

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Comply with requirements stated in Conditions of the Contract and in Specifications for administrative procedures in closing out the work.

1.02 SUBSTANTIAL COMPLETION

- A. The Contractor shall submit the following items when the Contractor considers the work to be substantially complete:
 - 1. A written notice that the work or designated portion thereof, is substantially complete.
 - 2. A list of items to be completed or corrected.
- B. Within a reasonable time after receipt of such notice, the Engineer and Owner shall make an inspection to determine the status of completion.
- C. Project record documents and operations and maintenance manuals must be submitted before the project shall be considered substantially complete.
- D. If the Engineer determines that the work is not substantially complete:
 - 1. The Engineer shall notify the Contractor in writing, stating the reasons.
 - 2. The Contractor shall remedy the deficiencies in the work and send a second written notice of substantial completion to the Engineer.
 - 3. The Engineer shall reinspect the work.
- E. When the Engineer finds that the work is substantially complete:
 - 1. He shall prepare and deliver to the Owner a tentative Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a tentative list of the items to be completed or

- corrected before final payment.
2. The Engineer shall consider any objections made by the Owner as provided in Conditions of the Contract. When the Engineer considers the work substantially complete, he will execute and deliver to the Owner and the Contractor a definite Certificate of Substantial Completion (Manatee County Project Management Form PMD-8) with a revised tentative list of items to be completed or corrected.

1.03 FINAL INSPECTION

- A. When the Contractor considered the work to be complete, he shall submit written certification stating that:
 1. The Contract Documents have been reviewed.
 2. The work has been inspected for compliance with Contract Documents.
 3. The work has been completed in accordance with Contract Documents.
 4. The equipment and systems have been tested in the presence of the Owner's representative and are operational.
 5. The work is completed and ready for final inspection.
- B. The Engineer shall make an inspection to verify the status of completion after receipt of such certification.
- C. If the Engineer determines that the work is incomplete or defective:
 1. The Engineer shall promptly notify the Contractor in writing, listing the incomplete or defective work.
 2. The Contractor shall take immediate steps to remedy the stated deficiencies and send a second written certification to Engineer that the work is complete.
 3. The Engineer shall reinspect the work.
- D. Upon finding the work to be acceptable under the Contract Documents, the Engineer shall request the Contractor to make closeout submittals.

- E. For each additional inspection beyond a total of three (3) inspections for substantial and final completion due to the incompleteness of the work, the Contractor shall reimburse the Owner for the Engineer's fees.

1.04 CONTRACTOR'S CLOSEOUT SUBMITTALS TO ENGINEER

- A. Project Record Documents (prior to substantial completion).
- B. Operation and maintenance manuals (prior to substantial completion).
- C. Warranties and Bonds.
- D. Evidence of Payment and Release of Liens: In accordance with requirements of General and Supplementary Conditions.
- E. Certification letter from Florida Department of Transportation and Manatee County Department of Transportation, as applicable.
- F. Certificate of Insurance for Products and Completed Operations.
- G. Final Reconciliation, Warranty Period Declaration, and Contractor's Affidavit (Manatee County Project Management Form PMD-9).

1.05 FINAL ADJUSTMENT OF ACCOUNTS

- A. Submit a final statement of accounting to the Engineer.
- B. Statement shall reflect all adjustments to the Contract Sum:
 - 1. The original Contract Sum.
 - 2. Additions and deductions resulting from:
 - a. Previous Change Orders
 - b. Unit Prices
 - c. Penalties and Bonuses
 - d. Deductions for Liquidated Damages
 - e. Other Adjustments
 - 3. Total Contract Sum, as adjusted.
 - 4. Previous payments.
 - 5. Sum remaining due.
- C. Project Management shall prepare a final Change Order, reflecting approved adjustments to the Contract Sum which

were not previously made by Change Orders.

1.06 FINAL APPLICATION FOR PAYMENT

- A. Contractor shall submit the final Application for Payment in accordance with procedures and requirements stated in the Conditions of the Contract.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01710

CLEANING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

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

1.02 DISPOSAL REQUIREMENTS

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

PART 2 PRODUCTS

2.01 MATERIALS

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

PART 3 EXECUTION

3.01 DURING CONSTRUCTION

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

3.02 DUST CONTROL

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

3.03 FINAL CLEANING

- A. Employ skilled workmen for final cleaning.
- B. Broom clean exterior paved surfaces; rake clean other surfaces of the grounds.
- C. Prior to final completion or Owner occupancy, Contractor shall conduct an inspection of sight-exposed interior and exterior surfaces and all work areas to verify that the entire work is clean.

END OF SECTION

SECTION 01720

PROJECT RECORD DOCUMENTS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

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

1.02 MAINTENANCE OF DOCUMENTS AND SAMPLES

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

1.03 MARKING DEVICES

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

1.04 RECORDING

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

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

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

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

1.05 SUBMITTAL

- A. Prior to substantial completion and prior to starting the bacteria testing of water lines, deliver signed and sealed Record Documents and Record Drawings to the Engineer. These will be reviewed and verified by the inspector. If there are any required changes or additions, these shall be completed and the entire signed and sealed set resubmitted prior to final pay application.
- B. The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare record drawings. Record drawings shall be certified by the professional(s) (Engineer or Surveyor licensed in Florida), as stipulated by the Land Development Ordinance and submitted on signed and dated mylar drawings together with a recordable compact disk (CD).
- C. The CD shall contain media in AutoCAD Version 2005 or later, or in any other CAD program compatible with AutoCAD in DWG or DXF form. All fonts, line types, shape files or other pertinent information used in the drawing and not normally included in AutoCAD shall be included on the media with a text file or attached noted as to its relevance and use.
- D. Accompany submittal with transmittal letter, containing:
 - 1. Date.
 - 2. Project title and number.
 - 3. Contractor's name and address.
 - 4. Title and number of each Record Document.
 - 5. Signature of Contractor or his authorized representative.

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

PART 2 STANDARDS

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

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

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01730

OPERATING AND MAINTENANCE DATA

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

- A. Compile product data and related information appropriate for Owner's maintenance and operation of products furnished under Contract.
- B. Prepare operating and maintenance data as specified in this and as referenced in other pertinent sections of Specifications.
- C. Instruct Owner's personnel in maintenance of products and equipment and systems.
- D. Provide three (3) sets of operating and maintenance manuals for each piece of equipment provided within this Contract.

1.02 FORM OF SUBMITTALS

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

C. Binders:

1. Commercial quality three-ring binders with durable and cleanable plastic covers.
2. Maximum ring size: 1 inch.
3. When multiple binders are used, correlate the data into related consistent groupings.

