TECHNICAL SPECIFICATIONS
Bid Submittal

5TH Clarifier at the Southwest Water Reclamation Facility

Prepared for:
Manatee County
Project Number 6037282

December 2009

Prepared by:

URS

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Manatee County
5th Clarifier at the
Southwest Water Reclamation Facility

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STATE OF FLORIDA
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12/3/2009

MANATEE COUNTY
5th CLARIFIER AT THE
SOUTHWEST WATER RECLAMATION FACILITY

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DIVISION 01
GENERAL REQUIREMENTS

SECTION 01005

GENERAL REQUIREMENTS

PART 1 GENERAL

1.01 SCOPE AND INTENT

A. Description

The work to be done consists of the furnishing of all labor, materials and equipment, and the performance of all work included in this Contract.

B. Work Included

The Contractor shall furnish all labor, superintendence, materials, plant, power, light, heat, fuel, water, tools, appliances, equipment, supplies, shop drawings, working drawings and other means of construction necessary or proper for performing and completing the work. He shall obtain and pay for all required permits necessary for the work, other than those permits such as the DEP permit and railroad permit which may have already been obtained. He shall perform and complete the work in the manner best calculated to promote rapid construction consistent with safety of life and property and to the satisfaction of the Engineer, and in strict accordance with the Contract Documents. The Contractor shall clean up the work and maintain it during and after construction, until accepted, and shall do all work and pay all costs incidental thereto. He shall repair or restore all structures and property that may be damaged or disturbed during performance of the work.

The cost of incidental work described in these General Requirements, for which there are no specific Contract Items, shall be considered as part of the general cost of doing the work and shall be included in the prices for the various Contract Items. No additional payment will be made therefore.

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

materials and equipment, prior approval of the Engineer notwithstanding.

C. Public Utility Installations and Structures

Public utility installations and structures shall be understood to include all poles, tracks, pipes, wires, conduits, house service connections, vaults, manholes and all other appurtenances and facilities pertaining thereto whether owned or controlled by the Owner, other governmental bodies or privately owned by individuals, firms or corporations, used to serve the public with transportation, traffic control, gas, electricity, telephone, sewage, drainage, water or other public or private property which may be affected by the work shall be deemed included hereunder.

The Contractor shall protect all public utility installations and structures from damage during the work. Access across any buried public utility installation or structure shall be made only in such locations and by means approved by the Engineer. The Contractor shall so arrange his operations as to avoid any damage to these facilities. All required protective devices and construction shall be provided by the Contractor at his expense. All existing public utilities damaged by the Contractor which are shown on the Plans or have been located in the field by the utility shall be repaired by the Contractor, at his expense, as approved by the Engineer. No separate payment shall be made for such protection or repairs to public utility installations or structures.

Public utility installations or structures owned or controlled by the Owner or other governmental body, which are required by this contract to be removed, relocated, replaced or rebuilt by the Contractor not identified in any separate bid item shall be considered as a part of the general cost of doing the work and shall be included in the prices bid for the various contract items. No separate payment shall be made therefore.

Where public utility installations or structures owned or controlled by the Owner or other governmental body are encountered during the course of the work, and are not indicated on the Plans or in the Specifications, and when, in the opinion of the Engineer, removal, relocation, replacement or rebuilding is necessary to complete the work under this Contract, such work shall be accomplished by the utility having jurisdiction, or such work may be ordered, in writing by the Engineer, for the

contractor to accomplish. If such work is accomplished by the utility having jurisdiction, it will be carried out expeditiously and the Contractor shall give full cooperation to permit the utility to complete the removal, relocation, replacement or rebuilding as required. If such work is accomplished by the Contractor, it will be in accordance with the General and Supplemental General Conditions.

All Owner and other governmental utility departments and other owners of public utilities which may be affected by the work will be informed in writing by the Engineer within two weeks after the execution of the Contract or Contracts covering the work. Such notice will set out, in general, and direct attention to, the responsibilities of the Owner and other governmental utility departments and other owners of public utilities for such installations and structures as may be affected by the work and will be accompanied by one set of Plans and Specifications covering the work under such Contract or Contracts.

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

The maintenance, repair, removal, relocation or rebuilding of public utility installations and structures, when accomplished by the Contractor as herein provided, shall be done by methods approved by the Engineer.

1.02 PLANS AND SPECIFICATIONS

A. Plans

When obtaining data and information from the Plans, figures shall be used in preference to scaled dimensions, and large scale drawings in preference to small scale drawings.

B. Copies Furnished to Contractor

The Contractor shall furnish each of the subcontractors, manufacturers, and material men such copies of the Contract Documents as may be required for their work. Additional copies of the Plans and Specifications, when requested, may be furnished to the Contractor at cost of reproduction.

C. Supplementary Drawings

When, in the opinion of the Engineer, it becomes necessary to explain more fully the work to be done or to illustrate the work further or to show any changes which may be required, drawings known as Supplementary Drawings, with specifications pertaining thereto, will be prepared by the Engineer and five paper prints thereof will be given to the Contractor.

D. Contractor to Check Plans and Data

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

E. Specifications

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

F. Intent

All work called for in the Specifications applicable to this Contract, but not shown on the Plans in their present form, or vice versa, shall be of like effect as if shown or mentioned in both. Work not specified in either the Plans or in the Specifications, but involved in carrying out their intent or in the complete and proper execution of the work, is required and shall be performed by the Contractor as though it were specifically delineated or described.

The apparent silence of the Specifications as to any detail, or the apparent omission from them of a detailed description concerning any work to be done and materials to be furnished, shall be regarded as meaning that only the best general practice is to prevail and that only material and workmanship of the best quality is to be used, and interpretation of these Specifications shall be made upon that basis.

The inclusion of the Related Requirements (or work specified elsewhere) in the General part of the specifications is only for the convenience of the Contractor, and shall not be interpreted as a complete list of related Specification Sections.

1.03 MATERIALS AND EQUIPMENT

A. Manufacturer

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

All transactions with the manufacturers or subcontractors shall be through the Contractor, unless the Contractor shall request, in writing to the Engineer, that the manufacturer or subcontractor deal directly with the Engineer. Any such transactions shall not in any way

release the Contractor from his full responsibility under this Contract.

Any two or more pieces or material or equipment of the same kind, type or classification, and being used for identical types of services, shall be made by the same manufacturer.

B. Delivery

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

C. Tools and Accessories

The Contractor shall, unless otherwise stated in the Contract Documents, furnish with each type, kind or size of equipment, one complete set of suitably marked high grade special tools and appliances which may be needed to adjust, operate, maintain or repair the equipment. Such tools and appliances shall be furnished in approved painted steel cases, properly labeled and equipped with good grade cylinder locks and duplicate keys.

Spare parts shall be furnished as specified.

Each piece of equipment shall be provided with a substantial nameplate, securely fastened in place and clearly inscribed with the manufacturer's name, year of manufacture, serial number, weight and principal rating data.

D. Installation of Equipment.

The Contractor shall have on hand sufficient proper equipment and machinery of ample capacity to facilitate the work and to handle all emergencies normally encountered in work of this character.

Equipment shall be erected in a neat and workmanlike manner on the foundations at the locations and elevations shown on the Plans, unless directed otherwise by the Engineer during installation. All equipment shall be correctly aligned, leveled and adjusted for satisfactory operation and shall be installed so that proper and necessary connections can be made readily between the various units.

The Contractor shall furnish, install and protect all necessary anchor and attachment bolts and all other appurtenances needed for the installation of the devices included in the equipment specified. Anchor bolts shall be as approved by the Engineer and made of ample size and strength for the purpose intended. Substantial templates and working drawings for installation shall be furnished.

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

Grout shall completely fill the space between the equipment base and the foundation. All metal surfaces coming in contact with concrete or grout shall receive a coat of coal tar epoxy equal to Koppers 300M.

E. Service of Manufacturer's Engineer

The Contract prices for equipment shall include the cost of furnishing (as required by equipment specifications sections) a competent and experienced engineer or superintendent who shall represent the manufacturer and shall assist the Contractor, when required, to install, adjust, test and place in operation the equipment in conformity with the Contract Documents. After the equipment is placed in permanent operation by the Owner, such engineer or superintendent shall make all adjustments and tests required by the Engineer to prove that such equipment is in proper and satisfactory operating condition, and shall instruct such personnel as may be designated by the Owner in the proper operation and maintenance of such equipment.

1.04 INSPECTION AND TESTING

A. General

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

For tests specified to be made by the Contractor, the testing personnel shall make the necessary inspections and tests and the reports thereof shall be in such form as will facilitate checking to determine compliance with the Contract Documents. Three (3) copies of the reports shall be submitted and authoritative certification thereof must be furnished to the Engineer as a

prerequisite for the acceptance of any material or equipment.

If, in the making of any test of any material or equipment, it is ascertained by the Engineer that the material or equipment does not comply with the Contract, the Contractor will be notified thereof and he will be directed to refrain from delivering said material or equipment, or to remove it promptly from the site or from the work and replace it with acceptable material, without cost to the Owner.

Tests of electrical and mechanical equipment and appliances shall be conducted in accordance with recognized test codes of the ANSI, ASME, or the IEEE, except as may otherwise be stated herein.

The Contractor shall be fully responsible for the proper operation of equipment during tests and instruction periods and shall neither have nor make any claim for damage which may occur to equipment prior to the time when the Owner formally takes over the operation thereof.

B. Costs

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

The cost of shop and field tests of equipment and of certain other tests specifically called for in the Contract Documents shall be borne by the Contractor and such costs shall be deemed to be included in the Contract price.

Materials and equipment submitted by the Contractor as the equivalent to those specifically named in the Contract may be tested by the Owner for compliance. The Contractor shall reimburse the Owner for the expenditures incurred in making such tests on materials and equipment which are rejected for non-compliance.

C. Inspections of Materials

The Contractor shall give notice in writing to the Engineer, at least two weeks in advance of his intention to commence the manufacture or preparation of materials especially manufactured or prepared for use in or as part of the permanent construction. Such notice shall contain

a request for inspection, the date of commencement and the expected date of completion of the manufacture of preparation of materials. Upon receipt of such notice, the Engineer will arrange to have a representative present at such times during the manufacture as may be necessary to inspect the materials or he will notify the Contractor that the inspection will be made at a point other than the point of manufacture, or he will notify the Contractor that inspection will be waived. The Contractor must comply with these provisions before shipping any material. Such inspection shall not release the Contractor from the responsibility for furnishing materials meeting the requirements of the Contract Documents.

D. Certificate of Manufacture

When inspection is waived or when the Engineer so requires, the Contractor shall furnish to him authoritative evidence in the form of Certificates of Manufacture that the materials to be used in the work have been manufactured and tested in conformity with the Contract Documents. These certificates shall be notarized and shall include copies of the results of physical tests and chemical analyses, where necessary, that have been made directly on the product or on similar products of the manufacturer.

E. Shop Tests of Operating Equipment

Each piece of equipment for which pressure, duty, capacity, rating, efficiency, performance, function or special requirements are specified shall be tested in the shop of the maker in a manner which shall conclusively prove that its characteristics comply fully with the requirements of the Contract Documents. No such equipment shall be shipped to the work until the Engineer notifies the Contractor, in writing, that the results of such tests are acceptable.

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

The cost of shop tests and of furnishing manufacturer's preliminary and shop test data of operating equipment shall be borne by the Contractor.

F. Preliminary Field Tests

As soon as conditions permit, the Contractor shall furnish all labor, materials, and instruments and shall make preliminary field tests of equipment. If the preliminary field tests disclose any equipment furnished under this Contract which does not comply with the requirements of the Contract Documents, the Contractor shall, prior to the acceptance tests, make all changes, adjustments and replacements required. The furnishing Contractor shall assist in the preliminary field tests as applicable.

G. Final Field Tests

Upon completion of the work and prior to final payment, all equipment and piping installed under this Contract shall be subjected to acceptance tests as specified or required to prove compliance with the Contract Documents.

