.02 RELATED WORK

- A. Concrete formwork is included in Section 03100.
- B. Patching and repair of defective and honeycombed concrete is included in Section 03300.
- C. Grout is included in Section 03600.
- D. Waterproofing, dampproofing and caulking are included in Division 7.
- E. Painting, toppings and special surfaces are included in Division 9.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:
 - 1. Concrete sealer. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations and Material Safety Data Sheet. Also submit confirmation that the sealer is compatible with additionally applied coatings.
 - 2. Chemical hardener. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations and Material Safety Data Sheet. Also submit confirmation that the hardener is compatible with sealer.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar
- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 RESPONSIBILITY FOR CHANGING FINISHES

- A. The surface finishes specified for concrete to receive coatings or other finish materials are those required for the proper application of the products specified under other Sections. Where products different from those specified are approved for use determine if changes in finishes are required and provide the proper finishes to receive these products.
- B. Perform changes in finishes made to accommodate products different from those specified at no additional cost to the Owner. Submit the proposed new finishes to the Engineer for approval.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Cementitious and component materials required for finishing concrete surfaces: As specified in Section 03300.
- B. Chemical hardener: Lapidolith by BASF Building Systems; Hornolith by Tamms; Surfhard by the Euclid Chemical Co. or equal fluosilicate base material.
- C. Concrete sealer: "Kure-N-Seal", by BASF Building Systems or equal acrylic sealer.

PART 3 EXECUTION

3.01 FORMED SURFACES

- A. Form removal: Conform to Sections 03100 and 03300.
- B. Do not damage edges or obliterate the lines of chamfers, rustications or corners when removing the forms or doing any other work adjacent thereto.
- C. Clean all exposed concrete surfaces and adjoining work stained by leakage of concrete.
- D. Off-Form Finish
 - 1. Remove fins and other projections and fill tie cones and defects as specified in Section 03300.
- E. Rubbed Finish
 - 1. Immediately upon stripping forms and before concrete changes color, carefully remove all fins with a hammer. While the surface is still damp apply a thin coat of medium consistency neat cement slurry using bristle brushes to provide a bonding coat within all pits, air holes or blemishes in the parent concrete. Do not coat large areas of the surface with this slurry.

2. Before the slurry dries or changes color, apply a dry (almost crumbly) grout consisting of one volume cement to 1-1/2 volumes of clean masonry sand having a fineness modulus of approximately 2.25 and complying with the gradation requirements of ASTM C144. Apply grout uniformly using damp (neither dripping wet nor dry) pads of coarse burlap approximately 6-in square used as a float. Scrub grout into the pits and air holes to provide a dense mortar in the imperfections to be patched.
3. Allow the mortar to partially harden for one or two hours depending upon the weather. If the air is hot and dry, keep the surface 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 perpendicular edge of a steel trowel without damaging the grout in the small pits or holes, cut off all grout that can be removed with a trowel. Grout allowed to remain on the surface too long will get too hard and will be difficult to remove.
4. Allow the surface to dry and rub it vigorously with clean dry burlap to completely remove any dried grout. No visible film of grout should 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 grout to dry after it has been cut off 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 surfaces again shall 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, a built-up film remains, use a fine abrasive stone to remove all such material without breaking through the surface film of the original concrete. Scrub lightly to remove excess material without working up a lather or mortar or changing the texture of the concrete.
6. Follow the final bagging or stoning operation with a thorough wash-down with stiff bristle brushes to remove extraneous materials from the surface. Spray the surface 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. The Rubbed Finish application may be deleted by the Engineer if the unfinished concrete surface is of superior quality and without surface voids.

3.02 FLOORS AND SLABS

- A. Consider the potential for longer setting time in concrete containing fly ash.
- B. Compact with internal vibrators as specified in Section 03300 and screed to the established grades. Provide floors and slabs level with a tolerance of 1/8-in when checked with a 12-ft straightedge, except where drains occur, in which case pitch floors to drains as indicated. Failure to meet either of above shall be cause for removal, grinding, or other correction as directed by the Engineer, at no additional cost to the Owner.
- C. Following screeding as specified above, float the slabs as approved by the Engineer. Continue floating operation until sufficient mortar is brought to the surface to fill all voids. Test the

surfaces with a straightedge to detect high and low spots which shall be eliminated. Do not overwork the concrete as evidenced by excess water and fine material on the surface.

- D. Do not use "jitterbugs" or other special tools designed for the purpose of forcing the coarse aggregate away from the surface and allowing a layer of mortar to accumulate on any slab finish. Do not dust surfaces with dry materials. Round off all edges of slabs and tops of walls with a steel edging tool. Use steel edging tool with radius of 1/4-in for all slabs subject to wheeled traffic.
- E. Measure floor flatness the day after a concrete floor is finished and before the shoring is removed, in order to eliminate any effects of shrinkage, curling and deflection. A 12-ft long straightedge shall be supported at each end with steel gauge blocks whose thickness are equal to tolerance specified. Floor surface shall not have crowns so high as to prevent 12-ft straightedge from resting on the two end blocks, nor low spots so low that a third block of twice the tolerance in thickness can pass under the supported straightedge. Compliance with the designated limits in four of five consecutive measurements will confirm compliance, unless obvious faults are observed. A check for adequate slope and drainage will also be made to confirm compliance.
- F. Descriptions
 - 1. Steel Trowel Finish. Finish by screeding and floating with straightedges to bring the surfaces to the elevations indicated. While the concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, the surface shall be wood floated to a true, even plane with no coarse aggregate visible. Apply sufficient pressure on the wood floats to bring moisture to the surface. After surface moisture has disappeared, hand steel trowel to produce a smooth, impervious surface, free from trowel marks. Trowel the surface again for the purpose of burnishing. The final troweling shall produce a ringing sound from the trowel. Do not use dry cement or additional water in troweling.
 - 2. Wood Float Finish. Finish by screeding with straightedges to bring the surfaces to the elevations indicated. Use a wood float to compact and seal surface. Remove all laitance and leave a clean surface.
 - 3. Light Broomed Finish. Steel trowel finish the concrete, as specified above but omit the final troweling and finish the surface by drawing a fine-hair broom lightly across the surface. Broom in the same direction and parallel to expansion joints, or in the case of inclined slabs, perpendicular to the slope, or except as directed otherwise.
 - 4. Broomed Finish. Steel trowel finish the concrete, as specified above but omit the final troweling. While the concrete is still soft enough, finish the surface with a stiff coarse fiber broom to produce the pattern and depth of scoring as approved by the Engineer.
 - 5. Power Machine Finish. In lieu of hand steel trowel finishing, an approved power machine for finishing concrete floors and slabs may be used in accordance with the directions of the machine manufacturer and as approved by the Engineer. Do not use a power machine until the concrete has attained the necessary set to allow finishing without introducing

high and low spots in the slab. Hand steel trowel the areas of slabs not accessible to power equipment. Provide a final steel troweling done by hand over all areas.

G. Concrete Sealer

1. Prepare and seal surfaces indicated on the Drawings to receive a sealer as follows:
 - a. Finish concrete as specified in the preceding paragraphs and in accordance with the Schedule of Finishes in Paragraph 3.05 below.
 - b. Newly Placed Concrete: Surface must be sound and properly finished. Surface is application-ready when it is damp but not wet and can no longer be marred by walking workers.
 - c. Newly-Cured Bare Concrete: Level any spots gouged out by trades. Remove all dirt, dust, droppage, oil, grease, asphalt and foreign matter. Cleanse with caustics and detergents as required. Rinse thoroughly and allow to dry so that surface is no more than damp, and not wet.
 - d. Existing Concrete: Restore surface soundness by patching, grouting, and filling cracks and holes. Surface must also be free of any dust, dirt and other foreign matter. Use power tools and/or strippers to remove any incompatible sealers or coatings. Cleanse as required, following the procedure indicated under cured concrete.
 - e. Application: Apply sealer so as to form a continuous, uniform film by spray, soft-bristle pushbroom, long-nap roller, lambswool applicator, or ordinary garden-type sprayers.
 - f. For curing only, two coats are required. Apply first coat evenly and uniformly as soon as possible after final finishing at the rate of 200 to 400 sq ft per gallon. Apply second coat when all trades are completed and structure is ready for occupancy at the rate of 400 to 600 sq ft per gallon.
 - g. To seal and dustproof, two coats are required. For sealing new concrete, both coats shall be applied full-strength. On aged concrete, when renovating, dustproofing and sealing, the first coat should be thinned 10 to 15 percent with reducer per manufacturer's directions.

3.03 CONCRETE RECEIVING CHEMICAL HARDENER

- A. After 28 days, minimum, concrete cure, apply chemical hardener in three applications to a minimum total coverage of the undiluted chemical of 100 sq ft per gallon and in accordance with manufacturer's recommendations as reviewed.

3.04 APPROVAL OF FINISHES

- A. All concrete surfaces, when finished, will be inspected by the Engineer.

- B. Refinish or rework unsatisfactory finishes until approved by the Engineer, at no additional cost to the Owner.
- C. Hardened unsatisfactory finishes will require removal, grinding, or other appropriate correction approved by the Engineer, at no additional cost to the Owner.

3.05 SCHEDULE OF FINISHES

- A. Finish concrete in the various specified manners either to remain as natural concrete or to receive an additional applied finish or material under another Section. Where products different from those specified are approved for use comply with the requirements of Paragraphs 1.05A and 1.05B.
- B. Finishes to the base concrete for the following conditions shall be as scheduled below and as further specified herein:
 - 1. Exposed exterior concrete excluding slabs and walking surfaces - Rubbed finish. (Rub open tank walls above and to 1-ft below normal water line).
 - 2. Concrete for exterior on stairs and other horizontal areas - Broomed finish, non-slip.
 - 3. Exposed interior concrete including underside slabs, beams and stairs and sides of openings, beams and stairs - Rubbed finish.
 - 4. Concrete for interior walking surfaces excluding stairs – wood float finish.
 - 5. Concrete for interior stairs and metal pan stairs - Light broomed finish, non-slip.
 - 6. Walls of open topped tanks - Rubbed finish above and to 1-ft below normal water line. Off-form finish from 1-ft below normal water line to base of wall.
 - 7. Concrete stairs, landings and platforms below normal water level in liquid retaining structures – Broomed finish, non-slip.
 - 8. Tops of curbs and pads - Steel trowel finish.
 - 9. Concrete on which liquids flow or are contained - Steel troweled finish.
 - 10. Ribbed Concrete - Off-form finish.
 - 11. Concrete not exposed in the finished work and not scheduled to receive an additional applied finish or material - Off-form finish at vertical surfaces, consolidate and screed to grade at horizontal surfaces.
 - 12. Concrete tank bottoms to be covered with grout - Broom finish as approved. See Section 03600 for additional requirements.
 - 13. Concrete to receive dampproofing - Off-form finish.

14. Concrete to receive capillary waterproofing - Off-form finish at vertical and overhead surfaces, light broomed finish at horizontal surfaces.
15. Concrete to receive cementitious slurry waterproofing - Off-form finish at vertical surfaces, light broomed finished horizontal surfaces.
16. Concrete to receive chemical hardener - Light broomed finish, non-slip, except at electrical rooms and areas and generator room provide wood float, non-slip.
17. Concrete to receive paint - Rubbed finish.
18. Concrete to receive floor sealer - See Paragraph 3.02G above.
19. Concrete to receive rubberized asphalt sheet membrane waterproofing - Wood float finish at horizontal surfaces, rubbed finish at vertical surfaces.
20. Concrete to receive roof insulation - Consolidate, screed and wood float to required grades.

END OF SECTION

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SECTION 03420

PRECAST, PRESTRESSED CONCRETE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and design, fabricate, deliver, and install precast, prestressed hollow core concrete planks and accessories complete as shown on the Drawings and as specified herein.
- B. The work of this Section includes:
 - 1. Precast, prestressed hollow core concrete planks and structural steel headers for openings.
 - 2. All inserts, weld plates, bolts, anchors, angles, sleeves and reinforcing bars which are shown on the Drawings to be cast into the precast, prestressed concrete members.
 - 3. Furnish all inserts, weld plates, anchors, reinforcing bars and other accessories to be placed in concrete for installation under Section 03300.
 - 4. Erection, including all shimming, connections, welding and removal of lifting attachments
 - 5. Grouting between precast, prestressed concrete members and as indicated.
 - 6. Concrete topping

1.02 RELATED WORK

- A. Concrete reinforcement, except as specified herein, is included in Section 03200.
- B. Cast-in-place concrete is included in Section 03300.
- C. Grout is included in Section 03600.
- D. Masonry is included in Section 04200.
- E. Miscellaneous metals are furnished under Section 05500.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and calculations for all members. The shop drawings and calculations shall be prepared and stamped by a Professional Engineer registered in State of Florida. Submittals shall include the following:

1. Shop drawings, fabrication drawings, and erection drawings showing member locations, dimensions, reinforcement and details of all inserts, weld plates, bolts, anchors, angles, sleeves, accessories, and openings. Also show all connection details, including location and type of connection, and type, size and length of all welds.
 2. Calculations showing all assumptions, loads, camber produced, dead and live load deflections and bearing pads.
 3. Submit installation and handling literature and requirements for making openings in the field.
 4. Copy of PCI Plant Certification for manufacturer.
 5. Copy of PCI Certificate of Compliance for erector.
 6. Test reports for tests performed in accordance with PCI MNL-116.
 7. Welder's certification in accordance with AWS D1.1 or D1.4, as applicable, for the shop and field welding procedures to be used.
- B. Review will be for conformance to these Specifications only and approval shall not relieve the Contractor of responsibility for precast, prestressed concrete members.
- C. Fabrication of members shall not proceed until shop drawings and calculations are approved.
- D. Design Data
- E. Certificates
- F. Manufacturer's Installation Instructions
- G. Qualifications

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
1. ASTM A36 - Standard Specification for Structural Steel.
 2. ASTM A108 - Standard Specification for Steel Bars, Carbon, Cold Finished, Standard Quality.
 3. ASTM A185 - Standard Specification for Steel Welded Wire Fabric, Plain, for Concrete Reinforcement
 4. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength.

5. ASTM A416 - Standard Specification for Steel Strand, Uncoated Seven-Wire for Prestressed Concrete.
 6. ASTM A497 – Standard Specification for Steel Welded Wire Fabric, Deformed, for Concrete.
 7. ASTM A615 - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement.
 8. ASTM A706 – Standard Specification for Low-Alloy Steel Deformed Bars for Concrete Reinforcement.
 9. ASTM C33 - Standard Specification for Concrete Aggregates.
 10. ASTM C39 – Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 11. ASTM C150 - Standard Specification for Portland Cement.
 12. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
 13. ASTM C494 – Standard Specification for Chemical Admixtures for Concrete.
 14. ASTM F1554 – Standard Specification for Anchor Bolts, 36, 55 and 105-ksi Yield Strength.
- B. American Concrete Institute (ACI)
1. ACI 318 - Building Code Requirements for Structural Concrete.
- C. American Welding Society (AWS)
1. AWS A5.1 – Specification for Covered Carbon Steel Arc Welding Electrodes.
 2. AWS D1.1 - Structural Welding Code - Steel.
 3. AWS D1.4 – Structural Welding Code - Reinforcing Steel
- D. Precast/Prestressed Concrete Institute (PCI)
1. MNL-116 – Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Products.
- E. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

- A. All precast, prestressed concrete shall be manufactured at an existing plant certified by the Precast/Prestressed Concrete Institute Plant Certification Program. Manufacturer shall be certified at the time of bidding. Certification shall be in the following product groups and categories: C2 Prestressed Hollow-Core and Repetitive Products.
- B. All precast, prestressed concrete shall conform to PCI MNL-116 and the additional requirements specified herein.
- C. All precast, prestressed concrete shall be installed by an erector qualified at the time of bidding as evidenced by PCI's Certificate of Compliance to erect Category S1 Simple Structural Systems.
- D. Welding: In accordance with AWS D1.1 or D1.4, as applicable.
- E. Welders Certification: In accordance with AWS D1.1 or D1.4, as applicable, by test within the past 6 months to perform type of work required in conformance with AWS D1.1 or D1.4, as applicable. Testing to be conducted and witnessed by an independent testing laboratory provided by the Contractor.

1.06 DESIGN CRITERIA

- A. Conform to ACI 318.
- B. Member sizes shall be as shown on the Drawings. All primary reinforcing, bar or prestressing strand, shall have a minimum of 3/4-in of clear concrete cover. All hollow core concrete planks shall have shear keyways on the sides that are adjacent to other members to permit grouting between adjacent members.
- C. Design precast, prestressed concrete members and connections to support the following loads:
 - 1. Self weight.
 - 2. Weight of concrete topping at a density of 150 pcf to the thickness shown on the Drawings.
 - 3. Concentrated dead loads weight of partitions, equipment and other permanent construction supported by precast, prestressed concrete members as shown on the Drawings.
 - 4. Uniformly distributed dead loads weight of ceilings, equipment and other permanent construction supported by precast, prestressed concrete members as shown on the Drawings.
 - 5. Live load as shown on the Drawings.
 - 6. Other loads shown on the Drawings.