1.03 MANUAL FOR EQUIPMENT AND SYSTEMS

- A. Submit three copies of complete manual in final form.
- B. Content for each unit of equipment and system, as appropriate:
 1. Description of unit and component parts.
 - a. Function, normal operating characteristics and limiting conditions.
 - b. Performance curves, engineering data and tests.
 - c. Complete nomenclature and commercial number of replaceable parts.
 2. Operating Procedures:
 - a. Start-up, break-in, routine and normal operating instructions.
 - b. Regulation, control, stopping, shut-down and emergency instructions.
 - c. Summer and winter operating instructions.
 - d. Special operating instructions.
 3. Maintenance Procedures:
 - a. Routine operations.
 - b. Guide to "trouble-shooting".
 - c. Disassembly, repair and reassembly.
 - d. Alignment, adjusting and checking.
 4. Servicing and lubricating schedule.
 - a. List of lubricants required.
 5. Manufacturer's printed operating and maintenance instructions.
 6. Description of sequence of operation by control manufacturer.

7. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
 - a. List of predicted parts subject to wear.
 - b. Items recommended to be stocked as spare parts.
 8. As installed control diagrams by controls manufacturer.
 9. Each contractor's coordination drawings.
 - a. As installed color coded piping diagrams.
 10. Charts of valve tag numbers, with location and function of each valve.
 11. List of original manufacturer's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
 12. Other data as required under pertinent sections of specifications.
- C. Content, for each electric and electronic system, as appropriate:
1. Description of system and component parts.
 - a. Function, normal operating characteristics and limiting conditions.
 - b. Performance curves, engineering data and tests.
 - c. Complete nomenclature and commercial number of replaceable parts.
 2. Circuit directories of panelboards.
 - a. Electrical service.
 - b. Controls.
 - c. Communications.
 3. As-installed color coded wiring diagrams.
 4. Operating procedures:
 - a. Routine and normal operating instructions.
 - b. Sequences required.
 - c. Special operating instructions.

5. Maintenance procedures:
 - a. Routine operations.
 - b. Guide to "trouble-shooting".
 - c. Disassembly, repair and reassembly.
 - d. Adjustment and checking.
 6. Manufacturer's printed operating and maintenance instructions.
 7. List of original manufacture's spare parts, manufacturer's current prices and recommended quantities to be maintained in storage.
 8. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
- D. Prepare and include additional data when the need for such data becomes apparent during instruction on Owner's personnel.
- E. Additional requirements for operating and maintenance data: Respective sections of Specifications.

1.04 SUBMITTAL SCHEDULE

- A. Submit one copy of completed data in final form fifteen days prior to substantial completion.
1. Copy will be returned after substantial completion, with comments (if any).
- B. Submit two copies of approved data in final form. Final acceptance will not be provided until the completed manual is received and approved.

1.05 INSTRUCTION OF OWNER'S PERSONNEL

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

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01740

WARRANTIES AND BONDS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

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

1.02 SUBMITTAL REQUIREMENTS

- A. Assemble warranties, bonds and service and maintenance contracts, executed by each of the respective manufacturers, suppliers and subcontractors.
- B. Number of original signed copies required: Two each.
- C. Table of Contents: Neatly typed, in orderly sequence. Provide complete information for each item.
 - 1. Product or work item.
 - 2. Firm, with name of principal, address and telephone number.
 - 3. Scope.
 - 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.

1.03 FORM OF SUBMITTALS

- A. Prepare in duplicate packets.

- B. Format:
 - 1. Size 8-1/2 inch x 11 inch punched sheets for standard 3-ring binder. Fold larger sheets to fit into binders.
 - 2. Cover: Identify each packet with typed or printed title "WARRANTIES AND BONDS". List:
 - a. Title of Project.
 - b. Name of Contractor.
- C. Binders: Commercial quality, three-ring, with durable and cleanable plastic covers.

1.04 TIME OF SUBMITTALS

- A. Make submittals within ten days after date of substantial completion and prior to final request for payment.
- B. For items of work, where acceptance is delayed materially beyond date of substantial completion, provide updated submittal within ten days after acceptance, listing date of acceptance as start of warranty period.

1.05 SUBMITTALS REQUIRED

- A. Submit warranties, bonds, service and maintenance contracts as specified in respective sections of Specifications.
- B. Approval by the Owner of all documents required under this section is a pre-requisite to requesting a final inspection and final payment

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 02200

EARTHWORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

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

1.02 DEFINITIONS

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

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

1.03 JOB CONDITIONS

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

1.04 QUALITY ASSURANCE

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

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

PART 2 PRODUCTS

2.01 MATERIALS

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

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

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

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

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

<u>Group Symbols</u>	<u>Typical Name</u>
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts
CH	Inorganic clays of high plasticity, fat clays

OH	Organic clays of medium to high plasticity
PT	Peat, muck, and other highly organic soils

- G. Structural Compact Fill: Preparation of the subgrade prior to pond backfilling will necessitate removal and replacement of pond bottom silts as well as the very loose silty soils on the flanks of the pond (see the Geotechnical Report for further requirements). The entire tank footprint, plus a margin of at least 5 feet outside the foundation perimeter should be striped down to the existing pond bottom elevation including over-excavation of any accumulated sediments, followed by proof-rolling with heavy vibratory compaction equipment. The contractor should anticipate the excavation would extend to approximate EL +15 feet. Compaction should consist of no less than ten (10) complete coverages throughout the entire tank area plus a margin of not less than 5 feet beyond the tank perimeters. The perimeter foundation area for the tank structures should be densified at the bottom of footing elevation. Compaction should continue so as to develop a uniform density of not less than 95% of the modified proctor maximum dry density per ASTM D-1557. Compaction tests should be conducted at intervals of no less than 1 test for each 2500 square feet and each 50 foot of foundation perimeter at a depth of 1 foot and at the compacted subgrade elevation.

PART 3 EXECUTION

3.01 PROTECTION OF EXISTING FACILITIES

- A. Support and protect all poles, fences, utility pipes, wire, conduits, buildings and structures.
- B. Proceed with caution during excavation so the exact location of underground utilities and structures, both known and unknown, may be determined. Contractor shall be responsible for the repair of utilities and structures when broken or otherwise damaged.
- C. Wherever water, or other pipes or conduits cross the excavation, the Contractor shall support said pipes and conduits without damage to them and without interrupting this Contract. The manner of supporting such pipes, or similar items, shall be subject to the approval of the Engineer.

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

3.02 CLEARING

- A. Before excavating, clear and remove logs, stumps, brush, vegetation, rubbish, and other perishable matter from the project site.
- B. Do not remove or damage trees that do not interfere with the finished work. Completely remove trees required to be removed, including stumps and roots. Replace trees removed unnecessarily. Properly treat damaged trees which can be saved.

