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SECTION 01530 - EXISTING UTILITIES

PART 1 GENERAL

1.1 DESCRIPTION

- A. This Section provides for specifications related to construction in the vicinity of existing utilities.

1.2 RELATED SECTIONS

- A. Section 01010 – Summary of Work
- B. Section 01015 – General Requirements

1.3 CONTRACTOR RESPONSIBILITIES

- A. The term existing utilities shall be deemed to refer to both publicly-owned and privately-owned utilities including, but not limited to, electric power and lighting, telephone, water, gas, storm drains, process lines, sanitary sewers, and all appurtenant structures.
- B. Prior to underground construction, the Contractor is required by the Underground Facility Damage Prevention and Safety Act, Chapter 556 FS to contact Sunshine 811, for the location of underground utilities.
- C. Where existing utilities and structures are indicated in the Contract Documents, it shall be understood that all of the existing utilities and structures affecting the Work may not be shown and that the locations of those shown are approximate only. It shall be the responsibility of the Contractor to ascertain the actual extent and exact location of existing utilities and structures. In every instance, the Contractor shall notify the proper authority having jurisdiction and obtain all necessary directions and approvals before performing any Work in the vicinity of existing utilities.

1.4 NOTIFICATION OF UTILITY OWNER

- A. Prior to any excavation in the vicinity of any existing underground facilities, including all water, sewer, storm drain, gas, petroleum products, or other pipelines; all buried electric power, communications, or television cables; all traffic signal and street lighting facilities; and all roadway and state highway rights-of-way the Contractor shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than three days nor more than seven days prior to excavation so that a representative may be present during such excavation.
- B. Coordinate the Work with various utilities within Project limits. Notify applicable utilities prior to commencing Work.
- C. Contact the City of Fort Lauderdale Public Services Department at 954-828-8000 for water and sewer utility locations.
- D. Contact Sunshine State One Call at 1-800-432-4770 at least 2 business days prior to any excavation.
- E. If damage occurs, or if conflicts or emergencies arise during Work, contact the appropriate utility, including but not limited to:

- 1) Electricity Company: Florida Power and Light.
 - a. Contact Person: Trouble Center (or police/fire – 911).
 - b. Telephone: 954-797-5000.
- 2) Telephone Company: Bell South.
 - a. Contact Person: Jason Boschen.
 - b. Telephone: 954-316-4005 or 954-605-1121.
- 3) Water and Sewer Department: Fort Lauderdale Public Services Department.
 - a. Contact Person: Emergency Hotline.
 - b. Telephone: 954-828-8000.
- 4) Gas Company: TECO Peoples Gas.
 - a. Contact Person: Dispatch.
 - b. Telephone: 305-957-3857, ext. 7490 or 1-877-832-6747.
- 5) Telecom: AT&T – Broadband/Comcast.
 - a. Contact: Andy Vaspasiano.
 - b. Telephone: 954-266-6589 or 954-444-2833.
- 6) Telecom: FP&L FiberNet.
 - a. Contact: Noel R. Reese.
 - b. Telephone: 305-552-3249 or 305-205-1283.
- 7) Broward County Traffic Engineering Division (For Traffic Signal Communications Systems Underground Cable and Traffic Loops):
 - a. Contact: Keith Smith.
 - b. Telephone: 954-484-9600, ext. 227.

1.5 RIGHT-OF-WAY'S

- A. The Contractor shall not do any Work that would affect any oil, gas, sewer, or water pipeline; any telephone, telegraph, or electric transmission line; any fence; or any other structure, nor shall the Contractor enter upon the rights-of-way involved until notified by the Engineer that the Owner has secured authority therefore from the proper party. After authority has been obtained, the Contractor shall give said party due notice of its intention to begin Work, if required by said party, and shall remove, shore, support, or otherwise protect such pipeline, transmission line, ditch, fence, or structure or replace the same. When two or more contracts are being executed at one time on the same or adjacent land in such manner that Work on one contract may interfere with that on another, the Owner shall determine the sequence and order of the Work. When the territory of one contract is the necessary or convenient means of access for the execution of another contract, such privilege of access or any other reasonable privilege may be granted by the Owner to the Contractor so desiring, to the extent and amount, and in the manner and at the times permitted. No such decision as to the method or time of conducting the Work or the use of territory shall be made the basis of any claim for delay or damage.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 TEMPORARY CONNECTIONS

- A. The Work shall be carried out in a manner to prevent disruption of existing services and to avoid damage to the existing utilities. Temporary connections shall be provided, as required, to insure no interruption of existing services. Any damage resulting from the Work of this Contract shall be promptly repaired by the Contractor at his own expense in a manner approved by the Engineer and further subject to the requirements of any authority having jurisdiction. Where it is required by the authority having jurisdiction that they perform their own repairs or have them done by others, the Contractor shall be responsible for all costs thereof.

3.2 UTILITY SUPPORT

- A. Where excavations by the Contractor require any utility lines or appurtenant structures to be temporarily supported and otherwise protected during the construction Work, such support and protection shall be provided by the Contractor. All such Work shall be performed in a manner satisfactory to the respective authority having jurisdiction over such Work.

3.3 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 limits recommended by the pipe manufacturer and the required minimum 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, then the Engineer may direct the use of fittings for a utility crossing as detailed on the Drawings. All existing utilities shall be potholed located prior to construction of conflicting piping.

3.4 ADVANCE INVESTIGATIONS

- A. The Contractor shall be responsible for uncovering and exposing existing utilities sufficiently in advance of pipe laying operations to confirm elevation, size, material, and clearance separation(s). If, upon excavation, an existing utility is found to be in conflict with the proposed construction or be of a size or material different from what is shown on the plans, the Contractor shall immediately notify the Engineer, who will in turn prepare a recommendation. Failure of the Contractor to perform the advance investigation shall not relieve it of any claims for delay or damages.

3.5 UNFORESEEN UTILITIES

- A. The attention of the Contractor is drawn to the fact that during excavation, the possibility exists of encountering water, sewer, petroleum, gas, telephone, electrical, or other utilities not shown on the Drawings. The Contractor is responsible for obtaining utility locations from the utility owners or utility locating company. The Contractor shall exercise extreme care before and during digging to locate and flag these lines so as to avoid damage to the existing lines. Should damage occur to an existing line, the Contractor shall repair the line at the no cost to the Owner.

3.6 CONNECTIONS TO EXISTING SYSTEMS

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

3.7 MAINTENANCE OF EXISTING STORM WATER FACILITIES OPERATION

- A. The Contractor shall fully cooperate at all times with the Owner in order to maintain the operation of the existing facilities with the least amount of interference and interruption possible. Continuous service, public health, and safety considerations shall exceed all others and the Contractor's schedule, plans, and Work shall at all times be subject to alteration and revision, if necessary, for the above considerations.
- B. The Engineer and Owner reserve the right to require the Contractor to Work 24 hours per day in all cases where, in their opinion, interference with operation of the system may result.

- C. In no case will the Contractor be permitted to interfere with the existing system until all materials, supplies, equipment, tools, and incidentals necessary to complete the interfering portion of the Work are on the site, or a temporary by-pass system is effectively in place. All existing utilities shall be potholed prior to construction of conflicting piping.
- D. The Contractor shall provide emergency storm drainage pumping if the existing stormwater management system is taken out of service.

3.8 RESTORATION OF PAVEMENT

- A. General: All paved areas including concrete, asphaltic concrete, berms cut or damaged during construction shall be replaced with similar materials and of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents. All pavements which are subject to partial removal shall be neatly saw-cut in straight lines.
- B. Temporary Resurfacing: Wherever required by the public authorities having jurisdiction, the Contractor shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements.
- C. Permanent Resurfacing: In order to obtain a satisfactory junction with adjacent surfaces, the Contractor shall saw-cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.

END OF SECTION

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SECTION 01531 - PROTECTION OF EXISTING PROPERTY

PART 1 GENERAL

1.1 DESCRIPTION

- A. The Contractor shall be responsible for the preservation and protection of property adjacent to the Work site against damage or injury as a result of his operations under this project. Any damage or injury occurring on account of any act, omission or neglect on the part of the Contractor shall be restored in a proper and satisfactory manner or replaced by and at the expense of the Contractor to an equal or superior condition than previously existed.
- B. In the event of any claims for damage or alleged damage to property as a result of Work, the Contractor shall be responsible for all costs in connection with the settlement of or defense against such claims. Prior to commencement of Work in the vicinity of property adjacent to the Work site, the Contractor, at his own expense, shall take such surveys as may be necessary to establish the existing condition of the property. Before final payment can be made, the Contractor shall furnish satisfactory evidence that all claims for damage have been legally settled or sufficient funds to cover such claims have been placed in escrow, or that an adequate bond to cover such claims has been obtained.

1.2 RELATED SECTIONS

- A. Section 01015 – General Requirements
- B. Section 01570 – Traffic Regulation

1.3 PRESERVATION AND RESTORATION

- A. Contractor shall be responsible for the preservation and protection of property adjacent to the Work site against damage or injury as a result of his operations under this project. Any damage or injury occurring on account of any act, omission or neglect on the part of the Contractor shall be restored in a proper and satisfactory manner or replaced by and at the expense of the Contractor to an equal or superior condition than previously existed.

1.4 ADJACENT PROPERTY OWNER NOTIFICATION

- A. The Contractor shall prepare a written notice to property owners adjacent to the project Work site notifying them of the schedule of Work affecting them and anticipated inconveniences they may expect. The notice shall meet the approval of the Engineer and be delivered to property owners at least 72 hours prior to construction adjacent to their property. This notice shall indicate the Work to be performed, the time it will take to perform the Work, and the time when the water service to the property owner will be disrupted.

1.5 PROTECTION OF STREET OR ROADWAY MARKERS

- A. The Contractor shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization. No pavement breaking or excavation shall be started until all survey or other permanent marker points that will be disturbed by the construction operations have been properly referenced for easy and accurate restoration. It shall be the Contractor's responsibility to notify the proper representatives of the Owner of the time and location that Work will be done. Such notification shall be sufficiently in advance of construction so that there will be no delay due to waiting for survey points to be satisfactorily referenced for restoration. All survey markers or points disturbed by the Contractor without proper authorization by the Engineer will be accurately restored by the Owner at the Contractor's expense after all street or roadway resurfacing has been completed.

1.6 BARRICADES, WARNING SIGNS AND LIGHTS

- A. In addition to the requirements of Section 01570 – Traffic Regulation, the Contractor shall provide, erect, and maintain as necessary, strong and suitable barricades, danger signs, and warning lights for the preservation and protection of property adjacent to the Work site. All barricades and obstructions along public roads shall be illuminated at night and all lights for this purpose shall be kept burning from sunset to sunrise.

1.7 TREES AND LANDSCAPING PROTECTION

- A. General: The Contractor shall exercise all necessary precautions so as not to damage or destroy any trees or landscaping in or near the project site and shall not trim or remove any trees or landscaping unless such trees or landscaping have been approved for trimming or removal by the jurisdictional agency or owner. All existing trees or landscaping which are damaged during construction shall be replaced by the Contractor or a certified tree/landscaping company to the satisfaction of the owner.
- B. Replacement: The Contractor shall immediately notify the jurisdictional agency or owner if any tree or landscaping is damaged by the Contractor's operations. If, in the opinion of the jurisdictional agency or owner, the damage is such that replacement is necessary, the Contractor shall replace the tree or landscaping at its own expense. The tree or landscaping shall be of a like size and variety as the tree or landscaping damaged, or, if of a smaller size, the Contractor shall pay any compensatory payment.
- C. All permit fees associated with the removal and replacement of trees and landscaping damaged or destroyed shall be the responsibility of the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01540 - SECURITY**PART 1 GENERAL****1.1 DESCRIPTION**

- A. This Section provides for requirements of security, entry control, personnel identification, and miscellaneous restrictions.

1.2 RELATED SECTIONS

- A. Section 01010 - Summary of Work

1.3 SECURITY PROGRAM

- A. Protect Work, existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
- B. Initiate program in coordination with Owner's existing security system at job mobilization.
- C. CONTRACTOR shall provide a security guard at the site whenever the CONTRACTOR'S personnel are not present, 24 hours per day/ 7 days per week. Is shall be the Security Guard's responsibilities such as operating pumps or equipment but shall be dedicated to protecting the trench or open hole. The security guard shall be equipped with a wireless telephone capable of calling 911 to report an emergency and shall always keep that telephone on their person.
- D. Maintain program throughout construction period until Owner occupancy as directed by Engineer.

1.4 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into project site and existing facilities.
- B. Allow entrance only to authorized persons with proper identification.
- C. Maintain log of workers and visitors, make available to Owner on request.
- D. Coordinate access of Owner's personnel to site in coordination with Owner's security forces.

1.5 PERSONNEL IDENTIFICATION

- A. All personnel shall wear clothing bearing the company information of which they are employed.
- B. Provide additional security as required by the Owner.
- C. Become familiar with Owner and Engineer representatives and restrict access to job site to these representatives.

PART 2 PRODUCTS (NOT USED)**PART 3 EXECUTION (NOT USED)****END OF SECTION**

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SECTION 01550 - SITE ACCESS AND STORAGE

PART 1 GENERAL

1.1 GENERAL

- A. This section provides general specifications for the contractors' mobilization, demobilization, access to the site and limitations on storage or lay-down area.

1.2 RELATED SECTIONS

- A. Section 01015 – General Requirements
- B. Section 01505 – Control of Work

1.3 REFERENCES

- A. FDOT Standard Specifications for Road and Bridge Construction
- B. FDOT Design Standards
- C. Broward County Traffic Engineering Division (BCTED) Minimum Standards
- D. Standards and Specifications of the local municipality
- E. The requirements of the Owner

1.4 HIGHWAY LIMITATIONS

- A. The Contractor shall make their own investigation of the condition of available public and private roads and of clearances, restrictions, bridge load limits, and other limitations affecting transportation and ingress and egress to the site of the Work.

1.5 CONTRACTOR'S WORK AND STORAGE AREA

- A. Contractor's Work and storage area plan shall be submitted for Owners approval no later than 30 days after Notice to Proceed (NTP).
 - 1) Owner approval of the Work area and storage plan is required prior to commencement.
 - 2) The limits of the Contractor's staging area and other applicable restrictions shall be subject to the local municipality.
- B. The Contractor shall make their own arrangements and pay for any necessary off-site storage or shop areas necessary for the proper execution of the Work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 GENERAL

- A. The Contractor shall set up construction facilities in a neat and orderly manner within designated areas and shall confine operations to Work and storage areas.

3.2 RESTORATION

- A. All areas disturbed by the construction activities shall be restored to proper grade, cleaned up, including the removal of debris, trash, and deleterious materials.
- B. Temporary restoration shall include all driveways, sidewalks, and roadways. They shall be swept clean and be maintained free of dirt and dust.
- C. All construction materials, supplies, or equipment, including piles of debris shall be removed from the area.
- D. All temporarily restored areas shall be maintained by the Contractor. These areas shall be kept clean and neat, free of dust and dirt, until final restoration operations are completed.
- E. Temporary restoration shall be completed within five days of pipe installation or as specified.
- F. The Contractor is responsible to utilize dust abatement operations in the temporarily restored areas as required, to the satisfaction of the Engineer.
- G. Final restoration shall be completed within 30 days of pipe acceptance. Final restoration shall include the completion of all required pavement replacement of roadways, driveways, curbs, gutters, sidewalks and other existing improvements disturbed by the construction; final grading, placement of sod, pavement marking, etc., all complete and finished, acceptable to the Engineer.
- H. In order to obtain a satisfactory junction with adjacent surfaces, the Contractor shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with the adjacent undisturbed pavement.

3.3 DEMOBILIZATION

- A. At the completion of Work the Contractor shall remove its personnel, equipment, and temporary facilities from the site in a timely manner. The Contractor shall also be responsible for transporting all unused materials belonging to the Owner to a place of storage on site designated by the Owner and for removing from the site and disposing of all other materials and debris resulting from the construction. It shall then return all areas used for its activities to a condition as recorded in the pre-construction video or better.

END OF SECTION

SECTION 01570 - TRAFFIC REGULATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. The Work to be performed under this section shall include furnishing all materials and labor necessary to regulate vehicular and pedestrian traffic.
- B. Provide, operate, and maintain equipment, services, and personnel, with traffic control and protective devices, as required to expedite vehicular traffic flow around the construction area.
- C. Remove temporary equipment and facilities when no longer required, restore grounds to original, or to specified conditions.

1.2 RELATED SECTIONS

- A. Section 01015 – General Requirements

1.3 SECTION 01505 – CONTROL OF WORK

1.4 REFERENCES

- A. The Work under this Contract shall be in strict accordance with the following codes and standards.
 - 1) The applicable municipality
 - 2) Broward County Traffic Engineering Division
 - 3) Florida Department of Transportation Design Standards and Specifications
 - 4) OSHA Safety and Health Standards for Construction.
 - 5) Federal Highway Administration Manual of Uniform Traffic Control Devices for Streets and Highways (MUTCD)
 - 6) Federal Highway Administration Traffic Controls for Street and Highway Construction and Maintenance Operations

1.5 GENERAL

- A. Mobilization shall include the obtaining of all permits; moving onto the site of all equipment; temporary buildings, and other construction facilities; and implementing security requirements; all as required for the proper performance and completion of the WORK.

PART 2 PRODUCTS (NOT USED)**PART 3 EXECUTION****3.1 MAINTENANCE OF TRAFFIC (MOT)**

- A. For the maintenance and protection of vehicular and pedestrian traffic in public or private streets and ways, the Contractor shall provide, place, and maintain all necessary barricades, traffic cones, warning signs, lights and other safety devices in accordance with the requirements of the "Manual of Uniform Traffic Control Devices, Part VI - Traffic Controls for Street and Highway Construction and Maintenance Operations," published by U.S. Department of Transportation, Federal Highway Administration (ANSI D6.1).
- B. The Contractor shall provide a Maintenance of Traffic Plan, sealed by a Professional Engineer registered in the State of Florida holding a current FDOT MOT certificate. The plan, and subsequent revisions, must be approved by Broward County and/or the Florida Department of Transportation and the local municipality.
- C. The Contractor shall take all necessary precautions for the protection of the Work and the safety of the public. All barricades and obstructions shall be illuminated at night, and all lights shall be kept burning from sunset until sunrise. The Contractor shall station such guards or flaggers and shall conform to such special safety regulations relating to traffic control as may be required by the public authorities within their respective jurisdictions. All signs, signals, and barricades shall conform to the requirements of OSHA and Subpart G, Part 1926, of the OSHA Safety and Health Standards for Construction.
- D. The Contractor shall remove traffic control devices when no longer needed, shall repair all damage caused by installation of the devices, and shall remove post settings and backfill the resulting holes to match grade.
- E. MOT application for City of Fort Lauderdale:
 - 1) The approval of a MOT application may require up to two (2) weeks from the time all required documents are received by the City of Fort Lauderdale Transportation and Mobility staff.
 - 2) Any rejected MOT submittal that is corrected and sent back will be considered a new submittal, which may require up to two (2) additional weeks to approve.
- F. It is CONTRACTOR responsibility to verify the time frame of each related entities and plan the schedule accordingly. Time extensions will not be granted to the CONTRACTOR for insufficient MOT applications or MOT applications not submitted.

3.2 CORRECTIONS

- A. Upon notification by the owner either verbally or in writing, the Contractor shall correct any noted deficiencies within one hour.
- B. Inspection of all traffic control items shall be accomplished at least twice per day. One of these inspections shall be at the end of the workday or at night.

3.3 TRAFFIC AND VEHICULAR ACCESS:

- A. Emergency Vehicles: No single-family residence, multi-family residence, apartment, commercial building, or place of employment shall be without access to emergency vehicles for a period longer than three hours. The Contractor shall notify in writing the Engineer, the police, fire and other emergency departments and agencies when and where Work is to be accomplished that will affect their operations at least two days in advance of such Work.
- B. Commercial Properties: Access to commercial property shall not be blocked for a period of more than 30 minutes during the time such properties are open for business.
- C. Residential Property: Access to residential property shall not be blocked for a period of more than 4 hours.

3.4 ROAD CLOSURE

- A. No roads shall be blocked to traffic without adequate detour facilities for a period of more than 30 minutes or as directed by the governing authority.
- B. At least seven days prior to a proposed road closure, the contractor shall submit to the Owner a complete traffic control plan. This plan shall include the following minimum information:
 - 1) Sketch of Work site and all area roads, streets, and mark driveways.
 - 2) Proposed detour route.
 - 3) All necessary traffic control devices to be used.
 - 4) Emergency contractor contact person name and phone to be available 24 hours a day.
 - 5) Estimated times/dates of road closure.

3.5 CONSTRUCTION IN OTHER THAN STATE HIGHWAY RIGHT-OF-WAY:

- A. Construction within right-of-way other than State highway shall be made in full compliance with all requirements of the Florida Department of Transportation and to the satisfaction of the local governing bodies. All necessary barricades, detours, lights and other protective measures shall be provided for the protection of both pedestrian and vehicular traffic.
- B. The Contractor shall provide and maintain such other warning signs and barricades in areas of and around their respective Work as may be required for the safety of all those employed in the Work or those visiting the site.

3.6 FLAGMEN

- A. Provide qualified and suitably equipped flaggers when construction operations encroach on traffic lanes, as required for regulation of traffic.

3.7 FLARES AND LIGHTS

- A. Provide lights as required to clearly delineate traffic lanes and to guide traffic as required.
- B. Provide lights for use by flaggers in directing traffic.

- C. Provide illumination of critical traffic and parking areas as required.

3.8 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to preclude interference with public traffic or parking, access by emergency vehicles, Owner's operations, or construction operations.
- B. Monitor parking of construction personnel's private vehicles.
- C. Maintain free vehicular access to and through parking areas and driveways.
- D. Prohibit parking on or adjacent to access roads, or in non-designated areas.

END OF SECTION

SECTION 01590 - PROJECT SIGNS

PART 1 GENERAL

1.1 REQUIREMENTS INCLUDED

- A. Contractor shall furnish a 4' x 8' sign, below is a sample, not specific to the project.
- B. Sign shall be made to be weather resistant and on display for entire length of contract.
- C. Shop drawings must be submitted prior to sign construction.
- D. The exact style and design of the sign will be provided during the preconstruction meeting.



END OF SECTION

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SECTION 01600 - MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.1 DESCRIPTION

- A. Material and equipment incorporated into the Work.
 - 1) Conform to applicable specifications and standards.
 - 2) Comply with size, make, and type and qualify specified, or as specifically approved in writing by the Engineer.
 - 3) Manufactured and Fabricated Products.
 - a. Design, fabricate, and assemble in accord with the best Engineering and shop practices.
 - b. Manufacture like part of duplicate units to standard sizes and gauges, to be interchangeable.
 - c. Two or more items of the same kind shall be identical, by the same manufacturer.
 - d. Products shall be suitable for service conditions.
 - e. Equipment capacities, sizes, and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.
- B. Do not use material or equipment for any purpose other than that for which it is designed or is specified.

1.2 RELATED SECTIONS

- A. Section 01340 – Shop Drawings, Working Drawings, and Samples
- B. Section 01630 – Substitutions
- C. Section 01730 – Operating and Maintenance Data
- D. Section 01740 – Warranties and Bonds

1.3 APPROVAL OF MATERIALS

- A. Only new materials and equipment shall be incorporated in the Work. All materials and equipment furnished by the Contractor shall be subject to the inspection and approval of the Engineer. No material shall be delivered to the Work without prior approval of the Engineer.
- B. Within 30 days after the effective date of the Agreement, the Contractor shall submit to the Engineer, data relating to materials and equipment he proposes to furnish for the Work. Such data shall be in sufficient detail to enable the Engineer to identify the particular product and to form an opinion as to its conformity to the specifications.

- C. Facilities and labor for handling and inspection of all materials and equipment shall be furnished by the Contractor. If the Engineer requires, either prior to beginning or during progress of the Work, the Contractor shall submit samples of materials for such special tests as may be necessary to demonstrate that they conform to the specifications. Such samples shall be furnished, stored, packed, and shipped as directed at the Contractor's expense. Except as otherwise noted, the Owner will make arrangements for and pay for the tests.
- D. The Contractor shall submit data and samples sufficiently early to permit Work. Any delay of approval resulting from the Contractor's failure to submit samples or data promptly shall not be used as a basis of claim against the Owner or the Engineer.
- E. In order to demonstrate the proficiency of workers or to facilitate the choice among several textures, types, finishes, and surfaces, the Contractor shall provide such samples of workmanship or finish as may be required.
- F. The materials and equipment used on the Work shall correspond to the approved samples or other data.

1.4 MANUFACTURER'S INSTRUCTIONS FOR INSTALLATION

- A. When Contract Documents require that installation of Work shall comply with manufacturer's printed instruction, obtain, and distribute copies of such instructions to parties involved in the installation, including copies to the Engineer.
 - 1) Maintain one set of complete instructions at the job site during installation and until completion.
- B. Handle, install, connect, clean, condition, and adjust products in strict accord with such instructions and in conformity with specified requirements.
 - 1) Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer for further instructions.
 - 2) Do not proceed with Work without clear instructions.
- C. Perform Work in accord with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by Contract Documents.

1.5 TRANSPORTATION AND HANDLING

- A. Arrange deliveries of Products in accord with construction schedules; coordinate to avoid conflict with Work and conditions at the site.
 - 1) Deliver Products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.
 - 2) Immediately upon delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals, and that Products are properly protected and undamaged.
- B. Provide equipment and personnel to handle Products by methods to prevent soiling or damage to Products or packaging.

1.6 STORAGE AND PROTECTION

- A. The Contractor shall furnish a covered, weather-protected storage structure, providing a clean, dry, noncorrosive environment for all mechanical equipment, valves, electrical and instrumentation equipment, and special equipment to be incorporated into this project. Storage of equipment shall be performed to allow easy access and be in strict accordance with the "instructions for storage" of each equipment supplier and manufacturer including weather/humidity protection, connection of heaters, placing of storage lubricants in equipment, blocking, or skid storage, etc. Corroded, damaged, or deteriorated equipment and parts shall be replaced before acceptance of the project.
- B. Store Products in accord with manufacturer's instructions, with seals and labels intact and legible.
 - 1) Store products subject to damage by the elements in weather-tight enclosures.
 - 2) Maintain temperature and humidity within the ranges required by manufacturer's instructions.
 - 3) Store fabricated products above the ground, on blocking or skids, to prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings. Provide adequate ventilation to avoid condensation.
 - 4) Store loose granular materials in a well-drained area on solid surfaces to prevent mixing with foreign matter.
- C. All materials and equipment to be incorporated in the Work shall be handled and stored by the Contractor before, during, and after shipment in a manner to prevent warping, twisting, bending, breaking, chipping, rusting, and any injury, theft or damage of any kind whatsoever to the material or equipment.
- D. Cement, sand, and lime shall be stored under a roof, off the ground, and shall be kept completely dry at all times. All structural and miscellaneous steel and reinforcing steel shall be stored off the ground, or otherwise, to prevent accumulations of dirt or grease, and to minimize rusting. Brick, block, and similar masonry products shall be handled and stored in a manner to reduce breakage, chipping, cracking, and spalling to a minimum.
- E. Moving parts shall be rotated a minimum of once weekly to ensure proper lubrications, 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. All materials which, in the opinion of the Engineer, have become so damaged as to be unfit for the use intended or specified, shall be promptly removed from the site of the Work, and the Contractor shall receive no compensation for the damaged material or its removal.
- F. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored Products to assure that Products are maintained under specific conditions, and free from damage or deterioration.

- G. Contractor shall be responsible for protection after installation by providing substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations.
- H. The Contractor shall be responsible for all materials, equipment, and supplies sold and delivered to the Owner under this Contract, until final inspection of the Work and acceptance thereof by the Owner. In the event any such material, equipment, and supplies are lost, stolen, damaged, or destroyed prior to final inspection and acceptance, the Contractor shall replace same without additional cost to the Owner.
- I. Should the Contractor fail to take proper action on storage and handling of equipment supplied under this Contract within seven days after written notice to do so has been given, the Owner retains the right to correct all deficiencies noted in previously transmitted written notice and deduct the cost associated with these corrections from the Contractor's Contract. These costs may be comprised of expenditures for labor, equipment usage, administrative, clerical, Engineering, and any other costs associated with making the necessary corrections.

1.7 SPECIAL TOOLS

- A. Manufacturers of equipment and machinery shall furnish any special tools (including grease guns or other lubricating devices) required for normal adjustment, operations and maintenance, together with instructions for their use. The Contractor shall preserve and deliver to the Owner these tools and instructions in good order no later than upon completion of the Contract.

1.8 STORAGE AND HANDLING OF EQUIPMENT ON SITE

- A. Because of the long period allowed for construction, special attention shall be given to the storage and handling of equipment on site. As a minimum, the procedure outlined below shall be followed.
 - 1) Equipment shall not be shipped until approved by the Engineer. The intent of this requirement is to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer, unless upon arrival it is to be stored as specified in Paragraph 1.6. Operation and maintenance data, as described in Section 01730, shall be submitted to the Engineer for review prior to shipment of equipment.
 - 2) All equipment having moving parts, such as gears, electric motors, etc. and/or instruments, shall be stored in a temperature and humidity-controlled building approved by the Engineer, until such time as the equipment is to be installed.
 - 3) All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.
 - 4) Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed with the Engineer by them. These instructions shall be carefully followed and a written record of this kept by the Contractor.

- 5) 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.
- 6) Lubricants shall be changed upon completion of installation and as frequently as required thereafter during the period between installation and acceptance. Mechanical equipment to be used in the Work, if stored for longer than ninety (90) days, shall have the bearings cleaned, flushed, and lubricated prior to testing and start up, at no extra cost to the Owner.
- 7) 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 guarantee the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.9 WARRANTY

- A. For all major pieces of equipment, submit a warranty from the equipment manufacturer as specified in Section 01740.

1.10 SPARE PARTS

- A. Spare parts for certain equipment have been specified in the pertinent sections of the Specifications. The Contractor shall collect and store all spare parts so required in an area to be designated by the Engineer. In addition, the Contractor shall furnish to the Engineer an inventory listing all spare parts, the equipment they are associated with, the name and address of the supplier, and the delivered cost of each item. Copies of actual invoices for each item shall be furnished with the inventory to substantiate the delivered cost.

1.11 LUBRICANTS

- A. During testing and prior to acceptance, the Contractor shall furnish all lubricants necessary for the proper lubrication of all equipment furnished under this Contract.

1.12 GREASE, OIL AND FUEL

- A. All grease, oil, and fuel required for testing of equipment shall be furnished with the respective equipment. 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 the equipment supplied.
- B. The Contractor shall be responsible for changing the oil in all drives and intermediate drives of each mechanical equipment after initial break-in of the equipment, which in no event shall be any longer than three weeks of operation.

1.13 PROTECTION AGAINST ELECTROLYSIS

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

1.14 FASTENERS

- A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the Contractor. Bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.
- B. All bolts, anchor bolts, nuts, washers, plates, and bolt sleeves shall be Type 316 stainless steel unless otherwise specifically indicated or specified.
- C. Fasteners of dis-similar metals shall be provided with nylon spacer washers.
- D. Unless otherwise specified, stud, tap, and machine bolts shall be of the best quality refined bar iron. Hexagonal nuts of the same quality of metal as the bolts shall be used.

PART 2 PRODUCTS (NOT USED)**PART 3 EXECUTION****3.1 EQUIPMENT, TESTING, AND INSPECTION**

- A. Regardless of the number of days specified in the individual sections for the manufacturer's representative to be present on the site for inspection and testing, if the equipment fails to perform as specified, then the representative shall remain on site until the malfunction is corrected.
- B. The cost for the additional days shall not be added to the cost for the Owner but shall be to the account of the Contractor.

END OF SECTION

SECTION 01610 - MANUFACTURERS FIELD SERVICES**PART 1 GENERAL****1.1 DESCRIPTION**

- A. Provide field services by manufacturer-trained personnel for the duration as specified in the individual equipment sections.
- B. Person-Day: One person for 8 hours within regular Contractor working hours.

1.2 RELATED SECTIONS

- A. Section 01730 – Operating and Maintenance Data
- B. Section 01740 – Warranties and Bonds

1.3 SUBMITTALS

- A. Training Schedule:
 - 1) Where specified, submit a training schedule not less than 21 days prior to start of equipment installation and revise as necessary for acceptance.
 - 2) Training Materials:
 - a. Submit written outlines of proposed training sessions not less than 21 days prior to scheduled training.
 - b. Provide complete training materials, to include operation and maintenance data as required in this section to be retained by each trainee.
- B. Quality Control Submittals:
 - 1) Manufacturer's Certificate of Proper Installation:
 - a. When specified in the individual specifications, submit certificate certifying:
 - (i) The product or system has been installed in accordance with the manufacturer's recommendations, inspected by manufacturer's authorized representative, and serviced with the proper lubricants.
 - (ii) Necessary safety equipment has been properly installed.
 - (iii) Electrical and mechanical connections have been made meeting quality and safety standards as required.
 - (iv) Free from undue stress imposed by exterior connections or loads.
 - (v) Proper adjustments have been made and the product or system is ready for testing, facilities startup and operation.
 - b. Submit on form appended to this section.
 - 2) Certificate of Successful Testing and Startup: Prepare and submit where specified in individual Specification sections, and upon completion of

successful testing and startup of respective equipment system, subsystem, or component.

- 3) Certificate of qualification of manufacturer's representative.

1.4 QUALIFICATIONS OF MANUFACTURER'S REPRESENTATIVE

- A. Authorized representative of the manufacturer, factory trained and experienced in technical applications, installation, operation and maintenance of respective equipment, subsystem, or system. Representative subject to acceptance by Owner and Engineer. No substitute representatives will be allowed unless prior written approval by the Engineer has been given.

1.5 FULFILLMENT OF SPECIFIED MINIMUM SERVICES

- A. Where manufacturers' services are specified, furnish manufacturer's representative qualified to provide these services. Where time is necessary in excess of that stated in the Specifications for manufacturers' services, additional time required to perform the specified services shall be considered incidental Work.
- B. Schedule manufacturer's field services to avoid conflicting with other field testing or other manufacturer's field services.
 - 1) Determine that all conditions necessary to allow successful testing have been met before scheduling field services.
- C. Only those days of service approved by the Engineer will be credited to fulfill the specified minimum services.
- D. If specified, manufacturer's services shall include as a minimum:
 - 1) Inspection, checking, and adjustment as required for equipment to function as warranted by manufacturer and necessary to provide written approval of installation.
 - 2) Revisiting the site as required to correct problems and until installation and operation are acceptable to the Engineer.
 - 3) Resolution of assembly or installation problems attributable to or associated with, respective manufacturer's products and systems.
 - 4) Assistance during functional and performance testing and startup demonstration, and until product acceptance by the Owner.
 - 5) Training of the Owner's personnel in the operation and maintenance of respective product as required herein.
 - 6) Completion of Manufacturer's Certificate of Proper Installation with applicable certificates for proper installation and initial, interim, and final test or service.

1.6 TRAINING SCHEDULE

- A. List specified equipment and systems with respective manufacturers that require training services of manufacturers' representatives and show:
 - 1) Estimated dates for installation completion.
 - 2) Estimated training dates to allow for multiple sessions when several shifts

are involved.

- B. Adjust training schedule to ensure training of appropriate personnel as deemed necessary by the Owner, and to allow full participation by manufacturers' representatives. Adjust schedule for interruptions in operability of equipment.

1.7 TRAINING OWNER'S PERSONNEL

- A. Provide trained, articulate personnel to coordinate and expedite training, to be present during training coordination meetings with the Owner, and familiar with operation and maintenance manual information specified in Section 01730 - Operation and Maintenance Data.
- B. Furnish manufacturers' representatives to provide detailed training to the Owner's personnel on operation and maintenance of specified product (system, subsystem, and component) and as may be required in applicable Specifications.
 - 1) Training services include pre-startup classroom instruction, post-startup classroom instruction, and onsite hands-on instruction.
 - 2) Manufacturer's Representative: Familiar with facility operation and maintenance requirements as well as with specified equipment.
- C. Pre-startup Training:
 - 1) Coordinate training sessions with the Owner's operating personnel and manufacturers' representatives, and with submission of operation and maintenance manuals in accordance with Section 01730 – Operating and Maintenance Data.
 - 2) Complete at least 14 days prior to actual startup.
- D. Post-Startup Training: If required in Specifications, furnish and coordinate training of the Owner's operating personnel by respective manufacturer's representatives.
- E. Taping of Training Sessions: Provide audio and color video taping of pre-startup and post-startup instruction sessions, including manufacturers' representatives' hands-on equipment instruction.
 - 1) Suitable for playback on standard equipment available commercially in the United States.
 - 2) Video Training Tapes: Produced by a qualified, professional video production company.
 - 3) Furnish the Owner with two complete sets of tapes fully indexed and cataloged with printed labels stating sessions and dates taped.

PART 2 PRODUCTS (NOT USED)**PART 3 EXECUTION****3.1 EQUIPMENT, TESTING & INSPECTION**

- A. Regardless of the number of days specified in the individual sections for the manufacturer's representative to be present on the site for inspection and testing, if the equipment fails to perform as specified, then the representative shall remain on site until the malfunction is corrected.
- B. The cost for the additional days shall not be added to the cost for the Owner but shall be to the account of the Contractor.

END OF SECTION

SECTION 01630 - SUBSTITUTIONS

PART 1 GENERAL

1.1 DESCRIPTION

- A. Furnish and install products specified and named in their respective Specifications or on the Drawings unless substitution is allowed.
- B. For products specified only by reference standard, select product meeting that standard, by any manufacturer.
- C. For products specified by naming several products or manufacturers, select any one of those products and manufacturers names which complies with their respective Specifications.
- D. For products specified by naming only one or more products or manufacturers and stating, "or equal", submit a request as for substitutions, for any product or manufacturer which is not specifically named.
- E. Requests for any substitutions not submitted in accordance with the instructions herein will be denied.

1.2 RELATED SECTIONS

- A. Section 01340 – Shop Drawings, Working Drawings, and Samples

1.3 PRODUCTS LIST

- A. Within 30 days after award of Contract, submit to Engineer five copies of complete list of major Products which are proposed for installation.
- B. Product selection is governed by the Contract Documents and governing regulations, not by previous project experience.
 - 1) Where a single or multiple products or manufacturers are named, provide one of the products indicated or submit a request for substitution for any product or manufacturer not named unless no substitutions are permitted
 - 2) Where the Specifications only require compliance with performance requirements, an imposed code, standard or regulation, select a product that complies with the requirements, standards, codes or regulations specified.
 - 3) Manufacturers named in a Specification section are those manufacturers considered capable of manufacturing products conforming to the specified requirements. The naming of a particular manufacturer does not imply acceptance or approval of just any standard product of that manufacturer.
- C. Tabulate Products by specification section number and title.
- D. For products specified only by reference standards, list for each such Product:
 - 1) Name and address of manufacturer.
 - 2) Trade Name.
 - 3) Model or catalog designation.

- 4) Manufacturer's data:
 - a. Reference standards.
 - b. Performance test data.