The Contractor shall furnish labor, fuel, energy, water and all other materials, equipment and instruments necessary for all acceptance tests, at no additional cost to the Owner. The Supplier shall assist in the final field tests as applicable.

H. Failure of Tests

Any defects in the materials and equipment or their failure to meet the tests, guarantees or requirements of the Contract Documents shall be promptly corrected by the Contractor by replacement or otherwise. The decision of the Engineer as to whether or not the Contractor has fulfilled his obligations under the Contract shall be final and conclusive. If the Contractor fails to make these corrections or if the improved materials and equipment, when tested, shall again fail to meet the guarantees of specified requirements, the Owner, notwithstanding its partial payment for work, and materials and equipment, may reject the materials and equipment and may order the Contractor to remove them from the site at his own expense.

In case the Owner rejects any materials and equipment, then the Contractor shall replace the rejected materials and equipment within a reasonable time. If he fails to do so, the Owner may, after the expiration of a period of thirty (30) calendar days after giving him notice in writing, proceed to replace such rejected materials and equipment, and the cost thereof shall be deducted from

any compensation due or which may become due the Contractor under his Contract.

I. Final Inspection

During such final inspections, the work shall be clean and free from water. In no case will the final pay application be prepared until the Contractor has complied with all requirements set forth and the Engineer has made his final inspection of the entire work and is satisfied that the entire work is properly and satisfactorily constructed in accordance with the requirements of the Contract Document.

1.05 TEMPORARY STRUCTURES

A. Temporary Fences

If, during the course of the work, it is necessary to remove or disturb any fence or part thereof, the Contractor shall, at his own expense, if so ordered by the Engineer, provide a suitable temporary fence which shall be maintained until the permanent fence is replaced. The Engineer shall be solely responsible for the determination of the necessity for providing a temporary fence and the type of temporary fence to be used.

1.06 TEMPORARY SERVICES

A. First Aid

The Contractor shall keep upon the site, at each location where work is in progress, a completely equipped first aid kit and shall provide ready access thereto at all times when people are employed on the work.

1.07 LINES AND GRADES

A. Grade

All work under this Contract shall be constructed in accordance with the lines and grades shown on the Plans, or as given by the Owner/Engineer. The full responsibility for keeping alignment and grade shall rest upon the Contractor.

B. Safeguarding Marks

The Contractor shall safeguard all points, stakes, grade marks, monuments and bench marks made or established on the work, bear the cost of reestablishing them if disturbed, and bear the entire expense of rectifying work improperly installed due to not maintaining or protecting or to removing without authorization such established points, stakes and marks.

The Contractor shall safeguard all existing and known property corners, monuments and marks adjacent to but not related to the work and, if required, shall bear the cost of reestablishing them if disturbed or destroyed.

C. Datum Plane

All elevations indicated or specified refer to the Mean Sea Level Datum of the NGVD 1929 Datum and/or NAVD 1988.

1.08 ADJACENT STRUCTURES AND LANDSCAPING

A. Responsibility

The Contractor shall also be entirely responsible and liable for all damage or injury as a result of his operations to all other adjacent public and private property, structures of any kind and appurtenances thereto met with during the progress of the work. The cost of protection, replacement in their original locations and conditions or payment of damages for injuries to such adjacent public and private property and structures affected by the work, whether or not shown on the Plans, and the removal, relocation and reconstruction of such items called for on the Plans or specified shall be included in the various Contract Items and no separate payments will be made therefor. Where such public and private property, structures of any kind and appurtenances thereto are not shown on the Plans and when, in the opinion of the Engineer, additional work is deemed necessary to avoid interference with the work, payment therefore will be made as provided for in the General Conditions.

Contractor is expressly advised that the protection of buildings, structures, tunnels, tanks, pipelines, etc. and related work adjacent and in the vicinity of his operations, wherever they may be, is solely his responsibility. Conditional inspection of buildings or structures in the immediate vicinity of the project which may reasonably be expected to be affected by the Work

shall be performed by and be the responsibility of the Contractor.

Contractor shall, before starting operations, make an examination of the interior and exterior of the adjacent structures, buildings, facilities, etc., and record by notes, measurements, photographs, etc., conditions which might be aggravated by open excavation and construction. Repairs or replacement of all conditions disturbed by the construction shall be made to the satisfaction of the Owner and to the satisfaction of the Engineer. This does not preclude conforming to the requirements of the insurance underwriters. Copies of surveys, photographs, reports, etc., shall be given to the Engineer.

Prior to the beginning of any excavations, the Contractor shall advise the Engineer of all buildings or structures on which he intends to perform work or which performance of the project work will affect.

B. Protection of Trees

1. All trees and shrubs shall be adequately protected by the Contractor with boxes and otherwise and in accordance with ordinances governing the protection of trees. No excavated materials shall be placed so as to injure such trees or shrubs. Trees or shrubs destroyed by negligence of the Contractor or his employees shall be replaced by him with new stock of similar size and age, at the proper season and at the sole expense of the Contractor.
2. Beneath trees or other surface structures, where possible, pipelines may be built in short tunnels, backfilled with excavated materials, except as otherwise specified, or the trees or structures carefully supported and protected from damage.
3. The Owner may order the Contractor, for the convenience of the Owner, to remove trees along the line or trench excavation. If so ordered, the Owner will obtain any permits required for removal of trees. Such tree removal ordered shall be paid for under the appropriate Contract Items.

C. Lawn Areas

Lawn areas shall be left in as good condition as before the starting of the work. Where sod is to be removed, it shall be carefully removed, and later replaced, or the area where sod has been removed shall be restored with new sod in the manner described in the Workmanship and Materials Paragraph in Section 02485, Seeding & Sodding.

D. Restoration of Fences

Any fence, or part thereof, that is damaged or removed during the course of the work shall be replaced or repaired by the Contractor and shall be left in as good a condition as before the starting of the work. The manner in which the fence is repaired or replaced and the materials used in such work shall be subject to the approval of the Engineer. The cost of all labor, materials, equipment, and work for the replacement or repair of any fence shall be deemed included in the appropriate Contract Item or items, or if no specific Item is provided therefore, as part of the overhead cost of the work, and no additional payment will be made therefore.

1.09 PROTECTION OF WORK AND PUBLIC

A. Barriers and Lights

During the prosecution of the work, the Contractor shall put up and maintain at all times such barriers and lights as will effectually prevent accidents. The Contractor shall provide suitable barricades, red lights, "danger" or "caution" or "street closed" signs and watchmen at all places where the work causes obstructions to the normal traffic or constitutes in any way a hazard to the public, in accordance with state and local requirements.

B. Smoke Prevention

A strict compliance with ordinances regulating the production and emission of smoke will be required. No open fires will be permitted.

C. Noise

The Contractor shall eliminate noise to as great an extent as practicable at all times. Air compressing plants shall be equipped with silencers and the exhaust of all gasoline motors or other power equipment shall be provided with mufflers. In the vicinity of hospitals and schools, special care shall be used to avoid noise or other nuisances. The Contractor shall strictly observe all local regulations and ordinances covering noise control.

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

D. Access to Public Services

Neither the materials excavated nor the materials or plant used in the construction of the work shall be so placed as to prevent free access to all fire hydrants, valves or manholes.

E. Dust prevention

The Contractor shall prevent dust nuisance from his operations or from traffic by keeping the roads and/or construction areas sprinkled with water at all times.

1.10 CUTTING AND PATCHING

The Contractor shall do all cutting, fitting or patching of his portion of the work that may be required to make the several parts thereof join and coordinate in a manner satisfactory to the Engineer and in accordance with the Plans and Specifications. The work must be done by competent workmen skilled in the trade required by the restoration.

1.11 CLEANING

A. During Construction

During construction of the work, the Contractor shall, at all times, keep the site of the work and adjacent premises as free from material, debris and rubbish as is practicable and shall remove the same from any portion of the site if, in the opinion of the Engineer, such material, debris, or rubbish constitutes a nuisance or is objectionable.

The Contractor shall remove from the site all of his surplus materials and temporary structures when no further need therefore develops.

B. Final Cleaning

At the conclusion of the work, all equipment, tools, temporary structures and materials belonging to the Contractor shall be promptly taken away, and he shall

remove and promptly dispose of all water, dirt, rubbish or any other foreign substances.
The Contractor shall thoroughly clean all equipment and materials installed by him and shall deliver such materials and equipment undamaged in a bright, clean, polished and new operating condition.

1.12 MISCELLANEOUS

A. Protection Against Siltation and Bank Erosion

1. The Contractor shall arrange his operations to minimize siltation and bank erosion on construction sites and on existing or proposed water courses and drainage ditches.
2. The Contractor, at his own expense, shall remove any siltation deposits and correct any erosion problems as directed by the Engineer which results from his construction operations.

B. Protection of Wetland Areas

The Contractor shall properly dispose of all surplus material, including soil, in accordance with Local, State and Federal regulations. Under no circumstances shall surplus material be disposed of in wetland areas as defined by the Florida Department of Environmental Protection or Southwest Florida Water Management District.

C. Existing Facilities

The work shall be so conducted to maintain existing facilities in operation insofar as is possible. Requirements and schedules of operations for maintaining existing facilities in service during construction shall be as described in the Special Provisions.

D. Use of Chemicals

All chemicals used during project construction or furnished for project operation, whether herbicide, pesticide, disinfectant, polymer, reactant, or of other classification, must show approval of either EPA or USDA. Use of all such chemicals and disposal of residues shall be in strict conformance with instructions.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01010

SUMMARY OF WORK

PART 1 GENERAL

1.01 WORK COVERED BY CONTRACT DOCUMENTS/REQUIREMENTS INCLUDED

A. The work included in this contract consists of the construction of a new Clarifier 5 with associated RAS/WAS Pump Station and yard piping and modifications to the existing Clarifier 1 and 2 RAS/WAS Pump Station at the Manatee County Southwest Water Reclamation Facility (SWWRF). All the work under this contract is located in easements, rights-of-way and property owned by Manatee County

B. The Contractor shall furnish all shop drawings, working drawings, labor, materials, equipment, tools, services and incidentals necessary to complete all work required by these Specifications and as shown on the Contract Drawings.

C. The Contractor shall perform the work complete, in place and ready for continuous service and shall include any repairs, replacements, and/or restoration required as a result of damages caused prior to acceptance by the Owner.

D. The Contractor shall furnish and install all materials, equipment and labor which is reasonably and properly inferable and necessary for the proper completion of the work, whether specifically indicated in the Contract Documents or not.

1.02 CONTRACTS

Construct all the Work under a single contract.

1.03 WORK SEQUENCE

A. All work done under this Contract shall be done with a minimum of inconvenience to the users of the system or facility. The Contractor shall coordinate his work with private property owners such that existing utility services are maintained to all users to the maximum extent possible.

B. The Contractor shall, if necessary and feasible, construct the work in stages to accommodate the Owner's use of the premises during the construction period; coordinate the construction schedule and operations with the Owner's Representative.

C. The Contractor shall, where feasible, construct the Work in stages to provide for public convenience and not close off public use of any facility until completion of construction to provide alternative usage.

1.04 CONSTRUCTION AREAS

A. The Contractor shall: Limit his use of the construction areas for work and for storage, to allow for:

1. Work by other Contractors.
2. Owner's Use.
3. Public Use.

B. Coordinate use of work site under direction of Engineer or Owner's Representative.

C. Assume full responsibility for the protection and safekeeping of products under this Contract, stored on the site.

D. Move any stored products under the Contractor's control, which interfere with operations of the Owner or separate contractor.

E. Obtain and pay for the use of additional storage of work areas needed for Contractor operations.

1.05 OWNER OCCUPANCY

A. It is assumed that portions of the Work will be completed prior to completion of the entire Work. Upon completion of construction of each individual facility, including testing, if the Owner, at its sole discretion, desires to accept the individual facility, the Contractor will be issued a dated certificate of completion and acceptance for each individual facility. The Owner will assume ownership and begin operation of the individual facility on that date and the three-year guaranty period shall commence on that date. The Owner has the option of not accepting the entire work as a whole until it is completed, tested and approved by the Engineer and Owner.