3.03 STRIPPING AND STOCKPILING TOPSOIL

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

3.04 EXCAVATING

- A. Make excavations to elevations and dimensions necessary to permit bracing, sheeting, erection of forms, inspection of foundation and installation of piping or

conduits. Excavate trenches to the required alignment, depth and width. Excavate trenches in advance of pipe and conduit installation only as far as necessary to provide proper alignment and grade. Plan trenching operations to cause a minimum of danger to adjacent property and a minimum of inconvenience to the public.

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

- I. Use diversion ditches, dikes, or other suitable means to prevent surface water from entering an excavation and to provide adequate drainage of the area adjacent to the excavation. Do not allow water to accumulate in an excavation. If possible, the grade should be away from the excavation.
- J. Excavations shall be inspected by a competent Contractor's representative after every rainstorm or other hazard-increasing occurrence, and the protection against slides and cave-ins shall be increased if necessary.
- K. Do not store excavated or other material nearer than four feet from the edge of any excavation. Store and retain materials as to prevent materials from falling or sliding back into the excavation. Install substantial stop log or barricades when mobile equipment is utilized or allowed adjacent to excavations.

3.05 DEWATERING

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

3.06 SHEETING

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

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

3.07 ROCK REMOVAL

- A. Rock, boulders or other hard, lumpy or unyielding materials encountered in trench bottoms shall be removed to a depth at least 12-inches below the bottom of any pipes to be installed. All rock and other hard

foundation material under structures shall be freed of all loose material, cleaned, and cut to a firm surface; either level, stepped vertically and horizontally or serrated, as may be directed. All seams shall be cleaned out and filled with concrete or mortar.

- B. Blasting of rock or other hard to remove materials will not be permitted on this project.

3.08 SUBGRADES

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

3.09 FOUNDATION SOILS REMOVAL AND COMPACTION

- A. In areas where buildings, structure foundations, and precast concrete tanks are located just below the surface, the site shall be proofrolled using a large vibratory roller (Dynapac CA-25 or equivalent). Proofrolling shall consist of at least ten overlapping passes. Water shall be added in order to achieve moisture content near optimum to facilitate compaction. Purpose of the proofrolling is to detect any areas of unstable or unsuitable soils as well as to density the near-surface soils. Materials which yield excessively during the proofrolling shall be undercut and replaced with well-compacted structural fill.
- B. The Owner will retain a Soils Engineer to be present during proofrolling operations to observe the proofrolling and recommend the nature and extent of any remedial work.
- C. In areas where foundations and prestressed concrete tanks are located, preparation of the subgrade prior to pond backfilling will necessitate removal and replacement of pond bottom silts as well as the very loose silty soils on the flanks of the pond (see the Geotechnical Report for further requirements). The entire tank footprint, plus a margin of at least 5 feet outside the foundation perimeter should be striped down to the existing pond bottom elevation including over-excavation of any accumulated sediments, followed by

proof-rolling with heavy vibratory compaction equipment. The contractor should anticipate the excavation would extend to approximate EL +15 feet. Compaction should consist of no less than ten (10) complete coverages throughout the entire tank area plus a margin of not less than 5 feet beyond the tank perimeters. The perimeter foundation area for the tank structures should be densified at the bottom of footing elevation. Compaction should continue so as to develop a uniform density of not less than 95% of the modified proctor maximum dry density per ASTM D-1557. Compaction tests should be conducted at intervals of no less than 1 test for each 2500 square feet and each 50 foot of foundation perimeter at a depth of 1 foot and at the compacted subgrade elevation.

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

3.10 BACKFILLING FOUNDATION AND STRUCTURE EXCAVATIONS

- A. Remove debris and other unstable or unsuitable materials from excavations before backfilling is started.
- B. Backfill excavations in areas to be paved with Special Backfill. Place Special Backfill in 12-inch lifts. Compact each lift of backfill to not less than 100% of the maximum dry density as determined in accordance with AASHTO T99, Method A. Compaction shall be by hand tamping or approved mechanical tamping devices, or in larger excavations by approved rollers. Do not compact backfill by puddling, unless permitted by the Engineer.
- C. Backfill excavations not requiring Special Backfill with Suitable Material. Place backfill and fill materials in lifts no greater than 12-inches in loose depth. Place backfill and fill materials in lifts no greater than four inches in loose depth where hand tampers are used. Backfill and fill shall be within 2% of optimum moisture content. For soils containing less

than 5% material passing a No. 200 sieve, moisture content may be increased to within 3% of optimum. Compact backfill and fill to not less than 95% of the maximum dry density. Compact backfill and fill for restoration of dirt driveways shall be not less than 100% of the maximum dry density for last lift. Tests for determination of maximum dry density shall meet the requirements of ASTM D698 Method C. Use compaction equipment which is suited to the soil being compacted.

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

3.11 BACKFILLING PIPING TRENCHES

- A. Do not backfill trenches and excavations until all utilities have been inspected by the Owner's representative and until all underground utilities and piping systems are installed in accordance with the requirements of the specifications and the drawings.
- B. Remove debris and other unsuitable materials from excavations before backfilling is started.

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

3.12 SHELL BASE

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

3.13 FINISH GRADING

- A. Shape the surface of all earthwork to conform to the lines, grades, contours and cross-sections shown on the drawings. Hand dressing may be required in certain areas or in confined areas where equipment operation is restricted.
- B. In final shaping of the surface of the earthwork a tolerance of 0.1 foot above or below the plan elevation will be allowed with the following exceptions:
 - 1. Earthwork shall be shaped to slope away from all buildings and structures.
 - 2. Earthwork shall be shaped to match adjacent pavement, curb, sidewalks, and similar appurtenances.
 - 3. Ditch bottoms and swales shall be shaped so that no water will be impounded except in areas designated for impoundment.

3.14 CLEANUP AND MAINTENANCE

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

3.15 STORAGE AND REMOVAL OF EXCAVATED MATERIAL

- A. Suitable excavated material required for filling and backfilling operations may be stockpiled on the job site.
- B. Remove unsuitable materials from the job site as unsuitable materials are excavated. Remove surplus

suitable materials from the job site as excavations are backfilled.

- C. Excavated suitable surplus materials shall remain the Owner's property and shall be stockpiled at the location(s) designated by the Owner.

3.16 DUST CONTROL

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

END OF SECTION

SECTION 02221

TRENCHING, BEDDING AND BACKFILL FOR PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

- A. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to perform all excavation, backfill, fill, grading, trench protection or other related work required to complete the piping work shown on the Drawings and specified herein. The work shall include, but not be limited to: duct conduit; pipe; backfilling; grading; disposal of surplus and unsuitable materials; and all related work.
- B. Prior to commencing work, the Contractor shall examine the site and undertake his own subsurface investigations and take into consideration all conditions that may affect his work.