1.4 SUBSTITUTION SUBMITTAL REQUIREMENTS

- A. For convenience in designation in the Contract Documents, materials to be incorporated in the Work may be designated under a trade name or the name of a manufacturer and its catalog information. The use of alternative material which is equal in quality and of the required characteristics for the purpose intended will be permitted, subject to the following requirements:
 - 1) The burden of proof as to the quality and suitability of such alternative equipment, products, or other materials shall be upon the Contractor.
 - 2) The Engineer will be the sole judge as to the comparative quality and suitability of such alternative equipment, products, or other materials and its decisions shall be final.
 - 3) Base Bid requirements outlined in the Bid Form.
- B. The Contractor may offer any material, process, or equipment which it considers equivalent to that indicated. Unless otherwise authorized in writing by the Engineer, the substantiation of offers of equivalency must be submitted within 30 days after award of Contract. The Contractor, at its sole expense, shall furnish data concerning items it has offered as equivalent to those specified. The Contractor shall have the material as required by the Engineer to determine that the quality, strength, physical, chemical, or other characteristics, including durability, finish, efficiency, dimensions, service, and suitability are such that the items will fulfill its intended function. Installation and use of a substitute item shall not be made until accepted by the Engineer. If a substitute offered by the Contractor is found to be not equal to the specified material, the Contractor shall furnish and install the specified material.
- C. The Contractor's attention is further directed to the requirement that failure to submit data substantiating a request for the substitution of an "or equal" item within 30 days after award of Contract, shall be deemed to mean that the Contractor intends to furnish one of the specific brand-named products named in the specification, and the Contractor does hereby waive all rights to offer or use substitute products in each such case. Wherever a proposed substitute product has not been submitted within 30 days after award of Contract, or wherever the submission of a proposed substitute product fails to meet the requirements of the specifications and an acceptable resubmittal is not received by the Engineer within 30 days after award of Contract, the Contractor shall furnish only one of the products originally-named in the Contract Documents.
- D. Within 30 days after award of Contract, Engineer will consider formal requests from the Contractor for substitution of specified products. Substitution requests shall not be accepted during bidding nor prior to Contract award.
- E. After the end of that period, the request will be considered only in case of product unavailability or other conditions beyond the control of the Contractor.
- F. Submit a separate request for each substitution. Support each request with:

- 1) Complete data substantiating compliance of the proposed substitution with requirements stated in the Contract Documents:
 - a. Product identification, including manufacturer's name and address.
 - b. Manufacturer's literature; identify:
 - (i) Product description.
 - (ii) Reference standards.
 - (iii) Performance and test data.
 - 2) Samples, as applicable.
 - 3) Name and address of similar projects on which product has been used, and the date of each installation.
 - 4) Itemized comparison of the proposed substitution with product specified; List significant variations.
 - 5) Comparison of the qualities of the proposed substitution with that specified.
 - 6) Changes required in other elements of the Work because of the substitution.
 - 7) Availability of maintenance service, and source of replacement materials.
 - 8) Data relating to changes in the construction schedule.
 - 9) Any effect of the substitution on separate contracts.
 - 10) List of changes required in other Work or products.
 - 11) Accurate cost data comparing proposed substitution with product specified.
 - 12) Designation of required license fees or royalties.
 - 13) Designation of availability of maintenance services, and sources of replacement materials.
 - 14) Cost data is complete and includes related costs under this Contract, but not:
 - a. Cost data comparing the proposed substitution with the product specified.
 - b. Any required license fees or royalties.
 - c. Engineer's costs of redesign or revision of Contract Documents.
 - 15) Substitute products shall not be ordered or installed without written acceptance of Engineer.
- G. Do not imply or indicate substitutions on shop drawings or product data submittals without a separate formal request.
- H. Only one request for substitution for each product will be considering. If not accepted, Contractor shall provide specified product.

- I. Substitutions or alternates that require re-design or analysis by the Engineer will not be evaluated without the written approval from the Owner that the Engineer will be paid by the Owner for the evaluation.
- J. Equipment, materials, products, and/or layouts submitted as a variance to the Contract Documents shall include the reason for proposed change, post-bid credit offering, and documentation that it meets the required specifications. Failure to include any of these items may result in rejection.
- K. Circumstances necessitating a revision to the permitted documents may not be accepted and will not be reviewed unless accompanied by an approval by the Owner that the Engineer shall be paid for the necessary evaluation and changes to the documents.

1.5 SUBSTITUTIONS WILL NOT BE CONSIDERED FOR ACCEPTANCE WHEN:

- A. They are indicated or implied on Shop Drawings or product data submittals without a formal request from Contractor.
- B. The manufacture of the product substitution does not meet the Qualifications as stated in the specifications as determined by the Engineer.
- C. They are requested directly by a subcontractor or supplier.
- D. No data is provided relating to changes in construction schedule.
- E. There is any effect of substitution on separate contracts.
- F. Changes are required in other Work or products.
- G. There is no accurate cost data comparing proposed substitution with product specified.
- H. There are required license fees or royalties above and beyond the specified vendor.
- I. Availability of maintenance services, sources of replacement materials does not equal that provided by the specified vendor.
- J. Acceptance will require substantial revisions to the Contract Documents.

1.6 CONTRACTOR'S REPRESENTATION

- A. A request for a substitution constitutes a representative that Contractor:
 - 1) Has investigated proposed product and has determined that it is equal to or superior in all respects to that specified.
 - 2) Will provide the same warranties or bonds for substitution as for product specified.
 - 3) Will coordinate installation of accepted substitution into the Work and will make such changes as may be required for the Work to be complete in all respects.
 - 4) Waives claims for additional costs caused by substitution which may subsequently become apparent.

1.7 ENGINEER'S DUTIES

- 1) Review Contractor's requests for substitutions in accordance the Shop

Drawing review requirements.

- 2) Notify Contractor, in writing, of decision to accept or reject requested substitution.
- 3) The Engineer shall be the judge of the acceptability of the proposed substitution.

1.8 SUBSTITUTION SUBMITTAL REQUIREMENTS – “NO SUBSTITUTIONS PERMITTED”

- A. Contractor may not request a substitute item or vendor/manufacturer for which the specifications indicate “No Substitutions Permitted”.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

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SECTION 01700 - CONTRACT CLOSEOUT

PART 1 GENERAL

1.1 SUBSTANTIAL COMPLETION

- A. Before requesting inspection for certification of Substantial Completion, complete the following. List exceptions in the request.
 - 1) If 100 percent completion cannot be shown, include a list of incomplete items, the value of incomplete construction, and reasons the Work is not complete.
 - 2) Advise Owner of pending insurance change-over requirements.
 - 3) Submit specific warranties, workmanship bonds, maintenance agreements, final certifications, and similar documents.
 - 4) Obtain and submit releases enabling the Owner unrestricted use of the Work and access to services and utilities; include occupancy permits, operating certificates, and similar releases.
 - 5) Submit record drawings, maintenance manuals, and similar final record information.
 - 6) Complete start-up testing of systems, and instruction of the Owner's operating and maintenance personnel. Discontinue or change over and remove temporary facilities from the site, along with construction tools, mock-ups, and similar elements.
- B. When the Contractor considers the Work to be substantially complete, they shall submit a written notice to the Engineer that the Work, or designated portion of the Work, is complete and ready for inspection.
- C. Within a reasonable time of receipt of a request for inspection, the Engineer will either proceed with inspection or advise the Contractor of unfulfilled requirements. When the Engineer and Owner concur that the Work, or designated portion of the Work, is substantially complete, the Engineer will prepare the Certificate of Substantial Completion following inspection.
- D. Should the Engineer determine that the Work is not substantially complete, they will advise the Contractor of construction that must be completed or corrected before the certificate will be issued.
 - 1) The Engineer will repeat inspection when requested and assured that the Work has been substantially completed.
 - 2) Results of the completed inspection will form the basis of requirements for final acceptance.

1.2 FINAL COMPLETION

- A. When Contractor considers the Work to be complete, they shall submit written certification to the Engineer that the Work is completed and ready for final inspection. Include the following:
 - 1) Submit the final payment request with releases and supporting

documentation not previously submitted and accepted. Include certificates of insurance for products and completed operations where required.

- 2) Submit an updated final statement, accounting for final additional changes to the Contract Sum.
 - 3) Submit a certified copy of the Engineer's final inspection list of items to be completed or corrected, stating that each item has been completed or otherwise resolved for acceptance, the list has been endorsed and dated by the Engineer.
 - 4) Submit final meter readings for utilities, a measured record of stored fuel, and similar data as of the date of Substantial Completion, or when the Owner took possession of and responsibility for corresponding elements of the Work.
 - 5) Submit consent of surety to final payment.
 - 6) Submit evidence of final, continuing insurance coverage complying with insurance requirements.
- B. The Engineer will inspect the Work upon receipt of notice that the Work, including inspection list items from earlier inspections, has been completed, except items whose completion has been delayed because of circumstances acceptable to the Engineer.
- 1) Upon completion of inspection, the Engineer will prepare a certificate of final acceptance or advise the Contractor of Work that is incomplete or of obligations that have not been fulfilled but are required for final acceptance.
 - 2) If necessary, re-inspection process will be repeated.
- C. Refer to Section 01720 - Project Record Documents.

1.3 SUBMITTALS

- A. Informational Submittals:
- 1) Submit prior to application for final payment.
 - a. Record Documents.
 - b. As-built drawings (signed and sealed hardcopies and electronic format – PDF and CAD files)
 - c. Special Bonds, Special Guarantees, and Service Agreements.
 - d. Consent of Surety to Final Payment.
 - e. Releases or Waivers of Liens and Claims.
 - f. Releases from Agreements.
 - g. Final Application for Payment: Submit in accordance with procedures and requirements stated in Section 01025, Measurement and Payment.
 - h. Spare Parts, Special Tools and Extra Materials: As required by

individual Specification sections.

B. Subcontractor Identification Form:

- 1) Submit form with final pay request.
- 2) Submit a separate form for each subcontractor used.
- 3) For Capital Improvement Projects, submit form along with final pay request to the PCM.
- 4) Form is attached as a Supplement to this Section.

1.4 RECORD DOCUMENTS

A. Quality Assurance:

- 1) Furnish qualified and experienced person, whose duty and responsibility shall be to maintain record documents.
- 2) Accuracy of Records:
 - a. Coordinate changes within record documents, making legible and accurate entries on each sheet of Drawings and other documents where such entry is required to show change.
 - b. Purpose of Project record documents is to document factual information regarding aspects of the Work, both concealed and visible, to enable future modification of the Work to proceed without lengthy and expensive site measurement, investigation, and examination.
- 3) Make entries within 24 hours after receipt of information that a change in the Work has occurred.
- 4) Prior to submitting each request for progress payment, request PCM's review and approval of current status of record documents. Failure to properly maintain, update, and submit record documents may result in a deferral by PCM to recommend whole or any part of Contractor's Application for Payment, either partial or final.

1.5 RELEASES FROM AGREEMENTS

A. Furnish Owner written releases from property owners or public agencies where side agreements or special easements have been made, or where Contractor's operations have not been kept within the Owner's construction right-of-way.

B. In the Event Contractor is Unable to Secure Written Releases:

- 1) Inform PCM of the reasons.
- 2) Owner or its representatives will examine the site, and Owner will direct Contractor to complete the Work that may be necessary to satisfy terms of the side agreement or special easement.
- 3) Should Contractor refuse to perform this Work, Owner reserves right to have it done by separate contract and deduct cost of same from Contract Price or require Contractor to furnish a satisfactory Bond in a sum to cover legal claims for damages.

- 4) When Owner is satisfied that the Work has been completed in agreement with Contract Documents and terms of side agreement or special easement, right is reserved to waive requirement for written release if:
 - a. Contractor's failure to obtain such statement is due to grantor's refusal to sign, and this refusal is not based upon any legitimate claims that Contractor has failed to fulfill terms of side agreement or special easement, or
 - b. Contractor is unable to contact or has had undue hardship in contacting grantor.

1.6 AS-BUILT DRAWINGS

A. Quality Assurance

- 1) As-built drawings must meet all minimum City of Fort Lauderdale CAD standards and be submitted in the latest version of AutoCAD available at the time the contract is signed.
- 2) As-built drawings will be submitted in both electronic and hard copy forms as follow:
 - a. 3 hard copy sets of as-builts will be submitted on 24x36 paper signed, sealed, and dated by a Florida Professional Licensed Surveyor (PLS).
 - b. 1 CD or jump drive which will include both DWG files for the package and a PDF document including the surveyors signature and seal.
- 3) As-built drawings will include the following:
 - a. PLS name, business name, license numbers, address, and telephone number
 - b. The following statement must be included:
 - (i) "I hereby certify that the as-built location information of the potable water, reclaimed water, wastewater and drainage facilities shown on these drawings conforms to the minimum technical standards for land surveying in the State of Florida, Chapter 5J-17.050(10)(i) (Florida Administrative Code), as adopted by the Department of Agriculture and Consumer Services, Board of Professional Surveyors and Mappers, and that said as-builts are true and correct to the best of our knowledge and belief."
 - c. As-built drawings will contain the information on the design drawings (plan and profile views) plus document changes between the design and construction including correcting all information that is incorrect due to changes during construction. Incorrect or no longer relevant information will be erased or struck through. All location changes constructed materially different (one-tenth foot horizontal, one tenth vertical) than the design location

will have their design location struck through and will be redrafted at the constructed location. Design drawing dimensioning will be corrected as necessary.

- d. Drawing will be a complete set including cover sheet, index, and any other sheets included in the approved design set. Standard detail sheets are not necessary.

B. Minimum As-Built Drawing Requirements

- 1) Show the location of easements used by the water and wastewater facilities.
- 2) Indicate pipe joint locations where water and wastewater or reclaimed water piping crosses.
- 3) Indicated the length of gravity wastewater piping and actual slope between manhole centers.
- 4) Show all abandoned in place facilities including the extent and method of abandonment.
- 5) Show elevations to the nearest tenth of a foot for top of pipe for water mains, force mains, and reclaimed water mains at vertical deflection points, all bends, valves and fittings and every 200 feet along straight runs and where they cross all other facilities.
- 6) Show elevations to the nearest one hundredth of a foot for manhole rims, gravity main inverts at the manhole, force main connections to manholes, lift station top of slab, bottom of wet well, influent pipe invert and control set points.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 MAINTENANCE OF RECORD DOCUMENTS

A. General:

- 1) Promptly following commencement of Contract Times, secure from Engineer, at no cost to Contractor, one complete set of Contract Documents. Drawings will be full size.
- 2) Delete Engineer title block and seal from all documents.
- 3) Label or stamp each record document with title, "RECORD DOCUMENTS," in neat large printed letters.
- 4) Record information concurrently with construction progress and within 24 hours after receipt of information that change has occurred. Do not cover or conceal Work until required information is recorded. Contractor is responsible for maintaining up-to-date "red-lined" markups, on site, of all changes including revised locations of buried features and provides access to the City for review at any time.
- 5) All piping inserts, fittings, and valve locations shall be located by a Florida

Licensed Surveyor in accordance with City of Fort Lauderdale surveying standards and per NAVD 88. Contractor shall provide adequate notice to the surveyor to ensure that all locations are accessible, prior to backfill.

B. Preservation:

- 1) Maintain documents in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.
- 2) Make documents and Samples available at all times for observation by PCM or Engineer.

C. Making Entries on Drawings:

- 1) Using an erasable colored pencil (not ink or indelible pencil), clearly describe change by graphic line and note as required.
 - a. Color Coding:
 - (i) Green when showing information deleted from Drawings.
 - (ii) Red when showing information added to Drawings.
 - (iii) Blue and circled in blue to show notes.
- 2) Date entries.
- 3) Call attention to entry by "cloud" drawn around area or areas affected.
- 4) Legibly mark to record actual changes made during construction, including, but not limited to:
 - a. Depths of various elements of foundation in relation to finished first floor data if not shown or where depth differs from that shown.
 - b. Horizontal and vertical locations of existing and new Underground Facilities and appurtenances, and other underground structures, equipment, or Work. Reference to at least two measurements to permanent surface improvements.
 - c. Location of internal utilities and appurtenances concealed in the construction referenced to visible and accessible features of the structure.
 - d. Locate existing facilities, piping, equipment, and items critical to the interface between existing physical conditions or construction and new construction.
 - e. Changes made by Addenda and Field Orders, Work Change Directive, Change Order, Written Amendment, and Engineer's written interpretation and clarification using consistent symbols for each and showing appropriate document tracking number.
- 5) Dimensions on Schematic Layouts: Show on record drawings, by dimension, the centerline of each run of items such as are described in previous subparagraph above.
 - a. Clearly identify the item by accurate notes such as "cast iron drain," "galv. water," and the like.

- b. Show, by symbol or note, vertical location of item ("under slab," "in ceiling plenum," "exposed," and the like).
- c. Make identification so descriptive that it may be related reliably to Specifications.

D. Coordination with Florida Licensed surveyor:

- 1) Contractor shall not cover any bends, valves, or fittings installed until they have been located by the survey crews for the purpose of preparing as-built and/or Record Drawings.
- 2) If the above conditions are not met, for any reason, Contractor shall bear the cost of potholing the constructed installation to allow for the locations.

3.2 FINAL CLEANING

- A. At completion of the Work or of a part thereof and immediately prior to Contractor's request for certificate of Substantial Completion; or if no certificate is issued, immediately prior to Contractor's notice of completion, clean entire site or parts thereof, as applicable.
- 1) Leave the Work and adjacent areas affected in a cleaned condition satisfactory to Owner and PCM.
 - 2) Remove grease, dirt, dust, paint or plaster splatter, stains, labels, fingerprints, and other foreign materials from exposed surfaces.
 - 3) Repair, patch, and touch up marred surfaces to specified finish and match adjacent surfaces.
 - 4) Clean all windows.
 - 5) Clean and wax wood, vinyl, or painted floors.
 - 6) Broom clean exterior paved driveways and parking areas.
 - 7) Hose clean sidewalks, loading areas, and others contiguous with principal structures.
 - 8) Rake clean all other surfaces.
 - 9) Replace air-handling filters and clean ducts, blowers, and coils of ventilation units operated during construction.
 - 10) Leave water courses, gutters, and ditches open and clean.
- B. Use only cleaning materials recommended by manufacturer of surfaces to be cleaned.

3.3 SUPPLEMENTS

- A. Subcontractor Identification Form (See next page).



SUBCONTRACTOR IDENTIFICATION FORM

This form shall be completed by all City of Fort Lauderdale Prime Contractors who subcontracted out any portion of his/her City contract. The form shall be forwarded to the City of Fort Lauderdale's Public Services Department (Engineering and Architectural Services) with the prime contractor's final pay request. A separate form is to be completed and submitted for each subcontractor. Please telephone (954) 761-5057 or 761-5083, if you have any questions regarding this form.

1) CITY OF FORT LAUDERDALE PROJECT NO. _____

2) PROJECT DESCRIPTION _____

3) SUBContractor _____

Business Name

Address

Telephone & Fax Nos.

Email Address/Company Website (if applicable)

4) SUBCONTRACTOR'S PRINCIPAL OFFICER _____

5) CLASSIFICATION OF WORK SUBCONTRACTED OUT ____

6) COST OF WORK SUBCONTRACTED OUT ____

7) Please check the item(s) which properly identify the ownership status of the subcontractor's firm:

☐ Subcontractor firm is not a MBE or WBE

☐ Subcontractor firm is a MBE, as at least 51 percent is owned and operated by one or more socially and economically-disadvantaged individuals:

☐ American Indian ☐ Asian ☐ Black ☐ Hispanic ☐ White

☐ Subcontractor firm is a WBE, as at least 51 percent is owned and operated by one or more women.

☐ American Indian ☐ Asian ☐ Black ☐ Hispanic ☐ White

8) **PRIME Contractor** _____

NAME & TITLE OF PRIME CONTRACTOR'S REPRESENTATIVE COMPLETING THIS FORM *(Please Print)*

(Telephone No.)

(Fax No.)

(Email Address)

SIGNATURE _____ **DATE** _____

Prime Contractor's Representative

END OF SECTION

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SECTION 01710 - CLEANING

PART 1 GENERAL

1.1 DESCRIPTION

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

1.2 RELATED SECTIONS

- A. Section 01010 – Summary of Work
- B. Section 01505 – Control of Work
- C. Section 01550 – Site Access and Storage

1.3 DISPOSAL REQUIREMENTS

- A. Do not dispose of any unsuitable fill, hazardous or organic material onsite. All such material shall be disposed of in a legal manner by the Contractor, the cost of which shall be included in the Bid.
- B. Conduct cleaning and disposal operations to comply with applicable codes, ordinances, regulations, and anti-pollution laws.

PART 2 PRODUCTS

2.1 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

3.1 DURING CONSTRUCTION

- A. The Contractor shall keep the area of the Work and other areas utilized or impacted by construction in a neat and clean condition, free from any accumulation of rubbish. The Contractor shall dispose of all rubbish and waste materials of any nature occurring at the Work site and shall establish regular intervals of collection and disposal of such materials and waste. The Contractor shall also keep its haul roads free from dirt, rubbish, and unnecessary obstructions resulting from its operations.
- B. Disposal of all rubbish and surplus materials shall be off the site of construction in accordance with local codes and ordinances governing locations and methods of disposal, and in conformance with all applicable safety laws, and to the particular requirements of Part 1926 of the OSHA Safety and Health Standards for Construction.

- C. Provide on-site containers for the collection of waste materials, debris, and rubbish as required.

3.2 DUST ABATEMENT

- A. The Contractor shall furnish all labor, equipment, and means required and shall carry out effective measures wherever and as often as necessary to prevent its operation from producing dust in amounts damaging to property, cultivated vegetation, or domestic animals, or causing a nuisance to persons living in or occupying buildings in the vicinity. Means for the control of dust shall include, but not be limited to, sweeping and water trucks. The Contractor shall be responsible for any damage resulting from any dust originating from its operations. The dust abatement measures shall be continued until the Contractor is relieved of further responsibility by the Engineer.

3.3 FINAL CLEANING

- A. Remove temporary protection and facilities installed for protection of the Work during construction.
- B. Comply with regulations of authorities having jurisdiction and safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on the Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from the site and dispose of in a lawful manner.
- C. Where extra materials of value remaining after completion of associated Work have become the Owner's property, arrange for disposition of these materials as directed.

END OF SECTION

SECTION 01720 - PROJECT RECORD DOCUMENTS**PART 1 GENERAL****1.1 DESCRIPTION**

- A. This Section includes the requirements for maintaining, recording and submitting Project Record Documents including, but not limited to,
 - 1) Record Drawings or As-Built Drawings
 - 2) Record Specifications and other Contract Documents
 - 3) Record Samples, Shop Drawings or Record Product Data

1.2 RELATED SECTIONS

- A. Section 01050 – Field Engineering and Surveying
- B. Section 01152 – Applications for Payment
- C. Section 01340 – Shop Drawings, Working Drawings, and Samples
- D. Section 01700 – Project Closeout

1.3 MAINTENANCE OF DOCUMENTS AND SAMPLES

- A. Maintain at the site for the Owner and Engineers review one record copy of:
 - 1) Drawings
 - a. The CONTRACTOR shall maintain full size (24"x36") field drawings to reflect the "as-built" items of WORK as the WORK progresses.
 - 2) Specifications
 - 3) Addenda
 - 4) Change Orders and other Modifications to the Contract
 - 5) Engineer's Field Orders or Written Instructions
 - 6) Approved Shop Drawings, Working Drawings, and Samples
 - 7) Field Test Reports
 - 8) Stormwater Pollution Prevention Plan (SWPPP)
 - 9) Construction Photographs
- B. Store Record Documents in the Contractor's field office apart from documents used for construction.
- C. File Record Documents in accordance with the CSI format number system utilized in the Contract Documents.
- D. Maintain Record Documents in a clean, dry, legible condition and in good order. Do not use Record Documents for construction purposes.
- E. Make Record Documents available at all times for inspection by the Engineer.

- F. As a prerequisite for monthly progress payments, the Contractor is to exhibit the current updated Record Documents for review by the Engineer and the Owner.

1.4 RECORDING

A. AS-BUILT INFORMATION

- 1) A set of "red-lined" electrical drawings shall be carefully maintained at the job site. Actual conditions are to be put on the drawings in red on a daily basis, so the drawings will continuously show locations and routings of cables, conduits, pull boxes, circuit numbers, and other information required by the ENGINEER.
- 2) After completion of construction, the CONTRACTOR shall provide three (3) sets of signed & sealed. As-Built Drawings with all the As-Built information, all locations, coordinated, dimensions and elevations of the constructed facilities, certified, signed and sealed thereon by a Land Surveyor registered in the State of Florida. All elevations shall refer to N.A.V.D. 88 (North American Vertical Datum of 1988) and all state plane coordinates shall be NAD 83 (with 1990 adjustment). The cost of such field layout and recording work shall be the responsibility of the CONTRACTOR. The As-Built utility information shall meet the requirements of the City of Fort Lauderdale and any other permitting agencies having jurisdiction on this project.
- 3) The as-built drawings cover sheet will be signed, sealed and dated by a Florida registered surveyor and mapper (PSM). The cover sheet will include the PSM's name, business name, PSM number, address and telephone number and contain the following statement:
- 4) "I hereby certify that the as-built location information of the potable water, reclaimed water, wastewater and drainage facilities shown on these drawings conforms to the minimum technical standards for land surveying in the State of Florida, Chapter 5J-17.050 (10)(i) (Florida Administrative Code), as adopted by the Department of Agriculture and Consumer Services, Board of Professional Surveyors and Mappers, and that said as-builts are true and correct to the best of our knowledge and belief."
- 5) The CONTRACTOR shall maintain full size (24"x36") field drawings to reflect the "as-built" items of WORK as the WORK progresses. Upon completion of the WORK, the CONTRACTOR shall prepare a record set of "AS-BUILT" DRAWINGS on full-size, reproducible material and an electronic file in .DWG format (AutoCAD, latest Version). One set of full size design DRAWINGS on reproducible material will be furnished to the CONTRACTOR by the design ENGINEER at the current square foot price. An electronic file of the design DRAWINGS on a compact disk will be furnished to the CONTRACTOR by the design ENGINEER at no additional cost (for as-built purposes only). No additional payment will be made for those "as-built" DRAWINGS.
- 6) The cost of maintaining record changes, and preparation of the AS-BUILT DRAWINGS shall be included in the unit prices bid for the affected items. Upon completion of the WORK, the CONTRACTOR shall furnish the CITY PROJECT MANAGER the reproducible AS-BUILT DRAWINGS and

electronic files. The completed AS-BUILT DRAWINGS shall be delivered to the CITY PROJECT MANAGER at least 48 hours prior to final inspection of the WORK. The Final Inspection will not be conducted unless the AS-BUILT DRAWINGS are in the possession of the CITY PROJECT MANAGER.

- 7) Representative items of WORK that should be shown on the record DRAWINGS as verified, changed or added are shown below:
 - a. Plans:
 - (i) Structure types, location with grade of rim and flow-line elevations.
 - (ii) Utility type, length, size and elevation in conflict structures
 - (iii) All maintenance access structures, valves and hydrants within right-of-way.
 - (iv) Spot elevations at plateaued intersections (P.C., P.T., and midpoint of all intersections, etc.)
 - b. Pavement Marking and Signing Plans:
 - (i) Sign location where installed if different from plans
 - c. Paving Grading and Drainage Plans:
 - (i) Location (horizontal and vertical) of all pipelines, structures, finished surface elevations in all areas directly impacted by the project, limits of new pavement, etc.
- 8) The CONTRACTOR shall submit three sets of progress AS_BUILT DRAWINGS with each application for payment. These DRAWINGS shall accurately depict the WORK completed and for which payment is being requested.
- 9) The term 'RECORD DRAWING' refer to the final drawing set signed and sealed by the Engineer of Record. The Engineer of Record will prepare or have prepared record drawings based on as-built information provided by a PSM and from information provided by the engineer's staff. The Engineer of Record shall retain the signed and sealed 'as-built' drawings provided by the PSM with the other project records for possible review by CITY upon request. RECORD DRAWING shall meet the requirements of the Contract Documents.
- 10) AS-BUILT and RECORD DRAWINGS shall include the following contents at a minimum:
 - a. The amount of information required on as-built and record drawings will require the drawing author to organize its presentation in order to make the drawings readable. On occasion, it may be necessary use a table to show coordinate information.
 - b. Show the limits of new pavement in addition to resurfaced pavement.

- c. Length of slotted exfiltration trench pipe and solid RCP drainage pipe.
- 11) Show elevations to the nearest one hundredth of a foot for:
- a. Drainage structure grates.
 - b. Inverts of every storm drainage pipe, including connections to existing pipes.
 - c. Utility crossings including the bottom of pipe elevation, material, and diameter of the higher utility and the top of pipe elevation, material, and diameter of the lower utility.
 - d. Finished asphalt pavement, concrete, and sod surfaces on at least a 50-ft grid minimum in addition to at grade changes, the top and bottom corners of ramps, along ADA accessible paths, along the lowest point in a swale, and at any other points within the project area as request by the ENGINEER or CITY.
- 12) Coordinates will be provided for CITY maintained facilities, including:
- a. Center of installed drainage structures.
 - b. Installed signage.
 - c. Other locations designated by CITY.
- 13) Show the changed location of any non-water/wastewater features so they are at the visually correct location relative to CITY maintained facilities.
- 14) Drawings shall include color photographs of all connections to existing CITY infrastructure as well as all critical utility crossings and where specifically required on the design drawings. The pictures will be taken with a GPS camera that automatically geotags the picture. A maximum of six photographs per sheet is acceptable. Each photograph shall have a minimum size of 8"x10". Photographs shall have a density of 3.0 megapixel or greater. Plot resolution is to be minimum 300 dots per inch. Photographs shall normally be taken from a point between four feet (4') and six feet (6') above the subject infrastructure and shall show good detail in both shadow and sunlit areas. Include a measuring device in the photo for scale and where applicable to indicate the depth or separation of the utilities. A symbol (i.e. an arrow) is to be used in the plan views indicating the location and direction of view for each photograph submitted. The symbol must include the photograph number. A caption under each photograph shall include the following information.
- a. Photograph number
 - b. Photograph description
 - c. Date of photograph
 - d. Location and direction of view (for example 201 NW 34 Street looking North)
 - e. State plane coordinates
 - f. All photographs included in the drawings will also be provided to

- CITY in JPEG format on CD or DVD media. The CD or DVD will be labeled with the CITY project name and number. Individual photo files will be named using the same photograph number contained in the drawings.
- g. The size and material of the piping shall be verified by the survey crew at the time of as-built.
 - h. As-builts of all drainage lines shall include the following information:
 - (i) Rims, inverts, length of piping between structures, length of exfiltration trench, and weir elevations if applicable.
 - (ii) The size and material of the piping shall be verified by the survey crew at the time of as-built.
 - i. As-builts for the edge of pavement and sidewalk locations shall include horizontal locations and shall indicate all deviations from the design plans.
 - j. All rock as-builts for parking lot, roadways and swales areas shall consist of the following:
 - (i) Rock elevations at all high and low points, and at enough intermediate points to confirm slope consistency and every 50' for roadways.
 - (ii) Rock as-builts shall be taken at all locations where there is a finish grade elevation shown on the design plans.
 - (iii) All catch basin and maintenance access structure rim elevations shall be shown.
 - (iv) Elevations around island areas will also be required.
 - (v) As-builts shall be taken on all paved and unpaved swales prior to placement of asphalt and/or topsoil/sod, at enough intermediate points to confirm slope consistency and conformance to the plan details.
 - (vi) Note: Rock as-builts required prior to paving. Consultant shall review rock as-builts within five days of receipt.
 - k. Retention area and swale as-built elevations shall be taken at the bottom of the retention area and at the top of bank. If there are contours indicated on the design plans, then they shall be as-built as well.
 - l. If a change is made via field order or deviation to any structure, pipeline, etc., a new location shall be noted on the as-builts. The CITY PROJECT MANAGER may request additional as-built information to verify horizontal or vertical locations.
- 15) A complete set of AS-BUILT DRAWINGS shall be prepared and delivered to the CITY PROJECT MANAGER. WORK shall be performed by a

Registered Professional Surveyor and Mapper shall include, but not be limited to the following:

- a. Valve boxes, splice boxes, pull boxes, all underground utilities-waterlines, electrical runs, irrigation system, storm drainage pipe and structures, sanitary sewer lines and structures, finished necessary grades, benches, curbs, fences, walls, signs, light fixtures and other items as necessary in accordance with CITY Record Plan/As-built plan requirements.

B. Record Drawings:

- 1) Maintain a clean, undamaged set of prints of Contract Drawings to serve as the project Record Drawings.
- 2) Label each sheet "RECORD DRAWING" in neat large printed letters with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.
- 3) The Record Drawings shall be presented at the same scale as the Contract Drawings.
- 4) The Record Drawings shall correctly and accurately show all changes from the Contract Drawings made during construction. This shall include a revised graphical representation overlaid on the original design layout.
- 5) All information shall be verified and certified by an independent Professional Surveyor and Mapper registered in the State of Florida.
- 6) All vertical information shall be provided in the datum indicated in the Contract Drawings.
- 7) Horizontal and vertical locations referenced to base-line or permanent surface improvements.
- 8) Mark whichever drawing is most capable of showing conditions fully and accurately; where Shop Drawings are used, record a cross reference at the corresponding location on the Record Drawings.
- 9) Give particular attention to concealed elements that would be difficult to measure and record at a later date.
- 10) Mark new information that was not shown on Contract Drawings or Shop Drawings.
- 11) Note related Change Order numbers where applicable.
- 12) Organize Record Drawing sheets into manageable sets, bind with durable paper cover sheets, and print suitable titles, dates, and other identification on the cover of each set.
- 13) Do not use Record Drawings for construction purposes.
- 14) Record information concurrently with construction progress.

C. The Record Drawings shall be neat and legible including the following:

- 1) Above ground piping and equipment:
 - a. All equipment locations, dimensions, and elevations as indicated

in the Contract Drawings.

- b. All building and tank locations, dimensions, and elevations as indicated in the Contract Drawings.
 - c. All above ground piping size, material, class, lengths, dimensions, and elevations as indicated in the Contract Drawings.
 - d. Horizontal locations of piping, fittings, valves, and appurtenances.
 - e. Elevations of the top of pipe, fittings, valves and appurtenances.as indicated in the Contract Drawings and at 50' maximum increments
 - f. All changes from the original design including a revised graphical representation overlaid on the original design layout.
- 2) Underground pressure pipe including potable water mains, sanitary sewer force mains, drainage force mains, and the like:
- a. All piping size, material, class, lengths, dimensions, bury depth, and elevations as indicated in the Contract Drawings.
 - b. Horizontal locations of piping, fittings, valves, and appurtenances.
 - c. Elevations of the top of pipe, fittings, valves, and appurtenances.
 - d. Elevations as indicated in the Contract Drawings and at 50' maximum increments
 - e. Lengths of restrained pipe.
 - f. Water service locations.
 - g. Meter sizes.
 - h. All changes from the original design including a revised graphical representation overlaid on the original design layout.
- 3) Gravity sanitary sewer:
- a. All piping size, material, class, lengths, slopes, dimensions, and elevations as indicated in the Contract Drawings.
 - b. Horizontal locations of manholes.
 - c. Rim, invert, and size of all manholes.
 - d. Service terminal end locations.
 - e. Wet well construction including rim elevation, diameter, bottom, invert, float elevations, and pump model with specs.
 - f. All changes to piping from the original design including a revised graphical representation overlaid on the original design layout.
- 4) Stormwater Drainage:
- a. All piping size, material, class, lengths, dimensions, and elevations as indicated in the Contract Drawings.
 - b. Horizontal locations of manholes and catch basins.

- c. Rim, invert, bottom elevations, and size of all manholes and catch basins.
- d. All surface elevations indicated on the Contract Drawings including, but not limited to, swales, berms, yards, sidewalks, curbs, and the like at 10' maximum increments. For ADA access paths, surface elevations shall be provided at each side of the path at 5' maximum increments.
- e. Horizontal location and elevation of all storm water retention or detention areas.
- f. All changes from the original design including a revised graphical representation overlaid on the original design layout.

5) Limerock base:

- a. Upon completion of all underground utilities and limerock base, and before placement of asphalt, provide the following for Engineer review:
 - (i) Finished limerock base elevations taken at the location of finished asphalt elevations as indicated in the Contract Drawings.
 - (ii) Additional elevations as required by the Engineer, including, but not limited to:
 - (iii) Finished limerock base at centerline, edge of median and edge of pavement.
 - (iv) Back of sidewalk or right of way.
 - (v) Bottom of swale or flow line of gutter.
 - (vi) Top of curb.
 - (vii) High points, low points and grade breaks.
 - (viii) Intersections.

6) Electrical, instrumentation, and controls:

- a. Horizontal location of all electrical equipment and control cabinetry.
- b. Elevations of the bottom of all electrical and control panels.
- c. Horizontal location and elevation of all conduits including conduit size, route and wire size.
- d. Horizontal location of all light poles and junction boxes.

7) Miscellaneous:

- a. Horizontal location and elevation of all concrete slabs.
- b. Horizontal location, size, and material of all fencing.
- c. Location size and material of all existing utilities encountered during construction whether indicated on the Contract Drawings or

- not.
 - d. Location of internal utilities and appurtenances concealed in the construction, referenced to visible and accessible features of the structure.
 - e. Depths of various elements of foundation in relation to finish first floor datum.
 - f. Field changes of dimensions and details.
 - g. Details not on original contract drawings.
- D. Record Specifications: Maintain one complete copy of the Project Manual, including addenda, and one copy of other written construction documents such as Change Orders and modifications issued in printed form during construction.
- 1) Mark these documents to show substantial variations in actual Work performed in comparison with the text of the Specifications and modifications.
 - 2) Give particular attention to substitutions, selection of options and similar information on elements that are concealed or cannot otherwise be readily discerned later by direct observation.
 - 3) Note related record drawing information and Product Data.
 - 4) Manufacturer, trade name, catalog number, and supplier of each product and item of equipment actually installed.
 - 5) Changes made by field order or by Change Order.
- E. Record Product Data (Shop Drawings): Maintain one copy of each Product Data submittal.
- 1) Mark these documents to show significant variations in actual Work performed in comparison with information submitted. Include variations in products delivered to the site, and from the manufacturer's installation instructions and recommendations.
 - 2) Give particular attention to concealed products and portions of the Work which cannot otherwise be readily discerned later by direct observation.
 - 3) Note related Change Orders and mark-up of record drawings and Specifications.
- F. Record Sample Submitted: Immediately prior to the date or dates of Substantial Completion, the Contractor will meet at the site with the Engineer and the Owner to determine which of the submitted Samples that have been maintained during progress of the Work are to be transmitted to the Owner for record purposes. Comply with delivery to the Owner's Sample storage area.
- G. Miscellaneous Record Submittals: Refer to other Specification Sections for requirements of miscellaneous record-keeping and submittals in connection with actual performance of the Work.

1.5 SUBMITTAL

- A. Project Record Documents, demonstrating construction progress, shall be submitted with each Application for Payment.
- B. Interim Project Record Drawings shall be submitted at significant project milestones including:
 - 1) Construction of wet well or other structures.
 - 2) Construction of catch basins, manholes, pipes, and appurtenances.
 - 3) As required by the Engineer.
- C. Project Record Documents, demonstrating construction completion shall be submitted with the balance of Closeout documents at the conclusion of construction including:
 - 1) Three sets of signed and sealed sets of prints.
 - 2) One compact disc copy of record drawings in PDF and AutoCAD format.
- D. Accompany submittals with transmittal letter in duplicate, containing:
 - 1) Date
 - 2) Project Title and Number
 - 3) Contractor's Name and Address
 - 4) Title and Number of each Record Document
 - 5) Signature of Contractor or their Authorized Representative

PART 2 PRODUCTS (NOT USED)**PART 3 EXECUTION (NOT USED)****END OF SECTION**

SECTION 01730 - OPERATING AND MAINTENANCE DATA**PART 1 GENERAL****1.1 DESCRIPTION**

- A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Contract.
 - 1) Prepare operating and maintenance data as specified in this Section and as referenced in other pertinent sections of Specifications.
 - 2) Instruct Owner's personnel in maintenance of products and in operation of equipment and systems.