1.06 PARTIAL OWNER OCCUPANCY

The Contractor shall schedule his operations for completion of portions of the Work, as designated, for the Owner's occupancy prior to substantial completion of the entire work.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01015

CONTROL OF WORK

PART 1 GENERAL

1.01 WORK PROGRESS

The Contractor shall furnish personnel and equipment which will be efficient, appropriate and adequately sized to secure a satisfactory quality of work and a rate of progress which will insure the completion of the work within the time stipulated in the Contract. If at any time such personnel appears to the Engineer to be inefficient, inappropriate, or insufficient for securing the quality of work required for producing the rate of progress aforesaid, he may order the Contractor to increase the efficiency, change the character, or increase the personnel and equipment and the Contractor shall conform to such order. Failure of the Engineer to give such order shall in no way relieve the Contractor of his obligations to secure the quality of the work and rate of progress required.

1.02 PRIVATE LAND

The Contractor shall not enter or occupy private land outside of easements, except by permission of the adjacent property owner.

1.03 WORK LOCATIONS

Work shall be located substantially as indicated on the drawings, but the Engineer reserves the right to make such modifications in locations as may be found desirable to avoid interference with existing structures or for other reasons.

1.04 OPEN EXCAVATIONS

A. All open excavations shall be adequately safeguarded by providing temporary barricades, caution signs, lights and other means to prevent accidents to persons and damage to property. The Contractor shall, at his own expense, provide suitable and safe bridges and other crossings for accommodating travel by pedestrians and workmen. Bridges provided for access to private property during construction shall be removed when no longer required. If the excavation becomes a hazard, or if it excessively restricts traffic at any point, the Engineer may require special construction procedures such as limiting the length of open trench, prohibiting stacking excavated material in the street and requiring that the trench shall not remain open overnight.

B. The Contractor shall take precautions to prevent injury

to the public due to open trenches. All trenches, excavated material, equipment, or other obstacles which could be dangerous to the public shall be barricaded and well lighted at all times when construction is not in progress.

1.05 DISTRIBUTION SYSTEMS AND SERVICES

A. The Contractor shall avoid interruptions to water, telephone, cable TV, sewer, gas, or other related utility services. He shall notify the Engineer and the appropriate agency well in advance of any requirement for dewatering, isolating, or relocating a section of a utility, so that necessary arrangements may be made.

B. If it appears that utility service will be interrupted for an extended period, the Engineer may order the Contractor to provide temporary service lines at the Contractor's expense. Inconvenience of the users shall be kept to the minimum, consistent with existing conditions. The safety and integrity of the systems are of prime importance in scheduling work.

1.06 PROTECTION AND RELOCATION OF EXISTING STRUCTURES AND UTILITIES

A. The Contractor shall assume full responsibility for the protection of all buildings, structures and utilities, public or private, including poles, signs, services to building utilities, gas pipes, water pipes, hydrants, sewers, drains and electric and telephone cables and other similar facilities, whether or not they are shown on the Drawings. The Contractor shall carefully support and protect all such structures and utilities from injury of any kind. Any damage resulting from the Contractor's operation shall be repaired by the Contractor at his expense.

B. The Contractor shall bear full responsibility for obtaining locations of all underground structures and utilities (including existing water services, drain lines and sewers). Services to buildings shall be maintained and all costs or charges resulting from damage thereto shall be paid by the Contractor.

C. Protection and temporary removal and replacement of existing utilities and structures as described in this Section shall be a part of the work under the Contract and all costs in connection therewith shall be included in the unit prices established in the Bid.

D. If, in the opinion of the Engineer, permanent relocation of a utility owned by the Owner is required, he may direct the Contractor, in writing, to perform the work. Work so ordered will be paid for at the Contract unit prices, if applicable, or as extra work as classified in

the General Conditions. If relocation of a privately owned utility is required, the Owner will notify the utility to perform the work as expeditiously as possible. The Contractor shall fully cooperate with the Owner and utility and shall have no claim for delay due to such relocation. The Contractor shall notify public utility companies in writing at least 48 hours (excluding Saturdays, Sundays and legal holidays) before excavating near their utilities.

1.07 TEST PITS

Test pits for the purpose of locating underground pipeline or structures in advance of the construction shall be excavated and backfilled by the Contractor at the direction of the Engineer. Test pits shall be backfilled immediately after the utility location and the surface shall be restored in a manner equal or better than the original condition. No separate payment will be made.

1.08 CARE AND PROTECTION OF PROPERTY

A. The Contractor shall be responsible for the preservation of all public and private property and shall use every precaution necessary to prevent damage thereto. If any direct or indirect damage is done to public or private property by or on account of any act, omission, neglect, or misconduct in the execution of the work on the part of the Contractor, such property shall be restored by the Contractor, at his expense, to a condition equal or better to that existing before the damage was done, or he shall make good the damage in another manner acceptable to the Engineer.

B. All sidewalks which are disturbed by the Contractor's operations shall be restored to their original or better condition by the use of similar or comparable materials. All curbing shall be restored in a condition equal to the original construction and in accordance with the best modern practice.

C. Along the location of this work, all fences, walks, bushes, trees, shrubbery and other physical features shall be protected and restored in a thoroughly workmanlike manner unless otherwise shown on the drawings. Fences and other features removed by the Contractor shall be replaced in the location indicated by the Engineer as soon as conditions permit. All grass areas beyond the limits of construction which have been damaged by the Contractor shall be regraded and sodded to equal or exceed original conditions.

D. Trees close to the work which drawings do not specify to be removed, shall be boxed or otherwise protected against

injury. The Contractor shall trim all branches that are liable to damage because of his operations, but in no case shall any tree be cut or removed without prior notification to the Engineer. All injuries to bark, trunk, limbs and roots of trees shall be repaired by dressing, cutting and painting according to approved methods, using only approved tools and materials.

E. The protection, removal and replacement of existing physical features along the line of work shall be a part of the work under the Contract and all costs in connection therewith shall be included in the unit and/or lump sum prices established under the items in the Bid.

1.09 MAINTENANCE OF TRAFFIC

A. Open pits, trenches, unpaved streets, debris, or other obstructions due to construction that will prevent the normal flow of traffic during an extended construction stoppage, for any reason, shall be minimized. In the event an extended construction stoppage is found to be necessary, Contractor shall, at his own expense, provide normal traffic flow during extended construction stoppage. Extended stoppage will be defined by the Engineer.

B. All excavated material shall be placed so that vehicular and pedestrian traffic may be maintained at all times. If the Contractor's operations cause traffic hazards, he shall repair the road surface, provide temporary roadways, erect wheel guards or fences, or take other safety measures which are satisfactory to the Engineer and Owner.

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

1.10 WATER FOR CONSTRUCTION PURPOSES

A. In locations where public water supply is available, the Contractor may purchase water for all construction purposes.

B. The Contractor shall be responsible for paying for all water tap fees incurred for the purpose of obtaining a potable water service or hydrant meter.

1.11 MAINTENANCE OF FLOW

The Contractor shall at his own cost, provide for the

flow of sewers, drains and water courses interrupted during the progress of the work and shall immediately cart away and remove all offensive matter. The entire procedure of maintaining existing flow shall be fully discussed with the Engineer and Owner well in advance of the interruption of any flow.

1.12 CLEANUP

During the course of the work, the Contractor shall keep the site of his operations in as clean and neat a condition as is possible. He shall dispose of all residue resulting from the construction work and at the conclusion of the work, he shall remove and haul away any surplus excavation, broken pavement, lumber, equipment, temporary structures and any other refuse remaining from the construction operations and shall leave the entire site of the work in a neat and orderly condition.

1.13 COOPERATION WITHIN THIS CONTRACT

A. All firms or person authorized to perform any work under this Contract shall cooperate with the General Contractor and his subcontractors or trades and shall assist in incorporating the work of other trades where necessary or required.

B. Cutting and patching, drilling and fitting shall be carried out where required by the trade or subcontractor having jurisdiction, unless otherwise indicated herein or directed by the Engineer.

1.14 PROTECTION OF CONSTRUCTION AND EQUIPMENT

A. All newly constructed work shall be carefully protected from injury in any way. No wheeling or walking or placing of heavy loads on it shall be allowed and all portions injured shall be reconstructed by the Contractor at his own expense.

B. All structures shall be protected in a manner approved by the Engineer. Should any of the floors or other parts of the structures become heaved, cracked, or otherwise damaged, all such damaged portions of the work shall be completely repaired and made good by the Contractor, at his own expense and to the satisfaction of the Engineer. If, in the final inspection of the work, any defects, faults, or omissions are found, the Contractor shall cause the same to be repaired or removed and replaced by proper materials and workmanship without extra compensation for the materials and labor required. Further, the Contractor shall be fully responsible for the satisfactory maintenance and repair of the construction and other work undertaken herein, for at least the warranty period described in the Contract.

C. Further, the Contractor shall take all necessary precautions to prevent damage to any structure due to water pressure during and after construction and until such structure is accepted and taken over by the Owner.

1.15 CONSTRUCTION WITHIN RIGHT-OF-WAY

Where pipe lines are installed within FDOT right-of-way, all excavation backfill and compaction for the purpose of reconstructing roadways and/or adjacent slopes contiguous thereto shall be in accordance with FDOT or Manatee County Standards and Specifications, whichever is applicable. Contractor shall satisfy the authorized representative of the FDOT with respect to proper safety procedures, construction methods, required permitting, etc., within the FDOT right-of-way.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01030

SPECIAL PROJECT PROCEDURES

PART 1 GENERAL

1.01 PERMITS

Upon notice of award, the Contractor shall immediately apply for all applicable permits not previously obtained by the Owner to do the work from the appropriate governmental agency or agencies. No work shall commence until all applicable permits have been obtained and copies delivered to the Engineer. The costs for obtaining all permits shall be borne by the Contractor.

1.02 CONNECTIONS TO EXISTING SYSTEM

The Contractor shall perform all work necessary to locate, excavate and prepare for connections to the terminus of the existing systems all as shown on the Drawings or where directed by the Owner/Engineer. The cost for this work and for the actual connection to the existing systems shall be included in the price bid for the project and shall not result in any additional cost to the Owner. The termination point for each contract shall be as shown on the Contract Drawings.

1.03 RELOCATIONS

The Contractor shall be responsible for the coordination of the relocation of structures, including but not limited to light poles, power poles, signs, sign poles, fences, piping, conduits and drains that interfere with the positioning of the work as set out on the Drawings. No relocation of the items under this Contract shall be done without approval from the Engineer.

1.04 EXISTING UNDERGROUND PIPING, STRUCTURES AND UTILITIES

A. The attention of the Contractor is drawn to the fact that during excavation, the possibility exists of the Contractor encountering various water, sewer, gas, telephone, electrical, or other utility lines not shown on the Drawings. The Contractor shall exercise extreme care before and during excavation to locate and flag these lines as to avoid damage to the existing lines. Cost for relocation of <u>all</u> existing lines shall be included in the price bid for the project. Should damage occur to an existing line, the Contractor shall bear the cost of all repairs.

B. It is the responsibility of the Contractor to ensure that all utility or other poles, the stability of which may be

endangered by the close proximity of excavation, are temporarily stayed in position while work proceeds in the vicinity of the pole and that the utility or other companies concerned be given reasonable advance notice of any such excavation by the Contractor.

C. The existing utility locations are shown without express or implied representation, assurance, or guarantee that they are complete or correct or that they represent a true picture of underground piping to be encountered. The Contractor shall be responsible for notifying the various utility companies to locate their respective utilities in advance of construction in conformance with all requirements provided for in the Florida Underground Facilities Damage Prevention and Safety Act (Florida Statutes, Title XXXIII, Chapter 556).

D. The existing piping and utilities that interfere with new construction shall be rerouted as shown, specified, or required. Before any piping and utilities not shown on the Drawings are disturbed, the Contractor shall notify the Engineer of the location of the pipeline or utility and shall reroute or relocate the pipeline or utility as directed. Cost for relocation of existing pipelines or utilities shall be included in the price bid for the project.