1.02 PROTECTION

- A. Dewatering, Drainage and Flotation
 - 1. The Contractor shall construct and place all pipelines, concrete work, structural fill, bedding rock and limerock base course, in-the-dry. In addition, the Contractor shall make the final 24" of excavation for this work in-the-dry and not until the water level is a minimum of 6" below proposed bottom of excavation.
 - 2. The Contractor shall, at all times during construction, provide and maintain proper equipment and facilities to remove promptly and dispose of properly all water entering excavation and keep such excavations dry so as to obtain a satisfactory undisturbed subgrade foundation condition until the fill, structure, or pipes to be built thereon have been completed to such extent that they will not be floated or otherwise damaged by allowing water levels to return to natural elevations.
 - 3. Dewatering shall at all times be conducted in such a manner as to preserve the natural undisturbed bearing capacity of the subgrade soils at proposed bottom of excavation.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials for use as fill and backfill shall be as described below. For each material, 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 ten calendar days prior to the date of anticipated use of such material.
2. Additional materials shall be furnished as required from off-site sources and hauled to the site.

B. Base Course

1. Asphalt, crushed concrete, soil cement or approved equal, shall be used as base course for bituminous paved roads and parking areas.

C. Common Fill

1. Common fill material shall be free from organic matter, muck or marl and rock exceeding 2-1/2" in diameter. Common fill shall not contain broken concrete, masonry, rubble or other similar materials. Existing soil may be used to adjust grades over the site with the exception of the construction area.
2. Material falling within the above specification, encountered during the excavation, may be stored in segregated stockpiles for reuse. All material which, in the opinion of the Engineer, is not suitable for reuse shall be spoiled as specified herein for disposal of unsuitable materials by the Contractor.

D. Crushed Stone

1. Crushed stone may be used for pipe bedding and at other locations indicated on the Drawings.
2. Crushed stone shall be size No. 57 with gradation as noted in Table 1 of Section 901 of Florida Department of Transportation, Construction of Roads

and Bridges.

PART 3 EXECUTION

3.01 FILL PLACEMENT

A. General

1. Material placed in fill areas under and around pipelines and structures shall be deposited within the lines and to the grades shown on the Drawings or as directed by the Engineer, making due allowance for settlement of the material. Fill shall be placed only on properly prepared surfaces which have been inspected and approved by the Engineer. If sufficient common fill material is not available from excavation on site, the Contractor shall provide borrows as may be required.
2. Limerock base course material, structural fill and screened limerock, may be provided as borrow.
3. All fill materials shall be placed and compacted "in-the-dry". The Contractor shall dewater excavated areas and is required to perform the work in such manner as to preserve the undisturbed state of the natural inorganic soil.

3.02 COMPACTION

- A. Structural fill, limerock base course and screened limerock in open areas, shall be placed in layers not to exceed nine inches in depth as measured before compaction. Each layer shall be compacted by a minimum of six coverages (3 passes each way) with the equipment described below, to at least 98 percent of the maximum density, as determined by AASHTO T-180. Incidental compaction due to traffic by construction equipment will not be credited toward the required minimum six coverages.
- B. Common fill shall be placed and compacted in a manner similar to that described above for structural fill, with the following exceptions: layer thickness prior to compaction may be increased to 12-inches in open areas; and common fill except dike fill, required below water level in peat excavation areas may be placed as one lift, in-the-wet, to an elevation one foot above the water level at the time of filling.

- C. Areas adjacent to pipelines, structures and other confined areas shall be compacted with a manually operated sled-type vibratory compactor. The Contractor shall also conform to additional backfill requirements at pipelines and structures as specified in the Contract Documents.

Compaction equipment is subject to approval by the Engineer.

3.03 TRENCH EXCAVATION AND BACKFILLING

- A. Excavation for all trenches required for the installation of pipes and electrical ducts shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches.
- B. Rock shall be removed to a minimum 6" clearance around the bottom and sides of all the pipe or ducts being laid.
- C. Where pipes or ducts are to be laid in limerock bedding or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.
- D. Where the pipes or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated manually, shall be done in such a manner that will give a flat bottom true to grade so that pipe or duct can be evenly supported on undisturbed material. Bell holes shall be made as required.
- E. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected and the trench filled with suitable compacted material to the mid-diameter of the pipe.
- F. Backfilling over ducts shall begin not less than three days after placing concrete encasement.
- G. All backfilling shall be prosecuted expeditiously and as detailed on the Drawings.
- H. Any space remaining between the pipe and sides of the

trench shall be packed full by hand shovel with selected earth, free from stones having a diameter greater than 2" and thoroughly compacted with a tamper as fast as placed, up to a level of one foot above the top of the pipe.

- I. The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.
- J. The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted by rolling, ramming, or puddling, as the Engineer may direct, sufficiently to prevent subsequent settling.

END OF SECTION

SECTION 02260

FINISH GRADING

PART 1 GENERAL

1.01 WORK INCLUDED

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

1.02 PROTECTION

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

PART 2 PRODUCTS

2.01 GENERAL

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

PART 3 EXECUTION

3.01 SUB-SOIL PREPARATION

- A. Rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Eliminate uneven areas and low spots. Remove debris, roots, branches, stones, etc. Remove sub-soil which has been contaminated with petroleum products.
- B. Cut out areas to sub-grade elevation, which are to receive stabilizing base for paving, housekeeping pads and sidewalks.

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

3.02 PLACING TOPSOIL

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

3.03 SURPLUS MATERIAL

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

END OF SECTION

SECTION 02276

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

- A. The work specified in this Section consists of furnishing, maintaining, and removing temporary erosion and sedimentation controls as necessary.
- B. Temporary erosion controls include, but are not limited to, sodding, mulching, and reseeding on-site surfaces and spoil and borrow area surfaces within acceptable limits as established by the Owner.
- C. The Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

1.02 SUBMITTALS

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

PART 2 PRODUCTS

2.01 EROSION CONTROL

- A. Sod specified in Section 02900 - Seeding and Sodding.

PART 3 EXECUTION

3.01 EROSION CONTROL

- A. Minimum procedures for grassing are:
 - 1. Scarify slopes to a depth of not less than six inches and remove large clods, rock, stumps, roots larger than 1/2 inch in diameter and debris.
 - 2. Sow seed within twenty-four (24) hours after the ground is scarified with either mechanical seed drills or rotary hand seeders.
 - 3. Apply mulch loosely and to a thickness of between 3/4-inch and 1-1/2 inches.

4. Apply netting over mulched areas on sloped surfaces.
5. Roll and water seeded areas in a manner which will encourage sprouting of seeds and growing of grass. Reseed areas which exhibit unsatisfactory growth. Backfill and seed eroded areas.