1.2 RELATED SECTIONS

- A. Section 01340 – Shop Drawings, Working Drawings, and Samples
- B. Section 01700 – Contract Closeout
- C. Section 01720 – Project Record Documents
- D. Section 01740 – Warranties and Bonds

1.3 QUALITY ASSURANCE

- A. Preparation of data shall be done by personnel:
 - 1) Trained and experienced in maintenance and operation of described products.
 - 2) Familiar with requirements of this Section.
 - 3) Skilled as technical writers to the extent required to communicate essential data.
 - 4) Skilled as drafters competent to prepare required drawings.

1.4 FORM OF SUBMITTALS

- A. Prepare data in form of an instructional manual for use by Owner's personnel.
- B. Format
 - 1) Size: 8 1/2 inches x 11 inches
 - 2) Paper: 20 pound minimum, white, for typed pages.
 - 3) Text: Manufacturer's printed data, or neatly typewritten.
 - 4) Drawings:
 - a. Provide reinforced punched binder tab, bind in with text.
 - b. Reduce larger drawings and fold to size of text pages, but not larger than 11 inches x 17 inches.
 - 5) Provide fly-leaf for each separate product, or each piece of operating equipment.
 - a. Provide types description of product, and major component parts of equipment.

- b. Provide indexed tabs.
- 6) Cover: Identify each volume with typed or printed title "OPERATING AND MAINTENANCE INSTRUCTIONS". List:
 - a. Title of Project
 - b. Identity of separate structure as applicable.
 - c. Identity of general subject matter covered in this manual.

C. Binders

- 1) Commercial quality three-ring binders with durable and cleanable plastic covers.
- 2) Maximum ring diameter shall be 2 inches.
- 3) When multiple binders are used, correlate the data into related consistent groupings.

1.5 CONTENT OF MANUAL

- A. Neatly typewritten Table of Contents for each volume, arranged in systematic order.
 - 1) Contractor, name of responsible principal, address, and telephone number.
 - 2) A list of each product required to be included, indexed to content of the volume.
 - 3) List, with each product, name, address, and telephone number of:
 - a. Subcontractor of installer.
 - b. Maintenance contractor, as appropriate.
 - c. Identify area of responsibility of each.
 - d. Local source of supply for parts and replacement.
 - 4) Identify each product name and other identifying symbols as set forth in Contract Documents.
- B. Product Data
 - 1) Include only those sheets which are pertinent to the specific product.
 - 2) Annotate each sheet to:
 - a. Clearly identify specific product or part installed.
 - b. Clearly identify data applicable to installation.
 - c. Delete references to inapplicable information.
- C. Drawings
 - 1) Supplement product data with drawings as necessary to clearly illustrate:
 - a. Relations of component parts of equipment and systems.
 - b. Control and flow diagrams.

- 2) Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
 - 3) Do not use Project Record Documents as maintenance drawing.
- D. Written text, as required to supplement product data for the particular installation:
- 1) Organize in consistent format under separate headings for different procedures.
 - 2) Provide logical sequence of instructions of each procedure.
- E. Copy of each warranty, bond, and service contract issued:
- 1) Provide information sheet for Owner's personnel, give:
 - a. Proper procedures in event of failure.
 - b. Instances which might affect validity of warranties or bonds

1.6 MANUAL FOR MATERIALS AND FINISHES

- A. Submit five copies of complete manual in final form.
- B. Content for architectural products, applied materials and finishes
- 1) Manufacturer's data, giving full information on products.
 - a. Catalog number, size, and composition.
 - b. Color and texture designations.
 - c. Information required for re-ordering special-manufactured products.
 - 2) Instructions for care and maintenance.
 - a. Manufacturer's recommendation for types of cleaning agents and methods.
 - b. Cautions against cleaning agents and methods which are detrimental to product.
 - c. Recommended schedule for cleaning and maintenance.
 - 3) Content, for moisture-protection and weather-exposed products
 - 4) Manufacturer's data, giving full information on products
 - a. Applicable standards.
 - b. Chemical composition.
 - c. Details of installation.
 - 5) Instructions for inspection, maintenance, and repair.
- C. Additional requirements for maintenance data: Respective sections of Specifications.
- D. Provide complete information for products specified.

1.7 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit five copies of complete manual in final form.

- B. Content, for each unit of equipment and system, as appropriate:
- 1) Description of unit and component parts.
 - a. Function, normal operating characteristics and limiting conditions
 - b. Performance curves, Engineering data and tests
 - c. Complete nomenclature and commercial number of replaceable parts.
 - 2) Operating procedures
 - a. Start-up, break-in, routine and normal operating instructions
 - b. Regulation, control, stopping, shut-down, and emergency instructions.
 - c. Summer and winter operating instructions
 - d. Special operating instructions
 - 3) Maintenance Procedures
 - a. Routine operations
 - b. Guide to "trouble-shooting"
 - c. Disassembly, repair and reassembly
 - d. Alignment, adjusting and checking
 - 4) Servicing and lubrication schedule
 - a. List of lubricants required
 - 5) Manufacturer's printed operating and maintenance instructions.
 - 6) Description of sequence of operation by control manufacturer.
 - 7) Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - a. Predicted list of parts subject to wear.
 - b. Items recommended to be stocked as spare parts
 - 8) As-installed control diagrams by controls manufacturer.
 - 9) Each contractor's coordination drawings
 - a. As-installed color-coded piping diagrams
 - 10) Charts of valve tag numbers, with location and function of each valve.
 - 11) List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
 - 12) Other data as required under pertinent sections of specifications.
- C. Contents, for each electric and electronic system, as appropriate.
- 1) Description of system and component parts
 - a. Function, normal operating characteristics, and limiting conditions

- b. Performance curves, Engineering data and tests
 - c. Complete nomenclature and commercial number of replaceable parts
- 2) Circuit directories of panel-boards
 - a. Electrical service
 - b. Controls
- 3) As-installed color-coded wiring diagrams
- 4) Operating procedures:
 - a. Routine and normal operating instructions
 - b. Sequences required
 - c. Special operating instructions
- 5) Maintenance procedures
 - a. Routine operations
 - b. Guide to "trouble-shooting"
 - c. Disassembly, repair and reassembly
 - d. Adjustment and checking
- 6) Manufacturer's printed operating and maintenance instructions
- 7) List of original manufacturer's spare parts, manufacturer's current prices, and recommended quantities to be maintained in storage.
- 8) Other data as required under pertinent sections of specifications
- D. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- E. Additional requirements for operating and maintenance data: Respective sections of Specifications.
- F. Provide complete information for product specified.

1.8 SUBMITTAL SCHEDULE

- A. Submit two copies of preliminary draft of proposed formats and outlines of contents of Operation and Maintenance Manuals within 30 days after Notice to Proceed.
 - 1) The Engineer will review the preliminary draft and return one copy with comments.
- B. Submit two copies of completed data in final form no later than 30 days following the Engineer's review of the last shop drawing and submittal specified under Section 01340.
 - 1) One copy will be returned with comments to be incorporated into final copies.

- C. Submit specified number of copies of approved data in final form directly to the offices of the Engineer within 30 calendar days of product shipment to the project site and preferably within 30 days after the reviewed copy is received.
- D. Submit six copies of addendum to the operation and maintenance manuals as applicable and certificates within 30 days after final inspection and plant start-up test.
- E. Final Operation and Maintenance submittals shall be in large three-ring binders organized by specification Section and plainly marked.

1.9 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection or acceptance, fully instruct Owner's designated operating and maintenance personnel in operation, adjustment, and maintenance of products, equipment, and systems.
- B. Operating and maintenance manual shall constitute the basis of instruction.
 - 1) Review contents of manual with personnel in full detail to explain all aspects of operations and maintenance.

1.10 ENGINEER'S O & M CHECKLIST

- A. The Engineer will review Operation and Maintenance Manuals submittals on operating equipment for conformance with the requirements of this Section. The review will generally be based upon the O&M Review Checklist (presented on the pages at the end of this section for the benefit of the Contractor and their suppliers).

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

O & M REVIEW CHECKLIST

EQUIPMENT SUBMITTED	_____	DATE OF SUBMITTAL	_____
MANUFACTURER	_____	DEGREE OF APPROVAL	_____
SPECIFICATION SECTION	_____	DRAWING NUMBER	_____

- _____ Is the submittal correct for model/series/configuration originally submitted with shop drawings?
- _____ Is the binding correct with assigned color/printing etc.?
(Pertains to final three volumes)
- _____ Is the submittal properly indexed?
- _____ Does the submittal pertain only to equipment being furnished?
- _____ Is the submittal easily understood and instructively arranged?
- _____ Does the submittal include start-up, shutdown and troubleshooting procedures?
- _____ Are sufficient drawings and schematics included to supplement written descriptions?
- _____ Is the listing of name plate data for each piece of supplied equipment provided and attached?
- _____ Are all submitted "C" and "D" size drawings printed on paper that is 11 inches high and folded to 8 1/2 inches wide?
- _____ Is proper and complete instruction for servicing included?
- _____ Is there a suggested operating log sheet for equipment?
- _____ Is schedule for lubrication provided?
- _____ Is there a recommended preventative maintenance schedule?
- _____ Are necessary safety precautions clearly indicated where they relate to the equipment?
- _____ Is the Area Representative information provided, i.e., Name, Address, Telephone Number?
- _____ Are specified spare parts indicated and listed?

The following are the points of rejection requiring resubmittal by Contractor:

END OF SECTION

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SECTION 01740 - WARRANTIES AND BONDS**PART 1 GENERAL****1.1 DESCRIPTION**

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

1.2 RELATED SECTIONS

- A. Section 01700 - Contract Closeout

1.3 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bond, service, and maintenance contracts, executed by each of the respective manufacturers, suppliers, and subcontractors.
- B. Number of original signed copies required: two (2) each.
- C. Table of Contents: neatly typed, in orderly sequence. Provide complete information for each item.
 - 1) Product or Work item
 - 2) Firm, with name of principal, address and telephone number
 - 3) Scope
 - 4) Date of beginning of Warranty, bond or service and maintenance contract
 - 5) Duration of warranty, bond or service maintenance contract
 - 6) Provide information for Owner's personnel:
 - a. Proper procedure in case of failure
 - b. Instances which might affect the validity of warranty or bond
 - 7) Contractor, name of responsible principal, address and telephone number

1.4 FORM OF SUBMITTALS

- A. Prepare in duplicate packets
- B. Format:
 - 1) Size 8 1/2 inches x 11 inches, punch sheets for standard 3-post binder
 - 2) Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
 - a. Title of Project
 - b. Name of Contractor
- C. Binders: Commercial quality, three-post (3) binder, with durable and cleanable plastic covers and maximum post width of 2 inches.

1.5 WARRANTY SUBMITTAL REQUIREMENTS

- A. For all equipment, submit a one-year warranty from the equipment manufacturer unless otherwise specified. The manufacturer's warranty period shall be concurrent with the Contractor's for one year commencing at the time of acceptance by the Owner.
- B. The Contractor shall be responsible for obtaining certificates for equipment warranty for all major equipment and which has a 1 HP motor, or which lists for more than \$1,000. The Engineer reserves the right to request warranties for equipment not classified as major. The Contractor shall still warrant equipment not considered to be "major" in the Contractor's one-year warranty period even though certificates of warranty may not be required.
- C. In the event that the equipment manufacturer or supplier is unwilling to provide a one-year warranty commencing at the time of Owner acceptance, the Contractor shall obtain from the manufacturer a two (2) year warranty commencing at the time of equipment delivery to the job site. This two-year (2) warranty from the manufacturer shall not relieve the Contractor of the one-year warranty starting at the time of Owner acceptance of the equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 02100 - SITE PREPARATION

PART 1 GENERAL

1.1 DESCRIPTION

- A. Section covers clearing, grubbing, stripping and demucking of the construction site, complete as specified herein.
- B. Clear and demuck the area within the limits of construction as required, including drainage easements.

1.2 RELATED SECTIONS

- A. Section 02221 - Trenching, Bedding, and Backfill for Pipe
- B. Section 02513 - Asphaltic Concrete Paving

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 CLEARING

- A. The surface of the ground, for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. However, those trees which are designated by the Engineer shall be preserved as hereinafter specified. Clearing operations shall be conducted so as to prevent damage to existing structures and installations, and to those under construction, so as to provide for the safety of employees and others. Clearing for structures shall consist of topsoil and vegetation removal. Clearing for pipelines shall consist of vegetation removal.

3.2 GRUBBING

- A. Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. In areas where Silva Cells are proposed additional depth shall be required to remove existing roots and debris to achieve the installation of this system. All depressions excavated below the original ground surface for or by the removal of such objects, shall be refilled with suitable materials and compacted to a density conforming to the surrounding ground surface.

3.3 STRIPPING

- A. In areas so designated, topsoil, not muck shall be stockpiled. Topsoil stockpiled shall be protected until it is placed as specified. Any topsoil remaining after all work is in place shall be disposed of by the Contractor.

3.4 DEMUCKING

- A. When encountered, organic material (muck) shall be excavated and removed. This material may be stockpiled temporarily but must be disposed of as directed by the Engineer or the Owner.

3.5 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

- A. The Contractor shall dispose of all material and debris from the clearing and grubbing operation by shipping such material and debris and disposing such material to a suitable location as required by the Engineer or the governmental agencies. Disposal by deep burial will not be permitted. The cost of disposal of material (including hauling) shall be considered a subsidiary obligation of the Contractor, the cost of which shall be included in the contract prices.

3.6 PRESERVATION OF TREES

- A. Those trees which are designated by the Engineer or as shown on the drawings for preservation shall be carefully protected from damage. The Contractor shall erect such barricades, guards, and enclosures as may be considered necessary by them for the protection of the trees during all construction operations.

3.7 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

- A. The Contractor shall exercise extreme care to avoid necessary disturbance of developed private property as applicable. Trees, shrubbery, gardens, lawn and other landscaping, which in the opinion of the Engineer must be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.
- B. All soil preparation procedures and replanting operations shall be under the supervision of nurseryman experienced in such operations.
- C. Improvements to the land such as fences, walls, outbuildings, etc., which of necessity must be removed shall be replaced with equal quality materials and workmanship.
- D. The Contractor shall clean up the construction site across developed private property directly after construction is complete upon approval of the Engineer.

3.8 PRESERVATION OF PUBLIC PROPERTY

- A. The appropriate paragraphs of Articles 3.06 and 3.07, of these specifications shall apply to the preservation and restoration of all damaged areas of public lands, rights-of-way, easements, etc.

END OF SECTION

SECTION 02200 - EARTHWORK

PART 1 GENERAL

1.1 DESCRIPTION

- A. Earthwork operations necessary to achieve the Work including, but not limited to, excavation of soil, grading, removal and replacement of unsuitable soil, fill, backfill, embankment and compaction more specifically described as follows:
 - 1) Earthwork operations generally consist of excavation and embankment of soil materials from the existing elevations to the proposed elevations.
 - 2) Embankment necessary to achieve the proposed elevations may consist of in situ soils, whether classified as suitable or unsuitable, or imported suitable soil material. All imported soil material for embankment is to be included in the Contract price.
 - 3) Soil material categorized as sub-grade is to be imported suitable soil. The Owner reserves the right to decline imported sub-grade material should in-situ suitable material be encountered and may seek a credit for imported, placed and compacted sub-grade per the Unit Price Schedule.
 - 4) Where unsuitable soil materials are encountered under or around sidewalks, pipes, exfiltration trenches, or structural elements, the Owner reserves the right to specify removal and replacement of unsuitable soil with imported suitable soil. All imported suitable soil material for placement under of around structural elements shall be included in the Contractor's Price.

1.2 RELATED SECTIONS

- A. Section 01410 – Materials and Installation Testing
- B. Section 02100 – Site Preparation
- C. Section 02205 – Clearing and Grubbing
- D. Section 02210 – Finish Grading

1.3 REFERENCES

- A. FDOT Standard Specifications for Road and Bridge Construction
- B. FDOT Design Standards
- C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- D. AASTHO M-145 - Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

1.4 PROJECT CONDITIONS

- A. Locate existing underground utilities in areas of work. Provide adequate means of support and protection during earthwork operations.

- B. Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult utility owner immediately for directions. Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
- C. Do not interrupt existing utilities serving occupied facilities.
- D. Use of Explosives: If the use of explosives is necessary for the execution of the Work, and the use of explosives is allowed by local government, the Contractor shall conduct their blasting operations in conformance with these specifications and all applicable state and local codes and regulations.
 - 1) The contractor shall obtain a testing laboratory to perform pre- and post-blasting surveys of all nearby structures at no cost to the Owner.
- E. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

PART 2 PRODUCTS

2.1 SOIL MATERIALS

- A. Satisfactory or Suitable Soil Materials: ASTM D2487 soil classification groups GW, GP, GP-GM, and SW.
- B. Unsatisfactory or Unsuitable Soil Materials: ASTM D2487 soil classification groups GM, GC, SW, SM, SC, CL, ML, OL, CH, MH, OH, and PT.
- C. Satisfactory and unsatisfactory soil materials for roadway embankment, including pipe trench backfill under roadways, shall meet the requirements as defined in AASHTO M-145 soil classification groups and FDOT index 505.
- D. Satisfactory materials encountered during excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Engineer, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials.
- E. Sub-base material
 - 1) Satisfactory materials may be Select, Structural, or Common fill.
- F. Select or Structural Fill
 - 1) Select or Structural fill material shall be a satisfactory soil material, well graded, consisting of a minimum of 60 percent clean medium fine grain sized quartz sand, free of organic, deleterious and/or compressible percent clean medium fine grain sized quartz sand, free of organic, deleterious and/or compressed material. Rock in excess of one inch in diameter shall not be permitted.
- G. Common Fill
 - 1) Common fill material shall be a satisfactory soil material containing no more than 20 percent by weight finer than No. 200 mesh sieve. It shall be free from organic matter, muck, marl, and rock exceeding 2 1/2 inches in diameter.

H. Course Aggregate

- 1) Course aggregate, or gravel, shall be used for rock bedding, drainage rock or as otherwise depicted in the Drawings. Unless otherwise noted, course aggregate shall consist of washed and graded crushed limerock meeting FDOT specification 901, size number 57 or approved equal.

I. Sand

- 1) Where specified, sand, clean sand, silica sand or other nomenclature shall refer to silica sand meeting FDOT specification 902-2.

J. Satisfactory or suitable soil materials shall free of muck, clay, rock, or gravel larger than 2-1/2 inches in any dimension, debris, trash, waste, frozen materials, broken concrete, masonry, rubble, vegetable or other similar materials or deleterious matter. Materials of this nature encountered during the excavation which, in the opinion of the Engineer, is not suitable for reuse shall be stockpiled for disposal as unsuitable materials.

K. Material substitutions may be permitted if accompanied by a Geotechnical Engineer's report substantiating the proposed substitution which is approved by the Engineer and is at no cost to the Owner.

PART 3 EXECUTION

3.1 EXCAVATION

A. The contractor shall perform trench excavations in accordance with applicable trench safety standards and is responsible to determine any safety or safety related standards that apply to the Project. The Owner and Engineer are not responsible to review and/or assess safety precautions, programs and costs, and the means, methods, techniques or technique adequacy, reasonableness of cost, sequences, and procedures of any safety precaution, including, but not limited to, compliance with any and all requirements of Florida Trench Safety Act.

B. Excavation is Unclassified, and includes excavation to sub-grade elevations indicated, regardless of character of materials and obstructions encountered.

C. Unauthorized Excavation: Removal of materials beyond indicated sub-grade elevations or dimensions without specific direction. Unauthorized excavation, as well as remedial work directed by Engineer, shall be at Contractor's expense.

D. Additional Excavation

- 1) Where unsuitable soil materials are encountered under or around structural elements, the Owner reserves the right to specify removal and replacement of unsuitable soil with imported suitable soil.

E. Stability of Excavations

- 1) Slope sides of excavations to comply with local codes and ordinances having jurisdiction.
- 2) Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
- 3) Maintain sides and slopes of excavations in safe condition until

completion of backfilling.

- F. Shoring and Bracing
 - 1) Establish requirements for trench shoring and bracing to comply with local codes and authorities having jurisdiction.
 - 2) Maintain shoring and bracing in excavations regardless of time period excavations will be open. Carry down shoring and bracing as excavation progresses.
- G. Dewatering
 - 1) The bottom of the excavations shall be firm and dry and, in all respects, acceptable to the Engineer.
 - 2) Prevent surface water and sub-surface or ground water from flowing into excavations. Do not allow water to accumulate in excavations.
 - 3) Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
 - 4) The Contractor shall obtain all dewatering permits as required from agencies having jurisdiction
- H. Stockpile satisfactory excavated materials where directed, until required for embankment, backfill or fill. Place, grade, and shape stockpiles for proper drainage.
- I. Excavation for Trenches: Dig trenches to the uniform width required for particular item to be installed, sufficiently wide to provide ample working room. Provide minimum 6 in. clearance on each side of pipe or conduit.
 - 1) Excavate trenches to depth indicated or required for indicated flow lines and invert elevations.
 - 2) Where rock is encountered, carry excavation 6 in. below scheduled elevation and backfill with a 6 in. layer of crushed stone or gravel prior to installation of pipe.
 - 3) For pipes or conduit 5 in. or less, excavate to indicate depths. Hand excavate bottom cut to accurate elevations and support pipe or conduit on undisturbed soil.
 - 4) For pipes or conduit 6 in. or larger, tanks and other work indicated to receive sub-base, excavate to sub-base depth indicated, or, if not otherwise indicated, to 6 in. below bottom of work to be supported.
 - 5) Except as otherwise indicated, excavate for exterior water-bearing piping so top of piping is minimum 3'-6" below finished grade.
 - 6) Grade bottoms of trenches as indicated, notching under pipe bells to provide solid bearing for entire body of pipe.
- J. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Engineer.

3.2 COMPACTION

- A. Areas to be compacted shall be moistened and compacted by either rolling, tamping or any other approved method by the Engineer in order to obtain the desired density.
- B. Hydraulic compaction will require a Geotechnical engineers' recommendation, observation, and certification at the Contractors expense.
- C. The Contractor shall inspect all compacted areas prior to further construction operations to ensure that satisfactory compaction has been obtained.
- D. All sub-grade shall be compacted as stated in the FDOT Standard Specifications for Road and Bridge Construction.
- E. All embankment shall be compacted by proof-rolling to achieve 95% of AASHTO T-99.
- F. All soil beneath structures shall be compacted to 98% of AASHTO T-180.
- G. Hydraulic compaction shall be permitted if accompanied by a geotechnical engineers' report substantiating the proposed methods. The geotechnical engineers report shall be submitted to the Engineer prior to any work and shall be at no cost to the Owner.
- H. The frequency of testing shall be as stated in the FDOT Standard Specifications for Road and Bridge Construction.
- I. All earthwork testing shall be at the expense of the Contractor unless otherwise stated in the Contract Documents.
- J. The Contractor shall instruct the testing laboratory to forward copies of all test reports to the Engineer.
- K. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.

3.3 EMBANKMENT, BACKFILL, AND FILL

- A. Place specified soil material in layers required to achieve proposed elevations:
 - 1) Place materials in layers of 8 inches loose depth for material compacted by heavy compaction equipment and 4 in. in loose depth for material compacted by hand operated tampers.
 - 2) Place materials in layers of 12 inches loose depth for material compacted by proof rolling equipment.
 - 3) Under grassed areas, use satisfactory or unsatisfactory excavated or imported soil material if approved by the Engineer.
 - 4) Under walks and pavements, use sub-base material, or satisfactory excavated or borrow material, or combination of both. Place shoulders along edges of sub-base course to prevent lateral movement with satisfactory excavated or borrow material.
 - 5) Under steps, use sub-base material.
 - 6) Under building slabs, use drainage fill material.

- 7) Under piping and conduit, use sub-base material where sub-base is indicated under piping or conduit; shape to fit bottom 90 degrees of cylinder.
- B. Backfill excavations as promptly as work permits, but not until completion of the following:
- 1) Acceptance of construction below finish grade including waterproofing and perimeter insulation.
 - 2) Inspection, testing, approval, and recording locations of underground utilities.
 - 3) Removal of shoring and bracing, and backfilling of voids with satisfactory materials.
- C. Remove all trash, roots, vegetation, debris, unsatisfactory soil materials, obstructions, and deleterious materials from ground surface prior to placement of fills. Plow strip, or break-up sloped surfaces steeper than 1 vertical to 4 horizontal so that fill material will bond with existing surface.
- D. When existing ground surface has a density less than that specified for particular area classification, break up ground surface, pulverize, moisture-condition to optimum moisture content, and compact to required depth and percentage of maximum density.
- E. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
- F. Place backfill and fill materials evenly adjacent to structures, without wedging against structures or displacement of piping or conduit. Compaction equipment used within 10 ft. of buried walls and soil supported structures shall not exceed 2000 lbs.

3.4 GRADING

- A. Grading Outside Building Lines: Grade areas adjacent to building lines to drain away from structures and to prevent ponding and as follows:
- 1) Finish to within not more than 0.10 ft. above or below required sub-grade elevations.
 - 2) Walks: Shape surface to line, grade, and cross-section, with finish surface not more than 0.10 ft. above or below required sub-grade elevation.
 - 3) Pavements: Shape surface to line, grade, and cross-section, with finish surface 1/2 in. above or below required sub-grade elevation.
 - 4) Sod: Where sod abuts pavement, sidewalks, etc., finish surface 2" below finish grade of hardscape as required to accommodate thickness of sod as not to prohibit drainage.
- B. Grading Surface of Fill under Building Slabs: Grade smooth and even, free of voids, compacted as specified, and to 1/2 in. below required elevation.

3.5 QUALITY CONTROL

- A. Perform earthwork in compliance with applicable requirements of governing authorities having jurisdiction.
- B. Contractor will engage soil testing and inspection service for quality control testing during earthwork operations.
- C. Allow testing service to inspect and approve sub-grades and fill layers before further construction work is performed.
- D. If in opinion of Engineer, based on testing service reports and inspection, sub-grade or fills which have been placed below specified density, provide additional compaction and testing at no additional expense to Owner.

3.6 CLEANING AND PROTECTION

- A. Protect newly graded areas from traffic and erosion. Keep free of trash and debris.
- B. Repair and re-establish grades in settled, eroded, and rutted areas to specified tolerances.
- C. Remove excess excavated and waste materials, including unacceptable excavated material, trash, and debris, and legally dispose of it at no cost to the Owner.

END OF SECTION

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SECTION 02205 - CLEARING AND GRUBBING**PART 1 GENERAL****1.1 DESCRIPTION**

- A. This Section includes removal and disposal of all designated trees, palms, brush, stumps, grass, roots, and other such protruding objects.

1.2 RELATED SECTIONS

- A. Section 01410 – Materials and Installation Testing
- B. Section 02100 – Site Preparation
- C. Section 02200 - Earthwork
- D. Section 02210 – Finish Grading

PART 2 PRODUCTS (NOT USED)**PART 3 EXECUTION****3.1 CLEARING AND GRUBBING**

- A. Clearing and Grubbing within areas specified in the Contract Documents or as directed by the Owner's representative included but not limited to the following:
 - 1) Removal and disposal of all designated trees, palms, brush, stumps, grass, roots, and other such protruding objects.
 - 2) Removal and disposal of fencing, existing pavement, and debris not required to remain or to be salvaged that is necessary to prepare the area for the proposed improvements.
 - 3) Contractor shall notify all utility companies or utility owners, both public and private of their intent to perform such work and shall coordinate field location of utility lines prior to commencement of construction.
 - 4) Other miscellaneous work considered necessary for the complete preparation of the overall project site is also included under this Section, included, but is not limited to, the following:
 - a. Leveling, harmonization and restoration of terrain outside the limits of construction for purposes of facilitating maintenance, proper grading and other post-construction operations.
 - b. Trimming of certain trees and shrubs within project limits for utilization in subsequent landscaping of the project.
- B. Unless otherwise shown in the Drawings or Contract Documents, Clearing and Grubbing shall be done within the following areas:
 - 1) In all athletic field areas.
 - 2) All areas where any type of excavation is to be done.
 - 3) All areas where any type of filling and embankment will be constructed.

- 4) All areas where any type of pavement will be constructed.
- 5) Other areas designated in the Plans or by the Specifications.
- 6) No clear and grubbing shall take place beyond the wetland delineation line established by the Engineer and the County Environmental Division.

C. Depths of Removal

- 1) In the areas listed below all roots and other debris shall be removed to a depth of at least one foot below ground surface. In areas where Silva Cells are proposed additional depth shall be required to remove existing roots and debris to achieve the installation of this system. The surface shall then be plowed to a depth of at least six inches and all roots exposed shall be removed to a depth of at least one foot. All stumps including subsurface roots shall be completely removed to the satisfaction of the Landscape Architect.

D. Trees to Remain: As an exception to the above provisions, where so directed by the Existing Tree Disposition Plan, the Landscape Architect or Engineer, desirable trees within the clearing limits shall be protected and left standing. No equipment shall stand, stop, or travel across or inside the drip line of any trees or vegetation designated to be saved or protected. Trees and Palms noted to remain shall be protected utilizing tree protective barricades per the details.

E. Boulders: Any rocks or boulders greater than two (2) inches in diameter laying on the top of the existing surface or otherwise encountered during the Clearing and Grubbing shall be removed and disposed of by the Contractor. No boulders or rock shall be left or placed on-site.

3.2 SELECTIVE CLEARING AND GRUBBING

- A. Selective Clearing and Grubbing shall consist of removing and disposing of all vegetation, obstructions, etc. as provided above except that in non-structural areas where the Contractor so elects, roots may be cut off to a depth of 24" below finish grade. Stumps shall be completely removed. Undergrowth shall be completely removed except in areas designated by the Landscape Architect for aesthetic purposes.
- B. Desirable trees, that are designated by the Landscape Architect to remain, shall be protected and trimmed in such a way to avoid damage to limbs during construction. All pruning of trees and palms shall be performed by, or under the direct supervision of a certified arborist hired by the Contractor.

3.3 ERADICATION OF EXOTIC VEGETATION

- A. N/A

3.4 REMOVAL OF EXISTING STRUCTURES

- A. Work specified in this Article shall include removal and disposal of existing sidewalks, footers, pipes, and structures of whatever type as specifically shown in the plans to be removed or as otherwise specified for removal in the Contract Documents. Also included are structures of whatever type or portions thereof which are encountered during construction operations. Where partial removal of a structure is approved by the Engineer, or Landscape Architect, the portion of the existing structure to remain shall be backfilled, plugged, or filled in such a way that will prevent the settlement, movement, erosion or collapse of the adjacent soils.

3.5 DISPOSAL OF MATERIALS

- A. All materials from Clearing and Grubbing operations shall be legally disposed of off-site as determined by the Contractor.
- B. All disposal costs shall be included in the Bid.

3.6 OWNERSHIP OF MATERIALS

- A. Except as may be otherwise stated in the Contract Documents, or directed by the Owner's Representative, all buildings, structures, appurtenances and other materials removed by the Contractor shall become the property of the Contractor, to be disposed of in areas provided by the Owner.

3.7 MEASUREMENT AND PAYMENT

- A. Unless stated otherwise, the cost of Clearing and Grubbing shall be incidental to the cost of construction.

END OF SECTION

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SECTION 02221 - TRENCHING, BEDDING, AND BACKFILL FOR PIPE**PART 1 GENERAL****1.1 DESCRIPTION**

- A. Furnish labor, materials, equipment, and incidentals necessary to perform all excavation, backfill, fill, grading, and slope protection required to complete the piping work shown on the Drawings and specified herein. The work shall include, but not necessarily be limited to, manholes, vaults, duct conduit, pipe, roadways, paving, bedding, backfilling, fill, required borrow; grading, disposal of surplus and unsuitable materials, and all related work such as sheeting, bracing, and dewatering

1.2 RELATED SECTIONS

- A. Section 01340 – Shop Drawings, Working Drawings, and Samples
- B. Section 02100 – Site Preparation
- C. Section 02200 – Earthwork
- D. Section 02401 – Dewatering

1.3 REFERENCES

- A. FDOT Standard Specifications for Road and Bridge Construction
- B. FDOT Design Standards
- C. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
- D. AASTHO M-145 - Standard Specification for Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes

1.4 JOB CONDITIONS

- A. The Contractor shall examine the site and review the available test borings or undertake their own soil borings prior to submitting their bid, taking into consideration all conditions that may affect their work. The Owner and Engineer will not assume responsibility for variations of sub-soil quality or conditions at locations other than places shown and at the time the available test borings were made.
- B. Existing Utilities: Locate existing underground utilities in the areas of work. If utilities are to remain in place, provide adequate means of protection during earthwork operations.
 - 1) Should uncharted, or incorrectly charted, piping or other utilities be encountered during excavation, consult the Engineer and the Owner of such piping or utility immediately for directions.
 - 2) Cooperate with Owner and utility companies in keeping respective services and facilities in operation. Repair damaged utilities to satisfaction of utility owner.
 - 3) Demolish and completely remove from site existing underground utilities

indicated on the drawings to be removed.

- C. Protection of Persons and Property: Contractor shall barricade open excavations occurring as part of this work and post with warning lights. Operate warning lights as recommended by authorities having jurisdiction.
 - 1) Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

1.5 SUBMITTALS

- A. The Contractor shall furnish the Engineer, for approval, a certificate of origin and compliance with specifications for any fill material obtained from off-site sources.
- B. At the discretion of the Engineer, the Contractor shall furnish the Engineer, for approval, a representative sample of fill material obtained from on-site sources weighing approximately 50 pounds, at least 14 calendar days prior to the date of anticipated use of such material.
- C. At the discretion of the Engineer, for each material obtained from off-site sources, the Contractor shall notify the Engineer of the source of the material and shall furnish the Engineer, for approval, a representative sample weighing approximately 50 pounds, at least 14 calendar days prior to the date of anticipated use of such material.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Satisfactory Soil Materials: ASTM D2487 soil classification groups GW, GP, SW, and SP.
- B. Unsatisfactory Soil Materials: ASTM D2487 soil classification groups GM, GC, SM, SC, CL, ML, OL, CH, MH, OH, and PT.
- C. Satisfactory and unsatisfactory soil materials for roadway embankment, including pipe trench backfill under roadways, shall meet the requirements as defined in AASHTO M-145 soil classification groups and FDOT index 505.
- D. Satisfactory materials encountered during excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Engineer, is not suitable for reuse shall be spoiled as specified herein for legal disposal at the cost of the Contractor as unsuitable materials.
- E. Sub-base material
 - 1) Refer to roadway section and/or specifications.
- F. Select or Structural Fill
 - 1) Select or Structural fill material shall be a satisfactory soil material, well graded, consisting of a minimum of 60 percent clean medium fine grain sized quartz sand, free of organic, deleterious and/or compressible percent clean medium fine grain sized quartz sand, free of organic, deleterious and/or compressed material. Rock in excess of 1 inch in diameter shall not be permitted.

G. Common Fill

- 1) Common fill material shall be a satisfactory soil material containing no more than 20 percent by weight finer than No. 200 mesh sieve. It shall be free from organic matter, muck, marl, and rock exceeding 2 1/2 inches in diameter.

H. Course Aggregate

- 1) Course aggregate, or gravel, shall be used for rock bedding, drainage rock or as otherwise depicted in the Drawings. Unless otherwise noted, course aggregate shall consist of washed and graded crushed limerock meeting FDOT specification 901, size number 57 or approved equal.

I. Sand

- 1) Where specified, sand, clean sand, silica sand, or other nomenclature shall refer to silica sand meeting FDOT specification 902-2.

J. Satisfactory soil materials shall free of muck, clay, rock, or gravel larger than 2-1/2 inches in any dimension, debris, trash, waste, frozen materials, broken concrete, masonry, rubble, vegetable or other similar materials or deleterious matter. Materials of this nature encountered during the excavation which, in the opinion of the Engineer, is not suitable for reuse shall be stockpiled for disposal as unsuitable materials.

K. Material substitutions may be permitted if accompanied by a Geotechnical Engineer's report substantiating the proposed substitution which is approved by the Engineer and is at no cost to the Owner.

PART 3 EXECUTION

3.1 GENERAL

- A. All excavation, backfill, and grading necessary to complete the work shall be made by the Contractor and the cost thereof shall be included in the Contract price.
- B. Material shall be furnished as required from off-site sources and hauled to site.
- C. The Contractor shall take all necessary precautions to maintain the work area in a safe and workable condition.
- D. The Contractor shall protect their work at all times by flagging, marking, lighting, and barricading. It shall also be the Contractor's responsibility to preserve and protect all above and underground structures, pipelines, conduits, cables, drains, or utilities which are existing at the time they encounter them. Failure of the Drawings to show the existence of these obstructions shall not relieve the Contractor from this responsibility. The cost of repair of damage which occurs to these obstructions during or as a result of construction shall be borne by the Contractor without additional cost to the Owners.

3.2 DEWATERING

- A. The bottom of the excavations shall be firm and dry and, in all respects, acceptable to the Engineer.

- B. Prevent surface water and sub-surface or ground water from flowing into excavations. Do not allow water to accumulate in excavations.
- C. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.
- D. The Contractor shall obtain all dewatering permits as required from agencies having jurisdiction

3.3 TRENCH EXCAVATION

- A. Excavation for all trenches required for the installation of pipes shall be made to the depths indicated on the Drawings. Excavate trench to provide minimum of 30-inch clear cover over the pipe bell unless otherwise noted on the Drawings. Excavate in such manner and to such widths as will give suitable room for laying the pipe within the trenches, for bracing and supporting and for pumping and drainage facilities. The trench width at the top of the pipe shall not exceed the allowable as determined by the depth of cut and indicated on the Drawings.
- B. Rock shall be removed to a minimum 8-inches clearance around the bottom and sides of all the pipe or ducts being laid.
- C. Where pipe is to be laid in limerock bedding or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench remains undisturbed.
- D. Where the pipes or ducts are to be laid directly on the trench bottom the lower part of the trenches shall not be excavated to the trench bottom by machinery. The last of the material being excavated shall be done manually in such a manner that will give a flat bottom true to grade so that pipe can evenly and uniformly supported along its entire length on undisturbed material or bedding rock. Bell holes shall be made as required manually so that there is no bearing surface on the bells and pipes are supported along the barrel only.
- E. The bottom of the excavations shall be firm and dry and, in all respects, acceptable to the Engineer. Excavate any organic soil material from the bottom of the trench and replace with rock bedding, at least 6 inches thick.

3.4 TRENCH PROTECTION

- A. The Contractor shall perform trench excavations in accordance with applicable trench safety standards and is responsible to determine any safety or safety related standards that apply to the Project. The Owner and Engineer are not responsible to review and/or assess safety precautions, programs and costs, and the means, methods, techniques or technique adequacy, reasonableness of cost, sequences, and procedures of any safety precaution, including, but not limited to, compliance with any and all requirements of Florida Trench Safety Act.