E. The Contractor shall exercise care in any excavation to locate all existing piping and utilities. All utilities which do not interfere with complete work shall be carefully protected against damage. Any existing utilities damaged in any way by the Contractor shall be restored or replaced by the Contractor at his expense as directed by the Engineer and/or the owner of the utility.

F. It is intended that wherever existing utilities such as water, sewer, gas, telephone, electrical, or other service lines must be crossed, deflection of the pipe within recommended limits and cover shall be used to satisfactorily clear the obstruction unless otherwise indicated in the Drawings. However, when in the opinion of the Engineer this procedure is not feasible, he may direct the use of fittings for a utilities crossing as detailed on the Drawings. No deflections will be allowed in gravity sanitary sewer lines or in existing storm sewer lines.

1.05 SUSPENSION OF WORK DUE TO WEATHER

Refer to FDOT Standards and Specifications Book, Section 8.

1.06 HURRICANE PREPAREDNESS PLAN

A. Within 30 days of the date of Notice to Proceed, the Contractor shall submit to the Engineer and Owner a Hurricane Preparedness Plan. The plan should outline the necessary measures which the Contractor proposes to perform at no additional cost to the Owner in case of a hurricane warning.

B. In the event of inclement weather, or whenever Engineer shall direct, Contractor shall insure that he and his Subcontractors shall carefully protect work and materials against damage or injury from the weather. If, in the opinion of the Engineer, any portion of work or materials is damaged due to the failure on the part of the Contractor or Subcontractors to protect the work, such work and materials shall be removed and replaced at the expense of the Contractor.

1.07 POWER SUPPLY

Electricity as may be required for construction and permanent power supply, shall be secured and purchased by the Contractor.

1.08 SALVAGE

Any existing equipment or material, including, but not limited to, valves, pipes, fittings, couplings, etc., which is removed or replaced as a result of construction under this project may be designated as salvage by the Engineer or Owner and if so shall be protected for a reasonable time until picked up by the Owner. Any equipment or material not worthy of salvaging, as directed by the Engineer, shall be disposed of by the Contractor at no additional cost.

1.09 DEWATERING

A. The Contractor shall do all groundwater pumping necessary to prevent flotation of any part of the work during construction operations with his own equipment.

B. The Contractor shall pump out water and wastewater which may seep or leak into the excavations for the duration of the Contract and with his own equipment. He shall dispose of this water in an appropriate manner.

1.10 ADDITIONAL PROVISIONS

A. Before commencing work on any of the existing pipelines, structures or equipment, the Contractor shall notify the Engineer, in writing, at least 10 calendar days in advance of the date he proposes to commence such work.

B. The Contractor shall provide, at his own expense, all necessary temporary facilities for access to and for protection of, all existing facilities. The Owner's personnel must have ready access at all times to the existing facilities. The Contractor is responsible for all damage to existing structures, equipment and facilities caused by his construction operations and must repair all such damage when and as ordered by the Engineer.

1.11 CONSTRUCTION CONDITIONS

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

1.12 PUBLIC NUISANCE

A. The Contractor shall not create a public nuisance including but not limited to encroachment on adjacent lands, flooding of adjacent lands, excessive noise or dust.

B. Sound levels must meet Manatee County Ordinance #87-34, (which amends Ordinance 81-3, The Manatee County Noise Control Ordinance). Sound levels in excess of such ordinance are sufficient cause to have the work halted until equipment can be quieted to these levels. Work stoppage by the Engineer or County for excessive noise shall <u>not</u> relieve the Contractor of the other portions of this specification including, but not limited to contract time and contract price.

C. No extra charge may be made for time lost due to work stoppage resulting from the creation of a public nuisance.

1.13 WARRANTIES

A. All material supplied under these Specifications shall be warranted by the Contractor and the manufacturers for a period of three (3) years. Warranty period shall commence on the date of Owner acceptance.

B. The material shall be warranted to be free from defects in workmanship, design and materials. If any part of the system should fail during the warranty period, it shall be replaced at no expense to the Owner.

C. The manufacturer's warranty period shall run concurrently with the Contractor's warranty or guarantee period. No exception to this provision shall be allowed. The

Contractor shall be responsible for obtaining warranties from each of the respective suppliers or manufacturers for all the material specified under these contract specifications.

D. In the event that the manufacturer is unwilling to provide a three-year warranty commencing at the time of Owner acceptance, the Contractor shall obtain from the manufacturer a four (4) year warranty starting at the time of equipment delivery to the job site. This four-year warranty shall not relieve the Contractor of the three-year warranty starting at the time of Owner acceptance of the equipment.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01045

CUTTING AND PATCHING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for all cutting, fitting and patching, including excavation and backfill, required to complete the work or to:

1. Make its several parts fit together properly.

2. Uncover portions of the work to provide for installation of ill-timed work.

3. Remove and replace defective work.

4. Remove and replace work not conforming to requirements of Contract Documents.

5. Provide penetrations of non-structural surfaces for installation of piping and electrical conduit.

PART 2 PRODUCTS

2.01 MATERIALS

Comply with specifications and standards for each specific product involved.

PART 3 EXECUTION

3.01 INSPECTION

A. Inspect existing conditions of project, including elements subject to damage or to movement during cutting and patching.

B. After uncovering work, inspect conditions affecting installation of products, or performance of work.

C. Report unsatisfactory or questionable conditions to Engineer. Do not proceed with work until Engineer has provided further instructions.

3.02 PREPARATION

A. Provide adequate temporary support as necessary to assure structural value to integrity of affected portion of work.

B. Provide devices and methods to protect other portions of project from damage.

C. Provide protection from elements for that portion of the project which may be exposed by cutting and patching work and maintain excavations free from water.

3.03 PERFORMANCE

A. Execute cutting and demolition by methods which will prevent damage to other work and will provide proper surfaces to receive installation of repairs.

B. Execute excavating and backfilling by methods which will prevent settlement or damage to other work.

C. Fit and adjust products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

D. Restore work which has been cut or removed; install new products to provide completed work in accordance with the requirements of the Contract Documents.

E. Replace surfaces airtight to pipes, sleeves, ducts, conduit and other penetrations through surfaces.

F. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.

END OF SECTION

SECTION 01050

FIELD ENGINEERING AND SURVEYING

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall provide and pay for field surveying service required for the project.

B. The Contractor shall furnish and set all necessary stakes to establish the lines and grades as shown on the Contract Drawings and layout each portion of the Work of the Contract.

1. All survey work required in execution of Project.

2. All costs of construction layout shall be included in the unit and lump sum prices contained in the respective divisions of the Contract Bid Form.

3. Civil, structural or other professional engineering services specified or required to execute Contractor's construction methods.

1.02 QUALIFICATION OF SURVEYOR AND ENGINEER

All construction staking shall be conducted by or under the supervision of a Florida Registered Professional Surveyor and Mapper approved by the Owner. The Contractor shall be responsible for the layout of all such lines and grades, which will be subject to verification by the Engineer.

1.03 SURVEY REFERENCE POINTS

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

B. Locate and protect all survey monumentation, property corners and project control points prior to starting work and preserve all permanent reference points during construction. All costs associated with the replacement of all survey monumentation, property corners and project control points shall be borne by the Contractor.

1. Make no changes or relocations without prior written notice to Engineer.

2. Report to Engineer when any reference point is lost or destroyed, or requires relocation because of necessary changes in grades or locations.

3. Require surveyor to replace project control points which may be lost or destroyed.

4. Establish replacements based on original survey control.

1.04 PROJECT SURVEY REQUIREMENTS

The Contractor shall establish temporary bench marks as needed, referenced to data established by survey control points.

1.05 RECORDS

Maintain a complete, accurate log of all control and survey work as it progresses.

The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data and properly prepare record drawings on mylar and 3-1/2" diskettes. The Record Drawings, together with two copies, shall be certified by the licensed professional and shall be submitted to the Owner/Engineer.

1.06 SUBMITTALS

A. Submit name and address of Professional Surveyor and Mapper to Engineer for Owner’s approval.

B. Submit certificate signed by the Professional Surveyor and Mapper certifying that elevations and locations of improvements are in conformance, or nonconformance, with Contract Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01090

REFERENCE STANDARDS

PART 1 GENERAL

1.01 REQUIREMENTS

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

1.02

A. Application: When a standard is specified by reference, comply with requirements and recommendations stated in that standard, except when requirements are modified by the Contract Documents, or applicable codes established stricter standards.

B. Publication Date: The most recent publication in effect on the date of issue of Contract Documents, except when a specific publication date is specified.

1.03 ABBREVIATIONS, NAMES AND ADDRESSES OR ORGANIZATIONS

Obtain copies of reference standards direct from publication source, when needed for proper performance of work, or when required for submittal by Contract Documents.

AA Aluminum Association
818 Connecticut Avenue, N.W.
Washington, DC 20006

AASHTO American Association of State Highway and Transportation Officials
444 North Capital Street, N.W.
Washington, DC 20001

ACI American Concrete Institute
Box 19150
Reford Station
Detroit, MI 48219

AI Asphalt Institute
Asphalt Institute Building
College Park, MD 20740

AISC American Institute of Steel Construction
1221 Avenue of the Americas
New York, NY 10020

AISI American Iron and Steel Institute
1000 16th Street NW
Washington, DC 20036

ANSI American National Standards Institute
1430 Broadway
New York, NY 10018

ASHRAE American Society of Heating, Refrigerating and Air Conditioning Engineers
179l Tullie Circle, N.E.
Atlanta, GA 30329

ASME American Society of Mechanical Engineers
345 East 47th Street
New York, NY 10017

ASTM American Society for Testing and Materials
1916 Race Street
Philadelphia, PA 19103

AWWA American Water Works Association
6666 West Quincy Avenue
Denver, CO 80235

AWS American Welding Society
2501 N.W. 7th Street
Miami, FL 33125

CRSI Concrete Reinforcing Steel Institute
180 North LaSalle Street, Suite 2110
Chicago, IL 60601

FDEP Florida Department of Environmental Protection
3900 Commonwealth Blvd. Tallahassee, Florida 32399

FDOT Florida Department of Transportation
Standards Specifications for Road and Bridge Construction
Maps & Publication Sales - Mail Station 12
605 Suwannee St.
Tallahassee, FL 32399-0450

FS Federal Specification
General Services Administration
Specifications and Consumer Information Distribution Section (WFSIS)
Washington Navy Yard, Bldg. 197
Washington, DC 20407

MCUOD Manatee County Utility Operations Department
4410 66th St. W.
Bradenton, FL 34210

MLSFA Metal Lath/Steel Framing Association
221 North LaSalle Street
Chicago, IL 60601

MMA Monorail Manufacturer's Association
1326 Freeport Road
Pittsburgh, PA 15238

NAAMM National Association of Architectural
Metal Manufacturers
221 North LaSalle Street
Chicago, IL 60601

NEMA National Electrical Manufacturer's Assoc.
2101 L Street N.W.
Washington, DC 20037

OHSA Occupational Safety and Health Assoc.
5807 Breckenridge Pkwy., Suite A
Tampa, FL 33610-4249

PCA Portland Cement Association
5420 Old Orchard Road
Skokie, IL 20076

PCI Prestressed Concrete Institute
20 North Wacker Drive
Chicago, IL 60606

SDI Steel Door Institute
712 Lakewood Center North
Cleveland, OH 44107

SMACNA Sheet Metal and Air Conditioning
Contractor's National Association
8224 Old Court House Road
Vienna, VA 22180

SSPC Steel Structures Painting Council
402 24th Street, Suite 600
Pittsburgh, PA 15213

SWFWMD Southwest Florida Water Management District
2379 Broad Street
Brooksville, FL 34604-6899

UL Underwriter's Laboratories, Inc.
333 Pfingston Road
Northbrook, IL 60062

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01150

MEASUREMENT AND PAYMENT

PART 1 GENERAL

1.01 SCOPE

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

B. All contract prices included in the Bid Form section will be full compensation for all shop drawings, working drawings, labor, materials, tools, equipment and incidentals necessary to complete the construction as shown on the Drawings and/or as specified in the Contract Documents to be performed under this Contract. Actual quantities of each item bid on a unit price basis will be determined upon completion of the construction in the manner set up for each item in this section of the Specifications. Payment for all items listed in the Bid Form will constitute full compensation for all work shown and/or specified to be performed under this Contract.