3.02 PERFORMANCE

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

END OF SECTION

SECTION 02900

SEEDING AND SODDING

PART 1 GENERAL

1.01 SCOPE OF WORK

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

1.02 RELATED WORK NOT INCLUDED

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

1.03 QUALITY ASSURANCE

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

1.04 SUBMITTALS

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

PART 2 PRODUCTS

2.01 MATERIALS

A. Fertilizer

1. The fertilizer shall be of the slow-release type meeting the following minimum requirements: 12 percent nitrogen, 8 percent phosphorus, 8 percent potassium; 40 percent other available materials derived from organic sources. At least 50 percent of the phosphoric acid shall be from normal super phosphate or an equivalent source which will provide a minimum of two units of sulfur. The amount of sulfur shall be indicated on the quantitative analysis card attached to each bag or other container. Fertilizer shall be uniform in composition, dry and free flowing delivered to sites in original unopened containers bearing manufacturer's statement or guarantee.

B. Seeding/Grassing

1. The Contractor shall grass all unpaved areas disturbed during construction which do not require sod. All grassing shall be completed in conformance with FDOT Specifications, Sections 570 and 981. The grassed areas shall be mulched and fertilized in accordance with FDOT Specifications, except that no additional payment will be made for mulching, fertilizing and/or watering.

C. Sodding

1. Sod shall be provided as required on the construction drawings or at locations as directed by the Engineer in accordance with Florida Department of Transportation, Specifications Section 575 and 981. The Contractor shall furnish Bahia grass sod or match existing sod whichever is more stringent. Placement and watering requirements shall be in accordance with FDOT Specifications Section 575, except that no additional payment will be made for placement and/or watering. This cost shall be included in the Contract price bid for sodding.

D. Topsoil

1. Topsoil stockpiled during excavation may be used as necessary. If additional topsoil is required to

replace topsoil removed during construction, it shall be obtained off site at no additional cost to the Owner. Topsoil shall be fertile, natural surface soil, capable of producing all trees, plants and grassing specified herein.

E. Water

1. It is the Contractor's responsibility to supply all water to the site, as required during seeding and sodding operations and through the maintenance period and until the work is accepted. The Contractor shall make whatever arrangements may be necessary to ensure an adequate supply of water to meet the needs for his work. He shall also furnish all necessary hose, equipment, attachments and accessories for the adequate irrigation of lawns and planted areas as may be required. Water shall be suitable for irrigation and free from ingredients harmful to plant life.

PART 3 EXECUTION

3.01 INSTALLATION

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

3.02 CLEANUP

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

3.03 MAINTENANCE

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

3.04 REPAIRS TO LAWN AREAS DISTURBED BY CONTRACTOR'S OPERATORS

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

END OF SECTION

SECTION 03300

CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Specification.

1.02 SUMMARY

- A. This Section specifies cast-in place concrete, including formwork, reinforcing, mix design, placement procedures, and finishes.

1. Cast-in-place concrete includes the following:

- a) Slabs-on-grade
- b) Equipment pads and bases

1.03 SUBMITTALS

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

1. Product data for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds, dry-shake finish materials and others if requested by Engineer.

2. Shop drawings for reinforcement detailing fabricating, bending, and placing concrete reinforcement. Shop drawings to show proposed location of all construction joints. Comply with ACI 315 "Manual of Standard Practice for Detailing Reinforced Concrete Structures" showing bar schedules, stirrup spacing, bent bar diagrams and arrangement of concrete reinforcement. Include special reinforcing required for openings through concrete structures. Engineer's review is for general compliance only. The Contractor will be responsible for size, number and lengths of reinforcing.

3. The testing laboratory shall submit three (3) copies of results of concrete cylinder tests to Engineer together with one (1) copy each to Owner, Contractor, and Concrete Supplier.
4. Ready-mixed concrete delivered shall be accompanied by delivery tickets showing the following:
 - a) Date and time leaving the plant
 - b) Type of cement and weight
 - c) Quantity of water and time added
 - d) Aggregate moisture correction factor
 - e) Admixtures and weight
 - f) Site arrival time
 - g) Site leaving time
 - h) Type of fly ash and weight
5. Laboratory test reports for concrete materials and mix design test. Contractor shall submit three (3) copies.
6. Material certificates in lieu of material laboratory test reports when permitted by Engineer. Material certificates shall be signed by manufacturer and Contractor, certifying that each material item complies with or exceeds specified requirements. Provide certification from admixture manufacturers that chloride content complies with specification requirements.
7. Hot weather and cold weather concreting plan shall include curing method and specific curing plan, ready mixed supplier plan, contingency plans and materials list as a minimum. All hot weather plans shall meet requirements of ACI 305. All cold weather plans shall meet requirements of ACI 306.
8. A pouring plan will be submitted by the Contractor to the Engineer for approval showing the location of all construction joints and sawed contraction joints.

1.04 **QUALITY ASSURANCE**

- A. Codes and Standards: Comply with provisions of the latest revision of the following codes, specifications and standards, except where more stringent requirements are shown or specified:
1. American Concrete Institute (ACI) 211 "Proportions for Normal, Heavyweight and Mass Concrete."
 2. American Concrete Institute (ACI) 301, "Specifications for Structural Concrete for Buildings."
 3. ACI 318, "Building Code Requirements for Reinforced Concrete."
 4. ACI 347 "Recommended Practice for Concrete Formwork."
 5. ACI 350 "Environmental Engineering Concrete Structures."
 6. Concrete Reinforcing Steel Institute (CRSI) "Manual of Standard Practice."
 7. ASTM C 94 Standard Specifications for Ready-Mix Concrete.
 8. Florida Building Code 2007 edition.
 9. ACI 305 "Specification for Hot Weather Concreting" and 306 "Standard Specification for Cold Weather Concreting."
- B. Concrete Testing Service: Owner will engage a testing agency to perform material evaluation tests.
- C. Materials and installed work may require testing and retesting at any time during progress of Work. Any retesting of rejected materials for installed Work, shall be done at Contractor's expense.
- D. Review requirements for submittals, status of coordinating work and availability of materials. Establish preliminary work progress schedule and procedures for materials inspection, testing and certifications. Require representatives of each entity directly concerned with cast-in-place concrete to attend conference, including, but not limited to, the following:

1. Contractor's superintendent
2. Agency responsible for concrete design mixes
3. Agency responsible for field quality control
4. Ready-mix concrete producer
5. Concrete subcontractor
6. Primary admixture manufacturers

PART 2 PRODUCTS

2.01 FORM MATERIALS

- A. Use plywood complying with U.S. Product Standard PS-1 "B-B (Concrete Form) Plywood," Class I, Exterior Grade or better, mill-oiled and edge-sealed, with each piece bearing legible inspection trademark.
- B. Forms for Unexposed Finish Concrete: Plywood, lumber, metal or another acceptable material. Provide lumber dressed on at least two (2) edges and one (1) side for tight fit.