- B. The Contractor shall construct and maintain sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction, and to protect adjacent structures, existing piping, and foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids form, they shall be immediately filled and compacted.
- C. For pipe trench sheeting, no sheeting is to be withdrawn if driven below mid-diameter of any pipe, and no wood sheeting shall be cut off at a level lower than 1 foot above the top of any pipe unless otherwise directed by the Engineer. If during the progress of the work the Engineer decides that additional wood sheeting should be left in place, the Engineer may direct the Contractor in writing. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given by the Engineer for an alternate method of removal.
- D. All sheeting and bracing not left in place, shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. All voids left or caused by withdrawal of sheeting shall immediately be refilled with sand or rammed with tools especially adapted to that purpose, by watering or otherwise as may be directed.
- E. The right of the Engineer to order sheeting and bracing left in place shall not be construed as creating any obligation on their part to issue such orders, and their failure to exercise their right to do so shall not relieve the Contractor from liability for damages to persons or property occurring from or upon the work occasioned by negligence or otherwise growing out of a failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

3.5 PIPE INTERFERENCES AND ENCASEMENT

- A. The Contractor shall abide by the following schedule of criteria concerning interferences with other utilities.
 - 1) In no case shall there be less than 0.5 feet between any two pipelines and structures.
 - 2) Concrete Encasement: Wherever there is less than 1.0-foot clearance between water mains and another pipe and the water main crosses under, then a 4" concrete encasement shall be provided for both pipes.
- B. The Engineer shall have full authority to direct the placement of the various pipes and structures in order to facilitate construction, expedite completion and to avoid conflicts.

3.6 BACKFILLING

- A. Do not backfill trenches until tests and inspections have been made and backfilling authorized by Engineer.
- B. Perform backfill in lifts and compact as specified in the Drawings.

- C. Backfilling over pipes shall begin as soon as practical after the pipe has been laid, jointed, and inspected and the trench filled with suitable compacted material to the mid-diameter of the pipe.
- D. Backfilling over ducts shall begin not less than three days after placing concrete encasement.
- E. All backfilling shall be prosecuted expeditiously as detailed on the Drawings.
- F. Any space remaining between the pipe and sides of the trench shall be packed full by hand shovel with selected earth and thoroughly compacted with a tamper as fast as placed, up to a level of one foot above the top of pipe.
- G. The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.
- H. The Contractor shall take all precautions necessary to maintain the bedding in a compacted state and to prevent washing, erosion or loosening of this bed.
- I. In areas where unsuitable soil is discovered in the pipe bedding, the unsuitable soil shall be removed and stockpiled for disposal by the contractor. Suitable soils shall be substituted at a depth as directed by the Engineer. If gravel is required by the Engineer as suitable bedding, the gravel shall be wrapped in filter fabric prior to backfill operations.
- J. Gravel bedding shall not be used under any circumstances as a drain for ground water.
- K. In locations where pipes pass through building walls, the Contractor shall take the following precautions to consolidate the refill up to an elevation of at least 1 foot above the bottom of the pipes:
 - 1) Place structural fill in such areas for a distance of not less than 3 feet either side of the centerline of the pipe in level layers not exceeding 6-inches in depth.
 - 2) Wet each layer to the extent directed and thoroughly compact each layer with a power tamper to the satisfaction of the Engineer.

3.7 COMPACTION

- A. Perform compaction and compaction tests as specified in the Drawings.
- B. Hydraulic compaction shall be permitted if accompanied by a Geotechnical Engineer's report substantiating the proposed methods. The Geotechnical Engineer's report shall be prepared and submitted to the Engineer prior to any work and shall be at no cost to the Owner.

3.8 GRADING

- A. Grading shall be performed at such places as are indicated on the Drawings, to the lines, grades, and elevations shown or as directed by the Engineer and shall be made in such manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.
- B. If at the time of excavation, it is not possible to place any material in its proper section of the permanent structure, it shall be stockpiled in approved areas for later use. No extras will be considered for the stockpiling or double handling of excavated material.
- C. The right is reserved to make minute adjustments or revisions in lines or grades if found necessary as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction.
- D. Stones or rock fragments larger than 2 1/2 inches in their greatest dimensions will not be permitted in the top 6 inches of the subgrade line of all fills or embankments.
- E. All fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings, or as directed by the Engineer.
- F. In cut, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All cut and fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings or as specified by the Engineer.
- G. No grading is to be done in areas where there are existing pipelines that may be uncovered or damaged until such lines which must be maintained are relocated, or where lines are to be abandoned, all required valves are closed and drains plugged at manholes.
- H. The Contractor shall replace all pavement cut or otherwise damaged during the progress of the work as specified elsewhere herein or as shown on the Drawings.

3.9 DISPOSAL OF UNSUITABLE AND SURPLUS MATERIAL

- A. All surplus and unsuitable excavated material shall be disposed of at the Contractor's cost in one of the following ways as directed by the Engineer.
 - 1) Transport to soil storage area on Owner's property and stockpile or spread as directed by the Engineer.
 - 2) Transport from Owner's property and legally dispose of. Any permit required for the hauling and disposing of this material beyond Owner's property shall be obtained prior to commencing hauling operations. Copies of all required permits shall be provided to the Engineer.

- B. Suitable excavated material may be used for fill if it meets the specifications for common fill and is approved by the Engineer. Excavated material so approved may be neatly stockpiled at the site where designated by the Engineer provided there is an area available where it will not interfere with the operation of the facility nor inconvenience traffic or adjoining property owners.

END OF SECTION

SECTION 02240 - DEWATERING**PART 1 GENERAL (NOT USED)****PART 2 PRODUCTS (NOT USED)****PART 3 EXECUTION****3.1 GENERAL**

- A. The Contractor shall be responsible for design, installation, and operation of a dewatering system to dewater specified excavations.
 - 1) The dewatering system shall be designed in accordance with the Best Management Practices (BMP's) adopted by FDEP.
 - 2) Inspection and control of dewatering system operations will be in accordance with the FDEP guidelines established in the Florida Erosion and Sediment Control Inspector's Manual (current edition).
- B. Continuously manage and control excavation water recharge in order to facilitate and not impede construction activities at all times, including weekends, holidays, and during periods of work stoppages, and furnish and install, and operate, a contingency backup dewatering system to maintain control of excavation water levels to facilitate construction (i.e.; no construction delays).

3.2 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements specified in Contract Documents and the requirements of this Section.
- B. Provide name, address, and phone numbers of all subcontractors.
- C. The Contractor shall submit a Dewatering Best Management Practices (BMP) Plan prior to the start of excavation expected to include dewatering operations. The Plan shall provide detailed descriptions of dewatering procedures to be utilized to meet the requirements of this Section. Methodologies to control dewatering discharge contamination include, but are not limited to:
 - 1) Holding tanks of adequate size and volume.
 - 2) Wellpointing systems.
 - 3) Sump pumping systems.
 - 4) Chemical precipitation of particulates.
 - 5) Filter systems and siltation controls.
 - 6) Outfall booms.
- D. The Contractor shall provide a Site Health and Safety Plan and Activity Hazard Analysis (AHA) for contaminated soil as specified in the Contract Documents and/or groundwater as specified in this Section, to include the following:
 - 1) A written description of the proposed method for temporary stockpiling, transportation, and disposal of all wastes.

- 2) Copy of permits of disposal facilities.
 - 3) Certification of disposal of all wastes.
 - 4) Directions to the nearest hospital and phone number.
 - 5) Emergency contact phone numbers.
 - 6) Laboratory analyses and sampling plan required for transportation and disposal of all wastes in accordance with applicable federal, state, and local requirements.
- E. Upon Completion of Remediation Activities, the following shall be provided:
- 1) Copy of manifests for all wastes leaving the site.
 - 2) Copy of the laboratory analyses results from all sampling activities.
 - 3) Copy of closure reports that may be required.

3.3 SURFACE WATER CONTROL

- A. Remove surface runoff controls when no longer needed.
- B. Seal off or berm catch basins in the area of construction to prevent discharge of untreated dewatering effluent or runoff from unstabilized construction areas into storm drains.
- C. All drain inlets or catch basins used for dewatering discharge shall be provided with silt and sediment removal barriers as approved by the CONSULTANT.
- D. All barriers shall be cleaned regularly to avoid sediment discharge into the storm drain system.
- E. Construction activities will be stopped at no cost to the Owner until sediment controls are properly maintained, installed, and in compliance with the dewatering permit.
- F. All barriers shall be removed upon issuance of a hurricane warning.

3.4 DEWATERING SYSTEMS

- A. Design, furnish, and install, operate, and maintain a dewatering system of sufficient size and capacity to permit excavation and subsequent construction activities in water-free conditions, and to lower and maintain the excavation area groundwater level a minimum of 2 feet below the lowest point of excavation. The dewatering system shall be designed and operated such that the system continuously maintains excavations water levels so as to maintain the excavation water level in order to allow for the initiation and completion of excavation backfill compaction and restoration activities.
- B. Dewatering systems shall include, but is not limited to, furnishing and installing wells or well points, and or other equipment and appurtenances as may be necessary, including system components or equipment, installed outside the outermost perimeter of the excavation limits, and sufficiently below lowest point of excavation, to maintain the specified or required groundwater elevation.
- C. Open trench pumping maybe permitted upon the approval of the CONSULTANT.
- D. Design and Operate Dewatering Systems:

- 1) To prevent loss of ground as water is removed.
 - 2) To avoid inducing settlement or damage to existing facilities, completed Work, or adjacent property.
 - 3) Avoid surface water pollution or discharge of sediment to storm drain systems or waterways.
- E. Provide supplemental ditches and sumps only as necessary to collect water from local seeps. Do not use ditches and sumps as primary means of dewatering. The Contractor shall not direct any flow of water over pavement surfaces. Discharge of water shall be conducted as approved by the local, state, and federal agencies and the CONSULTANT.
- F. Provide controls to prevent surface water from entering excavation pits, trenches, or stockpiled materials.

3.5 PIPELINES CONSTRUCTED UNDERWATER

- A. In the event that it is found that the water in a trench cannot be lowered by ordinary means, i.e., well points and pumps, an alternate construction method may be proposed by the Contractor. Complete details, specifications, manufacturer's descriptive literature, installation lists and any other pertinent data regarding the proposed alternate method shall be submitted as an alternate by the Contractor to the CITY PROJECT MANAGER within 5 calendar days of the time that the Contractor anticipates using such alternate method.
- B. If the CITY PROJECT MANAGER approves the alternate method in writing, it may be used, so long as the Work is performed in a manner which, in the opinion of the CONSULTANT, conforms to the method and procedure as set forth in the information supplied by the Contractor in their original application for use of an alternate method. The CITY PROJECT MANAGER may revoke approval of the alternate method if at any time, in his opinion, the Work is not conforming to any applicable portion of these Specifications.
- C. No pipeline shall be laid under water without approval of the CITY PROJECT MANAGER.
- D. If the dewatering system is eliminated or the effort reduced, and the pipe is laid underwater, additional pipe zone material will be required as backfill to the water table elevation, or to the level it was reduced to.

3.6 DISPOSAL OF WATER

- A. All water generated, pumped, or removed from excavations as a result of excavation dewatering activities shall be collected, containerized, and managed prior to discharge and or treatment at an approved discharge point or facility, in accordance with Broward County Code of Regulation, Sections 27. Contractor shall secure, obtain, and pay for all necessary local, state, and federal permits, licenses, fees, and or approvals to discharge water or perform onsite or offsite treatment and disposal. Treat water collected by dewatering operations as required by regulatory agencies, prior to discharge.
- B. Discharge water as permitted, and in regulatory compliance with Contractor obtained discharge permits/licenses.

- 1) All discharge activities shall be performed so as to prevent silt and sediment discharge and eliminate any soil erosion or flooding, or otherwise damage existing facilities, completed Work, or adjacent property.
 - 2) Maximum allowable turbidity of discharges to surface waters or storm drains will be 10 NTU's.
 - 3) Sump discharges cannot be discharged directly to storm drains or surface waters without treatment.
- C. Affected storm sewer outfalls shall be protected with floating silt booms as approved by the Broward County Environmental Protection and Growth Management Division (BCEPGMD) and the CONSULTANT. All accumulated debris resulting from the dewatering discharge collecting in the boom shall be removed on a daily basis.
- D. Visible silt plumes emanating from the area around the outfalls will be considered a failure of the silt and sediment removal measures and may result in a Notice of Violation issued by BCEPGMD. The Contractor will be responsible for all fines associated with the violation of the dewatering permit conditions issued to the Contractor.
- E. Failure to control dewatering discharges as described above and as detailed in the Florida Erosion and Sediment Control Inspector's Manual, may result in an order to cease dewatering operations until the discharge problems are corrected. No claims will be accepted for costs or delays associated with unacceptable dewatering discharge practices.
- 3.7 WELL POINT REMOVAL
- A. Well point holes shall be filled with sand which shall be washed into the hole.
- B. Well point holes located within asphalt pavement surfaces or concrete pavements, shall be filled with sand to the subgrade. The remaining hole shall be filled with nonshrink grout.
- 3.8 CONTAMINATED GROUNDWATER AND DISPOSAL REQUIREMENT
- A. If Contractor suspects, witnesses, or identifies, groundwater contamination at any time during the performance of the Work, Contractor shall notify the CITY PROJECT MANAGER immediately. Results will be obtained by the onsite mobile laboratory.

- B. If analytical testing documents and indicates elevated concentrations above FDEP action levels (Chapter 62-777, Florida Administrative Code), dewatering operations will be suspended until appropriate treatment and or construction measures can be implemented. Contractor shall not resume operations until notified to do so in writing by the CITY PROJECT MANAGER and construction of the remaining sewer pipelines in that area will be installed in the wet or normal construction activities shall be resumed in another areas determined by the CONSULTANT. There shall be no delay or mobilization claim associated with moving to another project area, unless all other Work has been completed. In addition, the local agency will be immediately notified via telephone and in writing by the Contractor. Dewatering activities in the area will not proceed until review of the matter with the local agency is resolved and written authorization is issued.
- C. The Contractor shall submit a dewatering plan to the CITY PROJECT MANAGER for review. The Contractor is advised that the SFWMD, FDOT, BCEPGMD, etc. may require that a dewatering plan, prepared by a state of Florida licensed professional engineer or registered professional geologist, be submitted and approved prior to issuance of a dewatering permit. The Contractor will retain a state of Florida licensed Professional Engineer or registered Professional Geologist to provide an initial report of potential dewatering issues in the site vicinity. The Contractor shall retain a state of Florida licensed Professional Engineer or registered geologist to provide any additional services required by regulatory agencies regarding dewatering and contaminated sites.
- D. The Contractor is advised that the BCEPGMD may have identified contaminated sites within ¼ mile radius of the project site. The Contractor may be required to provide testing and monitoring of the dewatering operations, and to institute dewatering methods and controls, as required by BCEPGMD, SFWMD, FDOT, etc. The contractor will be responsible for all costs associated with means and methods of dewatering which will be set forth by dewatering permits.
- E. Treatment of the groundwater will include three options depending on the magnitude of the contamination in the trench or as determined by the Contractor's Engineer or Geologist: Granular Activated Carbon (GAC) Treatment Vessels, Mobile Air Stripping Units, or Vacuum Truck Removal and Disposal or other approved method. The Contractor will provide a submittal list of all qualified groundwater remediation subcontractors for GAC vessel treatment/portable air stripping unit and vacuum truck disposal including phone numbers, contact names, and addresses prior to start of construction. The selected groundwater treatment/recycling facility for hauling contaminated groundwater shall also be identified.
- F. If contaminated groundwater in the dewatering trench is encountered, the remediation operations will begin once local agency approval is obtained. Contaminated water will be disposed first into a high volume holding (FRAC) tank and then treated through a GAC unit/portable air stripper or recovered into vacuum hauling trucks for disposal.

- G. Effluent water from the treatment system will be analyzed by the onsite mobile laboratory to confirm that concentrations are below regulatory limits. Effluent water will then be directed to a pre-approved alternative location as determined by local agency and/or the CONSULTANT.

END OF SECTION

SECTION 02250 - CONTAMINATED SOIL

PART 1 GENERAL

1.1 WORK INCLUDED

- A. This section covers the Work necessary to remove, transport, and properly dispose of the following wastes:
 - 1) Liquid petroleum product.
 - 2) Affected soil.
 - 3) Free petroleum product.

1.2 DEFINITIONS

- A. Liquid petroleum product (product) is fluid petroleum product partly or entirely composed of diesel fuel or gasoline.
- B. Affected soil is defined herein.
- C. Free petroleum product is defined as a liquid which forms a separate floating phase distinct from the groundwater.

1.3 SUBMITTALS

- A. Submittals shall be made in accordance with the requirements of the Contract Documents and the requirements of this Section.
- B. The Contractor Shall Provide the Following Submittals:
 - 1) A written description of the proposed method for temporary stockpiling, transportation, and disposal of all wastes.
 - 2) Copy of permits of disposal facilities.
 - 3) Certification of disposal of all wastes.
 - 4) Copy of manifests for all wastes leaving the site.
 - 5) Copy of the laboratory analyses required for transportation and disposal of all wastes in accordance with applicable federal, state, and local requirements.
 - 6) Provide name, address, and phone number of all subcontractors.

PART 2 MATERIALS (NOT USED)

PART 3 EXECUTION

3.1 LIQUID PETROLEUM PRODUCT

- A. Classification of liquid petroleum product shall be made by the Contractor's Consultant/Geologist responsible for the testing of the product.
- B. The Contractor shall remove all liquid petroleum product if discovered in the trench during dewatering operations.

- C. If the petroleum product is discovered, the product will be disposed as described herein.
- D. If contamination is discovered and it is determined that it must be removed, the Contractor shall commence remediation activities as determined by their Consultant/Geologist. During the remediation activities, the Contractor shall move to another location as determined by the CITY PROJECT MANAGER to resume normal construction activities. There shall be no delay or mobilization claim associated with moving to another project area, unless all other Work has been completed.

3.2 AFFECTED SOIL

- A. Excavation of affected soil shall be accomplished in accordance with the Contract Documents. The soil may be contaminated with petroleum product which may be partly or entirely diesel fuel, gasoline, or chlorinated solvents.
- B. Classification of affected soil for disposal purposes will be determined by the Contractor's Consultant using an Organic Vapor Monitor (OVM) with photo ionization detector or equivalent provided by the Consultant/Geologist. Soils with vapor readings higher than 10 parts per million (ppm) for diesel as defined in Chapter 62-770 of the Florida Administrative Code, are excessively contaminated and will be identified by the Consultant/Geologists for treatment and disposal. Affected soil must be placed on an impermeable barrier when temporarily stockpiled. All stockpile leachate or runoff must be collected for disposal in accordance with applicable federal, state, and local regulations. Soils designated for removal and disposal shall be prepared for shipment, transported, and disposed of in accordance with the requirements of this Section.
- C. Affected soils shall be processed by incineration at a state licensed facility. These soils shall be transported and disposed of in accordance with federal, state, and local regulations. The Contractor shall be responsible for all soil analyses required for transportation and disposal.
- D. The Contractor shall be responsible for testing soil which has been incinerated to certify the treated soil meets applicable federal, state, and local regulations for final disposal.

3.3 FREE PETROLEUM PRODUCT

- A. Some free petroleum products which may be partly or entirely diesel fuel or gasoline may be encountered during excavation activities. The Contractor shall remove free petroleum product, if necessary, when a separate floating phase greater than 0.10-inch thick is present as required by health and safety considerations. The free petroleum product shall be removed by skimming, pumping to an oil/water separator, or other approved methods.
- B. Free petroleum products shall be transported and disposed by the Contractor in accordance with federal, state, and local regulations. The Contractor is responsible for any laboratory analyses required for disposal of the free petroleum products.

3.4 TRANSPORT AND DISPOSAL

- A. Transport Regulations: The Contractor shall be responsible for the loading, labeling, placarding, marking, weighing, and transporting of all waste materials in accordance with the Florida Department of Transportation Regulations, and U.S. Department of Transportation Regulations. The Contractor shall use only transporters that are licensed and competent to haul these wastes.

3.5 WASTE CONTAINERS

- A. Each transport container of waste shall be visually inspected by the Contractor for leaks, drips, or container damage prior to being loaded. Containers which are found to be leaking or damaged shall not be loaded until the damage is repaired. The Contractor shall prepare the transport container to prevent spillage or contamination. The Contractor shall notify the CITY PROJECT MANAGER two hours before any loaded transport leaves the site.
- B. All transport containers leaving the site shall be inspected by the Contractor to ensure that no waste material adheres to the wheels or undercarriage.
- C. All vehicles on which waste is adhering shall be cleaned by sweeping tires and undercarriage or by other dry methods prior to leaving the site.

3.6 SHIPPING RECORDS

- A. The Contractor shall prepare accurate shipping records for any wastes leaving the site in accordance with applicable federal and state regulations. The Contractor shall be responsible for providing copies of the records to the CITY PROJECT MANAGER and shall immediately notify the CITY PROJECT MANAGER of any problems in completing shipments and disposal of wastes.
- B. The Contractor shall:
 - 1) Be responsible for appropriate measurement of unit quantity (weight or volume) of waste material removed from the site.
 - 2) Coordinate vehicle inspection and recording of quantities leaving the site with the CITY PROJECT MANAGER. These quantities shall be compared to recorded quantities received at the treatment or disposal facilities. The Contractor shall resolve any discrepancies occurring immediately, determining the probable cause for the discrepancy.
 - 3) Be solely responsible for any and all actions necessary to remedy situations involving waste spiked in transit.
- C. The Contractor shall ensure that a copy of the manifest is returned to the CITY PROJECT MANAGER by the designated treatment or disposal facility within 14 days of receipt of the material to be disposed.

3.7 COORDINATION

- A. The Contractor shall at any time provide the CITY PROJECT MANAGER with safe access to the Work whenever it is in preparation or progress for the purposes of conducting inspections or collecting samples. The Contractor may conduct concurrent sampling and analyses, if desired. Results of any such sampling and analysis shall be furnished to the CITY PROJECT MANAGER at no cost.

PART 4 PAYMENT**4.1 GENERAL**

- A. Payment for work in this Section is included as stated in the Bid Form. The Contractor shall be responsible for appropriate measurement of unit quantity (volume or weight) of waste material removed from the site, and for verification of those quantities with receipt records from the disposal site.

END OF SECTION

SECTION 02276 - STORMWATER POLLUTION PREVENTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. Implementation of the Stormwater Pollution Prevention Plan as depicted in the Drawings, as required by law and specified herein.
- B. Permitting as required through the Florida Department of Environmental Protection (FDEP) - Florida's National Pollutant Discharge Elimination System (NPDES) program for construction activities.
- C. Designing, providing, maintaining, and removing temporary erosion and sedimentation controls and/or Best Management Practices as necessary.
- D. Temporary erosion controls may include, but are not limited to, mulching, netting, and watering, on site surfaces and spoil and borrow area surfaces and providing interceptor ditches at ends of berms and at those locations that will ensure erosion during construction will be either eliminated or maintained within acceptable limits as established by the Owner.
- E. Temporary sedimentation controls include, but are not limited to, silt dams, traps, barriers, booms/curtains, and appurtenances at the foot of sloped surfaces and other areas that will ensure sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the Owner.

1.2 RELATED SECTIONS

- A. Section 01010 – Summary of Work
- B. Section 01015 – General Requirements

1.3 REQUIREMENTS

- A. Obtain a Generic Permit for Stormwater Discharge from Large and Small Construction Activities (CGP). From the Florida Department of Environmental Protection (FDEP) for all construction disturbances in size greater than one (1) acre.
 - 1) Disturbance includes clearing, grading and excavating.
 - 2) Projects which disturb less than one (1) acre will not require a CGP but will require the appropriate Best Management Practices and directed by the Owner, Engineer or governing authorities.
- B. Implement and maintain a Stormwater Pollution Prevention Plan (SWPPP).
 - 1) The SWPPP found in the Drawings is pictorial in nature, is provide to depict the general layout of SWPPP elements and is not intended to depict all the possible requirements.
 - 2) The Contractor is the entity that owns and operates the project and has authority to ensure compliance and is therefore considered the "Operator".
 - 3) Neither the Owner nor the Engineer is responsible to specify, implement, or maintain the SWPPP plan.

- C. Submit a CGP Notice of Intent (NOI) and the commencement of Construction.
- D. Submit reporting forms throughout the duration of Construction.
- E. Submit a CGP Notice of Termination (NOT) to discontinue permit coverage. An NOT may be submitted only when the site meets the eligibility requirements for termination specified in the CGP.
- F. For additional information on the NPDES Stormwater Program including all regulations and forms cited in the brochure visit: www.dep.state.fl.us/water/stormwater/npdes/.

PART 2 PRODUCTS

2.1 EROSION CONTROL

- A. Mulch: FDOT type per Section 981-3.2, Green Mulch
- B. Netting: Fabricated of material acceptable to the Owner.
- C. Other means as necessary and approved by FDEP and the Owner.

2.2 SEDIMENTATION CONTROL

- A. Bales: Clean, seed free cereal hay type
- B. Netting: Fabricated of material acceptable to the Owner
- C. Filter stone: Crushed stone conforming to Florida Department of Transportation specifications.
- D. Other means as necessary and approved by FDEP and the Owner.

PART 3 EXECUTION

3.1 EROSION CONTROL

- A. Minimum procedures for mulching and netting are:
 - 1) Apply mulch loosely to a thickness of between 3/4 inch and 1 1/2 inches.
 - 2) Apply netting over mulched areas on sloped surfaces.

3.2 SEDIMENTATION CONTROL

- A. Install and maintain silt dams, traps and barriers, and booms/curtains as shown on the approved schedule. Hay bales and fabric that deteriorates and filter stone that becomes dislodged shall be replaced as required.

3.3 PERFORMANCE

- A. Should any of the temporary erosion and sediment control measures employed by the Contractor fail to produce results that comply with the requirements of the Owner, Contractor shall immediately take any and all necessary steps to correct the deficiency at his own expense.

END OF SECTION

SECTION 02420 - SOIL PREPARATION AND SOIL MIXES**PART 1 GENERAL****1.1 DESCRIPTION**

- A. Provide all labor, materials, necessary equipment and services to complete the soil preparation and soil mixes work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".
- B. Including, but not limited to:
 - 1) Topsoil
 - 2) Soil Conditioners
 - 3) Planting Soil Mixes

1.2 RELATED WORK

- A. Section 02430 – Sodding
- B. Section 02420 – Soil Preparation and Soil Mixes
- C. Section 02450 – Tree and Plant Protection
- D. Section 02491 - Subsurface Tree Staking Systems Utilizing PDEA
- E. Section 02945 – Silva Cell system (Silva Cell 2)

1.3 QUALITY ASSURANCE

- A. Testing Agency: Approved Independent testing laboratory utilizing EPA, ASTM, USGS methods.
- B. Requirements or Regulatory Agencies: Conform to requirements of all Municipal, County and State agencies.
- C. Reference standards.

1.4 SUBMITTALS

- A. Test Reports: Test reports shall consist of pH range, major and minor element analysis, including but not limited to Ammonia, Nitrate, Phosphorus, Potassium, Magnesium, Calcium, Sulfur, Boron, Zinc, Manganese, Iron, Copper and soluble salt and any other materials designed by the Landscape Architect. Recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring the nutrient and ph to an acceptable or optimum range for planting. Reports shall be identified by project name, date, and soil mix type.
 - 1) Results of topsoil (on-site existing soil) analysis.
 - 2) Results of planting/topsoil mix(es) analysis: One test required per each type of soil mix.
- B. Certificates
 - 1) The Contractor must submit certificates from suppliers stating that the planting/topsoil mix, turfgrass sod and other landscape material used

comply with requirements specified.

- 2) Manufacturer's certificate of fertilizer's chemical composition including but not limited to percentage and derivation of nitrogen, phosphorus, potassium, and micronutrients.
- 3) Testing laboratory certification that content of soil conditioners meets specification requirements.

C. Soil Samples

- 1) Submit a one-pound sample of each soil mix specified.

D. All State, County and Municipal governmental regulations must be met including any licensing or certifications requirements for uses or applications.

E. Costs of all submittals, including but not limited to Test reports, Certificates, Licenses, and samples will be borne by the Contractor.

1.5 JOB CONDITIONS

- A. Contractor shall become familiar with the site and the required work to complete this section in accordance with the drawings and what is specified herein.
- B. Responsibility for finish grading shall occur under a separate contract. Any changes, modifications, or disturbances to the finish grading shall be corrected by the responsible contractor.
- C. PROTECTION: Protect and avoid any damage whatsoever to existing walks, pavement, curbs, utilities, plant material, and any other existing work.

PART 2 PRODUCTS

2.1 TOPSOIL

- A. Topsoil shall be an 80-20 mix, 80% freshwater sand (medium to coarse grade) and 20% inland glades muck thoroughly mixed with a commercial shredder/blender or equivalent. It shall be suitable for ornamental plant growth and free from hard clods, stiff clay, hardpan, gravel, subsoil, brush, large roots, weeds, refuse or other deleterious material, and of reasonably uniform quality. No site mixing will be acceptable.
- B. Mechanical analysis: Topsoil and soil mixture(s) shall meet these specifications and the following mechanical analysis and shall be proportioned by volume rather than by weight.

Sieve Size	% Passing By Dry Weight
1 inch	99-100
1/4 inch	97-99
No. 100	40-60

Materials larger than one-half inch shall be disposed of off the site or as directed by the architect. Existing leaf litter and plant material shall be excluded from topsoil and soil mix.

- C. Maximum Soluble Salts: 300 ppm.
- D. Sterilize topsoil to be used in soil mixture(s) to make free of all viable nut grass, and other undesirable weed seeds.
- E. A sample of the sand and a sample of the 80-20 sand and muck mixture shall be submitted to the Owner for approval prior to installation.
- F. The Landscape Architect has the right to reject topsoil utilized at any time during the execution of work that does not meet specifications. Topsoil and planting soil will be tested at Owners request for suitability of horticultural use.

2.2 SOIL CONDITIONERS

- A. Dolomitic Limestone: Approved product, designated for agriculture use.
- B. Aluminum Sulfate: Manufacturer's standard commercial grade.
- C. Florida Peat: Suitable for plant growth, capable of sustaining vigorous plant growth, and specifically pulverized for agricultural use. Florida peat shall be free of deleterious materials that would be harmful to plant growth, shall be free of nematodes, shall be of uniform quality, and shall have a pH value between 5.5 and 6.5 (as determined in accordance with ASTM E70). Florida peat shall be sterilized to make free of all viable nut grass and other undesirable weeds.
- D. Pesticides: As recommended by applicable Agricultural Public Agencies.
- E. Herbicides: As recommended by applicable Agricultural Public Agencies.
- F. Soil Fumigants: As recommended by applicable Agricultural Public Agencies.
- G. Fertilizer:
 - 1) Specified commercial grade fertilizer to comply with State of Florida Fertilizer laws. Chemical designation shall be as specified with at least 50% of the nitrogen derived from a non-water soluble organic source and all potash to be derived from sulfate forms for all plantings excluding sod and plantings on the lake edges.

 Chemical designation shall be as specified with at least 80% of the nitrogen derived from a non-water-soluble organic source and all potash to be derived from sulfate forms for all sod and plantings on lake edges.

 The following minor elements shall be included:

2.2% ZnO	0.25% CuO
4.0% MgO	0.005% Fe2O3
0.5% MnO	0.1% B2O3
 - 2) Federal Specifications O-F0241 Type 1, Grade A or B.
 - 3) The chemical designation for granular fertilizer for all plantings shall be 12-8-8.
- H. Water: Free of substances harmful to growth of plants. Water shall also be free of staining agents as well as elements causing odors.
- I. Soil Sterilizers: As recommended by State and Local Agriculture agencies.

- J. Sand: Clean, white, coarse-grained builders sand, free of substances harmful to growth of plants.
- K. Supply complete information on all analysis/test methodologies and results; laboratory certifications, manufacturer's specifications, and agency approvals to Landscape Architect prior to placement of soil conditioners. Landscape contractor shall make all modifications and improvements to soil and soil mixes deemed necessary by Landscape Architect to meet requirements herein, and to ensure proper growing medium for all plant material without cost to Owner, prior to planting.

2.3 PLANTING SOIL MIXES

- A. Planting soil shall be an evenly blended mixture of 80% sand/20% muck, (with any other soil conditions per Testing Agency recommendations) specified to each cubic yard of soil and thoroughly mix. Mix shall be suitable for plant growth and free from hard clods, stiff clay, hardpan, gravel, brush, large roots, nematodes, weeds, refuse, or other deleterious material, and of reasonably uniform quality.
- B. Palms: Planting soil mixture to be placed as backfill around the root balls of all Palms shall consist of a mixture as specified above.

Note: Bottom 1/4 of planting pit shall be backfilled with clean, coarse-grained builder's sand.
- C. Trees, Shrubs, and Groundcovers: Planting soil mixture to be placed as backfill around the root balls of all trees, shrubs, and groundcovers shall consist of a mixture of 80% sand and 20% muck.
- D. Sterilize planting soil mixtures to make free of all viable nut grass, and other undesirable weed seeds.
- E. All planting soil mixes shall be thoroughly blended to form a uniform planting medium suitable for exceptional plant growth.
- F. Test PH of existing soil and planting soil mixtures by method acceptable to current industry standards. If pH is not between 6.0 and 7.0, add approved soil conditioner/additive to bring PH within that range.
- G. Supply complete information on all analysis/test methodologies and results; laboratory certifications, manufacturer's specifications, and agency approvals and recommendations shall be made by the testing agency as to the type and quantity of soil additives required to bring the nutrient and pH to an acceptable or optimum range for planting to Landscape Architect prior to placement of soil mixtures. In addition, provide Landscape Architect with thoroughly mixed sample of all soil mixes for approval prior to placement (note PH ranges). Landscape Contractor shall make all modification and improvement to soil mixes deemed necessary by Landscape Architect to meet requirements herein, and to ensure proper growing medium for all plant material without cost to Owner, prior to planting.

PART 3 EXECUTION

3.1 INSPECTIONS

- A. Examine areas to receive soil preparation to assure work of other trades has been completed.
- B. Verify that plants to remain undisturbed have been clearly identified and protected from injury during construction. If not, identify and protect plants to remain according to procedures set forth in Section 02490 - Trees, Plants and Groundcover. Refer to Protective Fencing on plans.
- C. Remove all construction materials and debris from all areas to be landscaped, without additional expense to Owner, prior to subsoil preparation.
- D. Do not proceed with soil preparation until all unsatisfactory conditions are corrected.

3.2 SITE PREPARATION

- A. General: Within the entire area to be landscaped as shown on the drawings, the contractor shall complete the following site topsoil preparation items to eradicate all existing weed and/or natural groundcover. Initiate site topsoil preparation as stated herein and coordinate all work with the existing underground sprinkler system and electrical lines.
- B. Post Emergence Herbicide: Apply "Roundup" as manufactured by Monsanto Corp. according to manufacturer's recommended rate and specification within the limits of all areas to be landscaped not specified as existing, to be relocated, or to be removed. Protect existing plants from overspray.
- C. Pre-Emergence Herbicide: Apply "Ron-Star" or approved equal to all areas to be landscaped according to the manufacturer's recommended rate and specification. Contractor shall be responsible to re-apply appropriate herbicide to eradicate all remaining weeds and maintain a weed-free condition in all areas throughout all landscape planting operations.

3.3 PERFORMANCE

- A. Subsoil: Remove all debris, gravel, rocks and other deleterious material, within 12 inches of surface in areas to receive topsoil mixture, from the project site. Fine grade subsoil to assure finish grades are achieved by adding the specified depth of topsoil/planting mixture.
- B. Soil mixtures:
 - 1) Remove rocks and other objects
- C. Smooth soil mixtures to two 2 inches below top of surrounding paving, wherever planting beds abut paved surfaces.
 - 1) Do not compact planting soil mixture but do wet-soak planting areas to assure proper settlement. Replace topsoil/planting soil mixture to specified grade after watering, where necessary.
 - 2) Smooth topsoil to two inches (2") below finish grade in areas to be sodded. Remove plant material not indicated as existing or be relocated in order to adhere to sod lines.

- 3) Prior to installing planting soil, test tree pits and planting areas for percolation. If areas do not drain, it is the contractor's responsibility to assure percolation by approved means.
- 4) Remove limerock or soil cement in tree planter islands within paved parking areas at the depth specified on the plans. Do not damage sub-base material for paved surfaces. Assure percolation and then backfill with approved planting soil mix.

3.4 CLEAN-UP

- A. Immediately clean up spills, soil and conditioners on paved and finished surface areas.
- B. Remove debris and excess materials from project site immediately.

END OF SECTION

SECTION 02430 - SODDING**PART 1 GENERAL****1.1 DESCRIPTION**

- A. Provide all labor, materials, necessary equipment and services to complete the turfgrass Sodding work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

1.2 RELATED SECTIONS

- A. Section 02200 – Earthwork
- B. Section 02210 – Finish Grading
- C. Section 02420 – Soil Preparation and Soil Mixes
- D. Section 02450 – Tree and Plant Protection
- E. Section 02945 - Silva Cell system (Silva Cell 2)
- F. Section 02491 - Subsurface Tree Staking Systems Utilizing PDEA

1.3 QUALITY ASSURANCE

- A. Standards: Federal Specifications (FS) 0-F-241c (1), Fertilizers, Mixed, Commercial.
- B. Requirements or Regulatory Agencies: Conform to the requirements of the State Department of Agriculture.

1.4 SUBMITTALS

- A. Growers Certifications:
 - 1) Turfgrass Sod species and location of field from which turfgrass sod is cut.
 - 2) Compliance with state and federal quarantine restrictions. Manufacturer's certification of fertilizer and herbicide composition.
 - 3) All Contractors' licenses and or certifications for the uses and or application of herbicides, pesticides, and fertilizers per the State, County and governing municipality.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver turfgrass sod on pallets.
- B. Protect root system from exposure to wind or sun.
- C. Protect turfgrass sod against dehydration, contamination, and heating during transportation and delivery. Such protection shall encompass the entire period during which the turfgrass sod is in transit, being handled, or in temporary storage. Evidence of inadequate protection against drying out shall be cause for rejection.
- D. Do not deliver more turfgrass sod than can be installed within 24 hours.

- E. Keep stored turfgrass sod moist and under shade or covered with moistened burlap.
- F. Do not break, tear, stretch, or drop turfgrass sod. The Engineer may reject sod that has been damaged by poor handling.
- G. Unless otherwise authorized by Engineer, the Contractor shall notify the Engineer at least 48 hours in advance of anticipated delivery date of the turfgrass sod. A legible copy of the invoice showing species and variety of the turfgrass sod included for each shipment shall be submitted to the Engineer for approval.

1.6 JOB CONDITIONS

- A. Begin installation of turfgrass sod after preceding related work is accepted.
- B. Environmental Requirements:
 - 1) Install turfgrass sod during months acceptable to the Engineer.
 - 2) Do not install turfgrass sod on saturated soil.
- C. Protection: Erect signs and barriers against vehicular traffic on areas prepared for sod.

1.7 GUARANTEE

- A. Guarantee turfgrass sod for period of twelve months after date of Final Approval.
- B. Replacement turfgrass sod under this guarantee shall be guaranteed for twelve months from the date of installation.
- C. Repair damage to other plants during turfgrass sod replacement at no cost to the Owner.