1.02 ESTIMATED QUANTITIES

The quantities shown are approximate and are given only as a basis of calculation upon which the award of the Contract is to be made. The Owner/Engineer does not assume any responsibility for the final quantities, nor shall the Contractor claim misunderstanding because of such estimate of quantities. Final payment will be made only for satisfactorily completed quantity of each item.

1.03 WORK OUTSIDE AUTHORIZED LIMITS

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

1.04 MEASUREMENT STANDARDS

Unless otherwise specified for the particular items involved, all measurements of distance shall be taken horizontally or vertically.

1.05 AREA MEASUREMENTS

In the measurement of items to be paid for on the basis of area of finished work, the lengths and/or widths to be used in the calculations shall be the final dimensions measured along the surface of the completed work within the neat lines shown or designated.

1.06 LUMP SUM ITEMS

Where payment for items is shown to be paid for on a lump sum basis, no separate payment will be made for any item of work required to complete the lump sum items. Lump sum contracts shall be complete, tested and fully operable prior to request for final payment.

1.07 UNIT PRICE ITEM

Separate payment will be made for the items of work described herein and listed on the Bid Form. Any related work not specifically listed, but required for satisfactory completion of the work shall be considered to be included in the scope of the appropriate listed work items.

No separate payment will be made for the following items and the cost of such work shall be included in the applicable pay items of work. Final payments shall not be requested by the Contractor or made by the Owner until as-built (record) drawings have been submitted and approved by the Engineer.

1. Shop Drawings, Working Drawings.
2. Clearing, grubbing and grading except as hereinafter specified.
3. Trench excavation, including necessary pavement removal and rock removal, except as otherwise specified.
4. Dewatering and disposal of surplus water.
5. Structural fill, backfill, and grading.
6. Replacement of unpaved roadways, and shrubbery plots.
7. Cleanup and miscellaneous work.
8. Foundation and borrow materials, except as hereinafter specified.
9. Testing and placing system in operation.
10. Any material and equipment required to be installed and utilized for the tests.
11. Pipe, structures, pavement replacement, asphalt and shell driveways and/or appurtenances included within the limits of lump sum work, unless otherwise shown.
12. Maintaining the existing quality of service during construction.
13. Maintaining or detouring of traffic.
14. Appurtenant work as required for a complete and operable system.
15. Seeding and hydromulching.
16. As-built Record Drawings.

BID ITEM No. 1 - MOBILIZATION

Measurement and payment for this Bid Item shall include full compensation for the required 100 percent (100%) Performance Bond, 100 Percent (100%) Payment Bond, all required insurance for the project and the Contractor's mobilization and demobilization costs as shown in the Bid Form.

Payment for mobilization shall not exceed 10 percent (10%) of the total Contract cost unless the Contractor can prove to the Owner that his actual mobilization cost exceeds 10 percent (10%).

BID ITEM No. 2 -
CIVIL/MECHANICAL/STRUCTURAL/ELECTRICAL/INSTRUMENTATION WORK

Payment for all work included under this Bid Item shall be made at the Contract lump sum price listed in the Bid Form and shall represent full compensation for all labor, materials and equipment required for construction of the new Clarifier 5 with associated RAS/WAS Pump Station and modifications to the existing Clarifier 1 and 2 RAS/WAS Pump Station including, but not limited to: erosion and sedimentation control; demolition; excavation (including rock); dewatering; sheeting; fill; compaction; grading; surface restoration; asphalt work; concrete work; surface preparation and painting; electrical work; instrumentation work; and furnishing and installing prestressed concrete tank, clarifier mechanism, handrails, grating, stairs, pumps and accessories, piping, pipe restraining, fittings, valves, saddles and hot taps, line stops, electrical components, variable frequency drives (VFDs), transformer, panelboards, circuit breakers, lighting, flowmeter, and miscellaneous metals.

Payment for all work included under this lump sum Bid Item shall represent full compensation for furnishing all labor, materials, equipment and incidentals required to complete the construction of the new Clarifier 5 with associated RAS/WAS Pump Station and modifications to the existing Clarifier 1 and 2 RAS/WAS Pump Station as specified in Divisions 1 through 16 and as shown on the Contract Drawings ready for approval by the Engineer and acceptance by the Owner.

Payment for this lump sum bid item shall also include all other appurtenances and related work which are not specified or shown but are required to complete the work of the construction of the new Clarifier 5 with associated RAS/WAS Pump Station and modifications to the existing Clarifier 1 and 2 RAS/WAS Pump Station.

Measurement for periodic payments of this lump sum bid item will be in accordance with the approved Schedule of Values, to be supplied by the Contractor in accordance with the Contract Documents.

BID ITEM NO. 3 - MISCELLANEOUS WORK AND CLEANUP

Payment for all work included under this Bid Item shall be made at the Contract lump sum price bid listed in the Bid Form and shall represent full compensation for all labor, materials and equipment required to perform all the work as shown on the Contract Drawings and specified herein and any other miscellaneous work not specifically included for payment under other Bid Items obviously necessary to complete the Contract. Partial payments will be based on the breakdown of the Bid Item in accordance with the Schedule of Values submitted by the Contractor and approved by the Engineer. Payment shall also include full compensation for project photographs, as-builts record drawings, traffic control, rubbish and spoil removal, repair, replacement or relocation of all signs, walls, private irrigation systems and related items and any and all other items required to complete the project in accordance with Contract Documents.

BID ITEM NO. 4 - DISCRETIONARY WORK

Payment for all work under this Bid Item and listed in the Bid Form shall be made only at the Owner's discretion in order to satisfactorily complete the project in accordance with the Plans and Specifications.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01152

REQUESTS FOR PAYMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Submit Applications for Payment to the Project Manager or as directed at the preconstruction meeting, in accordance with the schedule established by Conditions of the Contract and Agreement between Owner and Contractor.

1.02 FORMAT AND DATA REQUIRED

A. Submit payment requests in the form provided by the Owner with itemized data typed in accordance with the Bid Form.

B. Provide construction photographs in accordance with Contract Documents.

1.03 SUBSTANTIATING DATA FOR PROGRESS PAYMENTS

A. When the Owner or the Engineer requires substantiating data, Contractor shall submit suitable information with a cover letter.

B. Submit one copy of data and cover letter for each copy of application.

1.04 PREPARATION OF APPLICATION FOR FINAL PAYMENT

Fill in application form as specified for progress payments.

1.05 SUBMITTAL PROCEDURE

A. Submit applications for payment at the times stipulated in the Agreement.

B. Number: Three (3) copies of each application; all signed and certified by the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01153

CHANGE ORDER PROCEDURES

PART 1 GENERAL

1.01 DEFINITION

A. Change Order: See General Conditions.

B. Field Directive Change: See General Conditions.

1.02 REQUIREMENTS INCLUDED

A. The Contractor shall promptly implement change order procedures:

1. Provide full written data required to evaluate changes.

2. Maintain detailed records of work done on a time-and-material/force account basis.

3. Provide full documentation to Engineer on request.

B. The Contractor shall designate a member of the Contractor's organization who:

1. Is authorized to accept changes to the Work.

2. Is responsible for informing others in the Contractor's employ of the authorized changes into the Work.

C. The Board of County Commissioners executes all Change Orders.

1.03 PRELIMINARY PROCEDURES

A. Project Manager may initiate changes by submitting a Request to Contractor. Request will include:

1. Detailed description of the change, products, costs and location of the change in the Project.

2. Supplementary or revised Drawings and Specifications.

3. The projected time extension for making the change.

4. A specified period of time during which the requested price will be considered valid.

5. Such request is for information only and is not an instruction to execute the changes, nor to stop work in progress.

B. Contractor may initiate changes by submitting a written notice to the Project Manager, containing:

1. Description of the proposed changes.

2. Statement of the reason for making the changes.

3. Statement of the effect on the Contract Sum and the Contract Time.

4. Statement of the effect on the work of separate contractors.

5. Documentation supporting any change in Contract Sum or Contract Time, as appropriate.

1.04 FIELD DIRECTIVE CHANGE

A. In lieu of a Change Order, the Project Manager may issue a Field Directive change for the Contractor to proceed with additional work within the original intent of the Project.

B. Field Directive change will describe changes in the work, with attachments of backup information to define details of the change.

C. Contractor must sign and date the Field Directive change to indicate agreement with the terms therein.

1.05 DOCUMENTATION OF PROPOSALS AND CLAIMS

A. Support each quotation for a lump sum proposal and for each unit price which has not previously been established, with sufficient substantiating data to allow the Engineer/Owner to evaluate the quotation.

B. On request, provide additional data to support time and cost computations:

1. Labor required.

2. Equipment required.

3. Products required.

a. Recommended source of purchase and unit cost.
b. Quantities required.

4. Taxes, insurance and bonds.

5. Credit for work deleted from Contract, similarly documented.

6. Overhead and profit.

7. Justification for any change in Contract Time.

C. Support each claim for additional costs and for work done on a time-and-material/force account basis, with documentation as required for a lump-sum proposal, plus additional information.

1. Name of the Owner's authorized agent who ordered the work and date of the order.

2. Date and time work was performed and by whom.

3. Time record, summary of hours work and hourly rates paid.

4. Receipts and invoices for:

a. Equipment used, listing dates and time of use.
b. Products used, listing of quantities.
c. Subcontracts.

1.06 PREPARATION OF CHANGE ORDERS

A. Project Manager will prepare each Change Order.

B. Form: see Section 00550 for sample form.

C. Change Order will describe changes in the Work, both additions and deletions, with attachments as necessary to define details of the change.

D. Change Order will provide an accounting of the adjustment in the Contract Sum and in the Contract Time.

1.07 LUMP SUM/FIXED PRICE CHANGE ORDER

A. Project Manager initiates the form, including a description of the changes involved and attachments based upon documents and proposals submitted by the Contractor, or requests from the Owner, or both.

B. Once the form has been completed, all copies should be sent to Contractor for approval. After approval by Contractor, all copies should be sent to Owner for approval. The Owner will distribute executed copies after approval by the Board of County Commissioners.

1.08 UNIT PRICE CHANGE ORDER

A. Contents of Change Orders will be based on, either:

1. Owner's definition of the scope of the required changes.

2. Contractor's Proposal for a change, as approved by the Owner.

3. Survey of completed work.

B. The amounts of the unit prices to be:

1. Those stated in the Agreement.

2. Those mutually agreed upon between Owner and Contractor.

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

A. At completion of the change, Contractor shall submit itemized accounting and supporting data as provided in the Article "Documentation of Proposals and Claims" of this Section.

B. Engineer will determine the allowable cost of such work, as provided in General Conditions and Supplementary Conditions.

C. Engineer will sign and date the Change Order to establish the change in Contract Sum and in Contract Time.

D. Owner and Contractor will sign and date the Change Order to indicate their agreement therewith.

1.10 CORRELATION WITH CONTRACTOR'S SUBMITTALS

A. Periodically revise Schedule of Values and Application for Payment forms to record each change as a separate item of work, and to record the adjusted Contract Sum.

B. Periodically revise the Construction Schedule to reflect each change in Contract Time.

1. Revise sub schedules to show changes for other items of work affected by the changes.

C. Upon completion of work under a Change Order, enter pertinent changes in Record Documents.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01200

PROJECT MEETINGS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Owner or Engineer shall schedule the pre-construction meeting, periodic progress meetings and special meetings, if required, throughout progress of work.

B. Representatives of contractors, subcontractors and suppliers attending meetings shall be qualified and authorized to act on behalf of the entity each represents.

C. The Contractor shall attend meetings to ascertain that work is expedited consistent with Contract Documents and construction schedules.