7. Wind Loads: ASCE 7 – 10
V = 145 mph
Exposure Category: C
Risk Category: 111

1.07 DELIVERY, STORAGE AND HANDLING

- A. Transport, store, and handle precast, prestressed concrete to protect from cracking, distortion, warping, staining and other damage and in accordance with the manufacturers' recommendations.
- B. Handle by means of lifting inserts or other means approved by the manufacturer.
- C. Lift, transport and support at points indicated by the manufacturer which are consistent with the shape and design of the member.
- D. Repair or replace damaged units at no additional cost to the Owner.

1.08 PROJECT / SITE REQUIREMENTS

- A. Existing Conditions
 - 1. Notify the Engineer of any inaccuracies in alignment or level of cast in place concrete in writing and correct before the precast, prestressed concrete is placed at no additional cost to the Owner.
 - 2. Notify the Engineer of any inaccuracies in location or alignment of reinforcing bar dowels, anchor bolts in writing and correct before the precast, prestressed concrete is placed at no additional cost to the Owner.
- B. Field Measurements

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. All cement, sand and gravel used in this Section, including patching of members, shall be obtained from one single source to provide a uniform color and texture.
- B. Cement: Portland cement conforming to ASTM C150, Type I or III.

- C. Aggregates: Sand and gravel conforming to ASTM C33. Size of coarse aggregate shall meet spacing requirements of prestressing steel and/or reinforcing steel. Maximum size of coarse aggregate shall be no larger than 1-in.
- D. Concrete Admixtures: Water reducing admixture in accordance with ASTM C494 and air entraining admixture in accordance with ASTM C260.
- E. Deformed Concrete Reinforcing Bars: ASTM A615, Grade 60 deformed bars.
- F. Deformed Concrete Reinforcing Bars required on the Drawings to be Field Bent or Welded: ASTM A706.
- G. Welded Steel Wire Fabric: ASTM A185.
- H. Welded Deformed Steel Wire Fabric: ASTM A497.
- I. Prestressing Strand: Uncoated seven wire low relaxation strand conforming to ASTM A416 Grade 270K.
- J. Structural steel: weld plates, angles and shall conform to ASTM A36.
- K. Anchor Bolts: ASTM F1554, Grade 36. Provide standard headed bolts with heavy hex nuts and Grade A washers.
- L. Carbon Steel Bolts and Studs: ASTM A307, Grade A.
- M. Automatic End Welded Headed Anchor Studs: Flux ended studs made from cold drawn steel, ASTM A108, Grades 1010 through 1020.
- N. Welding Electrodes, steel: AWS A5.1 E70xx.
- O. Non-shrink cementitious grout: As specified in Section 03600 and as approved.
- P. Concrete Topping: 2,500 psi concrete as specified in Section 03300

2.03 CONCRETE MIXES

- A. Concrete for all precast, prestressed concrete members shall have a minimum 28-day compressive strength of 5,000 psi as determined by cylinder tests in accordance with ASTM C39.
- B. Unless otherwise approved by the Engineer, concrete shall have a minimum compressive strength of 3,500 psi at transfer of prestressing force, as determined by cylinder tests in accordance with ASTM C39.
- C. Maximum water-cementitious materials ratio, by weight, shall be 0.45. Minimum cementitious content shall be 470 lbs per cubic yard.

- D. All concrete mixes shall incorporate a water reducing admixture and an air entraining admixture, each at a rate in accordance with manufacturers' recommendations.
- E. Admixtures containing chlorides shall not be used.

2.04 FABRICATION

- A. Procedures and tolerances shall conform to PCI MNL-116.
- B. Use steel forms at all exposed formed surfaces. Provide Grade B finish for formed surfaces. Provide a raked finish at top surfaces of members to be covered with concrete topping.
- C. Provide a minimum 1/2-in chamfer at all exposed corners.
- D. Place concrete continuously without joints for each precast, prestressed member.
- E. Provide formed surfaces smooth and free of honeycomb, structural defects, imperfections, chips, spalls, joint marks, or fins. At surfaces exposed to view, grind smooth offsets or fins over 1/8-in in dimension and fill air pockets and holes greater than 1/4-in in diameter.
- F. All inserts, openings, and blockouts required by the various trades or as indicated, located, and detailed on the final approved shop drawings shall be cast as such. Correct any omission or change in location or details indicated or required by the various trades as a result of the Contractor's actions at no additional cost to the Owner.
- G. Recess ends of strands a minimum of 1/2-in from end of precast, prestressed member and fill recesses with non-shrink grout.

PART 3 EXECUTION

3.01 ERECTION

- A. Install precast, prestressed concrete as shown on the Drawings, in accordance with manufacturer's instructions, and in accordance with approved shop drawings. Provide temporary shoring and bracing in accordance with the manufacturer's recommendations. Remove temporary shoring and bracing when erection is complete.
- B. Verify that supports, bearing surfaces, and inserts are within required tolerances and are prepared as specified prior to erecting precast, prestressed concrete.
- C. No holes shall be cut or drilled in the field, except as shown on the approved shop drawings, without written approval of the Engineer. Do not cut prestressing strands.
- D. Connections shall be as shown on the Drawings. All welding shall be in accordance with AWS D1.1 or D1.4 as applicable.
- E. Provide members level or sloped as indicated on drawings.

- F. Maximum vertical offset between members shall be 1/4-in.
- G. Maintain uniform joint widths between members.
- H. Grouting: Use approved non-shrink cementitious grout.
 - 1. Joint keys: Clean out and fill keys completely with grout. Remove grout that seeps to soffit before it hardens.
 - 2. Slab ends: Grout slab ends where shown on the Drawings. Clean out, provide grout stops, and completely fill voids with grout.
- I. Clean top surface of precast, prestressed concrete before placing concrete topping. Remove all debris, dirt, laitance, oil, grease and all other bond inhibiting materials from the surface by dry mechanical means such as sandblasting, chipping or wire brushing. Thoroughly clean surface of loose or weakened material and dust by dry mechanical means such as sandblasting, vacuuming and airblasting. Irregular voids or surface stones need not be removed if they are sound, free of laitance and firmly embedded into parent concrete.
- J. After top surface has been cleaned, thoroughly saturate with water and maintain saturation for a period of at least 12 hours. Protect area and equipment below from dripping water. Brush on a 1/16-in layer of cement and water mixed to the consistency of a heavy paste. Place concrete topping immediately after application of cement paste.
- K. Place concrete topping to the limits shown on the Drawings. Place to the minimum depth as shown on the Drawings. Consolidate as specified in Section 03300 and finish as specified in Section 03350.

3.02 ATTACHMENT OF ARCHITECTURAL, MECHANICAL AND ELECTRICAL COMPONENTS AND SYSTEMS

- A. Make attachments to hollow core concrete planks only at the center of the hollow core using drilled bolts through bolts with nuts and plate washers, adhesive anchors, or toggle bolts. Do not make attachments in the areas between hollow cores.

3.03 INSPECTION

- A. The Engineer will inspect precast, prestressed concrete in the field for compliance with this Section and the approved shop drawings. The Engineer may require repair or replacement of any items not meeting the requirements of this Section at no additional cost to the Owner.

END OF SECTION

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. Concrete formwork is included in Section 03100.
- B. Concrete reinforcement is included in Section 03200.
- C. Concrete joints and joint accessories are included in Section 03250.
- D. Cast-in-place concrete is included in Section 03300.
- E. Masonry grout is included in Section 04200.
- F. Miscellaneous metals are included in Section 05500.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of surface preparation, mixing and installation for:
 - 1. Commercially manufactured non-shrink cementitious grout and self-leveling cementitious underlayment grout. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to the specified ASTM standards, and Material Safety Data Sheet.
 - 2. Commercially manufactured non-shrink epoxy grout. Include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to the specified ASTM standards, and Material Safety Data Sheet.
 - 3. Cement grout. Include the type and brand of cement, the gradation of fine aggregate, product data on any proposed admixtures and the proposed grout mix.
 - 4. Concrete grout. Include data as required for concrete as delineated in Section 03300 and for fiber reinforcement as delineated in Section 03200.

B. Samples

1. Submit samples of commercially manufactured grout products when requested by the Engineer.
2. Submit samples of aggregates proposed for use in grout mixes when requested by the Engineer.

C. Laboratory Test Reports

1. For concrete grout, submit laboratory test data as required for concrete as delineated in Section 03300.

D. Qualifications

1. Submit documentation that grout manufacturers have a minimum of at least 10 years experience in the production and use of the grouts proposed.

1.04 REFERENCE STANDARDS

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 and 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 C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation
7. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink)
8. ASTM E329 - Standard specification for agencies engaged in the testing and/or inspection of materials used in construction

- B. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Qualifications

1. Grout manufacturers shall have a minimum of 10 years experience in the production and use of the type of grout proposed.

B. Pre-Installation Meeting

1. At least ten working days before grouting, hold a pre-installation meeting to review the requirements for surface preparation, mixing, placing and curing procedures for each product proposed for use. Notify all parties involved with grouting, including the Engineer, of the meeting at least ten working days prior to its scheduled date.

C. Field Testing

1. All field testing and inspection services will be provided by the Owner. Assist in the sampling of materials, and cooperate by allowing free access to the work and permitting the use of ladders, scaffolding, and such incidental equipment as may be required. Methods of testing will comply with the applicable ASTM Standards.
2. Field testing of concrete grout will be as specified for concrete in Section 03300.

1.06 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. Limit total storage time from date of manufacture to date of installation to six months or the manufacturer's recommended storage time, whichever is less.
- C. Remove immediately from the site material which becomes damp, contains lumps, or is hardened and replace with acceptable material at no additional cost to the Owner.
- D. Deliver non-shrink cementitious grout and self-leveling cementitious underlayment grout as a pre-portioned blend in prepackaged mixes requiring only the addition of water.
- E. Deliver non-shrink epoxy grout as a pre-proportioned, prepackaged, three component system requiring only mixing as directed by the manufacturer.

1.07 DEFINITIONS

- A. Non-shrink 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.

- B. Self-Leveling Cementitious Underlayment Grout: A commercially manufactured Portland cement based, non-shrinking, self-leveling underlayment.

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. Non-shrink Cementitious Grout

- 1. Non-shrink cementitious grouts: Conform to ASTM C1107. Grouts shall be portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and require only the addition of water. Non-shrink 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 non-shrink cementitious grout: Conform to the standards stated above. SikaGrout 212 by Sika Corp.; Set Grout by BASF Building Systems; NS Grout by The Euclid Chemical Co.; Five Star Grout by Five Star Products, Inc., or equal.
 - b. Flowable (Precision) non-shrink cementitious grout: Conform to the standards stated above. Masterflow 928 by BASF Building Systems; Hi-Flow Grout by The Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Five Star Grout by Five Star Products, Inc., or equal.

B. Non-shrink Epoxy Grout

- 1. Non-shrink epoxy grout: Grout shall be pre-proportioned, prepackaged, three component, 100 percent solids system consisting of epoxy resin, hardener and blended aggregate. It shall have a compressive strength of 10,000 psi in 7 days when tested in conformity with ASTM C579 and have a maximum coefficient of thermal expansion of 30×10^{-6} in/in/degrees F when tested in conformity with ASTM C531. Masterflow 648 CP by BASF Building Systems; Five Star HP Epoxy Grout by Five Stars Products, Inc; Sikadur 42 Grout-Pak by Sika Corp.; E³-G Epoxy Grout by the Euclid Chemical Co. or equal.

C. Cement Grout

- 1. A mixture of one part portland cement conforming to ASTM C150, Type I, II, or III and one to two 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. Conform to the requirements of Section 03300 except as specified herein. Proportion with Type II cement, coarse and fine aggregates, water, water reducing admixture and air entraining agent to produce a mix having an average strength of 3500 psi at 28 days (2500 psi nominal strength). Coarse aggregate size shall be 3/8-in maximum. Slump shall not exceed 5-in. Minimum cement content shall be 540 lbs per cubic yard and maximum water to cement ratio shall be 0.45.
2. Add synthetic reinforcing fibers as specified in Section 03200 to the concrete grout mix at the rate of 1.5 lbs of fibers per cubic yard of grout. Add fibers from the manufacturer's pre-measured bags and according to the manufacturer's recommendations to ensure complete dispersion of the fiber bundles as single monofilaments within the concrete grout.

E. Self-Leveling Cementitious Underlayment Grout

1. Grout shall be Portland cement based, non-shrinking, self-leveling underlayment factory prepared and packaged. Underlayment Self-Leveling by BASF Building Systems, LevelLayer by Dayton Superior, Flo-Top by the Euclid Chemical Company, or equal providing a one day compressive strength of 1200 psi minimum and a 28 day value of 3000 psi minimum.
2. Provide polymer emulsion, system primer for substrate preparation, Thoro Underlayment Primer 800 or equal for the specific product proposed.
3. Provide clean, dry and sound pea gravel, 1/4-in maximum and 1/8-in minimum size and conforming to ASTM C33 (Provide 1/8-in maximum size, clean, dry and sound sand conforming to ASTM C33 for the equal specific products).

F. Water

1. Potable water free of oil, acid, alkali, salts, chlorides (except those attributable to drinking water), organic matter, or other deleterious substances.

PART 3 EXECUTION

3.01 PREPARATION

- A. Place grout where indicated or specified over cured concrete which has attained its specified design strength unless otherwise approved by the Engineer.
- B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt, dust, grease, oil, form release agent, laitance and paints and free of all loose material or foreign matter which may affect the bond or performance of the grout.
- C. Roughen concrete surfaces by chipping, sandblasting, or other dry mechanical means to bond 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 airline to prevent oil from being blown onto the surface.
- D. Remove all loose rust, oil or other deleterious substances which may affect the bond or performance of the grout from metal embedments or bottom of baseplates prior to the installation of the grout.
- E. Wash concrete surfaces clean and then keep moist for at least 24 hours prior to the placement of non-shrink cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, or other method acceptable to the Engineer. Upon completion of the 24 hour period, remove visible water from the surface prior to grouting.
- F. Non-shrink epoxy grouts do not require saturation of the concrete substrate. Do not wet concrete surfaces to receive non-shrink epoxy grout. Surfaces in contact with epoxy grout shall be completely dry before grouting.
- G. Provide forms for grout. Line or coat forms with release agents recommended by the grout manufacturer. Provide forms anchored in place and shored to resist the forces imposed by the grout and its placement.
1. Forms for all grout other than concrete grout shall be designed to allow the formation of a hydraulic head and shall have chamfer strips built into forms.
- H. Level and align the structural or equipment bearing plates in accordance with the structural requirements or the recommendations of the equipment manufacturer, as applicable.
1. Support equipment 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 bond breaking coatings and removed after grouting unless otherwise approved by the Engineer. Grout voids created by the removal of shims, wedges and blocks.

3.02 INSTALLATION - GENERAL

- A. Mix, apply and cure products in strict compliance with the manufacturer's recommendations and these specifications.
- B. Provide staffing 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 base plate, supporting concrete, and grout between 40 and 90 degrees F during grouting and for at least 24 hours after placement, until grout compressive strength reaches 1000 psi or as recommended by the grout manufacturer, whichever is longer. Do not allow 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 40 to 90 degrees F range.
- E. Install grout to 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 - NON-SHRINK CEMENTITIOUS GROUTS AND CEMENT 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. Do not mix by hand. Mix in a mortar mixer with moving blades. Pre-wet the mixer and empty excess water. Add pre-measured 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-in 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. Provide forms as specified in Paragraph 3.01G. Place grout into the designated areas and prevent segregation and entrapment of air. Do not vibrate grout to release air or to consolidate the material. Fill all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes and vent holes as necessary.
- E. Place grout rapidly and continuously to avoid cold joints. Do not place grout 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 ordered and approved by the Engineer. Finish this surface with a wood float or 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, until grout compressive strength reaches 1000 psi or as recommended by the manufacturer, whichever is longer. Saturate the grout surface by use of saturated burlap bags, soaker hoses or ponding. Provide sunshades. 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 – NON-SHRINK EPOXY GROUTS

- A. Mix in accordance with manufacturer's recommendations. Mix full batches only, to maintain proper proportions of resin, hardener and aggregate. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Do not entrain air bubbles by mixing too quickly.