PART 2 PRODUCTS

2.1 TURFGRASS SOD

- A. Turfgrass Sod Species: Refer to species indicated on approved Landscape plans.
 - 1) Turfgrass Producers International Grade: Premium Grade Turfgrass Sod.
- B. All turfgrass sod shall conform to the following requirements:
 - 1) Furnish in pads that are not stretched, broken, or torn.
 - a. Turfgrass Sod pads shall be 18x24 inches in size (plus or minus 5%) with a 1-1/2 inch thickness (excluding top growth and thatch). Broken and torn or uneven ends will not be accepted.
 - 2) Uniformly mowed height when harvested:
 - a. Turfgrass Sod - 2 inches in height.
 - 3) Thatch: Maximum 1/2 inch uncompressed.
 - 4) Inspected and found free of diseases, nematodes, pests, and pest larvae, by entomologist of State of Florida Department of Agriculture.
 - 5) Weeds:

- a. Free of horse grass, nut grass or other objectionable weeds or weed seeds.

- 6) Uniform in green color, leaf texture, and density.

2.2 WATER

- A. Free of substances harmful to plant growth, objectionable odor or staining agents.

2.3 FERTILIZER

- A. FS 0-F-241c(1), Grade A or B.
- B. The Chemical designation for slow release granular fertilizer with minor trace elements in addition to 12% Nitrogen, 8% Phosphorous, and 8% Potassium (Lesco or approved equal) shall have at least 50% of the nitrogen from a non-water-soluble organic source for all plantings except on lake banks.
- C. Apply and distribute by methods and rates as recommended by manufacturer.
- D. All State, County, and Municipal governmental regulations must be met including any licensing or certification requirements for uses and/or applications.

2.4 HERBICIDES

- A. As recommended by the State of Florida Department of Agriculture.
- B. Post-emergent Herbicide: Roundup as manufactured by Monsanto Corp. or approved equal.
- C. Pre-emergent Herbicide: Ron Star or approved equal.
- D. When next to an aquatic water body, an approved aquatic herbicide or approved equal must be utilized that will meet the State, County or Municipal requirements.
- E. All State, County and municipal governmental regulations must be met including any licensing or certification requirements for uses or applications.

PART 3 EXECUTION

3.1 INSPECTION

- A. Verify that excavation for turfgrass sod is 4 inches below finish grade and approved Planting/Topsoil Mix to depth of 2 or more inches for turfgrass sod (2 inches) to meet finish grade.
- B. Water dry soil to depth of 6 inches 48 hours before turfgrass sodding.

3.2 INSTALLATION

- A. All areas to be turfgrass sodded shall receive finish grading per Section 02210.
- B. Transplant turfgrass sod within 48 hours after harvesting.
- C. Turfgrass Sod coverage must provide 100% coverage at Final Approval.
- D. Begin turfgrass sodding at bottom of slopes. When installing turfgrass sod adjacent to a water body, install turfgrass sod to the waterline.

- E. Lay first row of turfgrass sod in straight line with long dimension of pads parallel to slope contours.
- F. Butt side and end joints. Ensure that joints are tight, thereby eliminating the need to patch and/or top-dress to eliminate gaps.
- G. Stagger end joints in adjacent rows.
- H. Do not stretch or overlap rows.
- I. Water turfgrass sod immediately after transplanting.
- J. Top dressing for turfgrass sodded areas may be clean sand(sterilized), mined from fresh water sources. Sand mined from saltwater is unacceptable. Sand shall be free from construction debris, weeds, turfgrass sod, biodegradable materials, noxious pests and diseases and other deleterious materials.

3.3 LAWN ESTABLISHMENT

- A. Maintenance of sodded areas shall begin immediately after so installation and shall continue until final approval. Maintenance shall consist of protecting, watering, weeding, cutting, fertilizing, repairing eroded area, and re-sodding dead and/or damaged turfgrass sod.
- B. Watering:
 - 1) Keep turfgrass sod moist during first week after planting.
 - 2) After first week, supplement rainfall to produce a total of 2 inches per day until final acceptance.
 - 3) It is the contractors' responsibility to water all plant material.
- C. Mowing:
 - 1) Maintain turfgrass sod between 2 inches and 2-1/2 inches in height. When turfgrass sod reaches 3 inches in height, mow to 2 inches in height.
 - 2) Do not cut off more than 40% of grass leaf in single mowing.
 - 3) Remove all turfgrass sod clippings throughout.
- D. Re-turfgrass sod areas which in the opinion of the Engineer is required to establish a uniform stand of turfgrass sod.
- E. Weed Eradication:
 - 1) Apply specified or approved equal post-emergent herbicide per manufacture's rate and method of application to all areas to receive sod.
 - 2) Apply specified or approved equal pre-emergent herbicide before sodding and between second and third mowing, per manufacturer's rate and method of applications.
 - 3) Verify that the herbicide and applicant technique will not damage sod prior to application and replace all damaged sod and any other landscaping due to herbicide at no cost to the owner.
- F. Fertilizer: Apply fertilizer uniformly at manufacturer's recommended rate 30 days after turfgrass sodding and at three-month intervals thereafter. Water in to avoid "burning" or damaging turfgrass sod.

- G. Establishment period shall extend until final acceptance by the Owner according to the conditions of the Contract.

3.4 CLEANING

- A. Immediately clean spills from paved and finished surface areas.
- B. Remove debris and excess materials from project site.
- C. Dispose of protective barricades and warning signs at termination of lawn establishments.

END OF SECTION

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SECTION 02450 - TREE AND PLANT PROTECTION

PART 1 GENERAL

1.1 DESCRIPTION

- A. Provide all equipment and materials and do all work necessary to protect existing trees and plants from damage as a result of the Contractor's operations.

1.2 RELATED SECTIONS

- A. Section 02410 – Shrub and Tree Relocation
- B. Section 02420 - Soil Preparation and Soil Mixes
- C. Section 02430 - Sodding
- D. Section 02490 - Trees, Plants and Groundcovers
- E. Section 02491 - Subsurface Tree Staking Systems Utilizing PDEA
- F. Section 02945 - Silva Cell system (Silva Cell 2)

1.3 REFERENCED STANDARDS

- A. Comply with applicable requirements of the following standards. Where these standards conflict with other specified requirements, the most restrictive requirements shall govern.
 - 1) International Society of Arboriculture (ISA): Guide for Establishing Values of Trees and Other Plants

1.4 SUBMITTALS

- A. Proposed methods, materials to be employed, and schedule for effecting tree and plant protection shall be submitted for approval.

1.5 DAMAGE PENALTIES

- A. If any trees or shrubs are damaged, and replacement is required, a number and diameter of trees or shrubs of the same species and variety, as specified by the Owner, shall be furnished and planted by the Contractor. The total inch diameter of the replacement trees or shrubs shall equal the diameter of the tree or shrub to be replaced. The Contractor shall not be liable for any loss or damage which occurs while the Contractor is complying with instructions given by the Owner.

PART 2 PRODUCTS

2.1 TREE PROTECTION FENCING

- A. Tree protection fencing shall be mesh fence, 6 ft. high minimum, with 4"x4"x6' pressure treated wood posts.
- B. Posts shall be spaced 10 ft. O/C (max)
- C. Fencing other than that specified above shall be subject to the approval of the Engineer.

PART 3 EXECUTION**3.1 INSTALLATION OF FENCING**

- A. Prior to the start of demolition work and clearing and grubbing operations, tree protection fencing shall be installed in accordance with the following:
 - 1) Fencing shall be installed at the tree protection areas as directed by the Engineer or Owner.
 - 2) Fencing shall be located along the cut and fill lines staked by the project surveyor and approved by the Engineer or Owner.

3.2 ROOT PRUNING

- A. Prune minimum necessary to remove injured twigs and branches, deadwood, and suckers. Pruning shall be done with regard to natural form of plant material or as directed by the Engineer or Owner.
- B. Do not prune prior to delivery to site.
- C. All cuts one-inch in diameter or larger made during pruning of any plant material shall be painted with commercial grade sealant as approved and directed by Owner.
- D. Pruning cuts shall be monitored to ensure proper healing and to prevent insect/disease infestation.
- E. Landscape Contractor shall perform all specialized shearing and or pruning as directed by the Owner and as shown on the drawings at no additional cost to the Owner.

3.3 CLEARING WITHIN PROTECTION AREAS

- A. Elective clearing within tree protection areas shall only be performed when and as directed by the Owner.

3.4 REMOVAL OF PROTECTION

- A. Except as otherwise indicated or requested by Owner, temporary protection devices and facilities installed during course of the work shall be removed only after all work which may injure or damage trees and plants is completed.

END OF SECTION

SECTION 02490 - TREES, PLANTS, AND GROUNDCOVER**PART 1 GENERAL****1.1 SCOPE OF WORK**

- A. Provide all labor, materials, necessary equipment and services to complete the Trees, Plants and Groundcover work, as indicated on the Drawings, as specified herein or both, except as for items specifically indicated as "NIC ITEMS".

1.2 RELATED SECTIONS

- A. Section 02200 – Earthwork
- B. Section 02210 – Finish Grading
- C. Section 02420 – Soil Preparation and Soil Mixes
- D. Section 02430 – Sodding
- E. Section 02450 – Tree and Plant Protection
- F. Section 02491 - Subsurface Tree Staking Systems Utilizing PDEA
- G. Section 02945 - Silva Cell system (Silva Cell 2)

1.3 QUALITY ASSURANCE

- A. Inspection
 - 1) Furnish plant materials inspected by State Department of Agriculture at the growing site and tagged or otherwise approved for delivery by Landscape Architect.
 - 2) Inspection at growing site does not preclude right of rejection at project site.
- B. Furnish plant materials certified by State Department of Agriculture to be free from harmful insects or apparent disease. Verify that all plant material is free of harmful insects and disease.
- C. All plant material shall be Florida #1 or better as defined by the Florida Department of Agriculture "Codes and Standards for Nursery Plants Part I and II".
- D. Plant material shall be shade or sun grown, and/or acclimatized depending on planting location.

1.4 SUBMITTALS

- A. Certificate of inspection of plant material by State Authorities.
- B. Test Reports: Analysis of samples from planting soil supply areas.
- C. Maintenance Instruction: Prior to the end of the maintenance period, furnish three copies of written maintenance instructions to the Owner's Representative and Landscape Architect for maintenance and care of installed plants throughout their full growing season.

1.5 DELIVERY, STORAGE AND HANDLING

A. Inventory:

- 1) Verify that species of plants in holding area matches that on plant list and drawings.

B. Preparation for Delivery:

- 1) Prune head and/or roots of all trees under direction of Landscape Architect, and as required to assure safe loading, shipment and handling without damaging the natural form and health of the plant.
- 2) Balled and Burlapped (B&B) Plants:
 - a. Dig and prepare for shipment in manner that will not damage roots, branches, shape, and future development after replanting. Oak trees shall be root pruned 30 days prior to digging and hardened off at the supplier's nursery under mist for 30 to 60 days.
 - b. Ball with firm, natural balls of soil, per Florida Grades and Standards.
 - c. Wrap ball firmly with burlap or strong cloth and tie: ANSI Z60.1.
- 3) Specimen Plants: Exercise care in digging, wrapping, and binding of such specimens to assure safe loading, shipment and handling.

C. Delivery:

- 1) Deliver soil conditioners (pesticides, herbicides, fumigants, and fertilizers) to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to state law. Store in designated areas only.
- 2) Deliver planting soil mixes and mulch in bulk with manufacturer's guaranteed mix, name, and conformance to State law. Store in designated areas only.
- 3) Deliver plants with legible identification labels.
 - a. Label trees, evergreens, containers of like shrubs, or groundcover plants.
 - b. State correct plant name and size indicated on Plant List.
 - c. Use durable waterproof labels with water resistant ink which will remain legible for at least 60 days.
- 4) Protect during transport/delivery with shade cloth or other acceptable means to prevent wind burn.
- 5) Protect all plant material during delivery to prevent damage or desiccation to root ball or desiccation of crown and leaves.
- 6) Mist root balls, tree and palm crowns during delivery and handling to ensure against drying.
- 7) Remove unacceptable plant material immediately from job site.

D. Storage:

- 1) Balled and burlapped plant stock: Deliver direct from nursery.
- 2) Bare root plant material: Deliver direct from supplier.
- 3) Protect roots of all plant material from drying or other possible injury. Keep plant root ball and crown moist at all times.
- 4) Store plants in shade and protect from weather. Heel in trees in a vertical position as required. Irrigate all stored plants as required.
- 5) Maintain and protect plant material not to be planted within four hours. Plant palms upon delivery.

E. Handling:

- 1) Do not drop plants.
- 2) Do not pick-up container or balled plants by stems or trunks.
- 3) Do not use chains or cables on any trees or palms. Handle using nylon straps, 2-inch width min.

1.6 JOB CONDITIONS

- A. Planting Season: Perform actual planting only when weather and soil conditions are suitable in accordance with locally accepted practice.
- B. Verify that all existing trees to remain are properly identified and barricaded to prevent damage under this and future construction. Landscape Contractor shall be responsible for maintaining adequate identification and barricading of all existing plant material to remain throughout the installation and required maintenance period.

1.7 GUARANTEE

- A. Guarantee all plant material as for one year after substantial completion.
- B. Replacement plants under this guarantee shall be replaced within two weeks of rejection and guaranteed for twelve months from date of installation.
- C. Repair damage to other plants, lawn or construction work during plant replacement at no cost to the Owner (this includes, but is not limited to, damage to curbs, walks, roads, fences, site furnishings, etc.).

1.8 SCHEDULING

- A. Install trees, shrubs, and ground cover before lawns are installed.
- B. Notify Landscape Architect of anticipated installation date at last two weeks in advance.

PART 2 PRODUCTS

2.1 PLANT MATERIAL

- A. Well-formed and shaped, true to type, and free from disease, insects, and defects such as knots, sun-scald, windburn, injuries, abrasion or disfigurement.
- B. True to botanical and common name and variety: American Joint Committee on Horticultural Nomenclature, Standardized Plant Names, latest edition.

- C. Minimum grade of Florida No. 1 in accordance with "Grades and Standards for Nursery Plants" published by the State of Florida Department of Agriculture.

All plants not listed in "Grades and Standards for Nursery Plants", published by the Division of Plant Industry, shall conform to a Florida No. 1 as to:

- 1) Health and vitality
- 2) Condition of foliage
- 3) Root system
- 4) Freedom from pests or mechanical damage
- 5) Heavily branched and densely foliated according to the accepted normal shape.

- D. Nursery Grown: ANSI Z60.1-1969

- 1) Grown under climatic conditions similar to those in locality of project.
- 2) Container Grown Stock:
 - a. Growing in container for minimum 30 days before delivery, with sufficient root system for container.
 - b. Not root-bound or with root systems hardened off.
- 3) Use only ground cover plants well-established in removable containers, integral containers, or formed homogenous soil sections.

- E. Minimum root ball sizes for all palms shall be as delineated within "Grades and Standards for Nursery Plants, Part II, Palms and Trees", published by the State of Florida Department of Agriculture.

- 1) All plants not listed in Grades and Standards for Nursery Plants, published by the Division of Plant Industry, shall conform to a Florida No. 1 as to:
 - a. Health and vitality
 - b. Condition of foliage
 - c. Root system
 - d. Freedom from pests or mechanical damage
 - e. Heavily branched and densely foliated according to the accepted normal shape of the species or sport.

2.2 PLANTING SOIL

- A. Planting soil mixture for backfill around trees, shrubs, and groundcover shall be as specified in Section 02484 - Soil Preparation and soil mixes.

- 1) Terrasorb shall be added to all backfill.

2.3 SOIL CONDITIONERS

- A. Soil conditioners shall be as specified in Section 02484 - Soil Preparation and soil mixes.

- 1) As a fertilizer supplement to Phoenix Palms, a foliar spray shall be

applied one week after installation (excluding summer months) and again at three-month intervals. The chemical designation shall be 8-6-6 with at least 95% of the nitrogen derived from a water-soluble, organic source. The potash source shall be derived from sulphate forms. The following minor elements shall be included:

.06% MG
 .02% B
 .05% CU
 1.00% Fe
 1.00% Mn

- B. It shall be the responsibility of the contractor to supply and transport water to all landscape areas.

2.4 TOP MULCH

- A. Shredded Eucalyptus, shredded, loose, substantially free of mineral waste materials, and showing an acid reaction.
- B. Minimum organic matter by weight on an oven dry basis: 85%.
- C. Processed specifically for use as top mulch around plant beds.

2.5 GUYING AND STAKING MATERIAL

- A. Stakes for Tree Support:
- 1) Construction grade lumber.
 - 2) Braces and Vertical Stakes: Nominal 2" x 2 ".
 - 3) Stakes: Nominal 2" x 4" x 4' long and pointed at one end.
 - 4) Cross Braces: Nominal 1" x 4" boards.
 - 5) All above grade stakes shall be painted with one coat of brown paint. Paint to be approved by the Owner's Representative.
- B. Guying Wires: Annealed, galvanized iron or galvanized steel 12-gauge wire. Wire shall be flagged with white or yellow surveyor tape minimum 2 per guy wire, (one flag near ground level and one flag near the middle of the length of wire).
- C. Hose:
- 1) Type: New /12-inch diameter 2-ply reinforced rubber or plastic hose.
 - 2) Minimum size: 3/4 in.
- D. Turnbuckles:
- 1) Turnbuckles are recommended but not required. Landscape Contractor shall be responsible for keeping taut all guyed plant material and for keeping flagging in place. One turnbuckle per guy wire is required if used.
 - 2) Method of tightening guy wires to be approved by Landscape Architect.
 - 3) Guying to be tightened as needed, but always within two days of when found necessary.

2.6 SLOPE STABILIZATION

- A. Landscape contractor shall be responsible to stabilize grades by approved methods where necessary at his own cost.
- B. Contractor shall stabilize all sloped areas 3 to 1 or greater and areas found to be required to reduce surface erosion by the Owner's Representative with "Hold Gro" Erosion Control Fabric as manufactured by Gulf States Paper Company, Tuscaloosa, Alabama or approved equal. Contractor shall install erosion control fabric according to the manufacturer's instructions.

2.7 DRAINAGE GRAVEL

- A. Drainage gravel shall be River Run Gravel and shall be of graduated sizes.
- B. River Run Gravel shall be no smaller than one-half inch nor larger than two inches in any direction.
- C. Gravel shall be installed as shown on drawings or to a minimum depth of 2 inches above drains, and 4 inches throughout planters.
- D. Gravel shall be washed clean and contain no chemical elements harmful to plant growth.
- E. Coral rock shall not be used.

PART 3 EXECUTION

3.1 INSPECTION

- A. Verify final grades have been established prior to beginning planting operation.
- B. Inspect trees, shrubs, and ground cover plants for injury, insect infestation, and trees and shrubs for improper pruning.
- C. Do not begin planting of trees until deficiencies are corrected, or plants replaced.

3.2 LOCATION/STAKING

- A. Stake out locations for plants and outline of planting beds on ground.
- B. Do not begin excavation until stake out of plant locations and plant beds are acceptable to the Landscape Architect.
- C. All trees are to be located and staked for inspection by the Landscape Architect.

3.3 PREPARATION

- A. Pits and Trenches:
 - 1) Shape:
 - a. Vertical sides and flat bottom.
 - b. Plant pits to be square or circular.
 - 2) Size:
 - a. For Trees:
 - (i) Depth: Minimum 2 ft. from finish grade and increased as necessary to accommodate planting ball and at least 6-

inch planting soil backfill below ball or roots.

- (ii) Width or Diameter: 2 ft. greater than diameter of planting ball unless otherwise approved by Landscape Architect for special planting areas.

b. For Shrubs and Groundcovers:

- (i) Depth:

- (a) 2- and 3-gallon plant material shall receive a minimum of 2" of planting soil mixture beneath the root ball.
- (b) Plant materials sized 1 gallon or less, or materials planted 24 inches O.C. or less shall receive a full 12 inches of amended planting soil mix tilled to a minimum depth of 12 inches.

NOTE: All annuals beds shall receive a full 6 inches of amended planting soil mix tilled to a minimum depth of 6 inches.

- (c) For plants not requiring soil mix the entire bed shall be tilled by mechanical means to a depth of 12 inches.

- (ii) Width or Diameter:

- (a) All 2- or 3-gallon material shall be placed within a minimum 13-1/2 inch planting hole and backfilled with the specified planting soil mix.
- (b) All plant material sized 1 gallon or less, or material planted 24 inches O.C. or less shall receive complete bed amending. That is excavation of existing soil to a minimum of 12 inches

NOTE: 6 inches for all annual beds) below finished soil elevation, backfilling with a minimum 3 inches of planting soil mix, and then tilling with all required amendments to a depth of not less than 12 inches.

NOTE: 6 inches for all annual beds. All areas to be amended in such a manner shall be highlighted on contractor's record drawings.

- (iii) Bring all beds and pits to smooth, even surface conforming to established grades after full settlement has occurred.

NOTE: Amending of and quantities of planting soil mixes as outlined above contingent with existing soil conditions.

B. Planting Beds:

- 1) Planting beds to a depth of 12-inch topsoil mixture.
- 2) Bring beds to smooth, even surface conforming to established grades after full settlement has occurred.

- 3) Use acceptable excess excavated topsoil to form watering berms around the plants.
- C. Drainage percolation is available. Pits which are not adequately draining shall be excavated to a depth sufficient for drainage and backfilling with gravel or crushed rock. No allowances will be made for lost plants due to improper drainage. Landscape Contractor shall replace with same species size and specification at no cost to Owner.

3.4 PLANTING

A. General

- 1) Center plant in pit or trench.
- 2) Face for best effect, or as directed by Landscape Architect.
- 3) Set plant plumb and hold rigidly in position until soil has been tamped firmly around planting ball.
- 4) Use only planting soil backfill as specified hereinbefore.
- 5) Place sufficient planting soil under plant to bring top of planting ball to finish grade.
- 6) Backfill pit or trench with planting soil in 9 in. layers and water each layer thoroughly to settle soil and work soil completely around roots and planting ball.
- 7) After soil settles fill pit with planting soil, water, and leave pit surface even with finish grade.
- 8) Topsoil Berm:
 - a. Construct a topsoil berm 6 in. above finish grade forming a watering basin with a level bottom around each palm or tree.
 - b. Size: 2 ft. greater than diameter of planting ball.
 - c. Leave saucer for 3 months or as directed by Owner's Representative. At the end of 3 months regrade area and re-mulch 12 inches out from trunk (or planting bed) for all plantings. Remove excess from basin and clean area.

B. Balled Plants (B&B) and (WB&B):

- 1) Place in pit on planting soil backfill material that has been hand-tamped prior to placing plant.
- 2) Place with burlap intact so location of ground line at top of ball is same as at nursery where grown.
- 3) Remove binding at top 1/2 of planting ball and lay top of burlap back 6 inches. For wire balled trees, remove wire on top of ball.
- 4) Do not pull wrapping from under planting ball.
- 5) Do not plant if planting ball is cracked, broken or showing evidence of voids before or during planting process. Replace with plant of same species, size, and specification at no cost to Owner.

C. Container-Grown Plants:

- 1) Can/Container Removal:
 - a. Cut cans on two sides with an acceptable can cutter.
 - b. Do not injure planting ball.
 - c. Do not cut cans with spade or ax.
 - d. Do not cut sides on knockout cans.
 - e. Carefully remove plants without injury or damage to planting ball.
 - f. After removing plant. Superficially cut edge roots with knife on three sides.
- 2) Dig planting holes to size as shown.
- 3) Hand place plants which are in containers less than one gallon in size.
- 4) Hand backfill and hand tamp leaving slight depression around bases of plants.
- 5) Do not cover top of root ball.
- 6) Water for settlement and replace required planting soil.

3.5 FERTILIZER APPLICATIONS

- A. Apply granular fertilizer at time of planting and repeat 3 months from first application. Schedule fertilization with Landscape Architect.
- B. Apply granular fertilizer at following rates, to planting bed and saucer areas around each tree, palm and shrub:
 - 1) Trees:
 - a. Caliper 4 inches and larger:
 - (i) 5 lbs. per in. of Caliper
 - b. Caliper under 4 inches:
 - (i) 3 lbs. per in. of Caliper
 - c. Shrubs: 2 lbs. per 100 sq. ft. of area.
 - d. Ground Cover Plants: 2 lbs. per 100 sq. ft. of area.
 - e. Palms: 1 lb. per in. of palm trunk Caliper.
- C. Broadcast under foliage canopy and incorporate into soil.
- D. Water immediately until root structure of plant is wet. Assure protection from fertilizer burn.
- E. Apply foliar nutrient spray at time of planting (summer excluded) and repeat three months from first application. Schedule fertilization with Landscape Architect. Drench palm leaves with foliar nutrient spray at the manufacturer's recommended rate to all Phoenix Palm species.

3.6 WEED CONTROL

- A. Apply post-emergent herbicide, "Round-up" as manufactured by Monsanto Corp. or approved equal, per manufacturer's rate and method of application to all landscape bed areas as necessary.
- B. Apply pre-emergent herbicide "Ron-Star" before mulching and again as necessary throughout required maintenance period to prevent weed seed germination.
- C. The Landscape Contractor shall verify that the herbicide and application technique will not damage plant material prior to application, and shall replace, and/or repair damage to any plant injured by herbicide application at no cost to the Owner.

3.7 TOP MULCHING

- A. Top mulch planting pits, trenches, and areas within two days after planting.
- B. Cover watering basin or bed evenly with 3-inch compacted depth of top mulch material.
- C. Water thoroughly, immediately after mulching.
- D. "Cut in" mulch at plant bed/sod line.
- E. Hose down planting area with fine spray to wash leaves of plants at least twice a week, or as required.
- F. Exclude mulch from annual and Bromeliad beds.

3.8 GUYING AND STAKING OF TREES

- A. Stake trees as shown on the drawings except where the Sub-surface Tree Staking System utilizing the (PDEA) is specified.
 - 1) Stake Installation:
 - a. Drive stakes perpendicularly, 3 feet into ground at edge of root ball. Do not drive stake through soil separator or drainage gravel if present. Do not drive stakes through root ball.
 - b. Number of stakes as shown.
 - 2) Tying and Cross-bracing:
 - a. For trees over 4-inch caliper:
 - (i) Stake and tie firmly with guy wire.
 - (ii) Separate guy wire from bark by hose section.
 - b. For trees under 4 inches in caliper:
 - (i) Nail cross-brace between stakes.
 - (ii) Tie tree to cross-brace guy wire.
 - (iii) Separate guy wire from bark by hose section.

- B. Stake palm trees as shown. The Contractor shall be responsible for and guarantee the installation against toppling and be responsible for any and all damage incurred to toppling over.
- C. Prune minimum necessary to remove injured twigs and branches, deadwood, and suckers. Pruning shall be done with regard to natural form of plant material or as directed by the Landscape Architect.
 - 1) Do not prune prior to delivery to site.
Note: Pruning is required for collected palms and trees per "Grades and Standards for Nursery Plants Part II, Palms and Trees" and Section 02481.
- D. All cuts one-inch diameter or larger made during pruning of any plant material shall be painted with commercial grade sealant as approved and directed by Landscape Architect.
- E. Pruning cuts shall be monitored to ensure proper healing and to prevent insect/disease infestation.
- F. Landscape Contractor shall perform all specialized shearing and or pruning as directed by the Landscape Architect and as shown on the drawings at no additional cost to the Owner.

3.9 MAINTENANCE

- A. General:
 - 1) Begin maintenance immediately after each item is planted and continue until final inspection and acceptance.
 - 2) Maintain a health growing condition by pruning, watering, cultivating, weeding, mowing, mulching, tightening, and repairing of guys, resetting plants to proper grades or upright position, restoration of plant saucer, and furnishing and applying such sprays as necessary to keep planting free of insects and diseases.
 - 3) The root system of plants shall be watered at such intervals as will keep the surrounding soil in best condition for promotion of root growth and plant life.
 - 4) Keep planting saucers and beds free of weeds, grass and other undesired vegetation growth.
 - 5) Protect planting areas and plants against trespassing and damage of any kind for the duration of the maintenance period.
 - 6) Insect plants at least once a week and perform maintenance promptly. Replace impaired or dead plants promptly. Do not wait until near the end of the guarantee period to make replacements of plants which have become unacceptable.
 - 7) Ensure site is free of weeds, rocks, trash, and other debris.
 - 8) Remove soil ridges from around watering basins prior to end of maintenance period, as directed by the Landscape Architect.

- B. Watering: Water when soil moisture is below optimum level for best plant growth.

3.10 CLEANING

- A. Fill all pits/depressions in holding area and rough grade to meet surrounding elevations. Remove any organic or other debris resulting from the plant relocation process.
- B. Sweep and wash all paved surfaces.
- C. Remove planting debris from project site and holding area.
- D. Remove soil conditioners, soil mixes, gravel, etc. from project site and holding area.

END OF SECTION

SECTION 02491 - SUBSURFACE TREE STAKING SYSTEMS UTILIZING PERCUSSIVE DRIVEN EARTH ANCHORS (PDEA)

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. Percussion Driven Earth Anchors (PDEA) that are used to secure and stabilize trees. The PDEA is to be manufactured in accordance with a certified ISO 9001 company.
- B. Installation Tools and Equipment. Drive rods and all necessary tools and accessories to properly install the Percussion Driven Earth Anchors (PDEA).

1.2 UNIT PRICES

- A. Percussion Driven Earth Anchors (PDEA): Subsurface Tree Staking Anchoring kits, each.
- B. Installation Tools and Equipment. Hand tools for installing PDEA kits, each.

1.3 DEFINITIONS

- A. Percussive Driven Earth Anchor (PDEA) - Lightweight corrosion resistant earth anchor that does not disturb the soil during installation. The PDEA shall be driven from finished grade elevation using conventional portable hand tools. The PDEA can be pulled to exact holding capacity, if required, and fully operational immediately.
- B. Installation Equipment. Hand or Power drive rods, loadlocking hook/stressing jack, rod removers, ratchet tensioner lever tool. Multiple drive rod sections coupled together with specialized couplers to achieve the required depth of installation.

1.4 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions.
- B. Certifications: Manufacturer shall submit a letter of certification that the product meets or exceeds physical properties, endurance, performance and packaging requirements.
- C. PDEA manufacturers shall provide ISO 9001 compliance certificates.
- D. Manufacturing Quality Control (MQC) test results shall be provided upon request.

1.5 DELIVERY, STORAGE AND HANDLING

- A. PDEA should be packaged and stored in original packaging from the manufacturer.
- B. Installation Tools should be maintained and stored with original shipment from the manufacturer.

1.6 QUALITY ASSURANCE SAMPLING, TESTING, AND ACCEPTANCE

- A. The PDEA system should be produced in accordance with Platipus Anchors, Inc. ISO 9001 standards.

PART 2 PRODUCTS

2.1 MANUFACTURER'S/REPRESENTATIVE

- A. Platipus Anchors, Inc., 1902 Garner Station Blvd., Raleigh, NC 27603. Phone: (866)622-2283, Fax (919)662-0998, www.platipus-anchors.us
- B. Local Contact Phone: (866)752-8478 or (866)622-2283.

2.2 MATERIAL COMPONENTS OF THE SUBSURFACE TREE STAKING SYSTEM

- A. PDEAs in compliance with Landscape Architects design shall be manufactured in accordance with ISO 9001 Standards as manufactured by Platipus Anchors, Inc.
- B. Percussive Driven Earth Anchor (PDEA) - Drive Anchor Geometry
 - 1) Bell Shape: The bell shaped working surface area of the anchor offers significant increases in potential load. It provides very high load possibilities for a small surface area anchor by focusing the frustum of soil more clearly.
 - 2) Edge Beads: The edges are carefully rounded to further enhance the frustum area and reduce "spill off" during high loadings which reduces mechanical shear of soil.
 - 3) Delta Drive Point: Where high capacity small profile anchors are used in hard ground conditions it is essential to have a drive point which splits the material by way of separating the upper side and lower side, thus compressing the material into a predetermined area. This enhances the anchor's ability to drive more quickly through dense soil types.
 - 4) Anchor Keel: The use of a high keel which emanates from the anchor eye to the delta drive point reinforces the ability of the anchor to drive straight through difficult anchoring substrates.

PART 3 PERCUSSIVE DRIVEN EARTH ANCHOR (PDEA) – ROUND ROOTBALLS (B&B)

Subsurface Tree Staking Selection Guide for a Rootball Fixing System with Plati-Mat

TREE HEIGHT (H) /CALIPER (C)	DESCRIPTION OF ANCHOR TYPES	PRODUCT CODE	TYPICAL LOADS
up to 8' up to 1 1/2"	3 x S21 anchors, 6'6" x 2mm galvanized cable, 1 x ratchet tensioner & 3 x Plati-Mats	RF0P	up to 330lbs
8'-15'/ 1 1/2"-3"	3 x S41 anchors, 10' x 4mm galvanized cable, 1 x ratchet tensioner & 3 x Plati-Mats	RF1P	up to 1100lbs
15'-25'/3"-5 3/4"	3 x S61 anchors, 16'6" x 4mm galvanized cable, 1 x ratchet tensioner & 3 x Plati-Mats	RF2P	up to 2755lbs
25'-40'/5 3/4"-9 1/2"	3 x S81 anchors, 23' x 6mm galvanized cable, 1 x ratchet tensioner & 3 x Plati-Mats	RF3P	up to 5500lbs
Over 40'/Over 9 1/2"	3 x B61 anchors, 23' x 6mm galvanized cable, 1 x ratchet tensioner & 3 x Plati-Mats	RF4P	up to 6600lbs

**Percussive Driven Earth Anchor (PDEA) – Square Rootballs (Square Containerized)
Subsurface Tree Staking Selection Guide for a Rootball Fixing System with Plati-Mat**

TREE HEIGHT (H) /CALIPER (C)	DESCRIPTION OF ANCHOR TYPES	PRODUCT CODE	TYPICAL LOADS
8'-15'/ 1 1/2"-3"	4 x S41 anchors, 10' x 4mm galvanized cable, 1 x ratchet tensioner & 4 x Plati-Mats	RF1P 4 Leg	up to 1100lbs
15'-25'/3"-5 3/4"	4 x S61 anchors, 16'6" x 4mm galvanized cable, 1 x ratchet tensioner & 4 x Plati-Mats	RF2P 4 Leg	up to 2755lbs
25'-40'/5 3/4"-9 1/2"	4 x S81 anchors, (2) 23' x 6mm galvanized cable, 2 x ratchet tensioner & 4 x Plati-Mats	RF3P 4 Leg	up to 5500lbs
Over 40'/Over 9 1/2"	4 x B61 anchors, (2) 23' x 6mm galvanized cable, 2 x ratchet tensioner & 4 x Plati-Mats	RF4P 4 Leg	up to 6600lbs

**Percussive Driven Earth Anchor (PDEA) – Palm Trees
Subsurface Tree Staking Selection Guide for a Palm Tree Fixing System with Plati-Mat**

TREE HEIGHT (H) /CALIPER (C)	DESCRIPTION OF ANCHOR TYPES	PRODUCT CODE	TYPICAL LOADS
3 Leg: Up to 20'	3 x S81 anchors, 23' x 6mm galvanized cable, 1 x ratchet tensioner & 3 x Plati-Mats	RF3P	up to 5500lbs
3 Leg: 20' - 40'	3 x B61 anchors, 23' x 6mm galvanized cable, 1 x ratchet tensioner & 3 x Plati-Mats	RF4P	up to 6600lbs
4 Leg: Up to 20'	4 x S81 anchors, (2) 23' x 6mm galvanized cable, 2 x ratchet tensioner & 4 x Plati-Mats	RF3P4LEG	up to 5500lbs
4 leg: 20' – 40'	4 x B61 anchors, (2) 23' x 6mm galvanized cable, 2x ratchet tensioner & 4 x Plati-Mats	RF4P4LEG	up to 6600lbs

3.1 PERFORMANCE REQUIREMENTS

- 1) Subsurface Tree Staking Kit
- 2) ANCHOR: Either S02, S04, S06, S08, Aluminum Alloy Anchor. B06 Cast Iron Galvanized Anchor
- 3) LOWER TERMINATION: Galvanized Cable with Soft Eye including Aluminum Ferrule.
- 4) WIRE TENDON: Galvanized Wire Tendon x Required length to achieve necessary holding capacity.
- 5) RATCHET TENSIONER: Zinc plated ratchet tensioner to secure/tighten cable.
- 6) PLATI-MAT: Black wire mesh mats to spread the load generated by the anchors evenly over the rootball without damaging it.

PART 4 EXECUTION

4.1 CONTRACTORS GUIDELINES & CONSIDERATIONS

- A. Methods of selecting proper subsurface tree staking anchoring systems. Is there accurate information regarding the overall height and caliper of the trees.
- B. Root structure. The trees should be properly root wrapped or container grown of sufficient strength and proportion to support a subsurface tree staking method.
- C. Site location also impacts the type of tree staking model/kit. This can depend if trees are being planted on grade, above a structure or if exposed to high winds and rainfall.
- D. Soil conditions. Different types of soils, and ground conditions need to be also considered when selecting a subsurface tree staking anchoring system. Sandy conditions generally provides higher anchor capacities.
- E. Buried Services. Planting areas need to be checked for all underground services, such as drains, water, gas, electricity or fiber optic/telecom cables.

4.2 INSTALLATION OF PERCUSSIVE DRIVEN EARTH ANCHORS (PDEA)- SUBSURFACE TREE STAKING KIT-ROOTBALL FIXING SYSTEM WITH PLATI-MAT

- A. Allow clearance around and above the rootball.
- B. Anchors should be equally spaced as close to the base of the rootball as possible.
- C. Drive the anchor vertically until the eye is halfway down the rootball. The anchors should be driven to the full working depth using a suitable drive rod supplied by Manufacturer.
- D. Remove the drive rod by hand or with rod removers.
- E. The anchors must be loadlocked into their working position by pulling upwards on the cable. If the anchors are not loadlocked properly, the tree will become loose under windy conditions.
- F. Lay the Plati-Mat across the rootball in line with the anchors (this should result in a triangle format).
- G. Take cable and pass through each soft eye and lace the cable around the rootball.
- H. Pull the slack through and cut off excess cable.
- I. Thread the end of the cable through the hole in the tensioner wheel and cut off excess cable.
- J. Wind the cable onto the tensioner to tighten.
- K. Tighten and adjust the cable until fastened/taut all round. Due to settlement re-tensioning may be necessary after planting.

END OF SECTION

SECTION 02513 - ASPHALTIC CONCRETE PAVING**PART 1 GENERAL****1.1 DESCRIPTION**

- A. Furnish all labor, materials, equipment and incidentals required and place asphaltic concrete pavement in accordance with the elevations and typical sections as depicted in the Drawings and specified herein.

1.2 RELATED SECTIONS

- A. Section 01340 – Shop Drawings, Working Drawings, and Samples
- B. Section 01410 – Materials and Installation Testing
- C. Section 02100 – Site Preparation

1.3 REFERENCES

- A. The Work under this Contract shall be in strict accordance with the following codes and standards.
 - 1) The applicable municipality.
 - 2) Broward County Traffic Engineering Division.
 - 3) Florida Department of Transportation Specifications (FDOT).
 - 4) OSHA Safety and Health Standards for Construction.