1.02 PRE-CONSTRUCTION MEETING

A. Attendance:

1. Owner's Engineer.
2. Owner's Project Manager
3. Contractor.
4. Resident Project Representative.
5. Related Labor Contractor's Superintendent.
6. Major Subcontractors.
7. Major Suppliers.
8. Others as appropriate.

B. Suggested Agenda:

1. Distribution and discussion of:

    a. List of major subcontractors.
    b. Projected Construction Schedules.
    c. Coordination of Utilities

2. Critical work sequencing.

3. Project Coordination.

    a. Designation of responsible personnel.
    b. Emergency contact persons with phone numbers.

4. Procedures and processing of:

    a. Field decisions.
    b. Submittals.
    c. Change Orders.

d. Applications for Payment.

5. Procedures for maintaining Record Documents.

6. Use of premises:

a. Office, work and storage areas.
b. Owner's REQUIREMENTS.

7. Temporary utilities.

8. Housekeeping procedures.

9. Liquidated damages.

10. Equal Opportunity Requirements.

11. Laboratory testing.

12. Job meetings.

1.03 PROGRESS MEETINGS

A. Schedule regular meetings. The progress meetings may be held every 30 days or less with the first meeting 30 days after the pre-construction meeting.

B. Hold special meetings as required.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01310

CONSTRUCTION SCHEDULE & PROJECT RESTRAINTS

PART 1 GENERAL

1.01 GENERAL

A. Construction under this contract must be coordinated with the Owner and accomplished in a logical order to maintain utilization and flow through existing facilities and public properties and rights-of-way and to allow construction to be completed within the time allowed by Contract Documents and in the manner set forth in the Contract.

1.02 CONSTRUCTION SCHEDULING GENERAL PROVISIONS

A. No work shall be done between 7:00 p.m. and 7:00 a.m. nor on weekends or legal holidays without written permission of the Owner. However, emergency work may be done without prior permission.

B. Night work may be established by the Contractor as regular procedure with the written permission of the Owner. Such permission, however, may be revoked at any time by the Owner if the Contractor fails to maintain adequate equipment and supervision for the proper execution and control of the work at night.

C. Due to potential health hazards and requirements of the State of Florida and the U.S. Environmental Protection Agency, existing facilities must be maintained in operation.

D. The Contractor shall be fully responsible for providing all temporary piping, plumbing, electrical hook-ups, lighting, temporary structure, or other materials, equipment and systems required to maintain the existing facility's operations. All details of temporary piping and temporary construction are not necessarily shown on the Drawings or covered in the Specifications. However, this does not relieve the Contractor of the responsibility to insure that construction will not interrupt proper facility operations.

E. The Contractor shall designate an authorized representative of his firm who shall be responsible for development and maintenance of the schedule and of progress and payment reports. This representative of the Contractor shall have direct project control and complete authority to act on behalf of the Contractor in

fulfilling the commitments of the Contractor's schedule.

1.03 PROGRESS OF THE WORK

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

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. The Contractor shall submit a critical path schedule as described herein.

B. The planning, scheduling, management and execution of the work is the sole responsibility of the Contractor. The progress schedule requirement is established to allow Engineer to review Contractor's planning, scheduling, management and execution of the work; to assist Engineer in evaluating work progress and make progress payments and to allow other contractors to cooperate and coordinate their activities with those of the Contractor.

2.02 FORM OF SCHEDULES

A. Prepare schedules in the form of a horizontal bar chart diagram. The diagram shall be time-scaled and sequenced by work areas. Horizontal time scale shall identify the first work day of each week.

B. Activities shall be at least as detailed as the Schedule of Values. Activity durations shall be in whole working days. In addition, man-days shall be shown for each activity or tabulated in an accompanying report.

C. Diagrams shall be neat and legible and submitted on sheets at least 8-1/2 inches by 11 inches suitable for reproduction. Scale and spacing shall allow space for notations and future revisions.

D. The schedules shall be prepared and submitted using the latest version of Microsoft Project, or other Owner approved software.

2.03 CONTENT OF SCHEDULES

A. Each monthly schedule shall be based on data as of the last day of the current pay period.

B. Description for each activity shall be brief, but convey the scope of work described.

C. Activities shall identify all items of work that must be accomplished to achieve substantial completion, such as items pertaining to Contractor's installation and testing activities; items pertaining to the approval of regulatory agencies; contractor's time required for submittals, fabrication and deliveries; the time required by Engineer to review all submittals as set forth in the Contract Documents; items of work required of Owner to support pre-operational, startup and final testing; time required for the relocation of utilities. Activities shall also identify interface milestones with the work of other contractors performing work under separate contracts with Owner.

D. Schedules shall show the complete sequence of construction by activities. Dates for beginning and completion of each activity shall be indicated as well as projected percentage of completion for each activity as of the first day of each month.

E. Submittal schedule for shop drawing review, product data, and samples shall show the date of Contractor submittal and the date approved submittals will be required by the Engineer, consistent with the time frames established in the Specifications.

F. For Contract change orders granting time extensions, the impact on the Contract date(s) shall equal the calendar-day total time extension specified for the applicable work in the Contract change orders.

G. For actual delays, add activities prior to each delayed activity on the appropriate critical path(s). Data on the added activities of this type shall portray all steps leading to the delay and shall further include the following: separate activity identification, activity description indicating cause of the delay, activity duration consistent with whichever set of dates below applies, the actual start and finish dates of the delay or, if the delay is not finished, the actual start date and estimated completion date.

H. For potential delays, add an activity prior to each potentially delayed activity on the appropriate critical path(s). Data for added activities of this type shall include alternatives available to mitigate the delay including acceleration alternatives and further show the following: separate activity identification, activity description indicating cause of the potential delay and

activity duration equal to zero work days.

2.04 SUPPORTING NARRATIVE

A. Status and scheduling reports identified below shall contain a narrative to document the project status, to explain the basis of Contractor's determination of durations, describe the Contract conditions and restraints incorporated into the schedule and provide an analysis pertaining to potential problems and practical steps to mitigate them.

B. The narrative shall specifically include:

1. Actual completion dates for activities completed during the monthly report period and actual start dates for activities commenced during the monthly report period.

2. Anticipated start dates for activities scheduled to commence during the following monthly report period.

3. Changes in the duration of any activity and minor logic changes.

4. The progress along the critical path in terms of days ahead or behind the Contract date.

5. If the Monthly Status Report indicates an avoidable delay to the Contract completion date or interim completion dates as specified in the Agreement, Contractor shall identify the problem, cause and the activities affected and provide an explanation of the proposed corrective action to meet the milestone dates involved or to mitigate further delays.

6. If the delay is thought to be unavoidable, the Contractor shall identify the problem, cause, duration, specific activities affected and restraints of each activity.

7. The narrative shall also discuss all change order activities whether included or not in the revised/current schedule of legal status. Newly introduced change order work activities and the CPM path(s) that they affect, must be specifically identified. All change order work activities added to the schedule shall conform with the sequencing and Contract Time requirements of the applicable Change Order.

8. Original Contract date(s) shall not be changed except by Contract change order. A revision need not be submitted when the foregoing situations arise unless required by Engineer. Review of a report containing added activities will not be construed to be concurrence with the duration or restraints for such added activities; instead the corresponding data as ultimately incorporated into the applicable Contract change order shall govern.

9. Should Engineer require additional data, this information shall be supplied by Contractor within 10 calendar days.

2.05 SUBMITTALS

A. Contractor shall submit estimated and preliminary progress schedules (as identified in the Terms and Conditions of the Contract and the General Conditions), monthly status reports, a start-up schedule and an as-built schedule report all as specified herein.

B. All schedules, including estimated and preliminary schedules, shall be in conformance with the Contract Documents.

C. The finalized progress schedule discussed in the Contract Documents shall be the first monthly status report and as such shall be in conformance with all applicable specifications contained herein.

D. Monthly Status Report submittals shall include three copies of a time-scaled (days after notice to proceed) diagram showing all contract activities and supporting narrative. The initial detailed schedule shall use the notice to proceed as the start date. The finalized schedule, if concurred with by Owner, shall be the work plan to be used by the contractor for planning, scheduling, managing and executing the work.

E. The schedule diagram shall be formatted as above. The diagram shall include (1) all detailed activities included in the preliminary and estimated schedule submittals, (2) calendar days prior to substantial completion, (3) summary activities for the remaining days. The critical path activities shall be identified, including critical paths for interim dates, if possible.

F. The Contractor shall submit monthly progress schedules with each month's application for payment.

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

2.06 MONTHLY STATUS REPORTS

A. Contractor shall submit three copies of detailed schedule status reports on a monthly basis with the Application for Payment. The first such status report shall be submitted with the first Application for Payment and include data as of the last day of the pay period. The Monthly Report shall include a "marked-up" copy of the latest detailed schedule of legal status and a supporting narrative including updated information as described above. The Monthly Report will be reviewed by Engineer and Contractor at a monthly schedule meeting and Contractor will address Engineer's comments on the subsequent monthly report. Monthly status reports shall be the basis for evaluating Contractor's progress.

B. The "marked-up" diagram shall show, for the latest detailed schedule of legal status, percentages of completion for all activities, actual start and finish dates and remaining durations, as appropriate. Activities not previously included in the latest detailed schedule of legal status shall be added, except that contractual dates will not be changed except by change order. Review of a marked-up diagram by Engineer will not be construed to constitute concurrence with the time frames, duration, or sequencing for such added activities; instead the corresponding data as ultimately incorporated into an appropriate change order shall govern.

2.07 STARTUP SCHEDULE

A. At least 60 calendar days prior to the date of substantial completion, Contractor shall submit a time-scaled (days after notice to proceed) diagram detailing the work to take place in the period between 60 days prior to substantial completion, together with a supporting narrative. Engineer shall have 10 calendar days after receipt of the submittal to respond. Upon receipt of Engineer's comments, Contractor shall make the necessary revisions and submit the revised schedule within 10 calendar days. The resubmittal, if concurred with by Owner, shall be the Work Plan to be used by Contractor for planning, managing, scheduling and executing the remaining work leading to substantial completion.

B. The time-scaled diagram shall use the latest schedule of legal status for those activities completed ahead of the last 60 calendar days prior to substantial completion and detailed activities for the remaining 60-day period within the time frames outlined in the latest schedule of

legal status.

C. Contractor will be required to continue the requirement for monthly reports, as outlined above. In preparing this report, Contractor must assure that the schedule is consistent with the progress noted in the startup schedule.

2.08 REVISIONS

A. All revised Schedule Submittals shall be made in the same form and detail as the initial submittal and shall be accompanied by an explanation of the reasons for such revisions, all of which shall be subject to review by Engineer and concurrence by Owner. The revision shall incorporate all previously made changes to reflect current as-built conditions. Minor changes to the approved submittal may be approved at monthly meetings; a minor change is not considered a revision in the context of this paragraph.

B. A revised schedule submittal shall be submitted for review, when required by Engineer, for one of the following reasons:

1. Owner or Engineer directs a change that affects the date(s) specified in the Agreement or alters the length of a critical path.

2. Contractor elects a change that affects the date(s) specified in the Agreement or alters the length of a critical path.

C. If, prior to agreement on an equitable adjustment to the Contract time, Engineer requires revisions to the schedule in order to evaluate planned progress, Contractor shall provide an interim revised submittal for review with change effect(s) incorporated as directed. Interim revisions to the documents which are recommended to the Owner for concurrence will be incorporated in the next Monthly Status Report.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01340

SHOP DRAWINGS, PROJECT DATA AND SAMPLES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the Engineer for review and approval: working drawings, shop drawings, test reports and data on materials and equipment (hereinafter in this section called data), and material samples (hereinafter in this section called samples) as are required for the proper control of work, including, but not limited to those working drawings, shop drawings, data and samples for materials and equipment specified elsewhere in the Specifications and in the Contract Drawings.

B. Within thirty (30) calendar days after the effective date of the Agreement, the Contractor shall submit to the Engineer, a complete list of preliminary data on items for which Shop Drawings are to be submitted. Included in this list shall be the names of all proposed manufacturers furnishing specified items and the date on which each Shop Drawing shall be submitted. Review of this list by the Engineer shall in no way relieve the Contractor from submitting complete Shop Drawings and providing materials, equipment, etc., fully in accordance with the Specifications. This procedure is required in order to expedite final review of Shop Drawings.