2.02 REINFORCING MATERIALS

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

2.03 CONCRETE MATERIALS

- A. Portland Cement: ASTM C 150
 1. Type II

- B. Fly Ash: ASTM C 618, Class F
 - 1. Use one brand of cement and fly ash throughout Project unless otherwise acceptable to Engineer.
- C. Normal-Weight Aggregates: ASTM C 33 and as specified. Provide aggregates from a single source for exposed concrete.

2.04 WATER

- A. Mixing water shall meet specified requirements of ASTM C 94-00, Section 5.

2.05 ADMIXTURES, GENERAL

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

- A. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

- 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

- a) Monex Air or Monex NVR, Monex Resources, Inc.
- b) Air-Tite, Cormix Construction Chemicals
- c) Air-Mix or Perma-Air, Euclid Chemical Co.
- d) Darex AEA or Daravair, W.R. Grace & Co.
- e) MB-VR or Micro-Air, Master Builders, Inc.
- f) Sealtight AEA, W.R. Meadows, Inc.
- g) Sika AER, Sika Corp.

- B. Water-Reducing Admixture: ASTM C 494, Type A or D.

- 1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:

- a) Monex Resources, Inc.

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

2.06 CALCIUM CHLORIDE

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

2.07 RELATED MATERIALS

- A. Sand Cushion: Clean, manufactured or natural sand.

- B. Vapor Retarder: Provide vapor retarder that is resistant to deterioration when tested according to ASTM E 154, as follows:
1. Polyethylene sheet not less than 6 mils thick.
- C. Water-resistant barrier consisting of heavy kraft papers laminated together with glass-fiber reinforcement and overcoated with black polyethylene on each side.
- D. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd., complying with AASHTO M 182, Class 2.
- E. Moisture-Retaining Cover: One of the following, complying with ASTM C 171.
1. Waterproof paper
 2. Polyethylene film
 3. Polyethylene-coated burlap
- F. Epoxy Adhesive: ASTM C 881, two-component material suitable for use on dry or damp surfaces. Provide material type, grade and class to suit Project requirements.
1. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a) Burke Epoxy M.V., The Burke Co.
 - b) Spec-Bond 100, Conspec Marketing and Mfg. Co.
 - c) Resi-Bond (J-58), Dayton Superior
 - d) Euco Epoxy System #452 or #620, Euclid Chemical Co.
 - e) Epoxite Binder 2390, A.C. Horn, Inc.
 - f) Epabond, L&M Construction Chemicals, Inc.
 - g) Coneresive Standard Liquid, Master Builders, Inc.
 - h) Rezi-Weld 1000, W.R. Meadows, Inc.
 - i) Metco Hi-Mod Epoxy, Metalcrete Industries

- j) Sikadur 32 Hi-Mod, Sika Corp.
- k) Stonset LV5, Stonhard, Inc.
- l) Series, Symons Corp.

2.08 PROPORTIONING AND DESIGNING MIXES

- A. Prepare design mixes for each type and strength of concrete by either laboratory trial batch or field experience methods as specified in ACI 301, ACI 211, and ACI 350. For the trial batch method, use an independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.
- B. Do not use the same testing agency for field quality control testing.
- C. Limit use of fly ash to not exceed twenty-five percent (25%) of the total cementitious content by weight. Fly ash shall be used either as an admixture or as a partial cement replacement. Fly ash may be used in all structural concrete.
- D. Submit written reports to Engineer of each proposed mix for each class of concrete at least fifteen (15) days prior to start of Work. Do not begin concrete production until proposed mix designs have been reviewed by Engineer.

2.09 COMPRESSIVE STRENGTHS

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

<u>CLASS</u>	<u>7 DAY</u>	<u>28 DAY</u>	<u>MAXIMUM WATER - CEMENTITIOUS RATIO</u>	<u>MINIMUM CEMENTITIOUS MATERIAL (LBS/CY)</u>
Structural	2670	4000	0.44	564
Non-Structural	2000	3000	0.50	470
Structural, High Density	3000	4500	0.40	650

2.10 SLUMP LIMITS

- A. Proportion and design mixes to result in concrete slump at point of placement as follows:

1. Ramps, slabs and sloping surfaces: Not more than 3 inches.
- B. Reinforced foundation systems: Not less than 1 inch and not more than 3 inches.
- C. Concrete containing high-range water-reducing admixture (superplasticizer): Not more than 8 inches after adding admixture to site-verified 2 - 3 inch slump concrete.

2.11 CONCRETE MIX ADJUSTMENTS

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

2.12 ADMIXTURES

- A. Use high-range water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs, concrete required to be watertight, and concrete with water-cement ratios below 0.50.
- B. Use air-entraining admixture in exterior exposed concrete unless otherwise indicated. Add air-entraining admixture at manufacturer's prescribed rate to result in concrete at point of placement having total air content of five percent (5%) with a tolerance of plus or minus one percent (1%).

2.13 READY-MIXED CONCRETE

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

2.14 WATERPROOFING

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

2.15 CRACK INJECTION MATERIALS

A. Hydrophobic Resin:

1. Hydrophobic resin shall be a low viscosity, expanding polyurethane resin. It shall cure into a flexible rubber-like material that has the potential for unrestrained increase in volume in excess of 100 percent in the presence of water.
2. Prepare substrate and install in accordance with the manufacturers recommendations.
3. Available Products: Subject to compliance with requirements, products that may be incorporated in the Work include, but are not limited to, the following:
 - a) Sika Fix HH LV
 - b) Or equal

PART 3 EXECUTION

3.01 GENERAL

- A. Coordinate the installation of joint materials, vapor retarder/barrier and other related materials with placement of forms and reinforcing steel.
- B. Forms
 1. General: Design, erect, support, brace and maintain formwork to support vertical, lateral, static and dynamic loads that might be applied until concrete structure can support such loads. Construct formwork so concrete members and structures are of correct size, shape, alignment, elevation and position. Maintain formwork construction tolerances and surface irregularities complying with the following ACI 347 limits:
 - a) Provide Class A tolerances for concrete surfaces exposed to view.
 - b) Provide Class C tolerances for other concrete surfaces.

- C. Construct forms to sizes, shapes, lines and dimensions shown and to obtain accurate alignment, location, grades, level and plumb work in finished structures.
- D. Fabricate forms for easy removal without hammering or prying against concrete surfaces.
- E. Provisions for Other Trades: Provide openings in concrete formwork to accommodate work of other trades. Determine size and location of openings, recesses and chases from trades providing such items. Accurately place and securely support items built into forms.
- F. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before placing concrete. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT

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

adjoining widths to prevent continuous laps in either direction.