1.4 SUBMITTALS

- A. Submit mix design for approval in accordance with Section 01340.

PART 2 PRODUCTS**2.1 MATERIALS**

- A. Asphaltic concrete pavement shall conform to the following FDOT Standard Specifications:
 - 1) Section 160 – Stabilization.
 - 2) Section 200 – Limerock base.
 - 3) Section 300 – Prime and tack coats.
 - 4) Section 331 (2000) – Type S Asphalt.
 - 5) Section 334 – Superpave asphalt concrete.
- B. The materials of the asphaltic concrete surface shall conform the applicable sections of FDOT Standard Specifications for Asphaltic Concrete with the following exception:
 - 1) Recycled asphalt may not be used for the final course.

PART 3 EXECUTION

3.1 INSTALLATION

- A. All asphalt installation shall be in accordance with FDOT Standard Specification 330 – Hot Mix Asphalt General Construction Requirements.
- B. All soft and yielding material and 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 and to a foundation of uniform compaction and supporting power. The cost of removing and replacing unsuitable material shall be included in the bid for the paving.
- C. The subgrade, in both cut and fill sections, shall be compacted to a density and LBR as indicated in the Drawings. Unless the subgrade material at the time of compacting contains sufficient moisture to permit proper compaction it shall be moistened as necessary and then compacted. Subgrade material containing excess moisture shall be permitted to dry to the proper consistency before being compacted. The subgrade shall be shaped prior to making the density tests. The required density shall be maintained until the base or pavement has been laid or until the aggregate materials for the base or pavement course have been spread in place.
- D. The minimum compacted thickness of the limerock base shall be as depicted in the Drawings applied in four-inch maximum layers of equal depth unless otherwise depicted in the Drawings. The width of the limerock base shall be wider than the pavement as depicted in the Drawings.
- E. Before the prime coat is applied, all loose material, dust, dirt or other foreign material which might prevent bond with existing surface shall be moved to the shoulders to the full width of the base by means of revolving brooms, mechanical sweepers, blowers, supplemented by hand sweeping or other approved methods. The glazed finish shall have been removed from the base. The prime coat shall be applied by a pressure distributor so that approximately 0.1 gallons per square yard is applied uniformly and thoroughly to a clean surface.
- F. Prior to the application of the surface course, all loose material, dust, dirt and all foreign material which might prevent proper bond with the existing surface shall be removed to the full width of the repair by means of approved mechanical sweepers and supplemented by hand sweeping if required.
- G. Apply bituminous tack coat at a rate between 0.02 and 0.10 gallons per square yard. Bituminous material shall be heated as per manufacturers' recommendations.
- H. 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 a manner as to leave the casting fixed permanently in its correct position.
- I. Prior to the application of the surface course, all landscaping (including sodding) and irrigation shall be properly installed and accepted by the Owner or the Engineer.

3.2 PAVEMENT REPAIR

- A. All damage to pavement as a result of the work (construction or maintenance) under this contract shall be repaired according to the plans and specifications at the Contractor's cost. Pavement shall be repaired to match the original surface material and original grade; however, the asphalt concrete thickness shall not be less than 1 inch. The repair shall include the preparation of the subgrade, the placing and compacting of the limerock base, the preparation and priming of the base, the placing and maintaining of the surface treatment, all as specified herein and as shown on the Drawings.
- B. The width of all repairs shall extend at least 12 inches beyond the limit of the damage or as shown on the Drawings. The edge of the pavement to be left in place shall be saw cut to a true edge and should provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

3.3 TESTING

- A. Refer to Section 01410 – Materials and Installation Testing.

END OF SECTION

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SECTION 02525 - PAVERS**PART 1 GENERAL****1.1 SECTION INCLUDES**

- A. Furnish and install brick or concrete pavers and bedding material as depicted in the Drawings and specified herein.
- B. Paver manufacturer, type, pattern, shape and color or texture is specified on the Drawings or as specified by the Owner.
- C. Other necessary elements such as edge restraints, base and subbase material are not covered in this Section. Refer to typical roadway and paver installation plan and details in the Drawings.

1.2 RELATED SECTIONS

- A. Section 01340 – Shop Drawings, Working Drawings, and Samples

1.3 REFERENCES

- A. ASTM C 33 – Standard Specification for Concrete Aggregates
- B. ASTM C 144 – Standard Specification for Aggregate for Masonry Mortar
- C. ASTM C 902 – Standard Specification for Pedestrian and light Traffic Paving Brick
- D. ASTM C 936 – Standard Specification for Solid Concrete Interlocking Paving Units
- E. ASTM C1272 – Standard Specification for Heavy Vehicular Paving Brick
- F. FDOT Standard Specifications for Road and Bridge Construction - Section 526 Architectural Pavers
- G. Interlocking Concrete Paving Institute (ICPI)

1.4 SUBMITTALS

- A. Furnish submittal materials prior to installation in accordance with Section 01340 – Shop Drawings, Working Drawings, and Samples and the following.
 - 1) Full size samples of each paver size and color.
 - 2) A certification from the paver manufacturer that the pavers meet the requirements of this specification.
 - 3) A certified sieve analysis for gradation comparing results of the bedding and joint sand with the requirements of ASTM C 33 and ASTM C 144.
 - 4) An ICPI certification from the paver manufacturer for any concrete pavers specified herein
 - 5) Paver Installation Subcontractor submittal:
 - a. A copy of Subcontractor's current certificate of completion from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.

- b. Job references from projects of a similar size and complexity. Provide Owner/Client/General Contractor names, postal address, phone, fax, and email address.

1.5 MOCK-UPS

- A. Prior to installation, install a 6-foot by 6-foot paver area including typical edge restraint for the project. This area will be used to determine the quality expectation for the balance of the installation including the installation of the bedding material, joint sizes, lines, level, laying patterns and colors. The mock-up shall be approved by the Engineer prior to proceeding with the work.

1.6 STORAGE AND HANDLING

- A. Cover stockpiled materials with waterproof covering to prevent exposure to rainfall.

1.7 QUALITY ASSURANCE

- A. Paving Subcontractor Qualifications:
 - 1) Utilize an installer having successfully completed concrete paver installation similar in design, material, and extent indicated on this project.
 - 2) Utilize an installer holding a current certificate of completion from the Interlocking Concrete Pavement Institute Concrete Paver Installer Certification program.
- B. Breakage
 - 1) Broken, cracked or chipped pavers will not be accepted unless the amount of damage is within the guidelines of acceptability contained in the applicable ASTM standard.

1.8 MAINTENANCE

- A. Provide additional pavers to the Owner for maintenance equivalent to 5% of the total project area.

PART 2 MATERIALS

2.1 PAVER MATERIALS

- A. Where there are existing pavers, the Contractor shall remove, store, preserve, and reinstall the same pavers after subsurface or nearby work is complete.
- B. For installations on roadways and commercial driveways, provide brick pavers meeting the requirements of ASTM C 1272, type F, application PX and having a minimum thickness of 3 1/8 inch. Concrete pavers are not allowed for this application.
- C. For installation on sidewalks, medians and residential driveways, provide brick or concrete pavers, as specified, having a minimum thickness of 2 3/8 inch meeting the requirements of ASTM C 902, class MX, type I, application PX, or ASTM C 936 and FDOT 526.
- D. Bedding and joint sand will be clean, non-plastic bedding sand, free from deleterious or foreign matter, natural or manufactured from crushed rock.

- 1) Bedding sand shall meet the requirements of ASTM C 33.
- 2) Joint sand shall meet the requirements of ASTM C 144.

PART 3 INSTALLATION

- A. Spread the bedding material evenly over the base course which has been compacted and accepted by the Engineer. Screed to a nominal 1" thickness; not to exceed 1 ½ inch. Do not disturb the screeded bedding material. Ensure placement of sufficient bedding material to stay ahead of the laid pavers.
- B. Do not use bedding material to fill depressions in the base course.
- C. Lay pavers in the pattern(s) shown in the plans and maintain straight pattern lines.
- D. Cut pavers at edges as necessary to achieve the pattern indicated on the drawings. All cut pavers exposed shall be no smaller than one-third of a whole paver.
- E. Do not install bedding materials or pavers during heavy rain or over wet substrata.
- F. Joints between the pavers shall be a minimum of 1/16 inch to a maximum of 3/16 inch wide.
- G. Fill the gaps at the edges with cut or edge pavers.
- H. Compacting bedding and joint sand:
 - 1) Use a low amplitude vibratory compactor capable of 5,000 foot-pounds with 7-100 Hz frequencies to vibrate and compact pavers into bedding sand. A minimum of three passes is required until pavers no longer compact into the bedding sand to the satisfaction of the Engineer.
 - 2) Vibrate the pavers, sweeping dry joint sand into the joints and vibrating, until the joints are full. Do not vibrate within 3 feet of the unrestrained edges of pavers.
 - 3) At the end of each day, all work within 6 feet of the laying face must be left fully compacted, with sand-filled joints and covered with plastic sheets.
 - 4) Surface shall be broom clean after removal of excess joint sand.
- I. Leave the final surface elevation of pavers 1/8 to ¼ inch above adjacent surfaces including sidewalks, drainage inlets, concrete collars, gutters, channels, etc.
- J. Do not permit the final surface of pavers to deviate more than 3/8 inch under a 10-foot-long straightedge, or more than 1/8 inch between adjacent pavers.

3.2 PROTECTION

- A. All paver work shall be protected as necessary until Owner acceptance.

END OF SECTION

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SECTION 02580 - PAVEMENT MARKINGS AND SIGNING

PART 1 GENERAL

1.1 DESCRIPTION

- A. The Contractor shall supply all labor, equipment, materials and incidentals necessary to install pavement markings and signing in accordance with the Drawings and the following specifications.
- B. The Contractor and/or sub-contractor that performs the pavements markings and signage Work for the project shall have a current Broward County Certificate of Competency, issued by the Broward County Permitting, License and Consumer Protection Division.

1.2 RELATED SECTIONS

- A. Section 01340 – Shop Drawings, Working Drawings, and Samples

1.3 REFERENCED SPECIFICATIONS, CODES AND STANDARDS

- A. The American Association of State Highway and Transportation Officials (AASHTO)
- B. Federal Highway Administration – Manual on Uniform Traffic Control Devices (MUTCD) (2009)
- C. FDOT Design Standards (FY 2019-20).
- D. FDOT Standard Specifications for Road and Bridge Construction (July 2019).
- E. Broward County Traffic Engineering Division (BCTED) Minimum Standards and the BCTED Pavement Markings & Signs Detail Sheet.
- F. Other standard references in the Drawings.

PART 2 PRODUCTS

2.1 MATERIALS

- A. All pavement markings shall be thermoplastic unless otherwise noted. Thermoplastic pavement markings shall be fully reflectorized and meet the requirements of AASHTO M249 and the FDOT Standard Specifications for Road and Bridge Construction.
- B. Traffic paint shall be fully reflectorized and meet the requirements of the FDOT Standard Specifications for Road and Bridge Construction and shall be Sherwin-Williams "Pro-Mar" Traffic Marking Paint, series B29 or Glidden Traffic paint #63228. Provide two (2) coats of paint, 5 mil minimum wet film thickness each.
- C. Pavement markings on brick or concrete pavers shall be 3M 5730/31 tape applied with contact cement per manufacturers specifications.
- D. All signs in Broward County right of way shall have type XI retroreflective sheeting materials made with prisms, except for school zone and pedestrian signs which shall be comprised of reflective fluorescent yellow-green with type IV reflective sheeting.

PART 3 EXECUTION

- A. All pavement marking and signing shall be applied in accordance with Broward County Traffic Engineering Division (BCTED) Minimum Standards and the BCTED Pavement Markings & Signs Detail Sheet for Pavement Markings, Signing and Geometrics as applicable to the County in which the Work resides.
- B. All pavement markings shall be temporarily applied as paint upon completion of construction of asphalt paving. All such temporary paint shall be replaced with thermoplastic at least 28 days, but no later than 120 days, after paving.
- C. Precast concrete bumpers (wheelstops) are required for all parking stall unless specifically stated in the Drawings. Wheelstops are to be pinned using (2) - 24" #4 bar. Wheelstops are to be painted as directed by the Owner.
- D. Parking stalls shall be marked in accordance with the typical pattern indicated on the Drawings. Stall width and depth, and drive widths indicated are minimum and must not be reduced.
- E. An FDOT approved sealer must be applied to concrete surfaces prior to application of pavement markings.
- F. Paint concrete base and base plate at all parking lot lighting standards.
- G. Blue/blue RPM's are to be placed next to fire hydrants. The location shall be the center of the adjacent lane or as directed by the utility Owner.
- H. The Contractor shall refurbish pavement marking and signs damaged during construction at no additional cost to the Owner.
- I. All signs and sign supports intended for removal shall be removed completely and disposed of properly.
- J. All signs to be relocated shall be properly installed in a temporary location with applicable viability and not interfere with construction prior to proper installation in the proposed location.
- K. All signs in public right of way shall include the installer's ID sticker/decal on the back of all signs installed as part of this project.

END OF SECTION

SECTION 02710 - LIMEROCK BASE

PART 1 GENERAL

1.1 DEFINITIONS

- A. Completed Course: Compacted, unyielding, free from irregularities, with smooth, tight, even surface, true to grade, line, and cross section.
- B. Completed Lift: Compacted with uniform surface reasonably true to cross-section.

PART 2 PRODUCTS

2.1 LIMEROCK BASE ROCK

- A. The material used in limerock base shall be material classified as Miami Oolite Formation.
- B. The minimum of carbonates of calcium and magnesium in the limerock shall be 70 percent. The maximum percentage of water-sensitive clay material shall be 3.
- C. Limerock material shall be uniform in color and not contain cherty or other extremely hard pieces, or lumps, balls, or pockets of sand or clay size material in sufficient quantities as to be detrimental to the proper bonding, finishing, or strength of the limerock base.
- D. The limerock base shall be uniformly graded from coarse to fine with 97 percent passing a 3-1/2-inch sieve, 80 percent passing a 2-inch sieve. The fine material shall consist entirely of dust of fracture. All crushing or breaking up, which might be necessary in order to meet such size requirements, shall be done before the material is placed on the road.
- E. Physical Qualities:
 - 1) Liquid Limit, AASHTO T89: Maximum 35 percent.
 - 2) Nonplastic.
 - 3) Limerock material shall have an average limerock bearing ratio (LBR) value of not less than 100.

2.2 SOURCE QUALITY CONTROL

- A. Contractor: Perform tests necessary to locate acceptable source of materials meeting specified requirements.
- B. Final approval of aggregate material will be based on materials' test results on installed materials.
- C. Should separation of coarse from fine materials occur during processing or stockpiling, immediately change methods of handling materials to correct uniformity in grading.

PART 3 EXECUTION

3.1 SUBGRADE PREPARATION

- A. As specified in the Contract Documents.
- B. Obtain CONSULTANT's acceptance of subgrade before placement of limerock base rock.
- C. Do not place base materials on soft, muddy subgrade.

3.2 EQUIPMENT

- A. Use mechanical rock spreaders, equipped with a device that strikes off the rock uniformly to laying thickness, capable of producing even distribution. For areas where the use of a mechanical spreader is not practicable, the Contractor may spread the rock using bulldozers or blade graders.

3.3 HAULING AND SPREADING

- A. Hauling Materials:
 - 1) The limerock shall be transported to the point where it is to be used and dumped on the end of the preceding spread.
 - 2) Do not haul over surfacing in process of construction.
 - 3) Loads: Of uniform capacity.
 - 4) Maintain consistent gradation of material delivered; loads of widely varying gradations will be cause for rejection.
- B. Spreading Materials:
 - 1) Distribute material to provide required density, depth, grade and dimensions with allowance for subsequent lifts.
 - 2) Produce even distribution of material upon roadway without segregation.
 - 3) Should segregation of coarse from fine materials occur during placing, immediately change methods of handling materials to correct uniformity in grading.

3.4 CONSTRUCTION OF COURSES

- A. General: Complete each lift in advance of laying succeeding lift to provide required results and adequate inspection.
- B. Limerock Base:
 - 1) Maximum Completed Lift Thickness: 6 inches or equal thickness.
 - 2) Completed Course Total Thickness: As shown.
 - 3) Spread lift on preceding course to required cross-section.
 - 4) Lightly blade and roll surface until thoroughly compacted.
 - 5) Blade or broom surface to maintain true line, grade, and cross-section.
- C. Gravel Surfacing:
 - 1) Maximum Completed Lift Thickness: 6 inches or equal thickness.

- 2) Completed Course Total Thickness: As shown.
- 3) Spread on preceding course in accordance with cross-section shown.
- 4) Blade lightly and roll surface until material is thoroughly compacted.

3.5 ROLLING AND COMPACTION

- A. Commence compaction of each layer of base after spreading operations and continue until density of 98 percent of maximum density has been achieved as determined by AASHTO T 180.
- B. Density tests will be conducted every 500 square yards or as directed by the CITY PROJECT MANAGER.
- C. Roll each course of surfacing until material shall not creep under roller before succeeding course of surfacing material is applied.
- D. Commence rolling at outer edges of surfacing and continue toward center; do not roll center of road first.
- E. When the material does not have the proper moisture content to ensure the required density, wet or dry, as required. When adding water, uniformly mix it in by disking to the full depth of the course that is being compacted. During wetting or drying operations, manipulate as a unit, the entire width and depth of the course that is being compacted.
- F. Place and compact each lift to required density before succeeding lift is placed.
- G. Bind up preceding course before placing leveling course. Remove floating or loose stone from surface.
- H. Blade or otherwise work surfacing as necessary to maintain grade and cross-section at all times, and to keep surface smooth and thoroughly compacted.
- I. Surface Defects: Remedy surface defects by loosening and rerolling. Reroll entire area, including surrounding surface, until thoroughly compacted.
- J. Finished Surface: True to grade and crown before proceeding with surfacing.

3.6 SURFACE TOLERANCES

- A. Finished Surface of Base Course and Leveling Course: Within plus or minus 0.04-foot of grade shown at any individual point.
- B. Compacted Surface of Leveling Course: Within 0.04-foot from lower edge of 10-foot straightedge placed on finished surface, parallel to centerline.
- C. Overall Average: Within plus or minus 0.01-foot from crown and grade specified.

3.7 DRIVEWAY RESURFACING

- A. Replace gravel surfacing on driveways which were gravel surfaced prior to construction.
- B. Provide compacted gravel surfacing to depth equal to original, but not less than 4 inches.
- C. Leave each driveway in as good or better condition as it was before start of construction.

3.8 FIELD QUALITY CONTROL

A. In-Place Density Tests:

- 1) Construct base course so areas shall be ready for testing.
- 2) Allow reasonable length of time for CITY PROJECT MANAGER to perform tests and obtain results during normal working hours.

3.9 CLEANING

- #### A. Remove excess material; clean stockpile areas of aggregate.

END OF SECTION

SECTION 02771 - CONCRETE CURBS AND SIDEWALKS**PART 1 GENERAL (NOT USED)****PART 2 PRODUCTS****2.1 EXPANSION JOINT FILLER**

- A. 1/2-inch thick, preformed asphalt-impregnated, expansion joint material meeting AASHTO M153 Type I, II, or III, or AASHTO M213, or cellulose fiber types meeting the requirements of AASHTO M213, except the asphalt content is acceptable provided they contain minimum of 0.2 percent copper pentachlorophenate as a preservative and 1 percent water proofing wax.

2.2 CONCRETE

- A. Ready-mixed meeting ASTM C94, Option A, with compressive strength of 3,000 psi at 28 days.
- B. Maximum Aggregate Size: 1-1/2 inch.
- C. Slump: 2 to 4 inches.

2.3 CURING COMPOUND

- A. Liquid membrane-forming, clear or translucent, suitable for spray application and meeting ASTM C309, Type 1.

PART 3 EXECUTION**3.1 FORMWORK**

- A. Lumber Materials:
 - 1) 2-inch dressed dimension lumber, or metal of equal strength, straight, free from defects that would impair appearance or structural quality of completed curb and sidewalk.
 - 2) 1-inch dressed lumber or plywood may be used where short-radius forms are required.
- B. Metals: Steel in new undamaged condition.
- C. Setting Forms:
 - 1) Construct forms to shape, lines, grades, and dimensions.
 - 2) Stake securely in place.
- D. Bracing:
 - 1) Brace forms to prevent change of shape or movement resulting from placement.
 - 2) Construct short-radius curved forms to exact radius.
- E. Tolerances:
 - 1) Do not vary tops of forms from gradeline more than 1/8 inch when checked with 10-foot straightedge.

- 2) Do not vary alignment of straight sections more than 1/8 inch in 10 feet.

3.2 PLACING CONCRETE

- A. Excavate to the required depth, place and compact limerock base rock as specified in the Contract Documents. Compact directly under the area and 1 foot beyond each side of the sidewalk and curb.
- B. Prior to placing concrete, remove water from excavation and debris and foreign material from forms.
- C. Place concrete as soon as possible, and within 1-1/2 hours after adding cement to mix without segregation or loss of ingredients, and without splashing.
- D. Place, process, finish, and cure concrete in accordance with applicable requirements of ACI 304, and this section. Wherever requirements differ, the more stringent shall govern.
- E. To compact, vibrate until concrete becomes uniformly plastic.
- F. All edges shall be smooth and rounded.

3.3 CURB CONSTRUCTION

- A. Construct ramps at pedestrian crossings in compliance with FDOT and PROWAG minimum standards. Standards apply to work in the City's Rights of Way.
- B. Expansion Joints: Place at the beginning and end of curved portions of curb, and at connections to existing curbs. Install expansion joint filler at each joint.
- C. Gutter minimum slope shall be 0.33% unless otherwise approved by the CITY PROJECT MANAGER.
- D. Curb Facing: Do not allow horizontal joints within 7 inches from top of curb.
- E. All gutters and curb and gutters shall have a minimum 4" thick limerock "curb pad" LBR 100.
- F. Contraction Joints:
 - 1) Maximum 10-foot intervals in curb. They shall be constructed within 24 hours of pouring the new curb.
 - 2) Provide open joint type by inserting thin, oiled steel sheet vertically in fresh concrete to force coarse aggregate away from joint.
 - 3) Insert steel sheet to full depth of curb.
 - 4) Remove steel sheet with sawing motion after initial set has occurred in concrete and prior to removing front curb form.
 - 5) Finish top of curb with steel trowel and finish edges with steel edging tool.
- G. Front Face:
 - 1) Remove front form and finish exposed surfaces when concrete has set sufficiently to support its own weight.
 - 2) Finish formed face by rubbing with burlap sack or similar device to produce uniformly textured surface, free of form marks, honeycomb, and

other defects.

- 3) Remove and replace defective concrete.
 - 4) Apply curing compound to exposed surfaces of curb upon completion of finishing.
 - 5) Continue curing for minimum of 5 days.
- H. Backfill curb with earth upon completion of curing period, but not before 7 days has elapsed since placing concrete.
- 1) Backfill shall be free from rocks 2 inches and larger and other foreign material.
 - 2) Compact backfill firmly.

3.4 SIDEWALK CONSTRUCTION

- A. Thickness:
- 1) Refer to Drawings.
- B. Connection to Existing Sidewalk:
- 1) Remove old concrete back to an existing contraction joint.
 - 2) Clean the surface.
 - 3) Apply a neat cement paste immediately prior to placing new sidewalk.
- C. Expansion Joints: Place at maximum 20-foot intervals, at adjacent curb expansion joint, where sidewalk ends at curb, and around posts, poles, or other objects penetrating sidewalk. Install expansion joint filler at each joint.
- D. Contraction Joints:
- 1) Provide transversely to walks at locations opposite contraction joints in curb.
 - 2) Dimensions: 3/16-inch by 1-inch weakened plane joints.
 - 3) Construct straight and at right angles to surface of walk.
- E. Finish:
- 1) Broom surface with fine-hair broom at right angles to length of walk and tool at edges, joints, and markings.
 - 2) Ensure that the surface variations are not more than ¼ inch under a 10-foot straightedge, or more than 1/8 inch on a 5-foot transverse section.
 - 3) Mark walks transversely at 5-foot intervals, or in pattern shown on Drawings, with jointing tool; finish edges with rounded steel edging tool.
 - 4) Apply curing compound to exposed surfaces upon completion of finishing.
 - 5) Protect sidewalk from damage and allow to cure for at least 7 days.
- F. Curb Ramps:
- 1) All curb ramps and detectable warnings shall comply with the current FDOT Index 304 and the Accessibility Guidelines for Pedestrian Facilities

in the Public Right-of-Way by the United States Access Board.

END OF SECTION

SECTION 02945 - SILVA CELL SYSTEM ("SILVA CELL 2")**PART 1 GENERAL****1.1 DESCRIPTION**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

- A. Section Includes:
 - 1) Furnishing and install Silva Cell system, including: geotextile, geogrids, aggregates, subbase material, backfill, root barrier, compost, and the installation of planting soil.
- B. Related Sections
 - 1) Section 02420 – Soil Preparation and Soil Mixes
 - 2) Section 02430 – Sodding
 - 3) Section 02450 – Tree and Plant Protection
 - 4) Section 02490 – Trees, Plants, and Groundcover
 - 5) Section 02491 – Subsurface Tree Staking Systems Utilizing PDEA

1.3 DEFINITIONS

- A. Aggregate Subbase (below Cell frame): Aggregate material between the bottom of the Silva Cell base and the compacted subgrade below, designed to distribute loads from the Silva Cell bases to the subgrade.
- B. Aggregate Base Course (above Cell deck): Aggregate material between the paving and the top of the Soil Cell deck below designed to distribute loads across the top of the deck.
- C. Aggregate Setting Bed – For Pavers (above Cell deck): Aggregate material between the aggregate base course and unit surface pavers, designed to act as a setting bed for the pavers.
- D. Backfill: The earth used to replace or the act of replacing earth in an excavation beside the Silva Cell frames to the excavation extents.
- E. Finish Grade: Elevation of finished surface of planting soil or paving.
- F. Planting Soil: Soil as defined in Division 32 Section 02420 Soil Preparation and Soil Mixes , intended to fill the Silva Cell system and other planting spaces.
- G. Root Barrier: Plastic root diversion device.
- H. Silva Cell System:
 - 1) Silva Cell: One assembled unit made up of 1 base, 6 post assemblies, and 1 Silva Cell deck.
 - 2) Silva Cell System: Two or more Silva Cells used in combination with

each other and with required accessories.

- I. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill.
- J. Walk-Through: A process for light compaction of soils by walking through the soil following placement.

1.4 REFERENCE STANDARDS

- A. American Association of State Highway and Transportation Officials (AASHTO):
 - 1) AASHTO H-20
- B. ASTM International (ASTM):
 - 1) ASTM D448-12, Standard Classification for Sizes of Aggregate for Road and Bridge Construction
 - 2) ASTM D698-12e1, Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft³)
 - 3) ASTM D1241-07, Standard Specification for Materials for Soil-Aggregate Subbase, Base, and Surface Courses
 - 4) ASTM D3786/D3786M-13, Standard Test Method for Bursting Strength of Textile Fabrics-Diaphragm Bursting Strength Tester Method
 - 5) ASTM D4491-99a(2014)e1, Standard Test Methods for Water Permeability of Geotextiles by Permittivity
 - 6) ASTM D4533-D4533M-15, Standard Test Method for Trapezoid Tearing Strength of Geotextiles
 - 7) ASTM D4632-D4632M-15, Standard Test Method for Grab Breaking Load and Elongation of Geotextiles
 - 8) ASTM D4751-12, Standard Test Method for Determining Apparent Opening Size of a Geotextile
 - 9) ASTM D4833/D4833M-07(2013)e1, Standard Test Method for Index Puncture Resistance of Geomembranes and Related Products
 - 10) ASTM D5262-07(2012), Standard Test Method for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics
 - 11) ASTM D6241-14, Standard Test Method for Static Puncture Strength of Geotextile and Geotextile-Related Products Using a 50mm Probe
 - 12) ASTM D6637-11, Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method

1.5 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Conference: Prior to installation of the Silva Cell system and associated Work, meet at Project site with the Contractor, Silva Cell system installer and their field supervisor, manufacturer's technical representative, the Landscape Architect, the Owner at the Owner's discretion, and other entities concerned with the Silva Cell system performance.
 - 1) Provide at least 72 hours advance notice to participants prior to

convening pre-installation conference.

- 2) Introduce and provide a roster of individuals in attendance with contact information.
- 3) The pre-installation conference agenda will include, but is not limited to the review of:
 - a. Required submittals both completed and yet to be completed.
 - b. The sequence of installation and the construction schedule.
 - c. Coordination with other trades.
 - d. Details, materials and methods of installation.
 - (i) Review requirements for substrate conditions, special details, if any, installation procedures.
 - (ii) Installation layout, procedures, means and methods.
 - e. Mock-up requirements.

B. Sequencing and Scheduling:

- 1) General: Prior to beginning Work of this Section, prepare a detailed schedule of the Work involved for coordination with other trades.
- 2) Schedule utility installations prior to beginning Work of this Section.
- 3) Where possible, schedule the installation of the Silva Cell system after the area is no longer required for use by other trades and Work. Where necessary to prevent damage, protect installed system if Work must occur over or adjacent to the installed Silva Cell system.

1.6 SUBMITTALS

- A. Action Submittals: Submit these to the Landscape Architect for review and acceptance not less than 45 days prior to start of installation of materials and products specified in this Section.
- 1) Product Data: For each type of product, submit manufacturer's product literature with technical data sufficient to demonstrate that the product meets these specifications.
 - 2) Test and Evaluation Reports:
 - a. Submit results of compaction testing required by the Specifications for approval.
 - b. Include analysis of bulk materials including soils and aggregates, by a recognized laboratory that demonstrates that the materials meet the Specification requirements.
 - 3) Samples:
 - a. One full size sample of an assembled Silva Cell.
 - b. One 6-inch (150-mm) square piece of geogrid.
 - c. One 6-inch (150-mm) square piece of geotextile.

- 4) Manufacturer's Report: Submit Silva Cell system manufacturer's letter of review and approval of the Project, including Drawings and Specifications, Addenda, Clarifications and Modifications, and for compliance with product installation requirements.
- 5) Qualification Statements:
 - a. Manufacturer:
 - (i) Submit list of completed projects demonstrating durability and longevity of in-place systems.
 - (ii) Include project name, location, and date of completion.
 - b. Installer:
 - (i) Submit documentation of the qualifications of the Silva Cell system installer and their field supervisor, sufficient to demonstrate that both meet the requirements specified in Article 1.05 QUALITY ASSURANCE.
 - (ii) Submit list of completed projects of similar scope and scale demonstrating capabilities and experience.
- B. Closeout Submittals: Submit these to the Landscape Architect & Engineer at completion of installation.
 - 1) Warranty: Submit manufacturer's warranty, fully executed.

1.7 QUALITY ASSURANCE

- A. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary permits/approvals from these authorities.
- B. Manufacturer Qualifications:
 - 1) A manufacturer whose product is manufactured in an ISO/TS 16949 compliant and ISO 9001 - 2008 registered factory.
 - 2) A manufacturer with not less than 100 Silva Cell systems in-place, each system in use for not less than 3 years, confirming durability and longevity of the system.
 - 3) A manufacturer with documented written approval of their product for use as a stormwater treatment device by a minimum of 3 governmental jurisdictions.
 - 4) A manufacturer with an established and demonstrated utility service and repair process, including written procedure and photographs demonstrating work.
- C. Installer Qualifications: A qualified installer with not less than 5 years of successful experience installing Silva Cell systems or related products and materials, and whose work has resulted in successful installation of underground piping, chambers and vault structures, planting soils, and planter drainage systems of a similar scope and scale in dense urban areas.

- D. Installer's Field Supervisor: A full-time supervisor employed by the installer with not less than 5 years of successful experience similar to that of the installer and present at the Project site when Work is in progress. Utilize the same field supervisor throughout the Project, unless a substitution is submitted to and approved in writing by the Landscape Architect & Engineer.

1.8 LAYOUT AND ELEVATION CONTROL

- A. Provide layout and elevation control during installation of Silva Cells. Utilize grade stakes, benchmarks, surveying equipment and other means and methods to assure that layout and elevations conform to the layout and elevations indicated on the plans.

1.9 PERMITS AND CODE COMPLIANCE

- A. Comply with applicable requirements of the laws, codes, ordinances and regulations of Federal, State and Municipal authorities having jurisdiction. Obtain necessary permits/approvals from all such authorities.

1.10 DELIVERY, STORAGE, AND HANDLING

- A. Silva Cell System: Protect Silva Cell system components from damage during delivery, storage and handling.
 - 1) Store components on smooth surfaces, free from dirt, mud and debris. Store under tarp to protect from sunlight when time from delivery to installation exceeds one week.
 - 2) Perform handling with equipment appropriate to the size (height) of Silva Cells and site conditions; equipment may include, hand, handcart, forklifts, extension lifts, or small cranes, with care given to minimize damage to Silva Cell bases, posts, decks and adjacent assembled Silva Cells.
- B. Packaged Materials: Deliver packaged materials in original, unopened containers indicating weight, certified analysis, name and address of manufacturer, and indication of conformance with State and Federal laws, if applicable. Protect materials from deterioration during delivery and while on the Project site.
- C. Bulk Materials:
 - 1) Do not deliver or place backfill, soils, or soil amendments in frozen, wet, or muddy conditions.
 - 2) Provide protection including tarps, plastic and/or matting between bulk materials and finished surfaces sufficient to protect the finish material.
 - 3) Bring planting soil to the site using equipment and methods that do not overly mix and further damage soil peds within the soil mix.
- D. Provide erosion-control measures to prevent erosion or displacement of bulk materials and discharge of soil-bearing water runoff or airborne dust to adjacent properties, water conveyance systems, and walkways. Provide additional sediment control to retain excavated material, backfill, soil amendments and planting mix within the Project limits as needed.

1.11 FIELD CONDITIONS

- A. Existing Conditions: Do not proceed with Work when subgrades, soils and planting soils are in a wet, or muddy.

1.12 WARRANTY

- A. The Contractor shall warrant the Silva Cell system to be free of faults and defects in accordance with the General Conditions, except that the warranty shall be extended by manufacturer's written warranty against defects in materials and workmanship as follows:
- 1) DeepRoot® warrants to the original purchaser of its Silva Cell™ product that such product will be free from defects in materials and workmanship, and perform to DeepRoot's written specifications for the warranted product, when installed and used as specifically provided in the product's installation guidelines for a period of 20 years from the date of purchase. This warranty does not cover wear from normal use, or damage caused by abuse, mishandling, alterations, improper installation and/or assembly, accident, misuse, or lack of reasonable care of the product. This warranty does not apply to events and conditions beyond DeepRoot's control, such as ground subsidence or settlement, earthquakes and other natural events, acts of third parties, and/or Acts of God. If this warranty is breached, DeepRoot® will provide a replacement product. Incurred costs, such as labor for removal of the original product, installation of replacement product, and the cost of incidental or other materials or expenses are not covered under this warranty.
 - 2) Deeproot® makes no other warranties, express or implied, and specifically disclaims the warranty of merchantability or fitness for a particular purpose. Deeproot® shall not be liable either in tort or in contract for any direct, incidental or consequential damages, lost profits, lost revenues, loss of use, or any breach of any express or implied warranty.

PART 2 PRODUCTS

2.1 MANUFACTURER

- A. Acceptable Manufacturers:
- 1) DeepRoot Green Infrastructure, LLC
 - 2) 101 Montgomery Street, Suite 2850
 - 3) San Francisco, CA, 94104
 - 4) 415.781.9700
 - 5) 800.458.7668
 - 6) Fax 415.781.0191
 - 7) WWW.DEEPROOT.COM
- B. No substitutions are allowed.

2.2 DESCRIPTION

- A. The term Silva Cell shall be used to refer to a single Silva Cell or a stack of Silva Cells.
- B. Silva Cells shall be designed for the purpose of growing healthy trees.
- C. Silva Cells shall be modular, structural systems.
- D. Each Silva Cell shall be structurally-independent from all adjacent Silva Cells for incorporating utilities and other site features as well as for future repairs.
- E. Silva Cells shall be capable of supporting loads up to and including AASHTO H-20 (United States) when used in conjunction with approved pavement profiles.
- F. Silva Cells shall be open on all vertical faces and horizontal planes and shall have no interior walls or diaphragms.
- G. Silva Cells shall be capable of providing a large, contiguous, continuous volume of planting soil that does not inhibit or prevent the following:
 - 1) Placement of planting soil
 - 2) Compaction testing of planting soil, once in place
 - 3) Movement and growth of roots
 - 4) Movement of water within the provided soil volume, including lateral capillary movement
 - 5) Installation and maintenance of utilities placed within, adjacent to, or below the Silva Cell.
- H. Silva Cells shall be able capable of being filled with a variety of soil types and soils that include peds 1/2 inches in diameter as is appropriate for the application, location of the installation, and tree species.

2.3 SILVA CELL MATERIALS AND ACCESSORIES

- A. Silva Cell System Components: Each "Silva Cell 2" soil cell module (hereafter Silva Cell or "cell") is composed of one base, 6 post assemblies, and one deck.
 - 1) 2x Silva Cell 2 System:
 - a. Components: One base, six 2x posts, and one deck.
 - b. Assembled Dimensions (Each Cell): 47.2 inches long by 23.6 inches wide by 30.9 inches high (1200 mm long by 600 mm wide by 784 mm high).
- B. Silva Cell Materials and Fabrication:
 - 1) Bases and Posts: Homopolymer polypropylene.
 - 2) Decks: Fiberglass reinforced, chemically-coupled, impact modified polypropylene.
- C. Manufacturer's Related Silva Cell Installation Accessories:
 - 1) Strongbacks: An accessory designed to stabilize the Silva Cell posts temporarily, during soil placement, and removed for reuse prior to placing decks.

- 2) Anchoring Pins: Threaded pins and crossbar for securing assembled Silva Cells to subbase.