C. The Contractor is to maintain an accurate updated submittal log and will bring this log to each scheduled progress meeting with the Owner and the Engineer. This log should include the following items:

1. Submittal description and number assigned.
2. Date to Engineer.
3. Date returned to Contractor (from Engineer).
4. Status of Submittal (No exceptions taken, returned for confirmation or resubmittal, rejected).
5. Date of Resubmittal and Return (as applicable).
6. Date material released (for fabrication).
7. Projected date of fabrication.
8. Projected date of delivery to site.
9. Projected date and required lead time so that product installation does not delay contact.
10. Status of O&M manuals submitted.

1.03 CONTRACTOR'S RESPONSIBILITY

A. It is the duty of the Contractor to check all drawings, data and samples prepared by or for him before submitting them to the Engineer for review. Each and every copy of the Drawings and data shall bear Contractor's stamp showing that they have been so checked. Shop drawings submitted to the Engineer without the Contractor's stamp will be returned to the Contractor for conformance with this requirement. Shop drawings shall indicate any deviations in the submittal from requirements of the contract Documents.

B. Determine and verify:

1. Field measurements.
2. Field construction criteria.
3. Catalog numbers and similar data.
4. Conformance with Specifications and indicate all variances from the Specifications.

C. The Contractor shall furnish the Engineer a schedule of Shop Drawing submittals fixing the respective dates for the submission of shop and working drawings, the beginning of manufacture, testing and installation of materials, supplies and equipment. This schedule shall indicate those that are critical to the progress schedule.

D. The Contractor shall not begin any of the work covered by a drawing, data, or a sample returned for correction until a revision or correction thereof has been reviewed and returned to him, by the Engineer, with No Exceptions Taken or Approved As Noted.

E. The Contractor shall submit to the Engineer all drawings and schedules sufficiently in advance of construction requirements to provide no less than twenty-one (21) calendar days for checking and appropriate action from the time the Engineer receives them.

F. The Contractor shall submit five (5) copies of descriptive or product data submittals to complement shop drawings for the Engineer plus the number of copies which the Contractor requires. The Engineer shall retain five (5) sets. All blueprint shop drawings shall be submitted with one (1) set of 3 mil thick polyester film reproducibles. The Engineer will review the blueprints and return to the Contractor the set of marked-up sepias with appropriate review comments.

G. The Contractor shall be responsible for and bear all cost of damages which may result from the ordering of any material or from proceeding with any part of work prior

to the completion of the review by Engineer of the necessary Shop Drawings.

1.04 ENGINEER'S REVIEW OF SHOP DRAWINGS AND WORKING DRAWINGS

A. The Engineer's review of drawings, data and samples submitted by the Contractor shall cover only general conformity to the Specifications, external connections and dimensions which affect the installation.

B. The review of drawings and schedules shall be general and shall not be construed:

1. As permitting any departure from the Contract requirements.
2. As relieving the Contractor of responsibility for any errors, including details, dimensions and materials.
3. As approving departures from details furnished by the Engineer, except as otherwise provided herein.

C. If the drawings or schedules as submitted describe variations and show a departure from the Contract requirements which the Engineer finds to be in the interest of the Owner and to be so minor as not to involve a change in Contract Price or time for performance, the Engineer may return the reviewed drawings without noting any exception.

D. When reviewed by the Engineer, each of the Shop and Working Drawings shall be identified as having received such review being so stamped and dated. Shop Drawings stamped "REJECTED" and with required corrections shown shall be returned to the Contractor for correction and resubmittal.

E. Resubmittals will be handled in the same manner as first submittals. On resubmittals, the Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, to revisions other than the corrections requested by the Engineer on previous submissions. The Contractor shall make any corrections required by the Engineer.

F. If the Contractor considers any correction indicated on the drawings to constitute a change to the Contract Drawings or Specifications, the Contractor shall give written notice thereof to the Engineer.

G. The Engineer shall review a submittal/resubmittal a maximum of three (3) times after which cost of review shall be borne by the Contractor. The cost of engineering shall be equal to the Engineer's actual payroll cost.

H. When the Shop and Working Drawings have been completed to the satisfaction of the Engineer, the Contractor shall carry out the construction in accordance therewith and shall make no further changes therein except upon written instructions from the Engineer.

I. No partial submittals shall be reviewed. Incomplete submittals shall be returned to the Contractor and shall be considered not approved until resubmitted.

1.05 SHOP DRAWINGS

A. When used in the Contract Documents, the term "Shop Drawings" shall be considered to mean Contractor's plans for material and equipment which become an integral part of the Project. These drawings shall be complete and detailed. Shop Drawings shall consist of fabrication, drawings, setting drawings, schedule drawings, manufacturer's scale drawings and wiring and control diagrams. Cuts, catalogs, pamphlets, descriptive literature and performance and test data, shall be considered only as supportive to required Shop Drawings as defined above.

B. Drawings and schedules shall be checked and coordinated with the work of all trades involved, before they are submitted for review by the Engineer and shall bear the Contractor's stamp of approval and original signature as evidence of such checking and coordination. Drawings or schedules submitted without this stamp of approval and original signature shall be returned to the Contractor for resubmission.

C. Each Shop Drawing shall have a blank area 3-1/2 inches by 3-1/2 inches, located adjacent to the title block. The title block shall display the following:

1. Number and title of the drawing.
2. Date of Drawing or revision.
3. Name of project building or facility.
4. Name of contractor and subcontractor submitting drawing.
5. Clear identification of contents and location of the work.
6. Specification title and number.

D. If drawings show variations from Contract requirements because of standard shop practice or for other reasons, the Contractor shall describe such variations in his letter of transmittal. If acceptable, proper adjustment in the contract shall be implemented where appropriate. If the Contractor fails to describe such variations, he shall not be relieved of the responsibility of executing the work in accordance with the Contract, even though such drawings have been reviewed.

E. Data on materials and equipment shall include, without limitation, materials and equipment lists, catalog sheets, cuts, performance curves, diagrams, materials of construction and similar descriptive material. Materials and equipment lists shall give, for each item thereon, the name and location of the supplier or manufacturer, trade name, catalog reference, size, finish and all other pertinent data.

F. For all mechanical and electrical equipment furnished, the Contractor shall provide a list including the equipment name and address and telephone number of the manufacturer's representative and service company so that service and/or spare parts can be readily obtained.

G. All manufacturers or equipment suppliers who proposed to furnish equipment or products shall submit an installation list to the Engineer along with the required shop drawings. The installation list shall include at least five installations where identical equipment has been installed and have been in operation for a period of at least one (1) year.

H. Only the Engineer will utilize the color "red" in marking shop drawing submittals.

I. Before final payment is made, the Contractor shall furnish to Engineer project as-built drawings.

1.06 WORKING DRAWINGS

A. When used in the Contract Documents, the term "working drawings" shall be considered to mean the Contractor's fabrication and erection drawings for structures such as roof trusses, steelwork, precast concrete elements, bulkheads, support of open cut excavation, support of utilities, groundwater control systems, forming and false work; underpinning; and for such other work as may be required for construction of the project.

B. Copies of working drawings as noted above, shall be submitted to the Engineer where required by the Contract Documents or requested by the Engineer and shall be submitted at least thirty (30) days (unless otherwise specified by the Engineer) in advance of their being required for work.

C. Working drawings shall be signed by a registered Professional Engineer, currently licensed to practice in the State of Florida and shall convey, or be accompanied by, calculation or other sufficient information to completely explain the structure, machine, or system described and its intended manner of use. Prior to commencing such work, working drawings must have been

reviewed without specific exceptions by the Engineer, which review will be for general conformance and will not relieve the Contractor in any way from his responsibility with regard to the fulfillment of the terms of the Contract. All risks of error are assumed by the Contractor; the Owner and Engineer shall not have responsibility therefor.

1.07 SAMPLES

A. The Contractor shall furnish, for the review of the Engineer, samples required by the Contract Documents or requested by the Engineer. Samples shall be delivered to the Engineer as specified or directed. The Contractor shall prepay all shipping charges on samples. Materials or equipment for which samples are required shall not be used in work until reviewed by the Engineer.

B. Samples shall be of sufficient size and quantity to clearly illustrate:

1. Functional characteristics of the product, with integrally related parts and attachment devices.

2. Full range of color, texture and pattern.

3. A minimum of two samples of each item shall be submitted.

C. Each sample shall have a label indicating:

1. Name of product.
2. Name of Contractor and Subcontractor.
3. Material or equipment represented.
4. Place of origin.
5. Name of Producer and Brand (if any).
6. Location in project.
   (Samples of finished materials shall have additional markings that will identify them under the finished schedules.)
7. Reference specification paragraph.

D. The Contractor shall prepare a transmittal letter in triplicate for each shipment of samples containing the information required above. He shall enclose a copy of this letter with the shipment and send a copy of this letter to the Engineer. Review of a sample shall be only for the characteristics or use named in such and shall not be construed to change or modify any Contract requirements.

E. Reviewed samples not destroyed in testing shall be sent to the Engineer or stored at the site of the work. Reviewed samples of the hardware in good condition will be marked for identification and may be used in the work.

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

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 01370

SCHEDULE OF VALUES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall submit to the Engineer a Schedule of Values allocated to the various portions of the work, within 10 days after date of Notice to Proceed.

B. Upon request of the Engineer, the Contractor shall support the values with data which will substantiate their correctness.

C. The Schedule of Values shall be used only as the basis for the Contractor's Applications for Payment.

1.02 FORM AND CONTENT OF SCHEDULE OF VALUES

A. Schedule of Values will be considered for approval by Engineer upon Contractor's request. Identify schedule with:

1. Title of Project and location.
2. Project number.
3. Name and address of Contractor.
4. Contract designation.
5. Date of submission.

B. Schedule of Values shall list the installed value of the component parts of the work in sufficient detail to serve as a basis for computing values for progress payments during construction.

C. Follow the table of contents for the Contract Document as the format for listing component items for structures:

1. Identify each line item with the number and title of the respective major section of the specification.

2. For each line item, list sub values of major products or operations under item.

D. Follow the bid sheets included in this Contract Documents as the format for listing component items for pipe lines.

E. The sum of all values listed in the schedule shall equal the total Contract sum.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01381

PHOTOGRAPHIC DOCUMENTATION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall employ a competent photographer to take construction record photographs or perform video taping, including furnishing all labor, materials, equipment and incidentals necessary to obtain photographs and/or video tapes of all construction areas.

B. Preconstruction record information shall consist of both photographs and video tapes.

C. Construction progress information shall consist of photographs and digital photographs on a recordable compact disc (CD-R).

1.02 QUALIFICATIONS

A. All photography shall be done by a competent camera operator who is fully experienced and qualified with the specified equipment.

B. For the video recording, the audio portion should be done by a person qualified and knowledgeable in the specifics of the Contract, who shall speak with clarity and diction so as to be easily understood.

1.03 PROJECT PHOTOGRAPHS

A. Provide two prints of each photograph with each pay application.

B. Provide one recordable compact disc with digital photographs with each pay application.

C. Negatives:

1. All negatives shall remain the property of photographer. The Contractor shall require that photographer maintain negatives for a period of two years from date of substantial completion of the project.

2. Photographer shall agree to furnish additional prints to Owner and Engineer at commercial rates applicable at time of purchase. Photographer shall also agree to participate as required in any litigation requiring the photographer as an expert witness.

D. The Contractor shall pay all costs associated with the required photography and prints. Any parties requiring

additional photography or prints shall pay the photographer directly.

E. All project photographs shall be a single weight, color image. All finishes shall be smooth surface and glossy and all prints shall be 8 inches x 10 inches.

F. Each print shall have clearly marked on the back, the name of the project, the orientation of view, the date and time of exposure, name and address of the photographer and the photographer's numbered identification of exposure.

G. All project photographs shall be taken from locations to adequately illustrate conditions prior to construction, or conditions of construction and state of progress. The Contractor shall consult with the Engineer at each period of photography for instructions concerning views required.