- 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 rapidly and continuously to avoid cold joints. Place grout in lifts in accordance with manufacturer's recommendations.
- D. Provide forms as specified in Paragraph 3.01G. Place grout into the designated areas and prevent entrapment of air. Fill all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes and vent holes as necessary.
- E. 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.
- F. 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.
- G. 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 placement, until grout compressive strength reaches 1000 psi or as recommended by the manufacturer, whichever is longer.
- H. Provide grout control joints as indicated on the Drawings.

3.05 INSTALLATION - CONCRETE GROUT

- A. Inspect slabs finished under Section 03350 and scheduled to receive concrete grout. Protect and keep the surface clean until placement of concrete grout.
- B. Remove debris and clean the surface by sweeping and vacuuming of all dirt and other foreign materials. Pressure wash the surface. Do not flush debris into tank drain lines.
- C. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout by use of saturated burlap bags, soaker hoses or ponding. Remove excess water just prior to 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-in thick cement paste.
- D. Place concrete grout to final grade using the scrapers of the installed mechanical equipment as a guide for surface elevation and to eliminate high and low spots. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms powered by their motors shall not be used as a finishing machine or screed to push grout.
- E. Provide grout control joints as indicated on the Drawings.
- F. Steel trowel finish as specified in Section 03350. Cure the concrete grout as specified for cast-in-place concrete in Section 03300.

3.06 INSTALLATION – SELF-LEVELING CEMENTITIOUS UNDERLAYMENT GROUT

- A. Perform work generally as follows but conform to installation procedures as submitted and approved.
- B. Removal of flooring and underlying fill concrete material are included under Division 2. Provide additional substrate preparation as required to ensure proper bond of the grout system.
- C. Prime the prepared substrate with the system primer and remove all puddles. Allow to dry completely.
- D. Mix underlayment grout with water and the approved aggregate only and in the approved proportions to be flowable and self-leveling.
- E. Install in one lift for all locations and allow to level. Completely fill the required areas allowing no voids in the grout thickness. Slope to floor drains as required.
- F. Cure in conformance with manufacturer's instructions. Do not allow conditions which would permit premature drying.
- G. Protect the grouted areas as approved until finish material is applied under Division 9.

3.07 SCHEDULE

- A. The following list indicates where the particular types of grout are to be used:
 - 1. General purpose non-shrink cementitious grout: Use at all locations where non-shrink grout is indicated on the Drawings, except for base plates greater in area than 3-ft wide by 3-ft long.
 - 2. Flowable (precision) non-shrink cementitious grout: Use under all base plates greater in area than 3-ft wide by 3-ft long. Use at all locations indicated on the Drawings to receive flowable non-shrink grout. Flowable (precision), non-shrink, cementitious grout may be substituted for general purpose non-shrink cementitious grout.
 - 3. Non-shrink epoxy grout: Use at all locations specifically indicated on the Drawings to receive non-shrink epoxy grout.
 - 4. Cement grout: Use where indicated on the Drawings.
 - 5. Concrete grout: Use for overlaying the base under scraper mechanisms of clarifiers, in screw pump troughs, and as indicated on the Drawings. Use for concrete grout fill within liquid retaining structures and other locations where specifically indicated on the Drawings.
 - 6. Self-Leveling cementitious underlayment grout: Use over existing slab, as shown and required to provide substrate for tile work.

END OF SECTION

SECTION 03601

GROUTING AT ABANDONED PIPE

PART 1 - GENERAL

1.01 DESCRIPTION

- A. **Scope of Work:** The scope of work involves the grouting of the space left void in the abandonment of the existing pipelines and structures or the annular space between the host pipe and a sliplined pipe. The work consists of furnishing all labor, equipment and materials and performing all work connected with the placement of the cementaceous grout to fill the void.

1.02 QUALITY ASSURANCE

- A. Grouting shall be performed by a crew under the direct supervision of a superintendent that has experience in grouting of this nature.
- B. Storage, mixing, handling and placement shall be in accordance with manufacturer's instructions and specifications.

1.03 SUBMITTALS

- A. **Shop Drawings:** Shop drawings shall be submitted in accordance with Division 1. In addition, the following shall be submitted to the Owner's Representative for acceptance prior to construction.
 - 1. A detailed description of equipment and operational procedures to accomplish the grouting operation, including grout mixture design, grout mixer type, grout samples, and test data.
 - 2. A detailed description of the grouting time schedule.

PART 2 - PRODUCTS

2.01 GROUT MATERIAL

- A. The grout shall be a "flowable fill" consisting of a mixture of Type 1 Portland Cement, Type "F" Flyash (ASTM 618), sand and water.
- B. The mixture shall contain a minimum of 50 pounds cement and minimum of 400 pounds flyash per cubic yard of grout.

2.02 EQUIPMENT

- A. All grout shall be mixed with a high shear, high energy colloidal type mixer to achieve the best uniform density.
- B. The grout shall be pumped with a non-pulsating centrifugal or tri-plex pump.

- C. The mixer shall be capable of continuous mixing. Batch mixing shall not be permitted.

PART 3 - EXECUTION

3.01 GROUTING

- A. Grouting of the annular space due to the abandonment of the existing sewer pipe will be allowed in continuous individually bulkheaded segments of up to 300 linear feet.
- B. Grout shall be placed in a maximum of three stages, with the initial stage volume equal to or greater than 50% of the total volume for that section of pipe being grouted. The maximum time wait between grouting stages shall be 24 hours.
- C. For each stage, mix and pump the material in one continuous process so as to avoid partial setting of some grout material during that stage, thus, eliminating voids and possible subsequent surface damage due to "cave-ins".
- D. Each section shall be grouted by injecting grout from the lowest point and allowing it to flow toward the highest point to displace water from the annulus and assure complete void-free coverage. Grout shall be placed through tubes installed in the bulkheads at the insertion pits or manholes. Grout tubes shall be at least 2-inch nominal diameter.
- E. After the ends of each section of pipe are exposed, the entire space, not to exceed 300 linear feet end to end, shall be sealed by controlled pumping of grout until it flows from the pipe at the opposite end of the grouting. Grouting shall be carried out until the entire space is filled.
- F. Grout pressure in the void space is not to exceed five (5) psi above maximum hydrostatic groundwater level. An open ended, highpoint tap or equivalent vent must be provided and monitored at the bulkhead opposite to the bulkhead through which grout is injected. This bulkhead will be blocked closed as grout escapes to allow the pressuring of the annular space.

3.02 FIELD QUALITY CONTROL

- A. The quality of the grout, application of the equipment and installation techniques are the responsibility of the Contractor. The review and acceptance or approval of specific mix design, equipment or installation procedures shall in no way relieve the Contractor of his obligation to provide the final product as specified herein.

END OF SECTION

SECTION 04200

MASONRY

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and construct all masonry work as shown on the Drawings and as specified herein.
- B. The work under this Section includes, but is not necessarily limited to, the following:
 - 1. Split-Face concrete masonry units (SFCMU)
 - 2. Masonry joint reinforcing, ties and anchors and installation only of deformed steel bars for wall reinforcing and CMU lintel reinforcing in masonry.
 - 3. Grouting as specified herein.
 - 4. Patching existing masonry removed or damaged during construction.
 - 5. Set in place, all pressed metal frames, which are to be built into masonry walls.
 - 6. Insulation inserts in CMU.

1.02 RELATED WORK

- A. The Contract Documents include, but are not limited to the following related requirements.
 - 1. Deformed steel bars for wall reinforcing and CMU lintel reinforcing is furnished under Division 3.
 - 2. Miscellaneous metals are included in Division 5.
 - 3. Caulking is included in Division 7.
 - 4. Anti-Graffiti Coating is included in Division 9.

1.03 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300, representative samples of all required masonry and component and accessory materials. Submit with samples, all certifications and test data required to prove compliance with this Section and Building Code.
- B. Submit to the Engineer documentation that all components submitted comply with the specified reference standards.

- C. Resubmit as required until approved.
- D. Sample Panel: Before masonry work is begun, provide a sample panel for Engineer's approval. The panel shall be approximately 6-ft-long, 4-ft high, and of the same construction as the walls shown for the building(s). The sample panel shall be constructed separate from the Work. The panel shall show both interior and exterior workmanship, coursing, bond, thickness, and tooling of joints, range of color, and texture of the masonry and the color of the mortar, all of which shall be as specified. The accepted panel shall form the standard for acceptable finished work on the project. The panel shall be erected in a location as designated by the Engineer and, when directed, shall be completely removed from the job site.

1.04 REFERENCE STANDARDS

- A. American Concrete Institute/ACI International
 - 1. ACI 315 - Details and Detailing of Concrete Reinforcement
- B. American Concrete Institute/ACI International; American Society of Civil Engineers; and The Masonry Society
 - 1. ACI 530.1/ASCE 6/TMS 602 - Specification for Masonry Structures
- C. American Society for Testing and Materials (ASTM)
 - 1. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
 - 2. ASTM A 951/A 951M - Specification for Masonry Joint Reinforcement
 - 3. ASTM C33 - Standard Specification for Concrete Aggregates
 - 4. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units
 - 5. ASTM C140 - Standard Test Methods of Sampling and Testing Concrete Masonry Units
 - 6. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar
 - 7. ASTM C150 - Standard Specification for Portland Cement
 - 8. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes
 - 9. ASTM C270 - Standard Specification for Mortar for Unit Masonry
 - 10. ASTM C331 - Standard Specification for Lightweight Aggregates for Concrete Masonry Units
 - 11. ASTM C426 - Standard Test Method for Drying Shrinkage of Concrete Block

12. ASTM C476 - Standard Specification for Grout for Masonry
13. ASTM C744 – Standard Specification for Prefaced Concrete and Calcium Silicate
14. ASTM C 1329 - Specification for Mortar Cement Masonry Units
15. ASTM D2000 - Standard Classification System for Rubber Products in Automotive Applications (SAE Recommended Practice J200)
16. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials
17. ASTM E 514 - Test Method for Water Penetration and Leakage Through Masonry

D. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.
- B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.
- C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.
- D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.
- E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.06 PROJECT CONDITIONS

- A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.
 1. Extend cover a minimum of 24 inches down both sides and hold cover securely in place.
- B. Do not apply uniform floor or roof loads for at least 12 hours and concentrated loads for at least 3 days after building masonry walls or columns.

- C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.
 - 1. Protect base of walls from rain-splashed mud and from mortar splatter by spreading coverings on ground and over wall surface.
 - 2. Protect sills, ledges, and projections from mortar droppings.
 - 3. Protect surfaces of window and door frames, as well as similar products with painted and integral finishes, from mortar droppings.
 - 4. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.
- D. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.
 - 1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.
- E. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1.07 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1093 to conduct the testing indicated, as documented according to ASTM E548.

PART 2 PRODUCTS

2.01 MATERIALS - MASONRY

- A. Split-Face Concrete Masonry Units (SFCMU)
 - 1. SFCMU shall conform to ASTM C90, normal weight, hollow, load-bearing units of 8-in by 8-in by 16-in nominal size.
 - 2. Minimum compressive strength on the net area (average of three units) when tested in accordance with ASTM C140 shall be 1900 psi on the net area resulting in a minimum f_m' of 1500 psi. Minimum compressive strength of any individual unit shall be not less than 80 percent of the required three-unit average.

3. Water absorption shall not exceed 10 pounds per cubic foot (average of three units) when tested in accordance with ASTM C140.
 4. Moisture content at time of delivery to job site shall not exceed 35 percent of total absorption.
 5. No overall dimension (width, height, or length) shall differ by more than 1/16-in from the specified standard dimension, except that dimensions measured to a splitface or end shall not be held to this tolerance.
 6. Oven dry weight of the concrete shall not be less than 130 lbs/cu ft.
 7. Provide all internal corner units, external corner units (split face - both outside planes), solid units (split face on face-of-wall plane only) and other special units as shown or required. Saw cut units as required to provide special cut units required.
 8. Units shall be colored with integrally mixed, alkali-stable, lightfast, weather-resistant pigment. Color shall be maintained uniformly throughout the job within the normal manufacturing tolerances.
 9. Provide a list of not less than three projects utilizing integrally-colored units manufactured by the same supplier.
 10. Colors shall be selected by the Engineer from manufacturers standard color selection.
- B. In accordance with the applicable Code provide units that meet minimum equivalent thickness requirements for concrete masonry units where required for fire-rated construction as indicated on drawings.
- C. Precast lintels shall be minimum 3,500 psi concrete with reinforcing placed all as shown.

2.02 REINFORCING, TIES AND ANCHORS

A. Joint Reinforcement

1. Reinforcement for masonry joints shall be welded wire units prefabricated in straight lengths of not less than 10-ft with matching corner and tee units fabricated from cold-drawn steel wire complying with ASTM A82, with deformed continuous side rods and plain cross-rods, butt welded to side rods and a unit width of 1-5/8-in less than thickness of wall or partition. Units shall be galvanized after fabrication conforming to ASTM A153, Class B-2, 1.5 oz/sq ft.
2. Reinforcement shall be ladder or truss type (as approved), fabricated with single pair of galvanized 9 gauge side rods and continuous 9 gauge straight or diagonal cross-rods spaced not more than 16-in o.c.
3. Masonry Joint Reinforcement for Single-Wythe Masonry: Either ladder or truss type with single pair of side rods.

4. Reinforcement shall be manufactured by Dur-O-Wal; Hohmann and Barnard; AA Wire Products or equal.

B. Wall Ties and Anchors

1. Galvanized dove-tailed anchor slots shall be furnished for anchorage to cast-in-place concrete work. Provide at ends of all CMU partitions where concrete is adjacent.
2. Approved No. 9 galvanized wire or metal ties manufactured for use with the anchor slots provided shall be spaced at maximum of 16-in o.c. vertically and in each anchor slot.
3. Miscellaneous corrugated metal ties, where ties are not shown on Structural Drawings, shall be 1-1/2-in wide, 16 gauge, galvanized steel, length to provide embedment as shown or as approved, spaced at 16-in o.c.
4. All galvanizing shall be hot dipped type conforming to ASTM A153, Class B2.
5. Ties and anchors shall be manufactured by Dur-O-Wal; Hohmann and Barnard; AA Wire Products or equal.

2.03 MORTAR AND GROUT MATERIALS

- A. Portland cement shall conform to ASTM C150 Type II. Masonry cements shall NOT be used.
- B. Lime for masonry mortar shall be hydrated, conforming to ASTM C207, Type S.
- C. Sand shall be clean, durable particles, free from injurious amounts of organic matter. The sand shall conform to the limits of ASTM C144. Sand for grout shall conform to ASTM C144 or C33 as required.
- D. Water shall be free from oils, acids, alkalis, or organic matter and shall be clean and fresh.

2.04 MORTAR AND GROUT MIXES

- A. Ingredients shall be accurately measured by volume in boxes especially constructed for the purpose. Measurement by shovel will not be allowed. Measure materials in a damp, loose condition.
- B. Portland cement mortar shall conform to ASTM C270, Type S. Provide test data as required to substantiate strength requirements of 1,800 psi at 28 days.
- C. Grout for constructing CMU lintel blocks and for grouting cores to receive embedded anchors or reinforcing shall conform to ASTM C476, Fine Grout, proportioned by volume: 1 part portland cement, 0 to 1/10 part lime and sand equal to 2-1/4 to 3 times the sum of the volumes of cement and lime materials. Strength shall be 2,500 psi minimum at 28 days. Mix grout to have a slump of 10-in plus or minus 1-in, at time of placement.

- D. Nonshrink grout where required shall be mixed as recommended by the Manufacturer to give the necessary consistency for placing and to give a minimum compressive strength of 3,000-lb/sq in 3 days.
- E. All other grout shall be 1 part portland cement, 1 part sand.

2.05 ACCESSORIES

- A. Precast concrete splash blocks, sized as approved, shall be provided at all roof downspout outlets that are not directly connected to an underground drainage system. Reinforce splash blocks with welded wire mesh and provide slope in units for drainage. Provide with pigment for integral color as approved.
- B. Expansion and Joint Filler Material shall be closed cell, premolded, 50 percent compressible, neoprene foam strips complying with ASTM D1056, Grade 2A1. Thickness shall be 3/8-in or as otherwise shown by width required for joint and wall conditions.
- C. Control Joints shall be wide flange rapid preformed neoprene gasket.
- D. Hardware Cloth shall be waterproof paper backed with ½ inch hardware cloth.
- F. Compressible Filler: Premolded filler strips complying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene. Thickness shall be as required for joint and wall conditions.