2.4 RELATED PRODUCTS

- A. Root Barrier: Recyclable, black, injection molded panels manufactured with a minimum 50 percent post-consumer recycled polypropylene plastic with UV inhibitors, and integrated zipper joining system which allows instant assembly by sliding one panel into another; for redirecting tree roots down and away from hardscapes.
 - 1) Panel Sizes:
 - a. No. UB18-2: 24 inches long by 18 inches deep by 0.080 inches thick (61 cm long by 46 cm deep by 2.03 mm thick); for use with 2x and 3x systems, and for pavement profiles 12 inches or more in depth.
 - 2) Products meeting this specification:
 - a. DeepRoot Tree Root Barrier (DeepRoot Green Infrastructure, LLC)
- B. Geogrid: Net-shaped woven polyester fabric with PVC coating, uniaxial or biaxial geogrid, inert to biological degradation, resistant to naturally occurring chemicals, alkalis, and acids; used to provide a stabilizing force within soil structure as the fill interlocks with the grid .
 - 1) Tensile strength at ultimate (ASTM D6637): 1850 lbs/ft minimum
 - 2) Creep reduced strength (ASTM D5262): 1000 lbs/ft minimum
 - 3) Long term allowable design load (GRI GG-4): 950 lbs/ft minimum
 - 4) Grid aperture size (MD): 0.8 inch minimum
 - 5) Grid aperture size (CD): 1.28 inch maximum
 - 6) Roll size: 6-foot width is preferred, up to 18-foot.
 - 7) Products meeting this specification:
 - a. Stratagrid SG 150, (Strata Systems, Inc.); Cumming, GA;
<http://www.geogrid.com>
 - b. Miragrid 2XT (TenCate Nicolon); Norcross, GA;
<http://www.tencate.com>
 - c. Fortrac 35 Geogrid (Huesker, Inc.); Charlotte, NC;
<http://www.hueskerinc.com>
 - d. SF 20 Biaxial Geogrid (Synteen); Lancaster, SC;
<http://www.synteen.com>
- C. Geotextile: Nonwoven polypropylene fibers, inert to biological degradation and resistant of naturally occurring chemicals, alkalis and acids; applied to either the soil surface or between materials, providing filtration, separation, or stabilization properties.
 - 1) Grab tensile strength (ASTM D4632): 200 lbs minimum

- 2) Elongation (ASTM D4632): 50 percent minimum
- 3) Trapezoid tear strength (ASTM D4533): 80 lbs minimum
- 4) Mullen burst strength (ASTM D3786): 350 psi
- 5) Puncture strength (ASTM D4833): 110 lbs minimum
- 6) CBR puncture strength (ASTM D6241): 500 lbs minimum
- 7) Apparent opening size (ASTM D4751): 80 sieve maximum
- 8) Flow rate (ASTM D4491): 90 gal/min/ft² minimum
- 9) UV Resistance (at 500 hours): 70 percent strength retained
- 10) Products meeting this specification:
 - a. ADS Geosynthetics 0801T (ADS Geosynthetics); <http://www.ads-pipe.com>
 - b. Mirafi 180 N (TenCate Nicolon); Norcross, GA; <http://www.tencate.com>
 - c. Geotex 801 (Propex Geosynthetics); Chattanooga, TN: <http://www.geotextile.com>

- D. Plastic Cable Ties: A tensioning device or tool used to tie similar or different materials together with a specific degree of tension.

2.5 OTHER RELATED MATERIALS

- A. Wood Blocking: Nominal dimensioned untreated lumber used for spacing assembled Silva Cells.
- B. Aggregate Subbase (Below Silva Cell Base):

- 1) Aggregate meeting one of the following specifications:
 - a. Complying ASTM D1241, Type I, Gradation B; Type I mixtures shall consist of stone, gravel, or slag with natural or crushed sand and fine mineral particles passing a No. 200 sieve.

<u>Sieve</u>	<u>Percent Passing</u>
1-1/2 inches	100
1 inch	75 to 95
3/8 inch	40 to 75
No 4	30 to 60
No 10	20 to 45
No 40	15 to 30
No 200	5 to 15

- b. Local Department of Transportation (DOT) virgin aggregate that most closely meets the gradation of ASTM D1241.

- C. Aggregate Base Course (Above Silva Cell Deck):

- 1) As specified in Civil Drawings & Specifications.
- D. Backfill Material (Adjacent to Silva Cells): Clean, compactable, coarse grained fill soil free of organic material, trash and other debris, and free of toxic material injurious to plant growth.
- E. Planting Soil: Refer to Section 02420 – Soil Preparation and Soil Mixes.

PART 3 EXECUTION

3.1 EXAMINATION

- A. Examine the conditions under which the Silva Cells are to be installed.
 - 1) Carefully check and verify dimensions, quantities, and grade elevations.
 - 2) Carefully examine the Drawings to become familiar with the existing underground conditions before digging. Verify the location of aboveground and underground utility lines, infrastructure, other improvements, and existing trees, shrubs, and plants to remain including their root system.
 - 3) Notify the Contractor and the Landscape Architect & Engineer in writing in the event of conflict between existing and new improvements, of discrepancies, and other conditions detrimental to proper and timely completion of the installation.
 - 4) Obtain written approval of changes to the Work prior to proceeding. Proceed with installation only after changes have been made and unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Take proper precautions as necessary to avoid damage to existing improvements and plantings.
- B. Prior to the start of Work, layout and stake the limits of excavation and horizontal and vertical control points sufficient to install the complete Silva Cell system.
- C. Coordinate installation with other trades that may impact the completion of the Work.

3.3 TEMPORARY PROTECTION

- A. Protect open excavations and Silva Cell system from access and damage both when work is in progress and following completion, with highly visible construction tape, fencing, or other means until related construction is complete.
- B. Do not drive vehicles or operate equipment over the Silva Cell system until the final surface material has been installed.

3.4 EXCAVATION

- A. General: Excavate to the depths and shapes indicated on the Drawings. Provide smooth and level excavation base free of lumps and debris.
- B. Confirm that the depth of the excavation is accurate and includes the full section of materials required to place the subbase aggregate, Silva Cell, and pavement profile as indicated on the Drawings.

- C. Over-excavate beyond the perimeter of the Silva Cell to allow for:
 - 1) The extension of aggregate subbase beyond the Silva Cell layout as shown on the Drawings.
 - 2) Adequate space for proper compaction of backfill around the Silva Cell system.
- D. If unsuitable subgrade soils are encountered, consult the Owner's geotechnical consultants for directions on how to proceed.
- E. If conflicts arise during excavation, notify the Landscape Architect & Engineer in writing and make recommendations for action. Proceed with Work only when action is approved in writing.

3.5 SUBGRADE COMPACTION

- A. Compact subgrade to a minimum of 95 percent of maximum dry density at optimum moisture content in accordance with ASTM D698, Standard Proctor Method, or as approved by the Owner's geotechnical representative.
- B. Do not exceed 7 percent slope for subgrade profile in any one direction. If the 7 percent slope is exceeded, contact manufacturer's representative for directions on how to proceed.

3.6 INSTALLATION OF GEOTEXTILE OVER SUBGRADE

- A. Install geotextile over compacted subgrade.
 - 1) Lay geotextile flat with no folds or creases.
 - 2) Install the geotextile with a minimum joint overlap of 18 inches.

3.7 INSTALLATION OF AGGREGATE SUBBASE BELOW SILVA CELL BASES

- A. Install aggregate subbase to the depths indicated on the Drawings.
- B. Extend subbase aggregate a minimum of 6 inches beyond the base of the Silva Cell layout.
- C. Compact aggregate subbase to a minimum of 95 percent of maximum dry density at optimum moisture content in accordance with ASTM D698, Standard Proctor Method.
- D. Do not exceed 7 percent slope on the surface of the subbase. Where proposed grades are greater than 7 percent, step the Silva Cells to maintain proper relation to the finished grade.

3.8 INSTALLATION OF SILVA CELL BASE

- A. Install the Silva Cell system in strict accordance with manufacturer's instructions and as specified herein; where requirements conflict or are contradictory, follow the more stringent requirements.
- B. Layout and Elevation Control:
 - 1) Provide layout and elevation control during installation of the Silva Cell system to ensure that layout and elevations are in accordance with the Drawings.

- C. Establish the location of the tree openings in accordance with the Drawings. Once the trees are located, mark the inside dimensions of the tree openings on the prepared subbase.
- D. Locate and mark other Project features located within the Silva Cell layout (e.g. light pole bases, utility pipes). Apply marking to identify the extent of the Silva Cell layout around these features. Follow the layout as shown on the Drawings to ensure proper spacing of the Silva Cell bases. Refer to the Drawings for offsets between these features and the Silva Cells.
- E. Check each Silva Cell component for damage prior to placement. Reject cracked or chipped units.
- F. Place the Silva Cell bases on the compacted aggregate subbase. Start at the tree opening and place Silva Cell bases around the tree openings as shown on the Drawings.
- G. Working from tree opening to tree opening, place Silva Cell bases to fill in the area between tree openings.
 - 1) Maintain spacing no less than 1 inch and no more than 4 inches apart.
- H. Follow the Silva Cell layout plan as shown on the Drawings.
- I. Install Silva Cell bases around, over, or under existing or proposed utility lines, as indicated on the Drawings.
- J. Level each Silva Cell base as needed to provide full contact with subbase. Adjust subbase material, including larger pieces of aggregate, so each base sits solidly on the surface of the subbase. Silva Cell bases that rock or bend over any stone or other obstruction protruding above the surface of the subbase material are not allowed. Silva Cell bases which bend into dips in the subbase material are not allowed. The maximum tolerance for deviations in the plane of the subbase material under the bottom of the horizontal beams of each Silva Cell base is 1/4 inch in 4 feet.
- K. Anchor Silva Cell base with 2 crossbar/pin assemblies per base.
 - 1) For applications where Silva Cells are installed over waterproofed structures, use wood blocking or similar spacing system consistent with requirements of the waterproofing system to maintain required spacing.

3.9 INSTALLATION OF SILVA CELL POSTS

- A. 2x Silva Cell 2 System:
 - 1) Attach 2x posts to the installed Silva Cell base. Each base will receive six 2x posts. Place the end of the post with tabs into the base. Rotate post clockwise to snap in place.

3.10 INSTALLATION OF STRONGBACKS, GEOGRID, BACKFILL AND PLANTING SOIL

- A. Install strongbacks on top of the Silva Cell posts by snapping into place over installed posts prior to installing planting soil and backfill.
 - 1) Strongbacks are required only during the placement and compaction of the planting soil and backfill.
 - 2) Move strongbacks as the Work progresses across the installation.

- 3) Remove strongbacks prior to the installation of the Silva Cell decks.
- B. Install geogrid around the perimeter of the Silva Cell system where the compacted backfill and planting soil interface.
 - 1) Do not place geogrid between the edge of the Silva Cells and adjacent planting areas.
 - 2) Cut the geogrid to allow for a 6-inch overlap at the Silva Cell base and a 12-inch overlap at the Silva Cell deck.
 - 3) Provide a minimum 12-inch overlap between adjacent sheets of geogrid.
 - 4) Secure geogrid with cable ties below the top of the posts, along the post ridges.
- C. Place the first lift of backfill material loosely around the perimeter of the Silva Cell system, between the geogrid and the sides of the excavation. Place backfill to approximately the midpoint of the Silva Cell post. Do not compact.
- D. Place the first lift of planting soil in the Silva Cell system to approximately the midpoint of the Silva Cell post.
 - 1) Level the planting soil throughout the system.
 - 2) Walk-through the placed planting soil to remove air pockets and settle the soil. Do not compact greater than 80 percent of maximum dry density in accordance with ASTM D698, Standard Proctor Method.
 - 3) Check placed soil for compaction with a penetrometer or densitometer or similar.
- E. Compact the first lift of backfill material, previously spread, to 95 percent of maximum dry density in accordance with ASTM D698, Standard Proctor Method or in accordance with Project Specifications for hardscape areas, whichever is greater.
- F. Add and compact additional backfill material so that the final finished elevation is at approximately the same level of the placed planting soil within the Silva Cells.
 - 1) Maintain the geogrid between the Silva Cell system and the backfill material at all times.
- G. Place the second lift of backfill material loosely around the perimeter of the Silva Cell system, between the geogrid and the sides of the excavation so that the material is 2 to 3 inches below the top of the posts. Do not compact.
- H. Place the second lift of planting soil inside of the Silva Cell to the bottom of the strongbacks. Walk through.

3.11 INSTALLATION OF SILVA CELL DECK

- A. Obtain final approval by the Landscape Architect & Engineer of planting soil installation prior to installation of the Silva Cell decks.
- B. Remove strongbacks, level out the planting soil, and immediately install decks over the posts below. Place deck over the top of the posts. Push decks down until the deck clips lock into the posts, snapping the deck into place.
- C. Fold the 12 inches of geogrid onto the top of the decks.

3.12 FINAL BACKFILL PLACEMENT AND COMPACTION

- A. Place and compact final lift of backfill material to 95 percent of maximum dry density in accordance with ASTM D698, Standard Proctor Method, such that the backfill is flush with the top of the installed deck. Do not allow compacting equipment to come in contact with the decks.

3.13 INSTALLATION OF GEOTEXTILE AND AGGREGATE BASE COURSE OVER THE DECK

- A. Place geotextile over the top of the deck and extend to the edge of the excavation. Overlap joints a minimum of 18 inches. Leave enough slack in the geotextile for the aggregate base course to push the geotextile down in the gaps in between the decks.
- B. Install the aggregate base course (including aggregate setting bed if installing unit pavers) over the geotextile immediately after completing the installation of the fabrics. Work the aggregate from one side of the layout to the other so that the fabric and aggregate conform to the Silva Cell deck contours.
- C. Maintain equipment used to place aggregate base course completely outside the limits of the Silva Cell excavation area to prevent damage to the installed system.
- D. For large or confined areas, where aggregate cannot easily be placed from the edges of the excavated area, obtain approval for the installation procedure and types of equipment to be used in the installation from the Silva Cell manufacturer.
- E. Compact aggregate base course(s) to 95 percent of maximum dry density in accordance with ASTM D698, Standard Proctor Method. Utilize a vibration or plate compactor with a maximum weight of 800 lbs.
- F. Do not drive vehicles or operate equipment over the completed aggregate base course.

3.14 INSTALLATION OF CONCRETE CURBS AT TREE OPENINGS, AGGREGATE SUBBASE AND PAVEMENT ABOVE THE SILVA CELL SYSTEM

- A. Place concrete curbs along planting areas and tree openings as shown on the Drawings to retain the aggregate base course from migrating into the planting soil.
- B. When staking concrete forms (e.g. curbs around the tree openings), prevent stakes from penetrating the Silva Cell decks.
- C. Turn down edge of concrete paving to the Silva Cell deck along the edges of tree openings or planting areas to retain the aggregate base course material.
- D. When paving type is a unit paver or other flexible material, provide a concrete curb under the paving at the edge of the Silva Cell deck to retain the aggregate base course material at the tree opening.
- E. Place paving material over Silva Cell system in accordance with the Drawings.
 - 1) The Silva Cell system does not fully meet loading strength until the final paving is installed. Do not operate construction equipment on top of the Silva Cell system until paving installation has been completed.

- F. Use care when placing paving or other backfill on top of Silva Cell system to prevent damage to the Silva Cell system or its components.

3.15 INSTALLATION OF ROOT BARRIERS

- A. Install root barrier in accordance with manufacturer's installation instructions.

3.16 INSTALLATION OF PLANTING SOIL WITHIN THE TREE PLANTING AREA

- A. Remove rubble, debris, dust and silt from the top of the planting soil within the tree opening that may have accumulated after the initial installation of the planting soil within the Silva Cells.
- B. Install additional planting soil within the tree openings, to the depths indicated on the Drawings.
 - 1) Use the same soil used within the Silva Cells for planting soil within the tree openings.
- C. Compact planting soil under the tree root ball to between 85 and 90 percent of maximum dry density in accordance with ASTM D698, Standard Proctor Method, to prevent settlement of the root ball.
- D. Place trees in accordance with the Drawings.

3.17 PROTECTION

- A. Keep construction traffic away from the limits of the Silva Cells until the final pavement profile is in place. The Silva Cell system does not fully meet loading strength until the final paving is installed.
 - 1) Do not operate equipment directly on top of the Silva Cell system until paving installation has been completed.
 - 2) Provide fencing and other barriers to prevent vehicles from entering into the Silva Cell area.
- B. When the Silva Cell installation is completed and the permanent pavement is in place, limit traffic and construction related activities to only loads less than the design loads.

3.18 CLEAN UP

- A. Perform clean up during installation and upon completion of the Work. Maintain the site free of soil, sediment, trash and debris. Remove excess soil materials, debris, and equipment from the site following completion of the Work of this Section.
- B. Repair damage to adjacent materials and surfaces resulting from installation of this Work using mechanics skilled in remedial work of the construction type and trades affected.

END OF SECTION

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SECTION 03300 - CAST-IN-PLACE CONCRETE**PART 1 GENERAL****1.1 REFERENCES**

A. The following is a list of standards which may be referenced in this Section:

- 1) American Concrete Institute (ACI):
 - a. 117, Standard Specification for Tolerances for Concrete Construction and Materials.
 - b. 211.1, Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
 - c. 301, Standard Specification for Structural Concrete.
 - d. 302.1R, Guide For Concrete Floor and Slab Construction.
 - e. 304R, Guide for Measuring, Mixing, Transporting, and Placing Concrete.
 - f. 304.2R, Placing Concrete by Pumping Methods.
 - g. 305R, Hot Weather Concreting.
 - h. 306.1, Standard Specification for Cold Weather Concreting.
 - i. 309R, Guide for Consolidation of Concrete.
 - j. 318/318R, Building Code Requirements for Structural Concrete.
 - k. SP-15, Standard Specification for Structural Concrete.
- 2) ASTM International (ASTM):
 - a. C31, Standard Practice for Making and Curing Concrete Test Specimens in the Field.
 - b. C33, Standard Specification for Concrete Aggregates.
 - c. C39, Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
 - d. C88, Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
 - e. C94, Standard Specification for Ready-Mixed Concrete.
 - f. C143, Standard Test Method for Slump of Hydraulic-Cement Concrete.
 - g. C150, Standard Specification for Portland Cement.
 - h. C157, Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete.
 - i. C192, Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.
 - j. C231, Standard Test Method for Air Content of Freshly Mixed

Concrete by the Pressure Method.

- k. C260, Standard Specification for Air-Entraining Admixtures for Concrete.
 - l. C311, Standard Test Methods for Sampling and Testing Fly Ash or Natural Pozzolans for Use as a Mineral Admixture in Portland-Cement Concrete.
 - m. C452, Standard Test Method for Potential Expansion of Portland-Cement Mortars Exposed to Sulfate.
 - n. C494, Standard Specification for Chemical Admixtures for Concrete.
 - o. C595, Standard Specification for Blended Hydraulic Cements.
 - p. C618, Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete.
 - q. C1012, Standard Test Method for Length Change of Hydraulic-Cement Mortars Exposed to a Sulfate Solution.
 - r. C1018, Standard Test Method for Flexural Toughness and First-Crack Strength of Fiber-Reinforced Concrete (Using Beam with Third-Point Loading).
 - s. C1116, Standard Specification for Fiber-Reinforced Concrete and Shotcrete
 - t. C1218 Standard Test Method for Water-Soluble Chloride in Mortar and Concrete
 - u. C1240, Standard Specification for Silica Fume for Use as a Mineral Admixture in Hydraulic-Cement Concrete, Mortar, and Grout.
 - v. D2000, Standard Classification System for Rubber Products in Automotive Applications.
 - w. D4580, Standard Practice for Measuring Delaminations in Concrete Bridge Decks by Sounding.
 - x. E329, Standard Specification for Agencies Engaged in the Testing and/or Inspection of Materials Used in Construction.
- 3) National Bureau of Standards: Handbook No. 44, Specifications, Tolerances, and Other Technical Requirements for Commercial Weighing and Measuring Devices.

1.2 DEFINITIONS

- A. Defective Areas: Surface defects that include honeycomb, rock pockets, indentations greater than 3/16 inch, cracks 0.005 inch wide and larger as well as any crack that leaks for liquid containment basins and below-grade habitable spaces; cracks 0.010 inch wide and larger in nonfluid holding structures spalls, chips, air bubbles greater than 3/4 inch in diameter, pinholes, bug holes, embedded debris, lift lines, sand lines, bleed lines, leakage from form joints, fins and other projections, form popouts, texture irregularities, and stains and other color variations that cannot be removed by cleaning.
- B. Exposed Concrete: Concrete surfaces that can be seen inside or outside of structures regardless whether concrete is above water, dry at all times, or can be seen when structure is drained.
- C. Hydraulic Structures: Liquid containment basins.
- D. New Concrete: Less than 60 days old.
- E. Slurry Concrete: Mixture of sand, 3/8-inch minus aggregate, cement, and water for wall construction joints.

1.3 SUBMITTALS

- A. Action Submittals:
 - 1) Shop Drawings:
 - a. Product Data: Admixtures, bonding agent, bond breaker, and patching materials.
 - b. Design Data: Concrete mix designs signed by qualified mix designer.
 - 2) Placement Drawings:
 - a. Concrete, identifying location of each type of construction joint.
 - 3) Tremie concrete.
 - 4) Gradation for coarse and fine aggregates and combined together. List gradings, percent passing through each sieve size.
 - 5) Detailed plan for hot weather placements including curing and protection for concrete placed in ambient temperatures over 80 degrees F.
 - 6) Concrete repair methods and materials.
- B. Informational Submittals:
 - 1) Statements of Qualification:
 - a. Contractor's resident superintendent for concrete installation.
 - b. Mix designer.
 - c. Batch plant.
 - 2) Test Reports:
 - a. Admixtures, test reports showing chemical ingredients and percentage of chloride in each admixture and fly ash.

- b. Source test analysis report for fly ash, including percentage of chloride content.
 - c. Statement identifying aggregates reactivity. Determine water soluble chloride in each component of aggregates in accordance with ASTM C1218.
 - d. For each trial concrete mix design and signed by a qualified mix designer.
 - e. Cylinder compressive test results for laboratory concrete mixes.
- 3) Concrete Delivery Tickets:
- a. For each batch of concrete before unloading at Site.
 - b. Record of drum revolution counter, type, brand, test certification, Amount of fly ash if used in accordance with ASTM C94, Section 16.

1.4 QUALITY ASSURANCE

A. Qualifications:

- 1) Mix Designer: Licensed professional engineer registered in the State of Florida.
- 2) Batch Plant: Currently certified by the National Ready Mixed Concrete Association.

B. Preinstallation Conference:

- 1) Required Meeting Attendees:
 - a. Contractor, including pumping, placing and finishing, and curing subcontractors.
 - b. Ready-mix producer.
 - c. Admixture representative.
 - d. Testing and sampling personnel.
 - e. Engineer.
- 2) Schedule and conduct prior to incorporation of respective products into Project. Notify Engineer of location and time.
- 3) Agenda shall include:
 - a. Admixture types, dosage, performance, and redosing at Site.
 - b. Mix designs, test of mixes, and Submittals.
 - c. Placement methods, techniques, equipment, consolidation, and form pressures.
 - d. Slump and placement time to maintain slump.
 - e. Finish, curing, and water retention.
 - f. Protection procedures for weather conditions.

- g. Other specified requirements requiring coordination.
- 4) Conference minutes as specified in Section 01200, Project Meetings.

PART 2 PRODUCTS

2.1 MATERIALS

- A. Cement: Furnish from one source.
 - 1) Portland Cement Type I or Type II:
 - a. Meet ASTM C150.
 - b. Alkalis: Maximum 0.60 percent.
 - c. Tricalcium Aluminate Content of Type I Cement: Maximum 12 percent.
 - d. Nonhydraulic Abovegrade Structures: Type I or Type II cement.
 - e. Hydraulic and Belowgrade Structures and Sewers: Type II cement or combination of Type I mixed with fly ash.
 - f. Combine fly ash with cement at batch plant or during production of cement in accordance with ASTM C595, Type IP cement.
- B. Aggregates: Furnish from one source.
 - 1) Natural Aggregates:
 - a. Free from deleterious coatings and substances in accordance with ASTM C33, except as modified herein.
 - b. Free of materials and aggregate types causing popouts, discoloration, staining, or other defects on surface of concrete.
 - 2) Nonpotentially Reactive: In accordance with ASTM C33, Appendix XI, Paragraph X1.1.
 - 3) Aggregate Soundness: Test for fine and coarse aggregates in accordance with ASTM C33 and ASTM C88 using sodium sulfate solution.
 - 4) Fine Aggregates:
 - a. Clean, sharp, natural sand.
 - b. ASTM C33.
 - c. Materials Passing 200 Sieve: 4 percent maximum.
 - d. Limit deleterious substances in accordance with ASTM C33, Table 1 with material finer than 200 sieve limited to 3 percent, coal and lignite limited to 0.5 percent.
 - 5) Coarse Aggregate:
 - a. Natural gravels, combination of gravels and crushed gravels, crushed stone, or combination of these materials containing no more than 15 percent flat or elongated particles (long dimension

more than five times the short dimension).

- b. Materials Passing 200 Sieve: 0.5 percent maximum.
- c. Limit deleterious substances in accordance with ASTM C33, Table 3 for exposed concrete.

C. Admixtures: Furnish from one manufacturer.

- 1) Characteristics: Compatible with each other and free of chlorides or other corrosive chemicals.
- 2) Air-Entraining Admixture:
 - a. ASTM C260, nontoxic after 30 days and contains no chlorides.
 - b. Concrete with air-entrainment admixture added shall maintain air percentage as batched, within plus or minus 2 percent for time required for placement into structure.
- 3) Water-Reducing Admixture: ASTM C494, Type A or Type D.
 - a. Manufacturers and Products:
 - (i) Master Builders, Inc., Cleveland, OH; Pozzolith or Polyheed.
 - (ii) W. R. Grace & Co., Cambridge, MA; WRDA with HYCOL.
 - (iii) Euclid Chemical Co., Cleveland, OH; Eucon WR-91.
- 4) High Range Water Reducing Admixture (Superplasticizer):
 - a. ASTM C494.
 - b. Hold slump of 5 inches or greater for time required for placement.
 - c. Furnish type as recommended by manufacturer for allowed temperature ranges.
 - d. Type F or G.
 - e. Manufacturers and Products:
 - (i) Master Builders, Inc., Cleveland, OH; Rheobuild or Polyheed at dosage greater than 10 ounces per 100 pounds of cement.
 - (ii) W. R. Grace & Co., Cambridge, MA; Daracem 100.
 - (iii) Euclid Chemical Co., Cleveland, OH; Eucon 537.
- 5) Pozzolan (Fly Ash): Class C or Class F fly ash in accordance with ASTM C618, Table 1 and 2, except as modified herein:
 - a. Shall not be produced from process that has utilized hazardous or potentially hazardous materials.
 - b. Loss on Ignition: Maximum 3 percent.
 - c. Water Requirement: Maximum 100 percent of control.

$$\frac{CaO(\%) - 5}{FE_2O_3(\%)} : \text{Maximum } 1.5$$

- d.
- e. ASTM C618, Table 3, Reactivity with Cement Alkalis, apply when aggregate or portions of aggregate is reactive as specified under Paragraph Nonpotentially Reactive.
- f. ASTM C618, Table 3, Uniformity Requirements, apply when loss on ignition of fly ash furnished exceeds 3 percent.

- 6) Fly Ash: Maximum 25 percent, minimum 15 percent of total weight of fly ash plus cement.
- 7) For fly ash not meeting requirements of chemical ratio listed above, furnish the following:
 - a. Test fly ash in accordance with ASTM C1012.
 - b. Furnish test data confirming fly ash in combination with cement used meets strength requirements, is compatible with air-entraining agents and other additives and provides increased sulfate resistance equivalent to or better than Type II cement.
 - c. Conduct tests using proposed fly ash and cement samples together with control samples using Type II cement without fly ash.

D. Water: Clean and potable containing less than 500 ppm of chlorides.

2.2 CONCRETE MIX DESIGN

A. Design: Select and proportion ingredients using trial batches; sample, cure and test concrete mix through approved independent testing laboratory in accordance with ACI 211.1.

- 1) Concrete Compressive Strength, F'c:
 - a. 4,000 psi at 28 days, unless otherwise shown, except 3,000 psi at 28 days for secondary concrete elements such as curbs, sidewalks, and pipe/conduit encasements.
 - b. Design lab-cured trial mix cylinders.
 - c. Use additional cement or cement plus fly ash above minimum specified if required to meet average compressive strength, F'cr.
 - d. Use F'cr as basis for selection of concrete proportions as set forth in ACI 301.
 - e. F'cr: Equal to F'c plus 1,200 when data are not available to establish standard deviation.
- 2) Concrete Fill:
 - a. Design for 2,500 psi at 28 days using 3/4-inch aggregate, 4-inch maximum slump and 0.46 maximum water-cement ratio.
 - b. Use water-reducing admixture.

B. Proportions:

- 1) Design mix to meet aesthetic and structural concrete requirements.
- 2) In accordance with ACI 211.1, unless specified otherwise.
- 3) Unless specifically stated otherwise, water-cement ratio (or water-cement plus fly ash ratio) shall control amount of total water added to concrete as follows:

Water-Cement Ratio		
Coarse Aggregate Size	Maximum W/C Ratio w/ Superplasticizer	Maximum W/C Ratio w/o Superplasticizer
1-1/2"	0.40	0.44
1"	0.40	0.44
3/4"	0.40	0.44

- 4) Minimum Cement Content (or Combined Cement Plus Fly Ash Content When Fly Ash is Used):
 - a. 517 pounds per cubic yard for concrete with 1-1/2-inch maximum size aggregate.
 - b. 540 pounds per cubic yard for 1-inch maximum size aggregate.
 - c. 564 pounds per cubic yard for 3/4-inch maximum size aggregate.
 - d. Increase cement content or combined cement plus fly ash content, as required to meet strength requirements and water-cement ratio.

C. Admixtures:

- 1) Air Content: 4 to 6 percent when tested in accordance with ASTM C231; 3 percent maximum for interior slabs where heavy-duty concrete floor finish is required.
- 2) Fly Ash: Maximum 25 percent, minimum 15 percent of total weight of fly ash plus cement.
- 3) Water Reducers: Use in all concrete.
- 4) High Range Water Reducers (Superplasticizers): Use at Contractor's option. Control slump and workability to at least 4-1/2-inch slump at discharge into forms by adjusting high range water reducer at batch plant.

D. Slump Range at Site:

- 1) 4-1/2 inches minimum, 8 inches maximum for concrete with a high range water reducing admixture.
- 2) inches minimum and 5 inches maximum for concrete without high range water reducing admixture.

E. Combined Aggregate Gradation:

- 1) Structures: Select one of the gradations shown in the following table.
- 2) Combined Gradation Limits: Limits shown are for coarse aggregates and fine aggregates mixed together (combined).

Sieve Sizes	Combined Gradation		
	Percentage Passing		
	1-1/2" Max.	1" Max.	3/4" Max.
2"	- 100	-	-
1-1/2"	95 - 100	- 100	-
1"	65 - 85	90 - 100	- 100
3/4"	55 - 75	70 - 90	92 - 100
1/2"	-		68 - 86
3/8"	40 - 55	45 - 65	57 - 74
No. 4	30 - 45	31 - 47	38 - 57
No. 8	23 - 38	23 - 40	28 - 46
No. 16	16 - 30	17 - 35	20 - 36
No. 30	10 - 20	10 - 23	14 - 25
No. 50	4 - 10	2 - 10	5 - 14
No. 100	0 - 3	0 - 3	0 - 5
No. 200	0 - 2	0 - 2	0 - 2

F. Tremie Concrete:

- 1) Minimum cement content of 658 pounds per cubic yard.
- 2) Use high range water reducing admixture (superplasticizers) admixture in accordance with ASTM C494, Type F or Type G.
- 3) Fine Aggregate Range: 40 to 50 percent of total aggregates by weight.
- 4) Use natural round gravel if available in Project area.
- 5) Proportion mix for design strength and slump range of 6 to 9 inches with maximum water-cement ratio.
- 6) Use anti-washout admixture in accordance with manufacturer's recommendations.

2.3 CONCRETE MIXING

A. General: In accordance with ACI 304R.

B. Concrete Mix Temperatures: As shown below for various stages of mixing and placing:

CONCRETE TEMPERATURES				
Ambient Air Temp.	Concrete Member Size, Minimum Dimension			
	<12"	12"-36"	36"-72"	>72"
Minimum concrete temperature as mixed for indicated air temperature:				
Above 30 deg .F	60 deg. F	55 deg. F	50 deg. F	45 deg. F
0 to 30 deg. F	65 deg. F	60 deg. F	55 deg. F	50 deg. F
Below 0 deg. F	70 deg. F	65 deg. F	60 deg. F	55 deg. F
Maximum allowable gradual temperature drop in first 24 hours after curing period and after end of protection:				
-	50 deg. F	40 deg. F	30 deg. F	20 deg. F

C. Truck Mixers:

- 1) Equip with electrically actuated counters to readily verify number of revolutions of drum or blades.
- 2) Counter:
 - a. Resettable, recording type, mounted in driver's cab.
 - b. Actuated at time of starting mixers at mixing speeds.
- 3) Truck mixer operation shall furnish concrete batch as discharged that is homogeneous with respect to consistency, mix, and grading.
- 4) If slump tests taken at approximately 1/4 and 3/4 points of load during discharge give slumps differing by more than 2 inches when specified, slump is more than 4 inches, discontinue use of truck mixer unless causing condition is corrected and satisfactory performance is verified by additional slump tests.
- 5) Before attempting to reuse unit, check mechanical details of mixer, such as water measuring, and discharge apparatus, condition of blades, speed of rotation, general mechanical condition of unit, admixture dispensing equipment, and clearance of drum.
- 6) Do not use nonagitating or combination truck and trailer equipment for transporting ready-mixed concrete.
- 7) Concrete Volume in Truck:
 - a. Limit to 63 percent of total volume capacity in accordance with ASTM C94 when truck mixed.
 - b. Limit to 80 percent of total volume capacity when central mixed.
- 8) Mix each batch of concrete in truck mixer for minimum 70 revolutions of drum or blades at rate of rotation designated by equipment manufacturer.
- 9) Perform additional mixing, if required, at speed designated by equipment manufacturer as agitating speed.
- 10) Place materials, including mixing water, in mixer drum before actuating revolution counter for determining number of mixing revolutions.

D. Aggregates: Thoroughly and uniformly wash before use.

E. Admixtures:

- 1) Air-Entraining Admixture: Add at plant through manufacturer-approved dispensing equipment.
- 2) Water Reducers: Add prior to addition of high range water reducing admixture (superplasticizers).
- 3) High range water reducing admixture (superplasticizers) and Air-Entraining Admixtures:
 - a. Add at concrete plant only through equipment furnished or approved by admixture manufacturer.
 - b. Accomplish variations in slump, working time, and air content for

flowable mixes by increasing or reducing high range water reducing admixture (superplasticizers) dose or air-entraining admixture dose at ready-mix plant only.

- c. Equipment shall provide for easy and quick visual verification of admixture amount used for each dose.
- d. Add discharge amount to each load of concrete into separate dispensing container, verify amount is correct, and add to concrete.
- e. Additional dosage of high range water reducing admixture (superplasticizers) may be added in field using manufacturer-approved dispensing when unexpected delays cause too great of slump loss.

2.4 SOURCE QUALITY CONTROL

- A. Cement: Test for total chloride content.
- B. Fly Ash: Test in accordance with ASTM C311.
- C. Batch Plant Inspection: Engineer shall have access to and have right to inspect batch plants, cement mills, and supply facilities of suppliers, manufacturers, and Subcontractors, providing products included in these Specifications:
 - 1) Weighing Scales: Tested and certified within tolerances set forth in the National Bureau of Standards Handbook No. 44.
 - 2) Batch Plant Equipment: Either semiautomatic or fully automatic in accordance with ASTM C94.

PART 3 EXECUTION

3.1 PLACING CONCRETE

- A. Preparation: Meet requirements and recommendations of ACI 304R and ACI 301, except as modified herein.
- B. Inspection: Notify Engineer at least 1 full working day in advance before starting to place concrete.
- C. Discharge Time:
 - 1) As determined by set time, do not exceed 1-1/2 hours after adding cement to water unless special approved time delay admixtures are used. Coordinate time delay admixture information with manufacturer and Engineer prior to placing concrete.
 - 2) Adjust slump or air content at Site by adding admixtures for particular load when approved by Engineer. Then, adjust plant dosage for remainder of placement. Additional dosage at Site shall be through approved dispenser supplied by admixture manufacturer.
 - 3) Maintain required slump throughout time of concrete placement and consolidation. Discontinue use of high range water reducing admixture (superplasticizers) and provide new mix design if it fails to maintain slump between 4 to 8 inches and produce good consolidation for the length of

time required. Redesign mix adjusting set control admixtures to maintain setting time in range required.

D. Placement into Formwork:

- 1) Before depositing concrete, remove debris from space to be occupied by concrete.
- 2) Prior to placement of concrete, dampen fill under slabs on ground, dampen sand where vapor retarder is specified, and dampen wood forms.
- 3) Reinforcement: Secure in position before placing concrete.
- 4) Place concrete as soon as possible after leaving mixer, without segregation or loss of ingredients, without splashing forms or steel above, and in layers not over 1.5 feet deep, except for slabs which shall be placed full depth. Place and consolidate successive layers prior to initial set of first layer to prevent cold joints.
- 5) Use placement devices, for example, chutes, pouring spouts, and pumps.
- 6) Vertical Free Fall Drop to Final Placement: 5 feet in forms 8 inches or less wide and 8 feet in forms wider than 8 inches, except as specified.
 - a. For placements where drops are greater than specified, use placement device such that free fall below placement device conforms to required value.
 - b. Limit free fall to prevent segregation caused by aggregates hitting reinforcing steel.
- 7) Do not use aluminum conveying devices.
- 8) Provide sufficient illumination in the interior of forms so concrete deposition is visible, permitting confirmation of consolidation quality.
- 9) Joints in Footings and Slabs:
 - a. Ensure space beneath plastic water stop completely fills with concrete.
 - b. During concrete placement, make visual inspection of entire water stop area.
 - c. Limit concrete placement to elevation of water stop in first pass, vibrate concrete under water stop, lift water stop to confirm full consolidation without voids, place remaining concrete to full height of slab.
 - d. Apply procedure to full length of water stops.
- 10) If reinforcement is in direct sunlight or is more than 20 degrees F higher in temperature than concrete temperature before placement, wet reinforcement with water fog spray before placing concrete to cool reinforcement.
- 11) Trowel and round off top exposed edges of walls with 1/4-inch radius steel edging tool.

E. Conveyor Belts and Chutes:

- 1) Design and arrange ends of chutes, hopper gates, and other points of concrete discharge throughout conveying, hoisting, and placing system for concrete to pass without becoming segregated.
 - 2) Do not use chutes longer than 50 feet.
 - 3) Minimum Slopes of Chutes: Angled to allow concrete to readily flow without segregation.
 - 4) Conveyor Belts:
 - a. Approved by Engineer.
 - b. Wipe clean with device that does not allow mortar to adhere to belt.
 - c. Cover conveyor belts and chutes.
- F. Retempering: Not permitted for concrete where cement has partially hydrated.
- G. Pumping of Concrete:
- 1) Provide standby pump, conveyor system, crane and concrete bucket, or other system onsite during pumping, for adequate redundancy to assure completion of concrete placement without cold joints in case of primary placing equipment breakdown.
 - 2) Minimum Pump Hose (Conduit) Diameter. 4 inches.
 - 3) Replace pumping equipment and hoses (conduits) that are not functioning properly.
- H. Maximum Size of Concrete Placements:
- 1) Limit size of each placement to allow for strength gain and volume change due to shrinkage.
 - 2) Locate expansion, control, contraction, and construction joints where shown. When expansion or control joints are not shown, provide construction joints at maximum spacing of 40 feet. When expansion or control joint spacing exceeds 60 feet, provide intermediate construction joints at maximum spacing of 40 feet. Uniformly space construction joints. Vertical construction joint shall not be greater than 20 feet from wall corners or intersections.
 - 3) Consider beams, girders, brackets, column capitals, and haunches as part of floor or roof system and place monolithically with floor or roof system.
 - 4) Should placement sequence result in cold joint located below finished water surface, install water stop in joint.
- I. Minimum Time Between Adjacent Placements:
- 1) Construction Joints: 14 days (7 days wet cure and 7 days dry cure).
 - 2) Control Joints: 6 days.
 - 3) Expansion Joints/Contraction Joints: 1 day.
 - 4) At least 2 hours shall elapse after depositing concrete in long columns

and walls thicker than 8 inches before depositing concrete in beams, girders, or slabs supported thereon.