3.03 JOINTS

- A. Construction Joints: Locate and install construction joints so they do not impair strength or appearance of the structure, as acceptable to Engineer.
- B. Place construction joints perpendicular to main reinforcement. Continue reinforcement across construction joints except as indicated otherwise. Do not continue reinforcement through sides of strip placements.
- C. Use bonding agent on existing concrete surfaces that will be joined with fresh concrete.
- D. Joint fillers and sealants shall be as follows:
 - 1. Joint Fillers
 - a) Self-expanding Cork Joint Filler: Preformed strips complying with ASTM D 1752 for Type III.
 - b) Cork Joint Filler: Preformed strips complying with ASTM D 1752 for Type II.
 - c) Sponge Rubber Joint Filler: Preformed strips complying with ASTM D 1752 for Type I.
 - d) Bituminous Fiber Joint Filler: Performed strips complying with ASTM D 1751: Granulated cork with asphalt binder encased between two (2) layers of saturated felt of glass-fiber felt of width and thickness indicated.
 - 2. Joint Sealers shall be appropriate for their intended use and installations. Follow manufactures instruction for use and installation. All joint sealants shall be in accordance with ACI 504R.

3.04 PREPARING FORM SURFACES

- A. General: Coat contact surfaces of forms with an approved, non-residual, low-VOC, form-coating compound before placing reinforcement.

- B. Do not allow excess form-coating material to accumulate in forms or come into contact with in-place concrete surfaces against which fresh concrete will be placed. Apply according to manufacturer's instructions.
- C. Coat steel forms with a non-staining, rust-preventative material. Rust-stained steel formwork is not acceptable.

3.05 CONCRETE PLACEMENT

- A. Inspection: Before placing concrete, inspect and complete formwork installation, reinforcing steel, and items to be embedded or cast in. Notify other trades to permit installation of their work.
- B. General: Comply with ACI 304, "Guide for Measuring, Mixing, Transporting, and Placing Concrete," and as specified.
- C. Deposit concrete continuously or in layers of such thickness that no new concrete will be placed on concrete that has hardened sufficiently to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as specified. Deposit concrete to avoid segregation at its final location.
- D. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers no deeper than 24 inches and in a manner to avoid inclined construction joints. Where placement consists of several layers, place each layer while preceding layer is still plastic to avoid cold joints.
- E. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding, or tamping. Use equipment and procedures for consolidation of concrete complying with ACI 309.
- F. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations no farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items

without causing mix to segregate. A spare vibrator will be on-site for emergency use at all times.

- G. Placing Concrete Slabs: Deposit and consolidate concrete slabs in a continuous operation, within limits of construction joints or expansion joints, until completing placement of a panel or section.
- H. Consolidate concrete during placement operations so that concrete is thoroughly worked around reinforcement, other embedded items and into corners.
- I. Bring slab surfaces to correct level with a straightedge and strike off. Use bull floats or darbies to smooth surface free of humps or hollows. Do not disturb slab surfaces prior to beginning finishing operations.
- J. Maintain reinforcing in proper position on chairs during concrete placement.
- K. Cold-Weather Placement: Comply with provisions of ACI 306 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
- L. When air temperature has fallen to or is expected to fall below 40 °F, uniformly heat water and aggregates before mixing to obtain a concrete mixture temperature of not less than 50 °F and not more than 80 °F at point of placement.
- M. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
- N. Do not use salt, other materials containing antifreeze agents or chemical accelerators unless otherwise accepted in mix designs. Calcium chloride will not be allowed.
- O. Hot-Weather Placement: When hot weather conditions exist that would impair quality and strength of concrete, place concrete complying with ACI 305 and as specified.
- P. Cool ingredients before mixing to maintain concrete temperature at time of placement to be in accordance with ACI. Mixing water may be chilled or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of

mixing water. Ice can not be used to replace more than half of the design total water content. Using liquid nitrogen to cool concrete is Contractor's option.

- Q. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that steel temperature will not exceed the ambient air temperature immediately before embedding in concrete.
- R. Fog spray forms, reinforcing steel and subgrade just before placing concrete. Keep subgrade moisture uniform without puddles or dry areas.
- S. Use water-reducing retarding admixture when required by high temperatures, low humidity or other adverse placing conditions, as acceptable to Engineer.

3.06 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: Provide a rough-formed finish on formed concrete surfaces not exposed to view in the finished Work or concealed by other construction. This is the concrete surface having texture imparted by form-facing material used, with tie holes and defective areas repaired and patched, and fins and other projections exceeding 1/4 inch in height rubbed down or chipped off. Finish shall be a Class C in accordance with ACI 347.
- B. Smooth-Formed Finish: Provide a smooth-formed finish on formed concrete surfaces exposed to view or to be covered with a coating material applied directly to concrete, or a covering material applied directly to concrete, such as waterproofing, dampproofing, veneer plaster, painting or another similar system. This is an as-cast concrete surface obtained with selected form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defective areas with fins and other projections completely removed and smoothed. Finish shall be a Class A in accordance with ACI 347.
- C. Grout-Cleaned Finish: Provide grout-cleaned finish on scheduled concrete surfaces that have received smooth-formed finish treatment.
 - 1. Combine one part Portland cement to one and one-half parts fine sand by volume, and a 50:50 mixture of acrylic or styrene butadiene-based bonding admixture and water to form the consistency of thick paint. Blend standard

Portland cement and white Portland cement in amounts determined by trial patches so that final color of dry grout will match adjacent surfaces.

2. Thoroughly wet concrete surfaces, apply grout to coat surfaces, and fill small holes. Remove excess grout by scraping and rubbing with clean burlap. Keep damp by fog spray for at least thirty-six (36) hours after rubbing.
- D. Related Unformed Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces adjacent to formed surfaces, strike-off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.
- E. Float Finish: Apply float finish to monolithic slab surfaces to receive trowel finish and other finishes as specified; slab surfaces to be covered with membrane or elastic waterproofing, membrane or elastic roofing, or sand-bed terrazzo; and where indicated.
1. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating, using float blades or float shoes only, when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats or by hand-floating if area is small or inaccessible to power units. Finish surfaces to tolerances of F(F) 25 (floor flatness) and F(L) 20 (floor levelness) measured according to ASTM E 1155 (ASTM E 1155M). Cut down high spots and fill low spots. Uniformly slope surfaces to drains. Immediately after leveling, refloat surface to a uniform, smooth, granular texture. Class of surface shall be a class C surface in accordance with 347 R.
- F. Non-slip Broom Finish: Apply a non-slip light broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.
1. Immediately after float finishing, slightly roughen concrete surface by brooming with fiber-bristle broom perpendicular to main traffic route. Coordinate required final finish with Engineer before application.