2.06 MASONRY INSULATION

- A. In single wythe exterior walls provide internal polystyrene insulation inserts. The insulation shall be installed at the masonry unit plant to provide for normal handling and cutting at the site. Provide where shown on drawings. Provide also, uninsulated standard CMU lintel and bond beam units.
 - 1. CMU shall be two core units produced on standard molds to accept Korfil by Concrete Block Insulating Systems, West Brookfield, MA or equal U-shaped insulating units.
 - 2. Insulating inserts shall have a minimum density of 1.0 lb/CF, a maximum water vapor transmission rate of 1.4 perm-in and shall comply with ASTM C578. For three web (two core) units provide the inserts in each core to achieve an R-value of 4.28 in 8-in units.
 - 3. Protect the insulating inserts during cutting operation and protect all inserts from damage during site storage and erection.

PART 3 EXECUTION

3.01 MORTAR

- A. Mortar shall be machine mixed in an approved type of mixer in which the quantity of water can be accurately and uniformly controlled. The mixing time shall not be less than 5 minutes,

approximately 2 minutes of which shall be for mixing the dry materials and not less than 3 minutes for continuing the mixing after the water has been added. Where hydrated lime is used for mortar requiring a lime content, there will be allowed the option of using the dry-mix method or first converting the hydrated lime into a putty. Where the dry-mix method is employed, the materials for each batch shall be well turned over together until the even color of the mixed, dry materials indicates that the cementitious material has been thoroughly distributed throughout the mass, after which the water shall be gradually added until a thoroughly mixed mortar of the required plasticity is obtained.

- B. Mortar boxes shall be cleaned out at the end of each day's work and all tools shall be kept clean. Mortar that has begun to set shall not be used.

3.02 MASONRY - INSTALLATION

- A. No material which is frozen or covered with frost or snow shall be used in the construction and no antifreeze salts or ingredients shall be mixed with the mortar. Masonry shall not be laid at temperatures below 40 degrees F, without the approval of the Engineer and all work shall be done in such a manner as to ensure the proper and normal hardening of all mortar. All masonry work shall be protected and heated so that the temperature at the surface will not fall below 50 degrees F for a period of 72 hours after placing. Any completed work found to be affected by freezing shall be taken down and rebuilt at no expense to the Owner.
- B. All CMU shall be laid in a full bed of mortar, applied to shells only. Butter the vertical joint of unit already set in the wall and all contact faces of the unit to be set. Each unit shall be placed and shoved against the unit previously laid so as to produce a well-compacted vertical mortar joint for the full shell thickness. Units shall set with all cells in a vertical position. The moisture content of the units when laid shall not exceed 35 percent of the total absorption as determined by laboratory test.
- C. Masonry Bonding
 - 1. CMU shall be laid in running bond unless otherwise shown.
 - 2. Fill all joints with mortar, dense and neat.
 - 3. Both vertical and horizontal joints shall be maintained uniform in spacing.
 - 4. Joints for CMU shall be 3/8-in. Tool concave as approved.
 - 5. Joints of all masonry shall be tooled in accordance with the following:
 - a. Wait until unit mortar is thumb-print hard before tooling joint. This may required as much as 3 hours in the shade and 1 hour in the sun in the summertime.
 - b. The required personnel shall be kept on the job after hours, if necessary, to properly tool joints.

- E. Sizes shall be as specified and called for on the Drawings, and where "Soaps" and "Splits" are used, the space between these members and the backup material shall be slushed full of mortar and tied-back as approved.
- F. All ties and joint reinforcing for masonry shall be furnished and installed under this Section. Continuous longitudinal joint reinforcing shall be provided in all CMU walls, interrupted at control joints. Space at 16-in o.c. vertically unless shown otherwise.
- G. Build in and grout fully all wall reinforcing as shown.
- H. Loose steel lintels shall be furnished under Division 5 and installed under this Section. Loose lintels shall be set in a full bed of mortar and supported by solid or mortar filled hollow CMU as detailed.
- I. Control joints shall be installed at the intersection of masonry walls with structural concrete and elsewhere as detailed on the Drawings. The maximum length, horizontally, between vertical control joints shall be 30-ft, but joints shall be located only as directed or shown. Joints shall be equal in width to the standard mortar joint.
- J. Install weep vents at base coursing as shown, and over all windows, doors, and other wall openings as required.
- K. CMU Cell Filling
 - 1. Insulation inserts shall be placed at all non-reinforced cells of CMU walls separating air conditioned spaces from un-air conditioned spaces or exterior and where otherwise noted on the Drawings. Insulation inserts shall NOT be installed in grouted/reinforced cells.
 - 2. Each course shall be filled with the required material before starting next course. Care shall be taken to prevent introduction of moisture or mortar while placing fill in cells. Rod sand fill thoroughly at each course into the course below to eliminate voids in the fill material.
 - 3. Note: Some walls will require both insulation inserts and sand fill in the cells.
- L. All masonry slots, chases, or openings required for the proper installation of the work of other Sections shall be constructed as indicated on the Drawings or in accordance with information furnished before the work is started at the points affected. No chase shall cut into any wall constructed of hollow units after it is built, except as directed and approved by the Engineer.
- M. Build in all miscellaneous items to be set in masonry for which placement is not specifically provided under separate Divisions, including reglets, lintels, ties, electrical panel boxes, sleeves, vents, grilles, anchors, grounds, and exterior electric conduits and fixtures and cooperate with other trades whose work is to be coordinated with the work under this Section.
- N. All anchorage, attachment, and bonding devices shall be set so as to prevent slippage and shall be completely covered with mortar or grout.

- O. Bed and grout for items coming in contact with masonry where grouting is required, including, but not limited to, wall and joint reinforcing, ties and anchors, pressed metal frame anchors set in masonry. Install all anchor bolts, base plates and seats in masonry walls, and build in all items required for the completion of the building as they apply to masonry.
- P. Surfaces shall be brushed as work progresses and maintained as clean as it is practicable. Unfinished work shall be raked back where possible and toothed only where absolutely necessary. Before leaving fresh or unfinished work, walls shall be fully covered and protected against rain and wind and before continuing work previously laid shall be swept clean. The tops of walls or other unfinished work shall be protected against all damage by frost or the elements by means of waterproof paper, tarpaulins, boards or other means approved by the Engineer.

3.04 CONTROL AND EXPANSION JOINTS

- A. General: Install control and expansion joint materials in unit masonry as masonry progresses. Do not allow materials to span control and expansion joints without provision to allow for in-plane wall or partition movement.
- B. Form control joints in concrete masonry using one of the following methods:
 - 1. Fit bond-breaker strips into hollow contour in ends of concrete masonry units on one side of control joint. Fill resultant core with grout and rake out joints in exposed faces for application of sealant.
 - 2. Install preformed control-joint gaskets designed to fit standard sash block.
 - 3. Install interlocking units designed for control joints. Install bond-breaker strips at joint. Keep head joints free and clear of mortar or rake out joint for application of sealant.
 - 4. Install temporary foam-plastic filler in head joints and remove filler when unit masonry is complete for application of sealant.
- C. Provide horizontal, pressure-relieving joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod but not less than 3/8 inch.
 - 1. Locate horizontal, pressure-relieving joints beneath shelf angles supporting masonry.

3.05 FLASHING, WEEP HOLES, CAVITY DRAINAGE, AND VENTS

- A. General: Install embedded flashing and weep holes in masonry at shelf angles, lintels, ledges, other obstructions to downward flow of water in wall, and where indicated.[Install vents at shelf angles, ledges, and other obstructions to upward flow of air in cavities, and where indicated.
- B. Install flashing as follows, unless otherwise indicated:

1. Prepare masonry surfaces so they are smooth and free from projections that could puncture flashing. Where flashing is within mortar joint, place through-wall flashing on sloping bed of mortar and cover with mortar. Before covering with mortar, seal penetrations in flashing with adhesive, sealant, or tape as recommended by flashing manufacturer.
- C. Install single-wythe CMU flashing system in bed joints of CMU walls where indicated to comply with manufacturer's written instructions. Install CMU cell pans with upturned edges located below face shells and webs of CMUs above and with weep spouts aligned with face of wall. Install CMU web covers so that they cover upturned edges of CMU cell pans at CMU webs and extend from face shell to face shell.
- D. Install reglets and nailers for flashing and other related construction where they are shown to be built into masonry.

3.06 REPAIR, POINTING, AND FINAL CLEANING

- A. Exposed masonry shall be protected against staining by wall coverings and excess mortar shall be wiped off the surface as the work progresses to reduce need for cleaning at completion of the work.
- B. Where ordered, remove masonry units which are loose, chipped, broken, stained, or otherwise damaged and units which do not match adjoining units and install new units in fresh mortar or grout, pointed to eliminate, as approved by the Engineer, evidence of replacement.
- C. Pointing
 1. During the tooling of joints, enlarge any voids or holes, except weep holes and completely fill with mortar matching color as approved by the Engineer and tool to match. Point-up all joints at corners, openings, and adjacent work to provide a neat, uniform appearance and properly prepare joints for application of sealants where required.
 2. Before final cleaning, repoint all unsatisfactory joints as specified above and as required by the Engineer.
- D. Acid solutions shall not be used for cleaning CMU, glazed facing tile, or ceramic veneer units. Upon completion of the work, all surfaces of CMU and glazed wall units shall be washed with soap powder and warm water, applied with a scrubbing brush, and then rinsed thoroughly with clear water. Other cleaning methods may be ordered to obtain required appearance. Metal cleaning tools and brushes or abrasive powders shall not be used on glazed surfaces.
- E. Masonry areas not satisfactorily cleanable will ordered replaced at no extra cost to the Owner.

3.07 FIELD QUALITY CONTROL

- A. Owner will engage qualified personnel to perform continuous field inspection.
- B. Contractor will engage a qualified independent testing agency to perform field quality control indicated below:

1. Payment for these services will be made by Contractor.
 2. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.
- C. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction of each 2500 sq. ft. of wall area or portion thereof.
- D. Mortar properties will be tested per ASTM C780.
- E. Grout will be samples and tested for compressive strength per ASTM C1019.
- F. Masonry Unit Tests: For each type of concrete masonry unit indicated, units will be tested according to ASTM C140.

END OF SECTION

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. Concrete joint accessories are included in Section 03250.
- B. Masonry reinforcement, ties and accessories are included in Division 4.
- C. Painting is included in Division 9.
- D. Sluice gates, slide gates, operators and appurtenances, including wall thimbles, are included in Division 11.
- E. Pipe hangers and sleeves are included in Division 15.
- F. Equipment anchor bolts are included in the respective Sections of Divisions 11, 14 and 15.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, 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 6-in by 8-in samples of metal grating and planks, illustrating surface finish, color, texture and jointing details if requested by Engineer.
 - 2. Submit 12-in long samples of guardrail and handrail. Submit 1 sample of elbow, tee, wall bracket, escutcheon, end stop, rail joint connections if requested by Engineer.
 - 3. Submit samples as requested by the Engineer during the course of construction.
- C. Design Data
 - 1. Submit calculations, test data or manufacturers load and deflection tables demonstrating that the railings will resist the loads specified in the details at the post spacing provided.

2. Submit manufacturer's load and deflection tables for grating.

D. Certificates

1. Submit certification that the railing system is in compliance with OSHA requirements and the Florida Building Code.

1.04 REFERENCE STANDARDS

A. Aluminum Association (AA)

1. AA M31C22A41
 - a. M31: Mechanical Finish, Fine Satin
 - b. C22: Finish, Medium Matte
 - c. A41: Clear Anodic Coating, Class I

B. 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 Bars, Carbon, Cold Finished, Standard Quality.
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 Heat-Resisting Chromium and Chromium-Nickel Stainless Plate, Sheet, and Strip Pressure Vessels.
8. ASTM A276 - Standard Specification for Stainless Steel Bars and Shapes.
9. ASTM A307 - Standard Specification for Carbon Steel Bolts and Studs, 60,000 Psi Tensile Strength.
10. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength.

11. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
 12. ASTM A501 - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing.
 13. ASTM A536 - Standard Specification for Ductile Iron Castings.
 14. ASTM A570 - Standard Specification for Steel, Sheet and Strip, Carbon, Hot-Rolled, Structural Quality.
 15. 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.
 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.
- C. American Iron and Steel Institute (AISI).
1. Specification for Structural Steel Buildings.
- 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
1. FS-FF-B-575C - Bolts, Hexagonal and Square
- F. Occupational Safety and Health Administration (OSHA)
- G. Florida Building Code (FBC)
- H. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 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 and welding of stainless steel shall conform to AWS D1.6.

1.06 DELIVERY, STORAGE AND HANDLING

- A. Deliver items to be incorporated into the work of other trades in sufficient time to be checked prior to installation.
- B. Repair items that have become damaged or corroded to the satisfaction of the Engineer prior to incorporating them into the work.

1.07 PROJECT/SITE REQUIREMENTS

- A. Field measurements shall be taken at the site, prior to 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 | ASTM A36 |
| 2. Structural Steel Tubing | ASTM A500, Grade B |
| 3. 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 |

- | | |
|--|--|
| 4. Steel Sheets | ASTM A1008 |
| 5. Gray Iron Castings | ASTM A48, Class 35 |
| 6. Ductile Iron Castings | ASTM A536, Grade 65-45-12 |
| 7. Aluminum Extruded Pipe | ASTM B429, Alloy 6063 T6 |
| 8. Aluminum Extruded Shapes | ASTM B221, Alloy 6061 T6 |
| 9. Aluminum Sheet and Plate | ASTM B209, Alloy 6061 T6 |
| 10. Stainless Steel Plates, Sheets, and Structural Shapes | |
| a. Exterior, Submerged or Industrial Use
for welded) | ASTM A240, Type 316 (Type 316L |
| b. Interior and Architectural Use | ASTM A240, Type 304 |
| 11. Stainless Steel Bolts, Nuts, and Washers | ASTM A276, Type 316 |
| 12. Carbon Steel Bolts and Studs
galvanized nuts and washers where noted) | ASTM A307, Grade A (hot dip |
| 13. High Strength Steel Bolts, Nuts and washers | ASTM A325 (mechanically
galvanized per ASTM B695, Class 50,
where noted) |
| a. Elevated Temperature Exposure | Type I |
| b. General Application | Type I or Type II |
| 14. Galvanizing | ASTM A123, Zn w/0.05 percent
minimum Ni |
| 15. Galvanizing, hardware | ASTM A153, Zn w/0.05 percent
minimum Ni |

2.03 ANCHORS, BOLTS AND FASTENING DEVICES

- A. Anchor bolt material shall be ASTM F1554 unless otherwise noted.
- B. Unless otherwise noted, bolts for the connection of carbon steel or iron shall be steel machine bolts; bolts for the connection of galvanized steel or iron shall be galvanized steel or stainless steel machine bolts; and bolts for the connection of aluminum or stainless steel shall be stainless steel machine bolts.

- C. 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 cone portion of the bolt at least 1-in behind the concrete reinforcing steel. Expansion anchors shall be Hilti, Kwik-Bolt III; Simpson Strong-Tie Wedge-All; Powers Power-Stud or equal.
- D. Compound masonry expansion anchors shall be lead expansion sleeve type anchors complete with nuts and washers. Anchors shall be precision die-cast zinc alloy with a minimum of two lead alloy expansion sleeves. 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-in behind the concrete reinforcing steel. Expansion anchors shall be Star Expansion Industries, Star Slugin or equal.
- E. Adhesive capsule anchors shall be a two-part stud and capsule chemical resin anchoring system. Capsules shall contain premeasured amounts of polyester or vinyl ester resin, aggregate and a hardener contained in a separate vial within the capsule. Stud assemblies shall consist of an all-thread anchor rod with nut and washer. Adhesive capsule anchors shall be Hilti, HVA Adhesive Anchor; Molly, Parabond; Rawlplug, Rawl Chem-Stud or equal.
- F. Adhesive anchors, for fastening to hollow concrete block or brick, 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 an all-thread anchor rod with nut and washer. Anchors shall be Hilti, HIT C-20 System or 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 Federal Specification FF-B-575C. Bolts and nuts shall be hexagon type. Bolts, nuts, screws, washers and related appurtenances shall be Type 316 stainless steel.
- I. Toggle bolts shall be Hilti, Toggler Bolt or equal.

2.04 LADDERS

- A. Ladders, ladder accessories and ladder clearances shall conform to the requirements of OSHA.
- B. Aluminum ladders shall be fabricated with 2-1/2-in by 1/2-in aluminum bar side rails spaced a minimum 18-in apart. Rungs shall be fabricated from extruded aluminum shapes, alloy 6063-T5/T6, with a serrated tread, number A5680 by Washington Aluminum Company or equal spaced 12-in on center. Wall support brackets shall be aluminum 6061-T6 spaced 5-ft on center with Type 316 stainless steel fasteners. Where possible, the side rails shall be fastened to the floor with 1/2-in diameter Type 316 stainless steel expansion bolts.