- 5) For columns and walls 10 feet in height or less, wait at least 45 minutes prior to depositing concrete in beams, girders, brackets, column capitals, or slabs supported thereon.
- J. Removal of Water: Unless tremie method for placing concrete is specified, remove water from space to be occupied by concrete.
- K. Consolidation and Visual Observation:
- 1) Consolidate concrete with internal vibrators with minimum frequency of 8,000 cycles per minute and amplitude as required to consolidate concrete in section being placed.
 - 2) Provide at least one standby vibrator in operable condition at placement Site prior to placing concrete.
 - 3) Consolidation Equipment and Methods: ACI 309R.
 - 4) Provide sufficient windows in forms or limit form height to allow for concrete placement through windows and for visual observation of concrete.
 - 5) Vibration consolidation shall not exceed distance of 3 feet from point of placement.
 - 6) Vibrate concrete in vicinity of joints to obtain impervious concrete.
- L. Hot Weather:
- 1) Prepare ingredients, mix, place, cure, and protect in accordance with ACI 305R.
 - 2) Placement frequency shall be such that lift lines will not be visible in exposed concrete finishes.
 - 3) Maintain concrete temperature below 90 degrees F at time of placement or furnish test data or provide other proof that admixtures and mix ingredients do not produce flash set plastic shrinkage or cracking due to heat of hydration. Cool ingredients before mixing to maintain fresh concrete temperatures as specified or less.
 - 4) Provide for windbreaks, shading, fog spraying, sprinkling, ice, wet cover, or other means as necessary to maintain concrete at or below specified temperature.
 - 5) Prevent differential temperature between reinforcing steel and concrete.
 - 6) Evaporation Retardant: As specified in Section 03370, Concrete Curing.
- 3.2 PLACING TREMIE CONCRETE SEALS
- A. Place concrete when water level inside area to be filled with concrete is equal to groundwater elevation outside.
- B. Maintain relation of water levels until concrete design strength is obtained.

3.3 CONCRETE BONDING

A. Horizontal Construction Joints in Reinforced Concrete Walls:

- 1) Thoroughly clean and saturate surface of joint with water.
- 2) Limit slurry concrete placement to 2-inch maximum thickness, 1-inch minimum thickness.
- 3) Use positive measuring device such as bucket or other device that will contain only enough slurry concrete for depositing in visually measurable area of wall to ensure that portion of form receives appropriate amount of slurry concrete to satisfy placement thickness requirements.
- 4) Do not deposit slurry concrete from pump hoses or large concrete buckets, unless specified placement thickness can be maintained and verified through inspection windows close to joint.
- 5) Limit concrete placed immediately on top of slurry concrete to 12 inches thick. Thoroughly vibrate to mix concrete and slurry concrete together.

B. To Existing Concrete:

- 1) Thoroughly clean and mechanically roughen existing concrete surfaces to roughness profile of 1/4 inch.
- 2) Saturate surface with water for 24 hours prior to placing new concrete.

3.4 REPAIRING CONCRETE

A. General:

- 1) Inject cracks that leak with crack repair epoxy.
- 2) Obtain quantities of repair material and manufacturer's detailed instructions for use to provide repair with finish to match adjacent surface or apply sufficient repair material adjacent to repair to blend finish appearance.
- 3) Repair of concrete shall provide structurally sound surface finish, uniform in appearance or upgrade finish by other means until acceptable to Engineer.

B. Tie Holes:

- 1) Fill with nonshrink grout as specified in Section 03600, Grout.
- 2) Match color of adjacent concrete and demonstrate on mockup panels first.
- 3) Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water.

C. Alternate Form Ties; Through-Bolts:

- 1) Mechanically roughen entire interior surface of through hole. Epoxy coat roughened surface and drive elastic vinyl plug to half depth. Dry pack entire hole from both sides of plug with nonshrink grout, as specified in Section 03600, Grout. Use only enough water to dry pack grout. Dry pack while epoxy is still tacky. If epoxy has dried, remove epoxy by mechanical

means and reapply new epoxy.

- 2) Compact grout using steel hammer and steel tool to drive grout to high density. Cure grout with water.

D. Exposed Metal Objects:

- 1) Metal objects not intended to be exposed in as-built condition of structure including wire, nails, and bolts, shall be removed by chipping back concrete to depth of 1 inch and then cutting or removing metal object.
- 2) Repair area of chipped-out concrete per requirements of Section 03720, Vertical And Overhead Concrete Repair Systems.

E. Blockouts at Pipes or Other Penetrations:

- 1) Install per details shown on Drawings or submit proposed blockouts for review.
- 2) Use nonshrink, nonmetallic grout.

3.5 CONCRETE WALL FINISHED

A. Type W-1 (Ordinary Wall Finish):

- 1) Patch tie holes.
- 2) Knock off projections.
- 3) Patch defective areas.

B. Type W-2 (Smooth Wall Finish):

- 1) Patch tie holes.
- 2) Grind off projections, fins, and rough spots.
- 3) Patch defective areas and repair rough spots resulting from form release agent failure or other reasons to provide smooth uniform appearance.

C. Type W-4 (Finish for Cementitious Coatings):

- 1) Patch tie holes.
- 2) Grind off projections, fins, and rough spots.
- 3) Patch and repair defective areas as specified for Type W-2.

D. Type W-5 (Finish for Painting):

- 1) Patch tie holes.
- 2) Grind off projections, fins, and rough spots.
- 3) Patch and repair defective areas as specified for Type W-2.
- 4) Leave surface ready for painting as specified in Section 09900, Painting and Protective Coatings.

E. Type W-7 (Smooth Rubbed Wall Finish):

- 1) Only water curing will be permitted on walls being rubbed.
- 2) Perform rubbing while green concrete can be physically worked and

smoothed without adding other materials, if structurally possible, the day following placement. Finish no later than 3 days after placement has been completed.

- 3) Remove forms at such a rate that all finishing, form tie filling, fin removal, and patching can be completed on same day forms are removed while curing wall.
- 4) After pointings have set sufficiently to permit working on surface, thoroughly saturate entire surface with water for period of 3 hours and rub until uniform surface is obtained.
- 5) Rub either by hand with carborundum stone of medium-coarse grade or abrasive of equal quality, or mechanically operated carborundum stone.
- 6) Mechanically operated carborundum stones shall be approved by Engineer before concrete finishing.
- 7) No cement grout, other than cement paste drawn from the concrete itself by the rubbing process shall be used.
- 8) Finish paste formed by rubbing by either brushing or floating as follows:
 - a. Brushing:
 - (i) Carefully strike with clean brush.
 - (ii) Brush in long direction of surface being finished.
 - b. Floating:
 - (i) Spread uniformly over surface and allow to reset.
 - (ii) Finish by floating with canvas, carpet face, or cork float, or rub down with dry burlap.
- 9) Continue water curing of wall during finishing operation in areas not being rubbed.
- 10) Move water curing onto rubbed areas as soon as water will not erode rubbed surface.

F. Type W-8 (Rubbed Wall Finish):

- 1) Meet requirements for Type W-7, except allow paste obtained from rubbing to set at least 24 hours.
- 2) After thoroughly saturating with water, coat surface with mixture of 85 percent cement and 15 percent lime with sufficient water to give creamy consistency. Demonstrate on sample panel prior to production finishing.
- 3) Rub this mixture into surface with coarse carborundum stone and brush with damp brush.
- 4) Brush in long direction of surface being finished.
- 5) Latex bonding admixture may be used. Consult with Euclid Chemical Co., Cleveland, OH or Master Builders Co., Cleveland, OH.

G. Type W-9 (Grout Cleaned Finish):

- 1) Meet requirements for Type W-7, except that finish must be accomplished within 7 days of placement.
 - 2) Grout: Mixed with 1 part Portland cement and 1-1/2 parts fine sand and bonding agent to produce grout with consistency of thick paint. White Portland cement shall be substituted for part of gray Portland cement in order to produce color matching color of surrounding concrete, as determined by trial patch.
 - 3) Wet surface of concrete sufficiently to prevent absorption of water from grout and apply grout uniformly with brushes or spray gun.
 - 4) Immediately after applying grout, scrub surface vigorously with cork float or stone to coat surface and fill air bubbles and holes.
 - 5) While grout is still plastic, remove excess grout by working surface with rubber float, burlap, or other means. After surface whitens from drying (about 30 minutes at 70 degrees F), rub vigorously with clean burlap. Continue to water cure wall until curing period of 7 days is complete.
 - 6) Latex bonding admixture may be used.
- H. W-10 (Fractured Fin Finish):
- 1) Form exterior surface of walls with approved form liner.
 - 2) Use stainless steel form ties and place at valleys.
 - 3) Patch form tie holes.
 - 4) Achieve final texture by light sandblast and then breaking off tips of ridge with light bushhammering, or other approved process.
 - 5) Same person starting bushhammering shall complete process for any given structure and match approved mockup panel.
- I. Type W-11 (Abrasive Blast - Sandblast Finish):
- 1) Intent of this procedure is to remove surface skin to depth no more than 1/16 inch, and expose only fine aggregate and air holes near surface, thus producing uniform texture.
 - 2) Perform sandblasting on building or on concrete surfaces in same area of view at same time and obtain uniformity of appearance.
 - 3) Same person shall accomplish sandblasting on one structure and on concrete in same area.
 - 4) Perform sandblasting to match approved mockup panel.
 - 5) Abrasive: Use clean silica sand, free of foreign materials, and supplied in sealed sacks.
 - 6) Blast surface with 100 psi air pressure at rate of 2 to 3 square feet per minute with nozzle held approximately 2 feet from surface and perpendicular thereto.

3.6 CONCRETE SLAB FINISHED

A. General:

- 1) Finish slab concrete per the requirements of ACI 302.1R.
- 2) Use manual screeds, vibrating screeds, or roller compacting screeds to place concrete level and smooth.
- 3) Do not use "jitterbugs" or other special tools designed for purpose of forcing coarse aggregate away from surface and allowing layer of mortar, which will be weak and cause surface cracks or delamination, to accumulate.
- 4) Do not dust surfaces with dry materials.
- 5) Use evaporation retardant.
- 6) Round off edges of slabs with steel edging tool, except where cove finish is shown. Steel edging tool radius shall be 1/4 inch for slabs subject to wheeled traffic.

B. Type S-1 (Steel Troweled Finish):

- 1) Finish by screeding and floating with straightedges to bring surfaces to required finish elevation. Use evaporation retardant.
- 2) While concrete is still green, but sufficiently hardened to bear a person's weight without deep imprint, wood float to true, even plane with no coarse aggregate visible.
- 3) Use sufficient pressure on wood floats to bring moisture to surface.
- 4) After surface moisture has disappeared, hand trowel concrete to produce smooth, impervious surface, free from trowel marks.
- 5) Burnish surface with an additional troweling. Final troweling shall produce ringing sound from trowel.
- 6) Do not use dry cement or additional water during troweling, nor will excessive troweling be permitted.
- 7) Power Finishing:
 - a. Approved power machine may be used in lieu of hand finishing in accordance with directions of machine manufacturer.
 - b. Do not use power machine when concrete has not attained necessary set to allow finishing without introducing high and low spots in slab.
 - c. Do first steel troweling for slab S-1 finish by hand.

C. Type S-2 (Wood Float Finish):

- 1) Finish slab to receive fill and mortar setting bed by screeding with straightedges to bring surface to required finish plane.
- 2) Wood float finish to compact and seal surface.
- 3) Remove laitance and leave surface clean.
- 4) Coordinate with other finish procedures.

D. Type S-4 (Exposed Aggregate Finish):

- 1) Embed single layer of selected aggregates at surface of concrete slab immediately after it has been placed, screeded, and smoothed.
- 2) Embed aggregates by tamping with wood float, darby, or rolling device.
- 3) Accomplish exposure of selected aggregates by removing surface matrix by washing with water and brushing with stiff plastic bristled brush as soon as concrete has set sufficiently to support weight of a person.
- 4) Exposure: No greater than 1/3 the average diameter of aggregate, nor less than 1/4.
- 5) Next day acid wash until there is no noticeable cement film on aggregate exposed.
- 6) Apply clear sealer per manufacturer's recommendations.

E. Type S-5 (Broomed Finish):

- 1) Finish as specified for Type S-1 floor finish, except omit final troweling and finish surface by drawing fine-hair broom lightly across surface.
- 2) Broom in same direction and parallel to expansion joints, or, in the case of inclined slabs, perpendicular to slope, except for round roof slab, broom surface in radial direction.

F. Type S-6 (Sidewalk Finish):

- 1) Slope walks down 1/4 inch per foot away from structures, unless otherwise shown.
- 2) Strike off surface by means of strike board and float with wood or cork float to true plane, then flat steel trowel before brooming.
- 3) Broom surface at right angles to direction of traffic or as shown.
- 4) Lay out sidewalk surfaces in blocks, as shown or as directed by Engineer, with grooving tool.

G. Concrete Curbs:

- 1) Float top surface of curb smooth, and finish all discontinuous edges with steel edger.
- 2) After concrete has taken its initial set, remove front form and give exposed vertical surface an ordinary wall finish, Type W-1.

3.7 CONCRETE SLAB TOLERANCES

A. Slab Tolerances:

- 1) Exposed Slab Surfaces: Comprise of flat planes as required within tolerances specified.
- 2) Slab Finish Tolerances and Slope Tolerances: Crowns on floor surface not too high as to prevent 10-foot straightedge from resting on neither end blocks, nor low spots that allow block of twice the tolerance in thickness to pass under supported 10-foot straightedge.
- 3) Slab Type S-A: Steel gauge block 5/16 inch thick.

- 4) Slab Type S-B: Steel gauge block 1/8 inch thick.
 - 5) Slab Type S-A and S-B: Finish Slab Elevation: Slope slabs to floor drain and gutter, and shall adequately drain regardless of tolerances.
 - 6) Thickness: Maximum 1/4 inch minus or 1/2 inch plus from thickness shown. Where thickness tolerance will not affect slope, drainage, or slab elevation, thickness tolerance may exceed 1/2 inch plus.
- B. Thickness: Maximum 1/4 inch minus or 1/2 inch plus from thickness shown. Where thickness tolerance will not affect slope, drainage, or slab elevation, thickness tolerance may exceed 1/2 inch plus.

3.8 BEAM AND COLUMN FINISHED

- A. General: Inject cracks with crack repair epoxy. Patch and repair defective areas.
- B. Match Wall Type:
- 1) Repair rock pockets.
 - 2) Fill air voids.

3.9 BACKFILL AGAINST WALLS

- A. Do not backfill against walls until concrete has obtained specified 28-day compressive strength.
- B. Place backfill simultaneously on both sides of wall, where required, to prevent differential pressures.

3.10 FIELD QUALITY CONTROL

- A. General:
- 1) Provide adequate facilities for safe storage and proper curing of concrete test cylinders onsite for first 24 hours, and for additional time as may be required before transporting to test lab.
 - 2) Provide concrete for testing of slump, air content, and for making cylinders from the point of discharge into forms. When concrete is pumped, Samples used shall be taken from discharge end of pump hose.
 - 3) Evaluation will be in accordance with ACI 301 and Specifications.
 - 4) Specimens shall be made, cured, and tested in accordance with ASTM C31 and ASTM C39.
 - 5) Frequency of testing may be changed at discretion of Engineer.
 - 6) Pumped Concrete: Take concrete samples for slump (ASTM C143) and test cylinders (ASTM C31 and C39) and shrinkage specimens (ASTM C157) at placement (discharge) end of line.
 - 7) Reject concrete represented by cylinders failing to meet strength and air content specified.
- B. Tolerances:
- 1) Walls: Measure and inspect walls for compliance with tolerances.
 - 2) Slab Finish Tolerances and Slope Tolerances:

- a. Floor flatness measurements shall be made day after floor is finished and before shoring is removed to eliminate effects of shrinkage, curing, and deflection.
- b. Support 10-foot long straightedge at each end with steel gauge blocks of thicknesses equal to specified tolerance.
- c. Compliance with designated limits in four of five consecutive measurements is satisfactory, unless defective conditions are observed.

C. Water Leakage Tests:

- 1) Purpose: Determine integrity and watertightness of finished exterior and interior water holding concrete surfaces.
- 2) Potable Water Supply Reservoirs: Clean and sterilize prior to conducting test per the FAC.
- 3) Water-Holding Structures:
 - a. Perform leakage tests after concrete structure is complete and capable of resisting hydrostatic pressure of water test. Concrete shall have achieved its full design strength.
 - b. Perform leakage test before backfill, brick facing, grout topping slab, coatings, or other work that will cover concrete surfaces has begun.
 - c. Install temporary bulkheads, cofferdams, and pipe blind flanges, and close valves. Inspect each to see that it provides complete seal.
 - d. Fill with water to test level shown, or maximum liquid level if no test level is given. Maintain this level for 72 hours prior to start of test to allow water absorption, structural deflection, and temperature to stabilize.
 - e. Measure evaporation and precipitation by floating a partially filled, transparent, calibrated, open top container.
 - f. Measure water surface at two points 180 degrees apart when possible where attachments, such as ladders exist, at 24-hour intervals. Using sharp pointed hook gauge and fixed metal measure capable of reading to 1/100 of an inch. Continue test for period of time sufficient to produce at least 1/2-inch drop in water surface based on assumption that leakage would occur at maximum allowable rate specified or for 72 hours, whichever is lesser time.
- 4) Acceptance Criteria:
 - a. Volume loss shall not exceed 0.075 percent of contained liquid volume in 24-hour period, correcting for evaporation, precipitation, and settlement.
 - b. No damp spots or seepage visible on exposed surfaces. Damp

spot is defined as sufficient moisture to be transferred to dry hand upon touching.

- 5) Repairs When Test Fails: Dewater structure; fill leaking cracks with crack repair epoxy as specified in Section 03740, Concrete Repair Crack Injection. Patch areas of damp spots previously recorded, and repeat water leakage test in its entirety until the structure successfully passes the test.

3.11 MANUFACTURER'S SERVICES

- A. Provide the following representative at Site in accordance with Section 01610, Manufacturers' Services, for installation assistance, inspection, and certification of proper installation for concrete ingredients, mix design, mixing, and placement.
 - 1) Batch Plant Representative:
 - a. Observe how concrete mixes are performing.
 - b. Be present during first placement of each type of concrete mix.
 - c. Assist with concrete mix design, performance, placement, weather problems, and problems as may occur with concrete mix throughout Project.
 - d. Establish control limits on concrete mix designs.
 - 2) Admixture Manufacturer's Representative:
 - a. Demonstrate special features, product performance, product mixing, testing, and placement or installation for each type of admixture.
 - b. Observe how concrete mixes are performing.
 - c. Be present during first placement of each type of concrete mix.
 - d. Assist with concrete mix design, performance, placement, weather problems, and problems as may occur with concrete mix throughout Project, including instructions for redosing.
 - e. Provide equipment for control of concrete redosing for air entrainment or high range water reducing admixture (superplasticizers) at Site to maintain proper slump and air content if so needed.
 - 3) Bonding Agent Manufacturer's Representative: Demonstrate product performance, product mixing, and placement.

3.12 PROTECTION OF INSTALLED WORK

- A. After curing as specified in Section 03370, Concrete Curing, and after applying final floor finish, cover slabs with plywood or particle board or plastic sheeting or other material to keep floor clean and protect it from material and damage due to other construction work.
- B. Repair defective areas and areas damaged by construction.

END OF SECTION

SECTION 03370 - CONCRETE CURING

PART 1 GENERAL

1.1 THE REQUIREMENT

- A. Protect all freshly deposited concrete from premature drying and excessively hot or cold temperatures and maintain with minimal moisture loss at a relatively constant temperature for the period of time necessary for the hydration of the cement and proper hardening of the concrete in accordance with requirements specified herein.

1.2 RELATED WORK SPECIFIED ELSEWHERE

- A. Concrete Framework
- B. Joints in Concrete
- C. Cast-in-Place Concrete
- D. Grout
- E. Concrete Finishes

1.3 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in the Section entitled "Submittals", the contractor shall submit the following:
 - 1) Request for acceptance along with procedures for protection of concrete under wet weather placement conditions.
 - 2) Request for placement along with proposed procedures for hot weather placement.
 - 3) Request for acceptance and proposed materials and procedures for moisture preservation.

1.4 REFERENCE SPECIFICATIONS, CODES AND STANDARDS

- A. Without limiting the generality of other requirements of these specifications all work hereunder shall conform to the applicable requirements of the referenced portions of the following documents, to the extent that the requirements therein are not in conflict with the provisions of this Section.
 - 1) Specifications for Structural Concrete for buildings, ACI 301.
 - 2) Guide for Measuring, Mixing, Transporting, and Placing Concrete, ACI 304.
 - 3) Hot Weather Concreting, ACI 305.
 - 4) Specifications for Sheet Materials for Curing Concrete, ASTM C171.
 - 5) Specification for Liquid Membrane - Forming Compounds for Curing Concrete, ASTM C309.
 - 6) Federal Specification TT-C-800.

1.5 QUALITY ASSURANCE

- A. Curing compound shall not be used on any surface where concrete or other material will be bonded unless the manufacturer certifies that the curing compound will not prevent bond or indicates measures to be taken to completely remove the curing compound from areas to receive bonded applications.
- B. Care shall be taken to ensure that curing compounds are compatible with all finish concrete castings.

PART 2 PRODUCTS

2.1 CURING COMPOUNDS

- A. All materials shall meet the ASTM specifications C309, Type 1-D or Federal Specification TT-C-800 and shall have a minimum solids content of 30 percent.

PART 3 EXECUTION

3.1 PROTECTION AND CURING

- A. All concrete work shall be protected from the elements, flowing water and from defacement of any nature during construction operations.
- B. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury. Protect concrete during the curing period such that the concrete temperature does not fall below the requirements of Section 3.02 -Concrete Temperature. Cure concrete in accordance with paragraph E or paragraph F.
- C. When concrete is placed in cold weather as defined in ACI 306, the concrete shall be protected in accordance with requirements of ACI 306, Cold Weather Concreting.
- D. When concrete is placed in hot weather as defined in ACI 305, the concrete shall be protected in accordance with the requirements of ACI 305, Hot Weather Concreting.
- E. After placing and finishing, use one or more of the following methods to preserve moisture in concrete:
 - 1) Ponding or continuous fogging or sprinkling.
 - 2) Application of mats or fabric kept continuously wet.
 - 3) Continuous application of steam (under 150 degrees Fahrenheit).
 - 4) Application of sheet materials conforming to ASTM C171.
 - 5) Application of a curing compound conforming to ASTM C309 or Federal Specification TT-C-800. Apply the compound in accordance with the manufacturer's recommendation on after water sheen has disappeared from the concrete surface and after finishing operations. The rate of application shall not exceed 200 square feet per gallon. For rough surfaces, apply in two directions at right angles to each other.

- F. Keep absorbent forms wet until they are removed. After form removal, cure concrete by one of the methods in paragraph E. Frames may be "cracked" within twenty-four hours and kept moist until they are required to be kept in place.

3.2 CONCRETE TEMPERATURE

- A. When the average of the highest and lowest temperature during the period from midnight to midnight is expected to drop below 40 F for more than three successive days, concrete shall be delivered to meet the following minimum temperature immediately after placement:
 - 1) 55 degrees Fahrenheit for sections less than 12 in. in the least dimension
 - 2) 50 degrees Fahrenheit for sections 12 in. to 36 in. in the least dimension
 - 3) 45 degrees Fahrenheit for sections 36 in. to 72 in. in the least dimension
 - 4) 40 degrees Fahrenheit for sections greater than 72 in. in the least dimension
- B. The temperature of concrete as placed shall not exceed these values by more than 20 degrees Fahrenheit.
- C. These minimum requirements may be terminated when temperatures above 50 degrees Fahrenheit occur during more than half of any 24 hour duration.
- D. Unless otherwise specified or permitted, the temperature of concrete as delivered shall not exceed 90 degrees Fahrenheit.
- E. During and following curing, do not allow the surface of the concrete to change temperature more than the following:
 - 1) 50 degrees Fahrenheit in any 24-hr period for sections less than 12 in. in the least dimension.
 - 2) 40 degrees Fahrenheit for sections from 12 to 36 in. in the least dimension.
 - 3) 30 degrees Fahrenheit for sections 36 to 72 in. in the least dimension.
 - 4) 20 degrees Fahrenheit for sections greater than 72 in. in the least dimension.

3.3 FINAL CURING

- A. Cure for at least the first seven days after placement for all concrete except high early strength concrete, for which the period shall be at least the first three days after placement.
 - 1) Alternatively, moisture retention measures may be terminated when:
 - a. Tests are made on at least two additional cylinders kept adjacent to the structure and cured by the same methods as the structure and tests indicate 70 percent of the specified compressive strength, f'c, as determined in accordance with ASTM C39.
 - b. The temperature of the concrete is maintained at 50 degrees Fahrenheit or higher for the time required to achieve 85 percent of f'c in laboratory-cured cylinders representative of the concrete in place.

- c. The strength of concrete reaches f'_c as determined by accepted nondestructive methods or laboratory-cured cylinder test results.
- B. When one of the curing procedures in Paragraph 3.01-E is used initially, the curing procedure may be replaced by one of the other procedures when concrete is one day old, provided concrete is not permitted to become surface dry at any time.

END OF SECTION

SECTION 03600 - GROUT

PART 1 GENERAL

1.1 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.

1.2 SUBMITTALS

- A. Submit to the Engineer, in accordance with Section 01300, shop drawings and product data showing materials of construction and details of installation for:
 - 1) Commercially manufactured nonshrink cementitious grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.
 - 2) Commercially manufactured nonshrink epoxy grout. The submittal shall include catalog cuts, technical data, storage requirements, product life, working time after mixing, temperature considerations, conformity to required ASTM standards and Material Safety Data Sheet.
 - 3) Cement grout. The submittal shall include the type and brand of the cement, the gradation of the fine aggregate, product data on any proposed admixtures and the proposed mix of the grout.
 - 4) Concrete grout. The submittal shall include data as required for concrete and fiber reinforcement as delineated in Section. This includes the mix design, constituent quantities per cubic yard and the water/cement ratio.
- B. Samples
 - 1) Samples of commercially manufactured grout products when requested by the Engineer.
 - 2) Aggregates for use in concrete grout when requested by the Engineer.
- C. Laboratory Test Reports
 - 1) Submit laboratory test data as required under Section 03300 for concrete to be used as concrete grout.
- D. Qualifications
 - 1) Grout manufacturers shall submit documentation that they have at least 10 years' experience in the production and use of the proposed grouts which they will supply.

1.3 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM)
 - 1) ASTM C531 - Standard Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical Resistant Mortars, Grouts and Monolithic Surfacing and Polymer Concretes.
 - 2) ASTM C579 - Standard Test Method for Compressive Strength of

Chemical Resistant Mortars, Grouts and Monolithic Surfacing and Polymer Concretes.

- 3) ASTM C827 - Standard Test Method for Change in Height at Early Ages of Cylindrical Specimens from Cementitious Mixtures.
 - 4) ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).
 - 5) ASTM D695 - Standard Test Method for Compressive Properties of Rigid Plastics.
- B. U.S. Army Corps of Engineers Standard (CRD)
- 1) CRD C-621 - Corps of Engineers Specification for Nonshrink Grout.
- C. Where reference is made to one of the above standards, the revision in effect at the time of bid opening shall apply.

1.4 QUALITY ASSURANCE

- A. Qualifications
- 1) Grout manufacturer shall have a minimum of 10 years' experience in the production and use of the type of grout proposed for the work.
- B. Services of Manufacturer's Representative
- 1) A qualified field technician of the nonshrink grout manufacturer, specifically trained in the installation of the products, shall attend the pre-installation conference and shall be present for the initial installation of each type of nonshrink grout. Additional services shall also be provided, as required, to correct installation problems.
- C. Field Testing
- 1) All field testing and inspection services required shall be provided by the Owner. The Contractor shall assist in the sampling of materials and shall provide any ladders, platforms, etc., for access to the work. The methods of testing shall comply in detail with the applicable ASTM Standards.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials to the jobsite in original, unopened packages, clearly labeled with the Manufacturer's name, product identification, batch numbers and printed instructions.
- B. Store materials in full compliance with the manufacturer's recommendations. Total storage time from date of manufacture to date of installation shall be limited to 6 months or the manufacturer's recommended storage time, whichever is less.
- C. Material which becomes damp or otherwise unacceptable shall be immediately removed from the site and replaced with acceptable material at no additional expense to the Owner.
- D. Nonshrink cement-based grouts shall be delivered as preblended, prepackaged mixes requiring only the addition of water.
- E. Nonshrink epoxy grouts shall be delivered as premeasured, prepackaged, three component systems requiring only blending as directed by the manufacturer.

1.6 DEFINITIONS

- A. Nonshrink Grout: A commercially manufactured product that does not shrink in either the plastic or hardened state, is dimensionally stable in the hardened state and bonds to a clean base plate.

PART 2 PRODUCTS

2.1 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.

2.2 MATERIALS

- A. Nonshrink Cementitious Grout
 - 1) Nonshrink cementitious grouts shall meet or exceed the requirements of ASTM C1107, Grades B or C and CRD C-621. Grouts shall be Portland cement based, contain a pre-proportioned blend of selected aggregates and shrinkage compensating agents and shall require only the addition of water. Nonshrink cementitious grouts shall not contain expansive cement or metallic particles. The grouts shall exhibit no shrinkage when tested in conformity with ASTM C827.
 - a. General purpose nonshrink cementitious grout shall conform to the standards stated above and shall be SikaGrout 212 by Sika Corp.; Set Grout by Master Builders, Inc.; Gilco Construction Grout by Gifford Hill & Co.; Euco NS by The Euclid Chemical Co.; NBEC Grout by U. S. Grout Corp. or equal.
 - b. Flowable (Precision) nonshrink cementitious grout shall conform to the standards stated above and shall be Masterflow 928 by Master Builders, Inc.; Hi-Flow Grout by the Euclid Chemical Co.; SikaGrout 212 by Sika Corp.; Supreme Grout by Gifford Hill & Co.; Five Star Grout by U. S. Grout Corp. or equal.
- B. Nonshrink Epoxy Grout
 - 1) Nonshrink epoxy-based grout shall be a pre-proportioned, three component, 100 percent solids system consisting of epoxy resin, hardener, and blended aggregate. It shall have a compressive strength of 14,000 psi in 7 days when tested in conformity with ASTM D695 and have a maximum thermal expansion of 30×10^{-6} when tested in conformity with ASTM C531. The grout shall be Ceilcote 648 CP by Master Builders Inc.; Five Star Epoxy Grout by U.S. Grout Corp.; Sikadur 42 Grout-Pak by Sika Corp.; High Strength Epoxy Grout by the Euclid Chemical Co. or equal.
- C. Cement Grout
 - 1) Cement grouts shall be a mixture of one part Portland cement conforming to ASTM C150, Types I, II, or III and 1 to 2 parts sand conforming to ASTM C33 with sufficient water to place the grout. The water content

shall be sufficient to impart workability to the grout but not to the degree that it will allow the grout to flow.

D. Concrete Grout

- 1) Concrete grout shall conform to the requirements of Section 03300 except as specified herein. It shall be proportioned with cement, pozzolan, coarse and fine aggregates, water, water reducer and air entraining agent to produce a mix having an average strength of 2900 psi at 28 days, or 2500 psi nominal strength. Coarse aggregate size shall be ½ in maximum. Slump should not exceed 5-in and should be as low as practical yet still retain sufficient workability.

E. Water

- 1) Potable water, free from injurious amounts of oil, acid, alkali, organic matter, or other deleterious substances.

PART 3 EXECUTION

3.1 PREPARATION

- A. Grout shall be placed over cured concrete which has attained its full design strength unless otherwise approved by the Engineer.
- B. Concrete surfaces to receive grout shall be clean and sound; free of ice, frost, dirt, grease, oil, curing compounds, laitance and paints and free of all loose material or foreign matter which may affect the bond or performance of the grout.
- C. Roughen concrete surfaces by chipping, sandblasting, or other mechanical means to ensure bond of the grout to the concrete. Remove loose or broken concrete. Irregular voids or projecting coarse aggregate need not be removed if they are sound, free of laitance and firmly embedded into the parent concrete.
 - 1) Air compressors used to clean surfaces in contact with grout shall be the oilless type or equipped with an oil trap in the air line to prevent oil from being blown onto the surface.
- D. Remove all loose rust, oil or other deleterious substances from metal embedments or bottom of baseplates prior to the installation of the grout.
- E. Concrete surfaces shall be washed clean and then kept moist for at least 24 hours prior to the placement of cementitious or cement grout. Saturation may be achieved by covering the concrete with saturated burlap bags, use of a soaker hose, flooding the surface, or other method acceptable to the Engineer. Upon completion of the 24 hour period, visible water shall be removed from the surface prior to grouting. The use of an adhesive bonding agent in lieu of surface saturation shall only be used when approved by the Engineer for each specific location of grout installation.
- F. Epoxy-based grouts do not require the saturation of the concrete substrate. Surfaces in contact with epoxy grout shall be completely dry before grouting.

- G. Construct grout forms or other leakproof containment as required. Forms shall be lined or coated with release agents recommended by the grout manufacturer. Forms shall be of adequate strength, securely anchored in place and shored to resist the forces imposed by the grout and its placement.
 - 1) Forms for epoxy 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 and the recommendations of the equipment manufacturer.
- I. Equipment shall be supported during alignment and installation of grout by shims, wedges, blocks or other approved means. The shims, wedges and blocking devices shall be prevented from bonding to the grout by appropriate bond breaking coatings and removed after grouting unless otherwise approved by the Engineer.

3.2 INSTALLATION - GENERAL

- A. Mix, apply and cure products in strict compliance with the manufacturer's recommendations and this Section.
- B. Have sufficient manpower and equipment available for rapid and continuous mixing and placing. Keep all necessary tools and materials ready and close at hand.
- C. Maintain temperatures of the foundation plate, supporting concrete, and grout between 40 and 90 degrees F during grouting and for at least 24 hours thereafter or as recommended by the grout manufacturer, whichever is longer. Take precautions to minimize differential heating or cooling of baseplates and grout during the curing period.
- D. Take special precautions for hot weather or cold weather grouting as recommended by the manufacturer when ambient temperatures and/or the temperature of the materials in contact with the grout are outside of the 60 and 90 degrees F range.
- E. Install grout in a manner which will preserve the isolation between the elements on either side of the joint where grout is placed in the vicinity of an expansion or control joint.
- F. Reflect all existing underlying expansion, control and construction joints through the grout.

3.3 INSTALLATION - CEMENT GROUTS AND NONSHRINK CEMENTITIOUS GROUTS

- A. Mix in accordance with manufacturer's recommendations. Do not add cement, sand, pea gravel or admixtures without prior approval by the Engineer.
- B. Avoid mixing by hand. Mixing in a mortar mixer (with moving blades) is recommended. Pre-wet the mixer and empty excess water. Add premeasured amount of water for mixing, followed by the grout. Begin with the minimum amount of water recommended by the manufacturer and then add the minimum additional water required to obtain workability. Do not exceed the manufacturer's maximum recommended water content.

- C. Placements greater than 3-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. Place grout into the designated areas in a manner which will avoid segregation or entrapment of air. Do not vibrate grout to release air or to consolidate the material. Placement should proceed in a manner which will ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
- E. Place grout rapidly and continuously to avoid cold joints. Do not place cement grouts in layers. Do not add additional water to the mix (retemper) after initial stiffening.
- F. Just before the grout reaches its final set, cut back the grout to the substrate at a 45 degree angle from the lower edge of bearing plate unless otherwise approved by the Engineer. Finish this surface with a wood float (brush) finish.
- G. Begin curing immediately after form removal, cutback, and finishing. Keep grout moist and within its recommended placement temperature range for at least 24 hours after placement or longer if recommended by the manufacturer. Saturate the grout surface by use of wet burlap, soaker hoses, ponding or other approved means. Provide sunshades as necessary. If drying winds inhibit the ability of a given curing method to keep grout moist, erect wind breaks until wind is no longer a problem or curing is finished.

3.4 INSTALLATION - NONSHRINK EPOXY GROUTS

- A. Mix in accordance with the procedures recommended by the manufacturer. Do not vary the ratio of components or add solvent to change the consistency of the grout mix. Do not overmix. Mix full batches only to maintain proper proportions of resin, hardener and aggregate.
- B. Monitor ambient weather conditions and contact the grout manufacturer for special placement procedures to be used for temperatures below 60 or above 90 degrees F.
- C. Place grout into the designated areas in a manner which will avoid trapping air. Placement methods shall ensure the filling of all spaces and provide full contact between the grout and adjoining surfaces. Provide grout holes as necessary.
- D. Minimize "shoulder" length (extension of grout horizontally beyond base plate). In no case shall the shoulder length of the grout be greater than the grout thickness.
- E. Finish grout by puddling to cover all aggregate and provide a smooth finish. Break bubbles and smooth the top surface of the grout in conformity with the manufacturer's recommendations.
- F. Epoxy grouts are self-curing and do not require the application of water. Maintain the formed grout within its recommended placement temperature range for at least 24 hours after placing, or longer if recommended by the manufacturer.

3.5 INSTALLATION - CONCRETE GROUT

- A. Screed underlying concrete to the grade shown on the Drawings. Provide the surface with a broomed finish, aligned to drain. Protect and keep the surface clean until placement of concrete grout.
- B. Remove the debris and clean the surface by sweeping and vacuuming of all dirt and other foreign materials. Wash the tank slab using a strong jet of water. Flushing of debris into tank drain lines will not be permitted.
- C. Saturate the concrete surface for at least 24 hours prior to placement of the concrete grout. Saturation may be maintained by ponding, by the use of soaker hoses, or by other methods acceptable to the Engineer. Remove excess water just 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. (A bonding grout composed of 1 part Portland cement, 1.5 parts fine sand, an approved bonding admixture and water, mixed to achieve the consistency of thick paint, may be substituted for the cement slurry.)
- D. Place concrete grout to final grade using the scraper mechanism as a guide for surface elevation and to ensure high and low spots are eliminated. Unless specifically approved by the equipment manufacturer, mechanical scraper mechanisms shall not be used as a finishing machine or screed.
- E. Provide grout control joints as indicated on the Drawings.
- F. Finish and cure the concrete grout as specified for cast-in-place concrete.

3.6 SCHEDULE

- A. The following list indicates where the particular types of grout are to be used:
 - 1) General purpose nonshrink cementitious grout: Use at all locations where non shrink grout is called for on the plans except for base plates greater in area than 3-ft wide by 3-ft long and except for the setting of anchor rods, anchor bolts or reinforcing steel in concrete.
 - 2) Flowable nonshrink cementitious grout: Use under all base plates greater in area than 3-ft by 3-ft. Use at all locations indicated to receive flowable nonshrink grout by the Drawings. The Contractor, at his/her option and convenience, may also substitute flowable nonshrink grout for general purpose nonshrink cementitious grout.
 - 3) Nonshrink epoxy grout: Use for the setting of anchor rods, anchor bolts and reinforcing steel in concrete and for all locations specifically indicated to receive epoxy grout.
 - 4) Cement grout: Cement grout may be used for grouting of incidental base plates for structural and miscellaneous steel such as post base plates for platforms, base plates for beams, etc. It shall not be used when nonshrink grout is specifically called for on the Drawings or for grouting of primary structural steel members such as columns and girders.
 - 5) Concrete grout: Use for overlaying the base concrete to allow more control in placing the surface grade and elsewhere as shown on the Drawings.