- G. Filling In: Fill in holes and openings left in concrete structures for passage of work by other trades, unless otherwise shown or directed, after work of other trades is in place. Mix, place and cure concrete as specified to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete Work. All grout shall be non-shrinking.
- H. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.
- I. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor bolts for machines and equipment to template at correct elevations, complying with diagrams or templates of manufacturer furnishing machines and equipment.
- J. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings and associated items. Cast-in safety inserts and accessories as shown on drawings. Screed, tamp and non-slip broom concrete surfaces.
- K. Below Grade Concrete: Waterproof the exterior (grade) side of tank and building walls. Prepare surface based upon manufacturers recommendations. Material may be spray, brush or roller applied. Conform to manufacturers recommendations for chosen application.

3.07 CONCRETE CURING AND PROTECTION

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. In hot, dry and windy weather protect concrete from rapid moisture loss before and during finishing operations with an evaporation-control material. Apply according to manufacturer's instructions after screeding and bull floating, but before power floating and troweling.
- B. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Keep continuously moist for not less than fourteen (14) days as required due to weather.
- C. Curing Methods: Cure concrete by moist curing, by moisture-retaining cover curing, or by combining these methods, as specified.

1. Provide moisture curing by the following methods:
 - a) Keep concrete surface continuously wet by covering with water.
 - b) Use continuous water-fog spray.
 - c) Cover concrete surface with specified absorptive cover, thoroughly saturate cover with water, and keep continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with a 4 inch lap over adjacent absorptive covers.
2. Provide moisture-retaining cover curing as follows:
 - a) Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width with sides and ends lapped at least 3 inches and sealed by waterproof tape or adhesive. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs and other similar surfaces, by moist curing with forms in place for the full curing period or until forms are removed. As soon as initial set has occurred, place a soil soaker hose along the tops of all walls to keep concrete forms wet during the curing period. If forms are removed, continue curing by methods specified above, as applicable, for the remainder of the curing period. If forms are removed before the end of the curing period, then the concrete shall be continuously moist for the remainder of the curing period by fog spraying or covering with moist burlap.
4. Curing Unformed Surfaces: Cure unformed surfaces, including slabs, floor topping and other flat surfaces, by applying the appropriate curing method.
5. Final cure concrete surfaces to receive finish flooring with a moisture-retaining cover, unless otherwise directed.

3.8 REMOVING FORMS

- A. Formwork, such as columns, beam soffits, elevated slabs, joists, walls and other structural elements, may not be removed until concrete has attained at least seventy percent (70%) of design minimum compressive strength at twenty-eight (28) days. No earth loads or live loads will be structurally placed against or on any poured structurally reinforced concrete until the concrete has reached its twenty-eight (28) day compressive strength or otherwise approved by the Engineer. Determine potential compressive strength of in-place concrete by testing field-cured specimens representative of concrete location or members.
- B. Form-facing material may be removed four (4) days after placement only if shores and other vertical supports have been arranged to permit removal of form-facing material without loosening or disturbing shores and supports.

3.9 REUSING FORMS

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

3.10 CONCRETE SURFACE REPAIRS

- A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removing forms, when acceptable to Engineer.
- B. Repairing Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Engineer. Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets, fins and other projections on the surface, and stains and other

discolorations that cannot be removed by cleaning. Flush out form tie holes and fill with dry-pack mortar or precast cement cone plugs secured in place with bonding agent.

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

washdown, below grade members and all concrete in contact with earth, water or exposed directly to the elements shall be watertight. All leaks through concrete that exhibit any dampness or flowing water and any cracks, holes or other defective concrete in areas of potential leakage, shall be repaired and made watertight by CONTRACTOR. Where it is not possible to verify that a crack is not leaking, it shall be repaired. Determination of leakage and / or dampness shall be made by Engineer. Repair, removal, and replacement of defective concrete as directed by ENGINEER shall be at no additional cost to the OWNER.

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

3.11 QUALITY CONTROL TESTING DURING CONSTRUCTION

- A. General: The Contractor will employ a testing agency to perform tests and to submit test reports. The testing agency shall be approved by the Engineer. Any retesting due to non-acceptable work or materials shall be at the Contractors expense.
- B. Sampling and testing for quality control during concrete placement may include the following, as directed by Engineer.
- C. Sampling Fresh Concrete: ASTM C 172, except modified for slump to comply with ASTM C 94.
- D. Slump: ASTM C 143; one (1) test at point of discharge for each compressive strength test; additional tests when concrete consistency seems to have changed or as directed by the Engineer.
- E. Air Content: ASTM C 173, volumetric method for lightweight or normal weight concrete; ASTM C 231, pressure method for normal weight concrete; one (1) for each compressive strength test.
- F. Concrete Temperature: ASTM C 1064; one (1) test hourly when air temperature is 40 °F and below, when 90 °F and above, and one (1) test for each set of compressive-strength specimens.
- G. Compression Test Specimen: ASTM C 31; one (1) set of four (4) standard cylinders for each compressive-strength test, unless otherwise directed. Mold and

store cylinders for laboratory-cured test specimens except when field-cured test specimens are required.

- H. Compressive-Strength Tests: ASTM C 39; one (1) set for each day's pour exceeding 5 cu. yd. plus additional sets for each 50 cu. yd. more than the first 25 cu. yd. of each concrete class placed in any one (1) day; one (1) specimen tested at seven (7) days, two (2) specimens tested at twenty-eight (28) days, and one (1) specimen retained in reserve for later testing if required.
- I. When frequency of testing will provide fewer than five (5) strength tests for a given class of concrete, conduct testing from at least five (5) randomly selected batches or from each batch if fewer than five (5) are used.
- J. When strength of field-cured cylinders is less than eighty-five percent (85%) of companion laboratory-cured cylinders, evaluate current operations and provide corrective procedures for protecting and curing the in-place concrete.
- K. Strength level of concrete will be considered satisfactory if averages of sets of three (3) consecutive strength test results equal or exceed specified compressive strength and no individual strength test result falls below specified compressive strength by more than 500 psi.
- L. Test results will be reported in writing to Engineer, ready-mix producer, and Owner within twenty-four (24) hours after tests. Reports of compressive strength tests shall contain the Project identification name and number, date of concrete placement, name of concrete testing service, concrete type and class, location of concrete batch in structure, design compressive strength at twenty-eight (28) days, concrete mix proportions and materials, compressive breaking strength, and type of break for both seven (7) day tests and twenty-eight (28) day tests.
- M. Nondestructive Testing: Impact hammer, sonoscope or other nondestructive device may be permitted but shall not be used as the sole basis for acceptance or rejection.
- N. Additional Tests: The testing agency will make additional tests of in-place concrete when test results indicate specified concrete strengths and other

characteristics have not been attained in the structure, as directed by Engineer. Testing agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42, or by other methods as directed. These additional tests shall be at the Contractor's expense.

END OF SECTION