- C. Ladder cages shall be constructed as shown on the plans of aluminum alloy 6061-T6 for plates and bars and alloy 6063-T5 for extrusion.
- D. Fall prevention devices shall be installed on all ladders, 20 or more feet in height and without safety cages, and at locations indicated by the Drawings. The system shall be a rigid-rail and locking sleeve fall prevention device complete with all mounting hardware and accessories furnished in the same metal as the rail unless otherwise noted. Rail material shall be aluminum alloy 6061-T6 with bronze sleeves. Provide basic system accessories including: two bronze locking climbing sleeves (Saf-T-Lok Sleeve) two climbing belts (Saf-T-Belt), two harnesses (Saf-T-Climb Harness), removable extension kit. Where ladder begins below the access platform of a structure (eg: meter vaults, hatchways, etc.) provide a permanently installed mandril at each ladder to allow use of the removable extension previously specified. The systems shall be "Saf-T-Climb" by North Consumer Products (a Division of Siebe North, Inc) or equal.
- E. Ladder safety post extensions shall be provided on all fixed ladders occurring below hatches and at locations indicated by the Drawings. The telescoping tubular safety post extension shall be secured to the ladder rungs with stainless steel fasteners and brackets. The ladder post extension shall be Bilco's ladder UP Safety Post, Model 2 or equal.
- F. Ladder shields shall be "Ladder Gate" by Siebe Norton, Inc., Cerritos, CA or equal. The bottom of the ladder shield shall be 7-ft above finish grade.
- G. Manhole rungs for cast-in-place concrete work shall be 12-3/4-in wide with a drop front design and a serrated step surface and comply with the requirements of OSHA. Aluminum rungs shall be of alloy 6061-T6.
- H. Ship ladders shall be of all aluminum construction. Treads shall have abrasive nosing as manufactured by Reliance Steel Products Co.; IKG Industries or equal.

2.05 ACCESS HATCHES

- A. Access hatches shall have single or double leaf doors as indicated by the Drawings. The doors shall be 1/4-in aluminum diamond pattern plate with welded stiffeners, as necessary, to withstand a AASHTO H20 wheel load. Hatches shall have a 1/4-in aluminum channel frame with a perimeter anchor flange or strap anchors for concrete embedment around the perimeter. Unless otherwise noted on the Drawings, use pivot torsion bars for counterbalance or spring operators for easy operation along with automatic door hold open. Hardware shall be durable and corrosion resistant with Type 316 stainless steel hardware used throughout. Provide removable lock handle. Finish shall be the factory mill finish for aluminum doors and frames with bituminous coating on the exterior of the frames in contact with concrete. Access hatches shall be Types as indicated on the Drawings by U.S.F. Fabrication, Inc. Hialeah, FL or equal.

2.06 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. 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-in. Frames and supports shall be of aluminum construction. Fastening devices and hardware shall be Type 316 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-in on center. Nosing shall also be used at concrete ladder openings. Nosing shall be a single piece for each step extending to within 3-in 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. Aluminum guardrails and handrails shall be given an anodic oxide treatment in accordance with the AA M31C22A41. Other aluminum items shall have a cleaned and degreased mill finish.

2.07 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. 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, 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 galvanized. 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 galvanized.
- 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-in 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 oz/sq ft of surface.

2.08 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. 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.

2.09 CASTINGS

- A. Casting shall be of good quality, strong, tough, even-grained, smooth, free from scale, lumps, blisters, sand holes and defects of any kind which render them unfit for the service for which

they are intended. Castings shall be thoroughly cleaned and will be subjected to a hammer inspection in the field by the Engineer. All matching surfaces shall be machined to a true plane surface to allow contact surfaces to seat at all points without rocking. Allowances shall be made in the patterns so that the thickness specified shall not be reduced in obtaining finished surfaces. Castings will not be acceptable if the actual weight is less than 95 percent of the theoretical weight computed from dimensions. The Contractor shall provide facilities for weighing castings in the presence of the Engineer.

- B. Frames, covers, cast grates and trench drains for structures shall be gray iron castings except as otherwise specified or indicated on the Drawings. Sizes shall be as shown on the Drawings. Covers shall have letters "WATER," "SANITARY SEWER," or "DRAIN," as applicable, embossed on top.
- C. Frames and covers for installation in slabs shall be heavy duty, R-6013-R-6099. Series as manufactured by Neenah Foundry Co., or equal.
- D. Electrical and telephone manhole and handhole frames and covers for structures shall be ductile iron castings. The covers shall be watertight. Covers shall have the word "ELECTRIC," "HIGH VOLTAGE," "LOW VOLTAGE," "SIGNAL," "TELEPHONE," as applicable, embossed on or cast into the top in letters 2-in high. The clear opening shall be 36-in unless otherwise indicated on the Drawings.
- E. Trench drains shall be of the length shown on the Drawings and shall be heavy duty, R-4990 Series with a "Type A" cover as manufactured by Neenah Foundry Co. or equal.

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 and Division 4 respectively. 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 damage area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of Military Specifications MIL-P-15145. 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 manufacturer'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 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 prior to installation.
- I. 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.
- J. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.
- K. Where aluminum contacts wood, apply two coats of aluminum metal and masonry paint to the wood.
- L. Between aluminum gratings, aluminum stair treads, or aluminum handrail brackets and steel supports, insert 1/4-in 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

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SECTION 06100

ROUGH CARPENTRY

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install all items of rough carpentry work as shown on the Drawings and as specified herein.
- B. Install pressed metal frames, which are to be installed in finished openings.
- C. Install steel doors and finish hardware furnished under other Sections.

1.02 RELATED WORK

- A. Wood forms required for concrete work are included in Division 3.
- B. Anchor bolts and other metal appurtenances except as specified herein are included in Division 5.
- C. Doors and frames are furnished under Division 8.
- D. Finish hardware is furnished under Division 8.

1.03 SUBMITTALS

- A. Submit to the Engineer as provided in Section 01300, complete shop drawings showing details of fabrication and erection of all finish carpentry items and material furnished under this Section.

1.05 REFERENCE STANDARDS

- A. American Wood Preservers Association (AWPA)
 - 1. AWPA P-5 - Standards for Water Borne Preservatives
- B. American Society of Testing and Materials (ASTM)
 - 1. ASTM C209 – Standard Methods of Testing Insulating Board (Cellulosic Fiber), Structural and Decorative.
 - 2. ASTM C518 – Standard Test Method for Heat Flux Measurements and Steady-State Thermal Transmission Properties by Means of Heat Flow Meter Apparatus.

3. ASTM D1621 – Standard Test Method for Compressive Properties of Rigid Cellular Plastics.
 4. ASTM D2126 – Standard Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
 5. ASTM E84 – Standard Test Method for Surface Burning Characteristics of Building Materials.
 6. ASTM E96 – Standard Test Methods for Water Vapor Transmission of Materials.
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All lumber shall be of sound stock, delivered dry and shall be fully protected at all times from injury and dampness. Split, broken, or otherwise damaged pieces will not be allowed in the work.
- B. Wood for blocking and nailers shall be seasoned, 19 percent maximum moisture content, Construction Grade quality and of Douglas Fir; Southern Pine or Ponderosa Pine species.
1. All wood members shall be vacuum-pressure treated with 100 percent oxide pure alkaline copper quat (ACQ) meeting AWPA Standard P-5. Minimum net retention of solid preservative shall be as follows:
 - a. Above Ground: 0.25 lb per cu. ft.
 - b. Below Ground or Fresh Water Contact/Immersion: 0.40 lb per cu ft.
 - c. Wood Foundation or Structural Poles: 0.60 lb per cu. ft.
 - d. Salt Water Contact/Immersion: 2.50 lb per cu. ft.
 2. All treatment shall be performed in accordance with the requirements of the Standard Specifications of the American Wood Preservers Association for treating wood. Apply a heavy coat of the same preservative used in treating to all surfaces cut after treatment.
 3. Products containing arsenic in any form shall not be permitted.
- C. Nails, spikes, bolts, nuts and washers where sizes are not indicated or specified, shall be of suitable size and number as approved to securely fasten and hold members in place. Hot dip galvanize after fabrication except where stainless steel is shown.

PART 3 EXECUTION

3.01 INSTALLATION

- A. All rough carpentry shall be accurately cut, fitted and installed as detailed.
- B. Anchors shall be installed, where indicated or required, to anchor carpentry securely to masonry or concrete. Secure baffles to stainless steel framing where and as shown.
- C. Forms for structural concrete work shall be as specified under Division 3. Provide all other miscellaneous wood formwork as may be required for the completion of the work.
- D. Temporary wood doors and cloth or transparent plastic covered frames shall be provided for exterior wall openings during winter construction.
- E. Installation of Door Frames in Finished Openings
 - 1. Install door frame units and accessories in accordance with approved shop drawings, Manufacturer's data and as specified herein.
 - 2. Provide anchorage devices for securing metal frames in finished opening construction. Set anchorage devices opposite each anchor location, in accordance with details on shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed and free from dust and debris.
 - 3. At in-place concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.
 - 4. Remove spreader bars only after frames or bucks have been properly set and secured.
- F. Installation of Doors and Finish Hardware:
 - 1. Doors and finish hardware will be furnished under Division 8 and shall be installed under the work of this Section, except where specifically designated otherwise herein.
 - 2. As soon as the hardware is delivered to the job site, receive, verify and check each set and report to the Engineer any defect or shortage. Give notice to the hardware supplier for all such items, which may be defective or missing. Provide a receipt to the hardware supplier for all such items as are found to be correct.
 - 3. Finish hardware, after checking, shall be the responsibility of the Contractor until it is installed and the project is accepted in its entirety by the Owner.
 - 4. Install steel doors to comply with manufacturer's instructions, all as shown.
 - 5. Fit non-fire-rated steel doors accurately in their respective frames, with the following clearances:

- a. Jambs and Head - 3/32 inch.
 - b. Meeting Edges, Pairs of Doors - 1/8 inch.
 - c. Bottom (where no undercut) - 3/8 inch, where no threshold.
 - d. Bottom (where no undercut) - 1/8 inch, at threshold.
 - e. Provide undercuts as scheduled.
6. Hardware shall be attached and placed by skilled mechanics in accordance with approved hardware templates provided with the hardware, and shall be accurately fitted and adjusted. Lever handles shall be kept covered with heavy cloth and other hardware shall be protected from damage until final acceptance of the entire project by the Owner.
 7. Set each edge and joint of threshold in a seal strip of polyurethane sealant. Grout remainder of threshold in mortar.
 8. Adjust and check each operating item of hardware and each door, to ensure proper operation or function of every unit. Lubricate moving parts with type lubrication recommended by manufacturer (graphite-type if no other recommended). Replace units, which cannot be adjusted and lubricated to operate freely and smoothly as intended for the application made.
 9. Wherever hardware installation is made more than one month prior to acceptance or occupancy of a space or area, return to the work during the week prior to acceptance or occupancy and make a final check and adjustment of all hardware items in such space or area. Clean and relubricate operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
 10. All doors shall be in complete and proper operating condition. Remove and replace defective work, including doors or frames that are warped, bowed, or otherwise unacceptable.
 11. Immediately after erection, sand smooth all rusted or damaged areas of prime coat on steel and apply touch-up of compatible air-drying primer.

END OF SECTION

SECTION 07005

DAMPPROOFING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all materials, labor, equipment and incidentals required and perform all the dampproofing and related work necessary for the proper completion of the Project as shown on drawings and as specified herein.

1.02 RELATED WORK

- A. Precast concrete manholes and structures are included in Division 2.
- B. Concrete joints and joint accessories including sealant for concrete joints are included in Division 3.
- C. Cast-in-place concrete is included in Division 3.
- D. Patching and repairs of concrete surfaces, including removal of fins and other projections, filling recesses left by the removal of form ties, and patching of surface defects and honeycombed areas, is provided under Division 3.
- E. Vapor barriers under concrete slabs on grade are included in Section 07231.
- F. Joint Sealers and caulking are included in Section 07900.

1.03 SUBMITTALS

- A. Submit, in accordance with Section 01300, shop drawings and product data showing materials of construction, details, and manufacturer's recommendations for installation of all required products and systems.
- B. Samples
 - 1. Submit two representative samples of proposed materials a minimum of 90 days prior to use of the materials at the site.

1.04 QUALITY ASSURANCE

- A. Verify, at the site, both the dimensions and work of other trades adjoining items of Work in this Section before installation of the materials specified under this Section.

1.05 DELIVERY, STORAGE AND HANDLING

- A. Deliver and store packaged materials in original packages. Protect from damage from sunlight, weather, extreme temperatures, and in accordance with manufacturer's recommendations.
- B. Replace packages or materials showing evidence of damage or inclusion of foreign material at no additional cost to the Owner.

1.06 PROJECT/SITE REQUIREMENTS

- A. Perform work only when existing and forecasted weather conditions are within the limits, including temperature limits, established by the manufacturer of the materials and products used.
- B. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive the materials and products used, as specified in Paragraph 3.01.

1.07 APPLICATION SCHEDULE

- A. Dampproof the surfaces of all poured in place concrete walls, which are in contact with soil from the top of the footings up to 6-in below finished grade or to bottom of slab. Carry dampproofing over exposed top and outside edge of footings. Provide also on buried top slabs of structures without waterproofing protection.
- B. Dampproof the outer surfaces of precast and cast-in-place manholes and structures at the rate of 30 to 35 sq ft per gallon in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Dampproofing
 - 1. Troweled dampproofing shall be an asphalt emulsion reinforced with fibers conforming to ASTM D1227, Type II, Class 1. The dampproofing shall be Hydrocide 700 by Sonneborn Building Products, Division of ChemRex Inc., Minneapolis, MN; Karnak 920 Asphalt Emulsion by Karnak Corporation, Clark, NJ or equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation of materials specified under this Section shall not commence until the structure has passed the watertightness test specified elsewhere in these documents, where applicable.
- B. Installation of Dampproofing
 - 1. Surface to be treated shall be free from oil and dirt and shall be in the proper condition as indicated by the manufacturer prior to the application of the dampproofing material. The

concrete shall have been completely cured and the surface shall be dry and free from frost at the time of application.

2. Surfaces to be troweled dampproofed shall receive one heavy coat carefully applied so that "holidays" or air-bubble depressions in the surface are completely filled and a thickness of 1/16-in is obtained from the high points of the surfaces providing a 100 percent coating of the surface. Carry coating over exposed top and outside edge of footing.
3. Particular care shall be given to the application of dampproofing at all construction joints which are encountered.
4. The coat or coats specified is in addition to primer coats as recommended by the manufacturer.
5. Do not place backfill before cure time recommended by manufacturer and before the wall has been inspected by Engineer. The backfill shall be placed promptly after inspection by Engineer within time limits recommended by manufacturer.

3.01 CLEANUP

- C. At all times keep the premises free from accumulation of waste materials and rubbish. At the completion of the installation, remove all tools, equipment, scaffolding, surplus materials and rubbish from the area.
- D. Remove all dampproofing and caulking materials from all surfaces where materials are not required. Use cleaning material recommended by the manufacturer.

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SECTION 07231

VAPOR BARRIER

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install vapor barriers as shown on the Drawings and as specified herein.

1.02 RELATED WORK

- A. Termite Treatment is included in Division 2.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Vapor barrier shall be 10 mil thick polyethylene sheet with a vapor transmission rating of 0.20 perms or less. Provide with approved pressure sensitive polyethylene tape to seal joints.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Vapor barrier shall be installed under all interior slabs-on-grade, and after termite soil treatment has been applied. Laps between adjacent sheets shall be 10-in minimum. Vapor barrier will be carefully inspected by the Engineer prior to concrete placement. Additional polyethylene sheet required for repair and replacement of damaged vapor barrier shall be furnished and installed as directed by the Engineer at no additional cost to the Owner. Seal joints between sheets or repair material with the approved tape.

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SECTION 07510

SBS MODIFIED BITUMEN ROOFING SYSTEM

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and install modified bitumen, SBS type, roofing membrane system over roof insulation/coverboard, with base flashing, cap flashing, roof edge systems, other flashing and appurtenances, all as shown on the Drawings and as specified herein.
- B. Contractor will observe all published safety prevention policies and practices relating to application of roofing system and related work. All federal, state, and local codes shall be followed.
- C. Contractor will follow application and safety information, instructions and recommendations as published in the most current edition of the Manufacturer's Asphalt Roofing System Technical Guides.

1.02 RELATED WORK

- A. Wood blocking is included in Division 6.

1.03 REFERENCES

- A. American Society of Testing and Materials (ASTM)
 - 1. ASTM C 728 - Standard Specification for Perlite Thermal Insulation Board; 1997.
 - 2. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2004.
 - 3. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2004.
 - 4. ASTM D 41 - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2005.
 - 5. ASTM D 312 - Standard Specification for Asphalt Used in Roofing; 2000.
 - 6. ASTM D 1079 - Standard Terminology Relating to Roofing, Waterproofing, and Bituminous Materials; 2005a.
 - 7. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000.

8. ASTM D 4586 - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2000.
 9. ASTM D 6163 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements; 2000.
 10. ASTM D 6164 - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements; 2000.
 11. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.
 12. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2004.
- B. CAN-ULC-S770 - Standard Test Method Determination of L-Term Thermal Resistance Of Closed-Cell Thermal Insulating Foams; 2003.
- C. PS 20 - American Softwood Lumber Standard; 2005.
- D. SPRI ES-1 - Wind Design Standard for Edge Systems Used with Low Slope Roofing Systems; 2003. (ANSI/SPRI ES-1).
- E. National Roofing Contractors Association (NRCA) - Roofing and Waterproofing Manual.

1.04 DEFINITIONS

- A. Roofing Terminology: Refer to ASTM D 1079 for definition of terms related to roofing work not otherwise defined in this Section.
- B. LTTR: Long Term Thermal Resistance, as defined by CAN-ULC S770.

1.05 SUBMITTALS

- A. Submit to the Engineer for review as provided in Section 01300, technical data for all components and shop drawings showing details of construction and installation of roofing system, including but not limited to insulation, prefabricated metal roofing components, coping system, flashings and sealants.
- B. Submit, for approval, representative samples of membrane, flashing, insulation, fasteners and a full size cross-section sample of proposed metal flashing/reglet system when required.
- C. Provide, with shop drawings, certification by the roofing system manufacturer that the roofer who will execute the work is an authorized applicator of the proposed roofing system.
- D. Provide copy of current, valid statewide product approval for product, material or system as shown on the drawings and as specified in this section, in accordance with Rule 9N-3. Product approval shall be for the specific manufacturer, product type, model or style, and the State Approval Number. The successful Contractor, the Contractor shall be responsible to file the appropriate Product Approval information with the local authority having jurisdiction.

- E. Provide evidence of compliance with the requirements of Paragraph 1.07.A and 1.07.B, Regulatory Requirements, shall be included with the initial submittal for the products specified
- F. Warranty: Submit warranty samples as intent to issue warranty to Owner upon acceptance of work.

1.06 QUALITY ASSURANCE

- A. Manufacturer:
 - 1. Company specializing in manufacturing the roofing membrane specified in this Section with ten years of manufacturing experience.
 - 2. System supplier must have ISO 9002 certification.
 - 3. Manufacturer must be able to provide the project with the membrane and Isocyanurate insulation that is produced in their facilities.
- B. Applicator Qualifications: Roofing installer shall have the following:
 - 1) Current Firestone Red Shield Licensed Contractor status.
 - 2) At least five years experience in installing specified system.

1.07 REGULATORY REQUIREMENTS

- A. The products, materials and assemblies, including anchorage, proposed for the work of this Section shall comply with project specific calculated design pressures and the Florida Building Code (Code), including wind-borne debris region requirements, and shall be designed by the Manufacturer and installed by the Contractor to meet these requirements. Refer to project design pressures in the components and cladding table on the structural drawings. Where a conflict occurs between the requirements of this Specification and the Code, the more stringent requirement shall apply.
- B. It shall be the responsibility of the contractor to provide evidence of code compliance for the products, materials and assemblies, including anchorage specified in this section. Evidence of code compliance shall be demonstrated by compliance with the Florida Building Code, using one of the methods outlined in Chapter 9N-3 of the Florida Administrative Code, Department of Community Affairs, Florida Building Commission, Product Approval.

1.08 QUALITY INSPECTION OBSERVATION

- A. Inspection by Manufacturer: Provide a final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer.
 - 1. Technical Representative shall not perform any sales functions. Contractor shall complete any necessary repairs required for issuance of warranty.

1.09 PRE-ROOFING CONFERENCE

- A. Well in advance of commencement of roofing operations but after representative new roofing substrate has been constructed and prepared for roofing, a pre-roofing conference shall be held to inspect the substrate. The Contractor shall inform all parties having an interest in the roofing or work on the roof of the conference.
- B. Parties to the conference shall include the Engineer, Contractor, roofing subcontractor and his/her foreman, roofing membrane and insulation manufacturers, plumbing subcontractor and a representative of any other trade classification having work on a roof and deemed by the Engineer to attend.
- C. The conference shall include an inspection by all parties of the membrane substrate and its conformance with the Drawings, the approved shop drawings and the approved roofing manufacturer's specifications and instructions. All objections to approval of the substrate shall be noted by the Engineer or the Owners representative. The Contractor shall coordinate efforts to remedy objections and prepare the substrate properly to receive roofing and flashing so that the warranty can be issued. Work of this Section shall commence after remedies are made.

1.10 DELIVERY, STORAGE AND HANDLING

- A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.
- B. Store materials clear of ground and moisture with weather protective covering. Store roll goods on end. Store in a dry, well ventilated, weathertight place. Do not leave unused materials on the roof overnight and when roofing work is not in progress, remove damaged materials from the site.
- C. Keep combustible materials away from ALL ignition sources.

1.11 WARRANTY

- A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.
- B. Manufacturer's Standard Warranty - Upon completion of the work and acceptance by the Owner, the manufacturer shall furnish to the Owner a written and signed standard warranty, certifying the performance of his products and the consistency of the properties of such products to be watertight for a period of 20 years from date of acceptance. Furthermore, the manufacturer will, upon written notice by the Owner, inspect the roof and, if a leak is within the coverage of this warranty, will at its own expense, make or cause to be made all necessary repairs to the roof assembly, to put it into watertight condition.
 - 1. Limit of Liability: No dollar limitation.
 - 2. Scope of Coverage: Repair leaks in the roofing system caused by:

- a. Ordinary wear and tear of the elements.
 - b. Manufacturing defect in materials.
 - c. Defective workmanship used to install these materials.
- C. Wind Uplift Rider – The manufacturer shall provide, in addition to its Standard Warranty, a Wind Uplift Rider which will warrant that the building will not be damaged by any windstorm event causing an uplift pressure or design velocity pressure up to and including a 100 MPH wind event.
- D. Metal Roof Edging: Full-system warranty for roof edge system, covering blow-off from winds up to 150 mph.
- E. Metal Roof Edging with Exposed Decorative Fascia: Provide 20 year warranty for painted finish covering color fade, chalk, and film integrity.
- F. The Contractor is to cover damages to the building resulting from failure to prevent penetration of water during construction.
- G. Contractor's Standard Warranty - The Contractor is to guarantee all work against defects in materials and workmanship for a period of two (2) years following final acceptance of the Work.

PART 2 PRODUCTS

2.01 ROOFING SYSTEM DESCRIPTION

- A. Roofing System:
1. SBS Cap Sheet
 2. SBS Base Sheet
 3. Slope: Deck is flat, provide slope of 1/4 inch per foot by means of tapered insulation.
 4. Comply with applicable local building code requirements.
 5. Attachment: Asphalt attachment.
- B. Insulation:
1. Total R Value: 19, minimum.
 2. Tapered: Slope as indicated; provide minimum R-value at thinnest point; place tapered layer on top.

3. Base Layer: Polyisocyanurate foam board, non-composite.
 - a. Attachment: Asphalt attachment.

C. Insulation Cover Board:

1. Type: Gypsum-based board, 1/2 inch thick.
2. Attachment: Asphalt attachment.

D. Crickets: Tapered insulation of same type as specified for top layer; slope as indicated.

2.02 SBS MODIFIED BITUMEN MATERIALS

A. Cap Sheet: Granule surfaced SBS polymer-modified bitumen sheet, reinforced with non-woven polyester fabric, complying with ASTM D 6164, Type I, Grade G, formulated for hot asphalt application with the following additional characteristics:

1. Reinforcing Fabric: 5.3 oz per sq yd, with continuous fiberglass strands in machine direction.
2. Nominal Thickness: 0.150 inch.
3. Post Consumer Recycled Content: 3 percent, nominal.
4. Sheet Width: 3.3 feet, nominal.
5. Granule Color: White.
6. Acceptable Product: SBS FR Cap by Firestone or equal.

B. Interply Base Sheet: SBS polymer-modified bitumen sheet, complying with ASTM D 6163, Type I, Grade S, with glass fiber reinforcing fabric, formulated for hot asphalt and cold adhesive application to substrate and cap sheet, with the following additional characteristics:

1. Nominal Thickness: 0.087 inch.
2. Sheet Width: 3.3 feet, nominal.
3. Acceptable Product: SBS Base by Firestone or equal.

C. Flashings: Same materials and configuration as roofing membrane.

2.03 ROOF INSULATION AND COVER BOARDS

A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C 1289 Type I Class 1, with the following additional characteristics:

1. Thickness: As indicated elsewhere.
 2. Size: 48 inches by 48 inches, nominal.
 3. R-Value (LTTR):
 - a. 1.5 inch Thickness: 9.0, minimum.
 - b. 2.0 inch Thickness: 12.1, minimum.
 - c. 3.0 inch Thickness: 18.5, minimum.
 4. Compressive Strength: 20 psi when tested in accordance with ASTM C 1289.
 5. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
 6. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.
 7. Acceptable Product: ISO 95+ GL Polyisocyanurate Insulation by Firestone or equal.
- B. Gypsum-Based Cover Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C 1177/C 1177M, and with the following additional characteristics:
1. Size: 48 inches by 48 inches, nominal.
 2. Thickness: As indicated elsewhere.
 3. Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C 473.
 4. Spanning Capability: Recommended by manufacturer for following minimum flute spans:
 - a. 1/2 inch Thickness: 5 inches, minimum.
 5. Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E 84.
 6. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.
 7. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D 3273 for minimum of 4 weeks.
 8. Acceptable Product: Georgia-Pacific DensDeck Prime Roof Guard or equal.
- C. Asphalt for Insulation Attachments: Type as required by roof membrane manufacturer.

2.04 METAL ACCESSORIES

- A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.
1. Wind Performance:
 - a. Membrane Pull-Off Resistance: 100 lbs/ft, minimum, when tested in accordance with ANSI/SPRI ES-1 Test Method RE-1, current edition.
 - b. Fascia Pull-Off Resistance: At least the minimum required when tested in accordance with ANSI/SPRI ES-1 Test Method RE-2, current edition.
 - c. Provide product listed in current Factory Mutual Research Corporation Approval Guide with at least FM 1-270 rating.
 2. Description: Two-piece; extruded aluminum T-shaped edge member securing top and bottom edges of flat-faced formed metal fascia; Firestone AnchorGard.
 3. Fascia Face Height: 5 inches.
 4. Edge Member Height Above Nailer: 1-1/4 inches.
 5. Fascia Material and Finish: 0.040 inch thick formed aluminum, natural mill finish; matching concealed joint splice plates; factory-installed protective plastic film.
 6. Length: 144 inches.
 7. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
 8. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
 9. Anchor Bar Cleat: 20 gage, 0.036 inch G90 coated commercial type galvanized steel with pre-punched holes.
 10. Curved Applications: Factory modified.
 11. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.
 12. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14 inch long legs on corner pieces.
 13. Scuppers: Welded watertight.

14. Accessories: Provide matching brick wall cap, downspout, extenders, and other special fabrications as shown on the drawings.

2.05 ACCESSORY MATERIALS

- A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood; pressure preservative treated.
 1. Width: 3-1/2 inches, nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
 2. Thickness: Same as thickness of roof insulation.
- B. Cant Strips and Tapered Edge Strips: 45 degree face slope and minimum 5 inch face dimension; provide at all angle changes between vertical and horizontal planes that exceed 45 degrees.
 1. Type: Non-flammable perlite, complying with ASTM C 728.
 2. Install using hot asphalt (Type IV), roofing mastic, or mechanically fastened using fasteners and plates approved by roofing manufacturer.
- C. Lead Flashing: Soft lead sheet, minimum 3 pounds per square foot

PART 3 INSTALLATION

3.01 GENERAL

- A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.
- B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.
- C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.
- D. Perform work using competent and properly equipped personnel.
- E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.
- F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold

weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F.

- G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
 - 1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
 - 2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
 - 3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.
- H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.
- I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

- A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will no strain or rupture roof components or deform deck.
- B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.
- C. Examine roof substrate to verify that it is properly sloped to drains.
- D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.03 PREPARATION

- A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.
- B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.
- C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch wide with fill material acceptable insulation to membrane manufacturer.
- D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

- E. Wood Nailers: Provide wood nailers at all perimeters and other locations where indicated on the drawings, of total height matching the total thickness of insulation being used.

3.04 ASPHALT APPLICATION - GENERAL

- A. Application Directly to Concrete Deck: Do not install unless deck is sufficiently dry; test deck for dryness in accordance with roofing manufacturer's instructions.
- B. Apply by machine or hand mopping. Follow all industry and manufacturer requirements for heating, storage and handling of asphalt. Do not apply asphalt or ply sheets if asphalt temperature is above or below that recommended.
- C. During installation of the membrane, keep mop full with proper amounts of asphalt; do not scrub with the mop when applying the asphalt.
- D. Extend hot asphalt application not more than 5 to 10 feet beyond roll currently being installation and no more than 48 inches when the temperature is below 50 degrees F.
- E. Keep roof top traffic to a minimum on newly applied membrane and for a period after in order to minimize damage and bitumen displacement. Set rolls from the "cold" side of the roof.
- F. Roll the roofing membrane into the hot bitumen with positive pressure to assure firm and uniform attachment to the asphalt without creating any voids or wrinkles.

3.05 INSULATION AND COVER BOARD INSTALLATION

- A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.
- B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.
- C. Lay roof insulation in courses parallel to roof edges.
- D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch.
- E. Asphalt Attachment: Heat and apply asphalt in accordance with membrane manufacturer's instructions and recommendations; "walk-in" individual roof insulation boards to obtain maximum adhesive contact.

3.06 MODIFIED BITUMEN INSTALLATION WITH HOT ASPHALT

- A. In air temperature below 50 degrees F, unroll sheets and allow to relax; flatten with broom if necessary to eliminate voids and obtain proper embedment.
- B. Start at the low point with a full width sheet; embed sheets in full mopping of asphalt.

- C. Apply asphalt at rate recommended by roof membrane manufacturer; a minor flow of hot asphalt should be seen coming from the side laps.
- D. Granule Surfaced Sheets: Apply matching granules to areas of asphalt “bleed-out” while the asphalt is still hot.
- E. Complete the entire membrane installation without undue delay.

3.07 FLASHING AND ACCESSORIES INSTALLATION

- A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.
- B. Metal Accessories: Install metal edgings and gravel stops in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.
 - 1. Follow roofing manufacturer's instructions.
 - 2. Remove protective plastic surface film immediately before installation.
 - 3. Install water block sealant under the membrane anchorage leg.
 - 4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.
 - 5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.
 - 6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.
 - 7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.
- C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.
- D. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches high above membrane surface.
 - 1. Use the longest practical flashing pieces.
 - 2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.

3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
 4. Provide termination directly to the vertical substrate as shown on roof drawings.
- E. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
 2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches deep, with at least 1 inch clearance from penetration, sloped to shed water.
 3. Structural Steel Tubing: If corner radii are greater than 1/4 inch and longest side of tube does not exceed 12 inches, flash as for pipes; otherwise, provide a standard curb with flashing.
 4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.

3.08 WALKWAY INSTALLATION

- A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.

3.09 FIELD QUALITY CONTROL

- A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).
- B. Perform all corrections necessary for issuance of warranty.

3.10 CLEANING

- A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.
- B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.
- C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.11 PROTECTION

- A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION

SECTION 07900

JOINT SEALERS

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all materials, labor, equipment, and incidentals required to perform all caulking, sealants, joint fillers, and related work necessary for the proper completion of the project as required by the Drawings and as specified herein.

1.02 APPLICATION SCHEDULE

- A. Caulk all exterior wall joints, between adjacent materials, joints between frames or louvers and adjacent materials, copings, masonry control joints, and all other joints shown on the Drawings or required for the completion of the work. Joints noted as "caulk," "caulking," or "sealant" shall be caulked as specified herein.
- B. Caulk all interior joints between frames and masonry, at tops of masonry walls, between masonry and structural concrete, floor joints in tile, joints in rooms to be airtight, and all other joints shown on the Drawings or required for the completion of the work.
- C. Install compressible filler as shown on the drawings.

1.03 SUBMITTALS

- A. Submit to the Engineer for review in accordance with the provisions of Section 01300, shop drawings, working drawings, and product data including detailed product information and colors on materials proposed and material installation methods.
- B. Submit for review two sets of special-colored sealant samples in representative quantities. Resubmit until approved.
- C. Submit for review two sets of representative samples of any or all other proposed materials required for the work of this Section as requested by the Engineer.

1.04 REFERENCE SPECIFICATIONS

- A. American Society for Testing and Materials (ASTM):
 - 1. ASTM C920 - Specification for Elastomeric Joint Sealants
 - 2. ASTM D395 - Test Methods for Rubber Property - Compression Set
 - 3. ASTM D412 - Test Methods for Rubber Properties in Tension

4. ASTM D573 - Test Method for Rubber-Deterioration in an Air Oven
5. ASTM D695 - Test Method for Compressive Properties of Rigid Plastics
6. ASTM D790 - Test Methods for Flexural Properties of Unreinforced and Reinforced Plastics and Electrical Insulating Materials
7. ASTM D1002 - Test Method for Apparent Shear Strength of Single-Lap-Joint Adhesively Bonded Metal Specimens by Tension Loading (Metal to Metal)
8. ASTM D1149 - Test Method for Rubber Deterioration - Surface Ozone Cracking in a Chamber (Flat Specimens)
9. ASTM D1708 - Test Method for Tensile Properties of Plastics by Use of Microtensile Specimens
10. ASTM D2228 - Test Method for Rubber Property - Abrasion Resistance (Pico Abrader)
11. ASTM D2240 - Test Method for Rubber Property - Durometer Hardness

B. Federal Specifications

1. FS-HH-F-341 - Fillers, Expansion Joint; Bituminous (Asphalt and Tar) and Nonbituminous (Preformed For Concrete)

C. Sealants and Waterproofers Institute (SWI)

PART 2 PRODUCTS

2.01 MATERIALS

A. Caulking

1. Standards
 - a. SWI
 - b. ASTM C920
2. All colors for caulking above grade in the superstructure of the building shall be selected by the Engineer.
3. Exterior and interior sealant for joints on the horizontal plane shall be a two-part, pour grade polyurethane base, ASTM C920-87 Type M, Grade P, Class 25, THC-900 by Tremco; Sonolastic SL2 by Sonneborn; or equal. Primer shall be as recommended by the Manufacturer.

4. Exterior and interior sealant for joints on all other surfaces shall be a one-part, gun grade, polyurethane ASTM C920-87 Type S, Grade NS Class 25, Dymonic by Tremco; Sonolastic NP1 by Sonneborn; or equal. Primer shall be as recommended by the Manufacturer.
 5. Joint backing for joints in superstructure shall be approved closed cell polyethylene rods of diameters to suit joint conditions. Where joint depth will not allow for a rod and still provide 1/4-in. minimum depth of sealant, provide approved bond breaker tape at the bottom of the joint.
- B. Compressible filler shall be foamed polyurethane strip saturated with polybutylene waterproofing material. When compressed to 50 percent of its original volume, filler shall hold a head of 6 ft. of water, and a head of 10 ft. of water when compressed 60 percent. Filler shall maintain its resiliency to allow for installation in temperatures as low as 40EF. Filler shall remain waterproof at 50 percent compression between temperatures of -40EF and 200EF. Elongation shall be at least 325 percent with a tensile strength of not less than 53 psi.
1. The polybutylene compound shall not migrate in the polyurethane strip. Compressible filler shall be Polytite by Sandell Manufacturing Company; Combriband by Seco Corporation, Division of Phoenix Building Products, Incorporated; or equal.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Installation of Caulking
1. All joints to receive sealant shall be cleaned, primed, backfilled, and caulked in complete accordance with the Manufacturer's instructions.
 2. Sealant shall be applied generally to a square section configuration. Minimum depth of joint shall be 1/4-in. and maximum 1/2-in. For joints greater than 1/2-in. wide, provide sealant in a 2 to 1 width-to-depth ratio.
 3. The surfaces of all materials adjoining caulked joints shall be cleaned free of all smears of sealant or other soiling due to caulking operations.
- B. Installation of Compressible Filler
1. Install compressible filler according to the Manufacturer's written instructions for the situation where it is used.
- C. Indoor Air Quality:
1. Temporary ventilation: Provide temporary ventilation during work of this Section.
 - a. Coordinate interior application of joint sealants with interior finishes schedule.

END OF SECTION

SECTION 08110

STEEL DOORS AND FRAMES

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment and incidentals required and deliver the following as shown on the Drawings and as specified herein.
 - 1. Steel hollow-metal door panels.
 - 2. Pressed-metal door frames.
 - 3. All fasteners, frame closure pieces, system reinforcing and appurtenances required.
 - 4. Doors, frames and components shall be galvanized steel.

1.02 RELATED WORK

- A. Building in of frames in masonry is included in Section 04200 but as specified herein.
- B. Finish hardware is included in Section 08710.
- C. Field painting is included in Division 9.

1.03 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300, shop drawings of all metal doors, frames and appurtenances. Shop drawings shall show each door and frame type, schedule of doors and frames, door and frame elevations and details, conditions at openings with various wall thicknesses and materials, location and installation requirements for hardware, thickness of materials, joints, connections and trim, and frame anchorage meeting Code requirements.
 - 1. The Contractor shall provide to local authorities, if required, manufacturer's anchorage details meeting project design loads and specific Code requirements for this jurisdiction, for door frames submitted.
- B. Shop drawings shall show elevations and details of each frame type, schedule of doors and frames, frame elevations and details, conditions at openings with various wall thickness' and materials, location and installation requirements for hardware, thickness of materials, joints and connections and trim.
- C. Hardware templates shall be furnished to the door manufacturer by the Contractor for correct hardware alignment and reinforcing.

- D. Submit to the hardware supplier the requirements of any hardware for exterior doors that is necessary to be a component of the door system in order to conform to the Florida Building Code.
- E. Submit to the glazing supplier the requirements of any glazing for exterior doors that is necessary to be a component of the door system in order to conform to the Florida Building Code.
- F. Evidence of compliance with the requirements of Paragraph 1.05.A Quality Assurance shall be included with the initial submittal for the products.
- G. Evidence of compliance with the requirements of Paragraph 1.06 Regulatory Requirements shall be included with the initial submittal for the products.
- H. Provide samples and certification as follows:
 - 1. Frame corner with 6-in long legs showing construction with the galvanized material specified, welding, touch-up and priming.
 - 2. Door panel corner, 6-in square, showing door and insulating materials, construction and finishing as specified above.
 - 3. Provide certification as approved that all materials, construction requirements and fire ratings herein specified will be met in the project.
 - 4. If required by Engineer, provide independent laboratory testing, conforming to ASTM E376, of galvanized coating on samples of the door and frame submitted for approval to confirm thicknesses of zinc on base metal.
- I. Provide copy of current, valid statewide product approval for product, material or system as shown on the drawings and as specified in this section, in accordance with Rule 9N-3. Product approval shall be for the specific manufacturer, product type, model or style, and the State Approval Number. The successful Contractor, the Contractor shall be responsible to file the appropriate Product Approval information with the local authority having jurisdiction.

1.04 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM A153 - Specification for Zinc Coatings (Hot-Dip) on Iron and Steel Hardware.
 - 2. ASTM A525 - Standard Specification for General Requirements for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip Process.
 - 3. ASTM A526 - Specification for Steel Sheet, Zinc-Coated (Galvanized) by the Hot-dip Process, Commercial Quality.

4. ASTM E376 - Practice for Measuring Coating Thickness by Magnetic- Field or Eddy-Current (Electromagnetic) Test Methods.

B. American National Standards Institute (ANSI)

1. A115 - Specification for Preparation of Steel Doors and Frames for Hardware.

C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.05 QUALITY ASSURANCE

A. Provide custom hollow metal work manufactured by a single firm specializing in the production of this type of work. Hollow metal work shall conform to Hollow Metal Manufacturers Association (Division of National Association of Architectural Metal Manufacturers) standards for commercial hollow metal doors and frames except where more stringent requirements are specified herein.

1.06 REGULATORY REQUIREMENTS

A. The products, materials and assemblies, including anchorage, proposed for the work of this Section shall comply with project specific calculated design pressures and the Florida Building Code (Code), including wind-borne debris region requirements, and shall be designed by the Manufacturer and installed by the Contractor to meet these requirements. Refer to project design pressures in the components and cladding table on the structural drawings. Where a conflict occurs between the requirements of this Specification and the Code, the more stringent requirement shall apply.

B. It shall be the responsibility of the Contractor to provide evidence of code compliance for the products, materials and assemblies, including anchorage specified in this section. Evidence of code compliance shall be demonstrated by compliance with the Florida Building Code, using one of the methods outlined in Chapter 9N-3 of the Florida Administrative Code, Department of Community Affairs, Florida Building Commission, Product Approval.

1.07 DELIVERY, STORAGE AND HANDLING

A. Deliver materials in Manufacturer's original unopened and undamaged packages with labels legible and intact. Doors and panels shall be individually wrapped in corrugated cardboard with wood strips on vertical edges and banded with metal straps. Store materials in unopened packages in a manner to prevent damage from the environment and construction operations. Handle in accordance with Manufacturer's instructions.

PART 2 PRODUCTS

2.01 GENERAL

A. All exterior doors and components shall be designed by the Manufacturer and installed by the Contractor to withstand wind pressures, both positive and negative and salient corner

conditions as calculated in accordance with the Building Code to withstand the wind load required by the Building Code.

- B. At no additional cost to the Owner, provide additional, non-standard door bracing, reinforcements or heavier gauge materials required in order to conform to wind load and the requirements of 1.06 and 2.01.A herein.

2.02 MATERIALS

- A. Galvanized steel sheets - Zinc-coated carbon steel sheets of commercial quality, complying with ASTM A526, with ASTM A525, G60 zinc coating, mill phosphatized.
- B. Zinc-rich touch-up primer - 95 percent metallic zinc dust primer in a vehicle compatible with the specified painting system.
- C. Supports and anchors - Fabricate of not less than 16 gauge sheet metal. Galvanize after fabrication units complying with ASTM A153, Class B.
- D. Inserts, bolts and fasteners - Hot-dip galvanize, complying with ASTM A153, Class C or D as applicable.
- E. Rust inhibitive primer - Air drying or baking type as approved compatible with epoxy finish paints. Provide non-standard primer if required to obtain approval for compatibility.

2.03 FABRICATION, GENERAL

- A. Fabricate metal units to be rigid, neat in appearance, and free from defects, warp, or buckle. Accurately form metal to required sizes and profiles. Fit and assemble units in the Manufacturer's plant including units which are approved to be partially disassembled and field spliced. Weld exposed joints continuously; grind, dress and make smooth, flush and invisible. Metallic filler to conceal manufacturing defects is not acceptable. Clearly identify work that cannot, where approved, be permanently factory-assembled before shipment, to assure proper assembly at the project site.
- B. Exposed fasteners - Unless otherwise indicated, provide countersunk flat phillips heads for exposed screws and bolts.
- C. Prepare metal units to receive mortised and concealed finish hardware, including cutouts, reinforcing, drilling and tapping in accordance with final Finish Hardware Schedule and templates provided by hardware supplier. Comply with applicable requirements of ANSI A 115 series specifications for door and frame preparation for hardware.
- D. Reinforce metal units to receive surface-applied hardware. Drilling and tapping for surface-applied finish hardware may be done at project site.
- E. Shop Painting - Clean, treat and paint exposed galvanized surfaces of fabricated metal units.

1. Clean steel surfaces of mill scale, rust, oil, grease and other foreign materials and apply approved zinc-rich primer to galvanized surfaces damaged in fabrication.
2. Apply pretreatment to cleaned metal surfaces, using cold phosphate solution or hot phosphate solution.
3. Apply one full shop coat of rust inhibitive primer within time limits recommended by pretreatment manufacturer. Apply a smooth coat of even consistency to provide a uniform dry film thickness of not less than 2.0 mils.

2.04 DOORS

A. General

1. Provide flush design doors, 1 –3/4-in thick, seamless hollow construction, unless otherwise indicated.
2. For single-acting swing doors, bevel both vertical edges 1/8-in in 2-in.
3. Provide filler of mineral-wool or other approved insulating material solidly packed full door height to fill voids between inner core reinforcing members. No asbestos products will be allowed.

B. Galvanized Steel Doors

1. Fabricate doors of two outer, galvanized, stretcher-leveled steel sheets not less than 16 gauge. Construct doors with smooth, flush surfaces without visible joints or seams on exposed faces or stile edges. Provide weep hole openings in the bottom of doors to permit escape of entrapped moisture.
2. Reinforce inside of doors with vertical galvanized sheet steel sections not less than 22 gauge. Space vertical reinforcing 6-in o.c. and extend full door height. Spot-weld at not more than 5-in o.c. to both face sheets.
3. Reinforce tops and bottoms of doors with 16 gauge horizontal steel channels welded continuously to outer sheets. Close top and bottom edges to provide seal, as integral part of door construction while providing recesses for required hardware and appurtenances.

C. Finish hardware reinforcement – Reinforce doors using galvanized steel for required finish hardware, as follows:

1. Hinges – Steel plate 3/16-in thick by 1-1/2-in wide by 6-in longer than hinge, secured by not less than six spot-welds.
2. Mortise locksets and dead bolts – 14 gauge steel sheet, secured with not less than two spot-welds.
3. Cylinder locks – 12 gauge steel sheet, secured with not less than two spot-welds.

4. Flush bolts – 12 gauge steel sheet, secured with not less than two spot-welds.
5. Surface-applied closers – 12 gauge steel sheet, secured with not less than six spot-welds.
6. Push plates and pull handles – 16 gauge steel sheet, (except when through bolts are shown or specified), secured with not less than two spot-welds.
7. Other required comparable reinforcements as submitted and approved.

2.05 FRAMES

- A. Provide pressed metal frames for doors, side-lights, borrowed lights and for other openings where shown, of size and profile as indicated.
- B. Fabricate frames of full-welded unit construction, with corners mitered, reinforced, and continuously welded full depth and width of frame. No field spliced frames will be allowed.
- C. Form frames of 14 gauge galvanized steel sheets.
- D. Finish hardware reinforcement - Reinforce frames using galvanized steel for required finish hardware, as follows:
 1. Hinges - Steel plate 3/16-in thick by 1-1/2-in wide by 6-in longer than hinge, secured by not less than six spot-welds.
 2. Strike plate clips - Steel plate 3/16-in thick by 1-1/2-in wide by 3-in long.
 3. Surface-applied closers - 12 gauge steel sheet, secured with not less than six spot-welds.
 4. Other required comparable reinforcements as submitted and approved.
- E. Where installed in masonry, leave vertical mullions in frames open at top for grouting.
- F. Jamb anchors - Furnish jamb anchors as required to secure frames to adjacent construction, formed of not less than 18 gauge galvanized steel.
 1. Masonry construction - Adjustable, flat, corrugated, or perforated, t-shaped to suit frame size, with leg not less than 2-in wide by 10-in long. Provide U.L. approved fixed anchors at labeled openings. Furnish at least three anchors per jamb up to 7-ft-6-in height; four anchors up to 8-ft-0-in jamb height; one additional anchor for each 24-in or fraction thereof over 8-ft-0-in height.
- G. Floor anchors - Provide floor anchors for each jamb and mullion which extends to floor, formed of not less than 14 gauge galvanized steel sheet, as follows:
 1. Monolithic concrete slabs - Clip type anchors, with two holes to receive fasteners, welded to bottom of jambs and mullions.

- H. Head reinforcing - For frames over 4-ft-0-in wide in masonry wall openings, provide continuous steel channel or angle stiffener, not less than 12 gauge for full width of opening, welded to back of frame at head.
- I. Spreader bars - Provide removable spreader bar across bottom of frames, tack welded to jambs and mullions.

2.06 DOOR AND FRAME STOPS

- A. Provide stops in frames to receive glass and doors, where indicated and as shown.
- B. Form fixed stops integral with frame unless otherwise indicated.
- C. Provide removable stops where indicated or required, on secured room side of opening, formed of not less than 18 gauge steel sheets. Secure with oval head machine screws spaced uniformly not more than 12-in o.c. Form corners with butted hairline joints.
- D. Coordinate width of rabbet between fixed and removable stops with type of glass and type of installation indicated.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install hollow metal units and accessories in accordance with approved shop drawings, Manufacturer's data and as specified herein.
- B. The Contractor shall install the components of this Section to comply with the requirements of 1.06 of this Section.
- C. Setting masonry anchorage devices - Provide masonry anchorage devices where required for securing hollow metal frames to in-place concrete or existing masonry construction. Set anchorage devices opposite each anchor location, in accordance with details on shop drawings and anchorage device manufacturer's instructions. Leave drilled holes rough, not reamed and free from dust and debris.
- D. Placing Frames - Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces and spreaders leaving surfaces smooth and undamaged.
 - 1. In new masonry construction, coordinate frame setting with and prior to the building of masonry walls. Provide the required anchors for building in place.
 - 2. At in-place concrete or masonry construction, set frames and secure in place with machine screws and masonry anchorage devices.
 - 3. Remove spreader bars only after frames or bucks have been properly set and secured.

3.02 ADJUSTMENT AND TOUCH-UP

- A. Leave work in complete and proper operating condition. Remove and replace defective work, including doors or frames which are warped, bowed or otherwise unacceptable.
- B. Immediately after erection, sand smooth any rusted or damaged areas of prime coat and apply touch-up of compatible air-drying primer.

END OF SECTION

SECTION 08710

FINISH HARDWARE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish and deliver to the project site all finish hardware for hinged doors as hereinafter specified and scheduled. Provide padlocks as specified and in quantity scheduled.
- B. Hardware for exterior doors may be a component of a door system required to conform to the Florida Building Code (Code). Coordinate the hardware schedule for those doors with the appropriate supplier to ensure compliance with the Code.
- C. Furnish all templates and schedules required by the manufacturers of the metal doors and frames to enable the Manufacturer's to make proper provision in their work to receive the finish hardware. All locks, lock strikes and flush bolts shall be made to ANSI standard dimensions.
- D. Coordinate key cylinders with the County's master key system.

1.02 RELATED WORK

- A. Installation of hardware is included under Division 6.
- B. Doors are included in other Sections of Division 8.

1.03 SUBMITTALS

- A. Samples
 - 1. If required by the Engineer, a sample of each item of hardware proposed for use shall be submitted for approval.
- B. Hardware Schedules
 - 1. Submit to the Engineer a complete hardware schedule as provided in Section 01300 for shop drawings. Provide catalogue cuts for each item of hardware.
 - 2. No templates shall be distributed until the hardware schedule and any required samples have been approved by the Engineer.
 - 3. Provide approved physical hardware items to door manufacturers as required for fabrication onto doors.
- C. Evidence of compliance with the requirements of Paragraph 1.05, Regulatory Requirements, shall be included with the initial submittal for the products specified.

1.04 QUALITY ASSURANCE

- A. The hardware supplier shall have in his/her employ one or more members of the American Society of Architectural Hardware Consultants, who shall be responsible for the preparation and execution of the work of this Section.

1.05 REGULATORY REQUIREMENT

- A. Hardware for exterior doors may be a component of a door system required to conform to the Code. Coordinate the hardware schedule for those doors with the appropriate supplier to ensure compliance with the project specific calculated design pressures, including wind-borne debris region requirements, Refer to project design pressures in the components and cladding table on the structural drawings. Where a conflict occurs between the requirements of this Specification and the Code, the more stringent requirement shall apply.
- B. It shall be the responsibility of the contractor to provide evidence of code compliance for the products, materials and assemblies, including anchorage specified in this section. Evidence of code compliance shall be demonstrated by compliance with the Florida Building Code, using one of the methods outlined in Chapter 9N-3 of the Florida Administrative Code, Department of Community Affairs, Florida Building Commission, Product Approval.

1.06 DELIVERY, STORAGE AND HANDLING

- A. All hardware shall have the required screws, bolts and fastenings necessary for proper installation, wrapped in paper and packed in the same package as the hardware. Each package shall be legibly labeled, indicating that portion of the work for which it is intended.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All hardware shall be best grade, entirely free from imperfections in manufacture and finish. Qualities, weights and sizes specified herein are the minimum that will be accepted. All UL labeled doors shall have UL approved hardware, except that hinges which are not UL approved shall have a melting point of greater than 2000 degrees F.
- B. Hardware Items
 - 1. Hinges - Stainless steel, Stanley FBB191, three 4-1/2-in by 4-1/2-in. Equals - Hager, McKinney.
 - 2. Door Closers - Sargent 281 Series (cast iron bodies). Covers shall be primed compatible with finished paint specified except with plastic covers, no priming required. Provide with cushion stop arm where no separate stop is provided and with other arm functions as scheduled. Equals - LCN4000 Series.
 - 3. Kick Plates - Stainless Steel, 6-in high by 0.050-in thick by 2-in less width of door (LWOD), 1-in LWOD, at double doors.

4. Stops - Ives 436 or 438 as required by floor condition. Other stops as scheduled. Equals - Baldwin, Quality.
5. Flush Bolts – Glynn-Johnson FB6W forged brass, 1/2 inch diameter flattened bolt tip and standard 12 inch rod.
6. Sound/Weather Seals - Zero 153A sill protection x Zero 188N Surface type neoprene head and jambs.
7. Meeting stile - Zero 328 each leaf on inside. All clear aluminum except provide in bronze anodized finish at bronze anodized/bronze colored doors. Equals - Pemko, Reese.
8. Silencers - Glynn-Johnson GJ 64. Equals - Baldwin, Quality.
9. Thresholds - Zero 655 5-in thresholds in aluminum (unless otherwise noted). Zero 65A 5-in threshold in aluminum for latch track hardware applications. Equals - Pemko, Reese.
10. Exit Devices – Sargent - 9900 Series surface vertical rod exit device, function as indicated in Hardware Schedule. Trim design shall be ETP. Stainless steel assemblies, covers, internal parts, pins, springs and pivots. Provide full coverage, stainless steel back plates at full vision light doors. Equal - Von Duprin.
11. Secure Firefighter's Key Box
 - a. Knox Co., UL approved, Series 3200-R Knox-Box key box (entrance access box) with cylinder protection flap (hinged) for recessed mounting in masonry. Locate recessed as directed. Finish - factory finished, baked polyester powder coat on prime coat in color as selected. Provide with five 1/4-in minimum stainless steel bolts and expansion anchors as specified in Division 5 with anchors drilled and set in masonry into CMU backup and bolts securing key box as approved.
 - b. The manufacturer's authorization form shall be obtained by the Contractor and he/she shall coordinate obtaining the required authorization by fire agency and pay required processing fees. Keys for box will be issued only to the fire agency.
- C. Closers shall be sized as recommended by Manufacturer and as approved for size and location of door served.
- D. On exterior doors, provide hinges with pins not removable when door is closed. Provide 1/2 pair hinges for each 2-ft-6-in or part thereof of door height.
- E. Provide type of threshold required by the Door Schedule for particular doors and provide weather seals at exterior doors.
- F. Provide three silencers in lock side jamb of single doors and four silencers in head of double doors. No silencers are required at doors with sound/weather seals.

2.02 FINISHES

- A. Stainless steel finish shall be US32D.
- B. Chrome plated, bronze or brass finish shall be US26D.

2.03 KEYING

- A. All cylinder locks including padlocks shall be masterkeyed into the existing set at the site as approved. All cylinders shall be construction keyed for Contractor's use during construction period. Install permanent cylinders when directed.
- B. Furnish:
 - 1. Three masterkeys.
 - 2. Two change keys with each lock.
 - 3. Three construction day keys.

PART 2 EXECUTION

3.01 EXAMINATION

- A. Prior to installation of any hardware, examine all doors, frames, walls and related items for conditions that would prevent proper installation of finish hardware. Correct all defects prior to proceeding with installation.

3.02 INSTALLATION

- A. Coordination
 - 1. Prior to installation of hardware, schedule and hold a meeting for the purpose of instructing installers on proper installation and adjustment of finish hardware. Representatives of locks, exit devices, closers, automatic operators, and electrified hardware shall conduct training; provide at least 10 days notice to representatives. After training a letter of compliance, indicating when the training was held and who was in attendance, shall be sent to the Engineer.
 - 2. Prior to ordering electrified hardware, schedule and hold a meeting for the purpose of coordinating finish hardware with security, electrical, doors and frames, and other related suppliers. A representative of the supplier of finish hardware, and doors and frames, the electrical subcontractor, and the Owner's security contractor shall meet with the Owner, Engineer and the General Contractor prior to ordering finish hardware. After meeting a letter of compliance, indicating when the training was held and who was in attendance, shall be sent to the Engineer.

- B. Hardware will be installed by qualified tradesmen, skilled in the application of commercial grade hardware. For technical assistance if necessary, installers may contact the manufacturer's rep for the item in question, as listed in the hardware schedule.
- C. Mount hardware units at heights indicated in "Recommended Locations for Builders Hardware for Standard Steel Doors and Frames" by the Door and Hardware Institute.
- D. Install each hardware item in compliance with the manufacturer's instructions and recommendations, using only the fasteners provided by the manufacturer.
- E. Do not install surface mounted items until finishes have been completed on the substrate. Protect all installed hardware during painting.
- F. Set units level, plumb and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
- G. Operating parts shall move freely and smoothly without binding, sticking, or excessive clearance.

3.03 ADJUSTING, CLEANING, AND DEMONSTRATING

- A. Adjust and check each operating item of hardware and each door, to insure proper operation or function of every unit. Replace units which cannot be adjusted to operate freely and smoothly.
- B. Where door hardware is installed more than one month prior to acceptance or occupancy of a space or area, return to the installation during the week prior to acceptance or occupancy and make a final check and adjustment of all hardware items in such space or area. Clean operating items as necessary to restore proper function and finish of hardware and doors. Adjust door control devices to compensate for final operation of heating and ventilating equipment.
- C. Clean adjacent surfaces soiled by hardware installation.
- D. Instruct Owner's personnel in the proper adjustment, lubrication, and maintenance of door hardware and hardware finishes.

3.04 FIELD QUALITY CONTROL

- A. Prior to Substantial Completion, the installer, accompanied by representatives of the manufacturers of locks, exit devices, closer, and any electrified hardware, shall perform the following work:
 - B. Examine and re-adjust each item of door hardware as necessary to restore function of doors and hardware to comply with specified requirements.
 - C. Consult with and instruct Owner's personnel in recommended additions to the maintenance procedures.

- D. Replace hardware items that have deteriorated or failed due to faulty design, materials, or installation of hardware units.
- E. Prepare a written report of current and predictable problems of substantial nature in the performance of the hardware.
- F. At completion of project, a qualified factory representative for the manufacturers of locksets, closer, exit devices, and access control products shall arrange and hold a training session to instruct the Owner's personnel on the proper maintenance, adjustment, and/or operation of their respective products. After training a letter of compliance, indicating when the training was held and who was in attendance, shall be sent to the Engineer.

3.05 PROTECTION

- A. Provide for the proper protection of complete items of hardware until the Owner accepts the project as complete. Damaged or disfigured hardware shall be replaced or repaired by the responsible party.

3.06 SCHEDULE OF HARDWARE SETS

- A. Provide hardware for each door to comply with requirements of Section "Finish Hardware," hardware set numbers indicated in door schedule, and in the following schedule of hardware sets.
- B. The following general hardware sets represent hardware for one opening (single or pair of doors). Refer to Materials paragraphs above for additional items required under specified conditions. The quantities of each set are the responsibility of each bidder. Refer to Door Schedule for locations. The actual content of each set shall be determined by approved hardware sets.

HW 1

Hinges

1 Exit Device - 9913ET

1 Closer

1 Kickplate

Silencers

Bottom Seal

HW 2 – pair of doors

Hinges

1 Exit Device - 9913ET

1 Flush Bolts (inactive leaf)

2 Closers - Stop/Holder Arms

2 Kickplates

Silencers

Bottom Seal

3.07 INSTALLATION

- A. The Contractor shall install the components of this Section in accordance with the manufacturer's installation instructions, and in compliance with 1.05 of this Section.

END OF SECTION

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SECTION 08800

GLAZING

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. Furnish all labor, materials, equipment, and incidentals required and install all glass and glazing as shown and as specified herein.
- B. Exterior glazing may be a component of a door system required to conform to the Florida Building Code. Coordinate the glazing materials and installation for those applications with the appropriate supplier to ensure compliance with the Code.

1.02 RELATED WORK

- A. Steel Doors and Frames are included in Section 08110.

1.03 SUBMITTALS

- A. As provided in Section 01300, submit full size shop drawings showing step-by-step glass setting and sealing procedures. Evidence of compliance with the requirements of Paragraph 1.04, Regulatory Requirement, shall be included with the initial submittal for the products specified. Submit certification that wired glass is UL tested and approved.
- B. Submit to the Engineer two representative samples of each type glazing material specified below. Provide samples of glass in 12-in square minimum size. Resubmit any or all as required until approved.

1.04 REGULATORY REQUIREMENT

- A. Glazing for exterior systems may be a component of a door or window system required to conform to the Code. Coordinate the glazing requirements for those doors or windows with the appropriate supplier to ensure compliance with the project specific calculated design pressures, including wind-borne debris region requirements. Refer to project design pressures in the components and cladding table on the structural drawings. Where a conflict occurs between the requirements of this Specification and the Code, the more stringent requirement shall apply.
- A. It shall be the responsibility of the contractor to provide evidence of code compliance for the products, materials and assemblies, including anchorage specified in this section. Evidence of code compliance shall be demonstrated by compliance with the Florida Building Code, using one of the methods outlined in Chapter 9N-3 of the Florida Administrative Code, Department of Community Affairs, Florida Building Commission, Product Approval.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. All materials for the work of this Section shall be delivered, stored, and handled so as to preclude damage of any nature. All glazing shall be delivered and stored in its original container, plainly marked with identification of material and maker. Materials in broken containers or in packages showing watermarks or other evidence of damage shall not be used and shall be removed from the site.

PART 2 PRODUCTS

2.01 MATERIALS

- A. Each piece of glazing shall bear the Manufacturer's label showing the strength, grade, thickness, type and quality of the material and all labels shall remain in place until the glass has been set and inspected by the Engineer except that safety and insulating glass shall have permanently etched labels. When material is not cut to size by the Manufacturer and is furnished from local stock, the glass and glazing subcontractor shall submit an affidavit stating the strength, grade, thickness, type, quality, and Manufacturer of the material furnished.
- B. Impact Resistant Glazing (Laminated Glass)
1. All exterior glazed openings shall be impact resistant glass.
 2. Interior glazed openings so designated on the drawings shall be impact resistant glass as described herein, where the heat-strengthened layer would face the process bay.
 3. Glass and glazing shall be 9/16-in heat-strengthened laminated impact glass. Construction shall be exterior light ¼-in heat-strengthened, bronze-tinted 0.090 polyvinyl butrate interlayer as manufactured by Monsanto, interior light shall be clear, ¼-in heat-strengthened glass.
 4. Glazing materials for exterior glazed openings shall be Norton V2100 Series tape, Dow-Corning 795 silicone, and elastomeric glazing gaskets.
- C. Glazing compound (unless otherwise noted) shall be 999-A Glazing Silicone by Dow, equal by General Electric or equal.
- D. Glazing tape (unless otherwise noted) for use with the glazing compound shall be Tremco No. 440; Pecora Extru-Seal Butyl Rubber Tape or Dap Inc. Butyl Rubber Sealing Tape or equal. Tape shall be compatible with the glazing compound.
- E. Setting blocks, 85 plus or minus 5 durometer and spacer blocks, 50 durometer, shall be closed cell neoprene.

PART 3 EXECUTION

3.01 INSTALLATION

A. General

1. Glazing work for exterior components shall conform to the methods and materials utilized in testing the door, window and storefront systems for approval for Code Compliance.
2. All glazing work shall be performed in accordance with the standards of the Flat Glass Marketing Association's Glazing Manual, latest revision, unless otherwise noted or specified and shall also conform to the approved shop drawings and the Manufacturer's glazing instructions.
3. All frame elements shall have been painted where required and shall be thoroughly cleaned before glazing commences.

B. Exterior Glazing - Non-gasket system.

1. Set tape 1/8-in down from top of fixed bead.
2. Run a bead of approved gun-grade sealant from base of tape to bottom of glazing pocket leaving weep holes, where provided, free of sealant.
3. Place setting blocks, insert glass and press against tape and sealant until continuous perimeter contact is made.
4. Run a heel bead of approved sealant along exposed edge of glass.
5. Apply glazing bead.
6. Install spacer blocks between glazing bead and glass.
7. Run a continuous finish bead of sealant to fill voids above spacers on interior side and to fill void above tape on exterior side.

C. Exterior Glazing - Gasket System

1. Glaze per approved shop drawings using gaskets and appurtenances furnished with the system. Provide setting blocks as required.

3.02 PROTECTION AND CLEANING

- #### A.
- Clean and remove all labels from all glazing when directed and clean glazing compound from frames around glazing installed under this Section upon completion of the work. All defective or broken glazing and glazing broken because of faulty setting shall be replaced under this Section.

- B. All glazing shall be protected under this Section from accidental damage with tapes or streamers attached to the sash or frame. No tape or streamer shall contact the glazing.
- C. The Contractor shall install exterior components of this Section to comply with 1.04.A of this Section.

END OF SECTION