1.04 VIDEO TAPE RECORDINGS

A. Video taping shall be done within the limits of construction. Video taping shall include full taping of the area including the condition of adjacent buildings, adjacent equipment, structures, sidewalks, driveways, etc. All video taping shall be in full color.

B. A complete view, in sufficient detail with audio description of the exact location shall be provided.

C. The engineering plans shall be used as a reference for orientation in the audio portion of the tapes.

D. Two complete sets of video tapes shall be delivered to the Engineer for the permanent and exclusive use of the Engineer prior to the start of any construction on the project.

E. All video tapes shall contain the name of the project, the date and time of the video taping, the name and address of the photographer and any other identifying information required.

F. Construction shall not start until preconstruction video tapes are completed, submitted and accepted by the Engineer. In addition, no progress payments shall be made until the preconstruction video tapes are accepted by the Engineer.

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

END OF SECTION

SECTION 01410

TESTING AND TESTING LABORATORY SERVICES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Owner shall employ and pay for the services of an independent testing laboratory to perform testing specifically indicated on the Contract Documents or called out in the Specifications. Owner may elect to have materials and equipment tested for conformity with the Contract Documents at any time.

1. Contractor shall cooperate fully with the laboratory to facilitate the execution of its required services.

2. Employment of the laboratory shall in no way relieve the Contractor's obligations to perform the work of the Contract.

1.02 LIMITATIONS OF AUTHORITY OF TESTING LABORATORY

A. Laboratory is not authorized to:

1. Release, revoke, alter or enlarge on requirements of Contract Documents.

2. Approve or accept any portion of the Work.

3. Perform any duties of the Contractor.

1.03 CONTRACTOR'S RESPONSIBILITIES

A. Cooperate with laboratory personnel; provide access to Work and/or to Manufacturer's operations.

B. Secure and deliver to the laboratory adequate quantities of representational samples of materials proposed to be used and which require testing.

C. Provide to the laboratory the preliminary design mix proposed to be used for concrete, and other material mixes which require control by the testing laboratory.

D. Materials and equipment used in the performance of work under this Contract are subject to inspection and testing at the point of manufacture or fabrication. Standard specifications for quality and workmanship are indicated in the Contract Documents. The Engineer may require the Contractor to provide statements or certificates from the manufacturers and fabricators that the materials and

equipment provided by them are manufactured or fabricated in full accordance with the standard specifications for quality and workmanship indicated in the Contract Documents. All costs of this testing and providing statements and certificates shall be a subsidiary obligation of the Contractor and no extra charge to the Owner shall be allowed on account of such testing and certification.

E. Furnish incidental labor and facilities:

1. To provide access to work to be tested.
2. To obtain and handle samples at the project site or at the source of the product to be tested.
3. To facilitate inspections and tests.
4. For storage and curing of test samples.

F. Notify laboratory sufficiently in advance of operations to allow for laboratory assignment of personnel and scheduling of tests.

1. When tests or inspections cannot be performed due to insufficient notice, Contractor shall reimburse Owner for laboratory personnel and travel expenses incurred due to Contractor's negligence.

G. Employ and pay for the services of the same or a separate, equally qualified independent testing laboratory to perform additional inspections, sampling and testing required for the Contractor's convenience and as approved by the Engineer.

H. If the test results indicate the material or equipment complies with the Contract Documents, the Owner shall pay for the cost of the testing laboratory. If the tests and any subsequent retests indicate the materials and equipment fail to meet the requirements of the Contract Documents, the contractor shall pay for the laboratory costs directly to the testing firm or the total of such costs shall be deducted from any payments due the Contractor.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01510

TEMPORARY AND PERMANENT UTILITIES

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

The Contractor shall be responsible for furnishing all requisite temporary utilities, i.e., power, water, sanitation, etc. The Contractor shall obtain and pay for all permits required as well as pay for all temporary usages. The Contractor shall remove all temporary facilities upon completion of work.

1.02 REQUIREMENTS OF REGULATORY AGENCIES

A. Comply with National Electric Code.

B. Comply with Federal, State and Local codes and regulations and with utility company requirements.

C. Comply with County Health Department regulations.

PART 2 PRODUCTS

2.01 MATERIALS, GENERAL

Materials for temporary utilities may be "used". Materials for electrical utilities shall be adequate in capacity for the required usage, shall not create unsafe conditions and shall not violate requirements of applicable codes and standards.

2.02 TEMPORARY ELECTRICITY AND LIGHTING

Arrange with the applicable utility company for temporary power supply. Provide service required for temporary power and lighting and pay all costs for permits, service and for power used.

2.03 TEMPORARY WATER

A. The Contractor shall arrange with Manatee County Utilities Customer Service office to provide water for construction purposes, i.e., meter, pay all costs for installation, maintenance and removal, and service charges for water used.

B. The Contractor shall protect piping and fitting against freezing.

2.04 TEMPORARY SANITARY FACILITIES

A. The Contractor shall provide sanitary facilities in compliance with all laws and regulations.

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

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall maintain and operate systems to assure continuous service.

B. The Contractor shall modify and extend systems as work progress requires.

3.02 REMOVAL

A. The Contractor shall completely remove temporary materials and equipment when their use is no longer required.

B. The Contractor shall clean and repair damage caused by temporary installations or use of temporary facilities.

END OF SECTION

SECTION 01570

TRAFFIC REGULATION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. The Contractor shall be responsible for providing safe and expeditious movement of traffic through construction zones. A construction zone is defined as the immediate areas of actual construction and all abutting areas which are used by the Contractor and which interfere with the driving or walking public.

B. The Contractor shall remove temporary equipment and facilities when no longer required, restore grounds to original or to specified conditions.

1.02 TRAFFIC CONTROL

A. The necessary traffic control shall include, but not be limited to, such items as proper construction warning signs, signals, lighting devices, markings, barricades, channelization and hand signaling devices. The Contractor shall be responsible for installation and maintenance of all devices and detour routes and signage for the duration of the construction period. The Contractor shall utilize the appropriate maintenance of traffic plan from the FDOT Maintenance of Traffic Standards, Series 600 of the FDOT Roadway & Traffic Design Standards, Latest Edition.

B. The Contractor shall provide at least 72 hours notification to the affected highway department of the necessity to close any portion of a roadway carrying vehicles or pedestrians so that final approval of such closings can be obtained at least 48 hours in advance. At no time will more than one (1) lane of a roadway be closed to vehicles and pedestrians without an approved road closure from the County Transportation Department. With any such closings, adequate provision shall be made for the safe expeditious movement of each. It shall also be the Contractor's responsibility to notify the School Board, police, fire and emergency departments whenever roads are impassable.

C. The Contractor shall be responsible for removal, relocation, or replacement of any traffic control device in the construction area which exists as part of the normal preconstruction traffic control scheme. Any such actions shall be performed by the Contractor under the supervision and in accordance with the instructions of the applicable highway department unless otherwise

specified.

D. The Engineer will consult with the Owner immediately on any vehicular or pedestrian safety or efficiency problem incurred as a result of construction of the project.

E. The Contractor shall provide ready access to businesses and homes in the project area during construction. The Contractor shall be responsible for coordinating this work with affected homeowners.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01580

PROJECT IDENTIFICATION AND SIGNS

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Furnish, install and maintain County project identification signs.

B. Remove signs on completion of construction.

C. Allow no other signs to be displayed.

1.02 PROJECT IDENTIFICATION SIGN (COUNTY)

A. One painted sign, of not less than 32 square feet (3 square meters) area, with painted graphic content to include:

1. Title of Project.
2. Name of Owner.
3. Names and titles of authorities as directed by Owner.
4. Prime Contractor.

B. Graphic design, style of lettering and colors: As approved by the Engineer and subject to approval of the Owner.

C. Erect on the site at a lighted location of high public visibility, adjacent to main entrance to site, as approved by the Engineer and the Owner

1.03 INFORMATIONAL SIGNS

A. Painted signs with painted lettering, or standard products.

1. Size of signs and lettering: as required by regulatory agencies, or as appropriate to usage.

2. Colors: as required by regulatory agencies, otherwise of uniform colors throughout project.

B. Erect at appropriate locations to provide required information.

1.04 QUALITY ASSURANCE

A. Sign Painter: Professional experience in type of work required.

B. Finishes, Painting: Adequate to resist weathering and fading for scheduled construction period.

PART 2 PRODUCTS

2.01 SIGN MATERIALS

A. Structure and Framing: May be new or used, wood or metal, in sound condition structurally adequate to work and suitable for specified finish.

B. Sign Surfaces: Exterior softwood plywood with medium density overlay, standard large sizes to minimize joints.

1. Thickness: As required by standards to span framing members, to provide even, smooth surface without waves or buckles.

C. Rough Hardware: Galvanized.

D. Paint: Exterior quality, as specified in the Contract Documents.

PART 3 EXECUTION

3.01 PROJECT IDENTIFICATION SIGN

A. Paint exposed surface or supports, framing and surface material; one coat of primer and one coat of exterior paint.

B. Paint graphics in styles, size and colors selected.

3.02 MAINTENANCE

The Contractor shall maintain signs and supports in a neat, clean condition; repair damages to structures, framing or sign.

3.03 REMOVAL

The Contractor shall remove signs, framing, supports and foundations at completion of project.

END OF SECTION

SECTION 01600

MATERIAL AND EQUIPMENT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

A. Material and equipment incorporated into the work:

1. Conform to applicable specifications and standards.

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

3. Manufactured and Fabricated Products:

a. Design, fabricate and assemble in accordance with the best engineering and shop practices.

b. Manufacture like parts of duplicate units to standard sizes and gages, to be interchangeable.

c. Two or more items of the same kind shall be identical and manufactured by the same manufacturer.

d. Products shall be suitable for service conditions.

e. Equipment capacities, sizes and dimensions shown or specified shall be adhered to unless variations are specifically approved in writing.

4. Do not use material or equipment for any purpose other than that for which it is specified.

5. All material and equipment incorporated into the project shall be new.

1.02 MANUFACTURER'S INSTRUCTIONS

A. When Contract Documents require that installation of work shall comply with manufacturer's printed instructions, obtain and distribute copies of such instructions to parties involved in the installation, including two copies to Engineer.

1. Maintain one set of complete instructions at the job site during installation and until completion.

B. Handle, install, connect, clean, condition and adjust products in strict accordance with such instructions and in conformity with specified requirements.

1. Should job conditions or specified requirements conflict with manufacturer's instructions, consult with Engineer prior to proceeding.

2. Do not proceed with work without clear instructions.

C. Perform work in accordance with manufacturer's instructions. Do not omit any preparatory step or installation procedure unless specifically modified or exempted by the Contract Documents.

1.03 TRANSPORTATION AND HANDLING

A. Arrange deliveries of products in accordance with construction schedules, coordinate to avoid conflict with work and conditions at the site.

1. Deliver products in undamaged condition, in manufacturer's original containers or packaging, with identifying labels intact and legible.

2. Immediately on delivery, inspect shipments to assure compliance with requirements of Contract Documents and approved submittals and that products are properly protected and undamaged.

B. Provide equipment and personnel to handle products by methods to prevent soiling or damage to products or packaging.

1.04 STORAGE AND PROTECTION

A. Store products in accordance with manufacturer's instructions, with seals and labels intact and legible

1. Store products subject to damage by the elements in weather tight enclosures.

2. Maintain temperature and humidity within the ranges required by manufacture's instructions.

B. Exterior Storage

1. Store fabricated products above the ground, on blocking or skids to prevent soiling or staining. Cover products which are subject to deterioration with impervious sheet coverings, provide adequate ventilation to avoid condensation.

2. Store loose granular materials in a well-drained

area on solid surfaces to prevent mixing with foreign matter.

C. Arrange storage in a manner to provide easy access for inspection. Make periodic inspections of stored products to assure that products are maintained under specified conditions and free from damage or deterioration.

D. Protection After Installation

1. Provide substantial coverings as necessary to protect installed products from damage from traffic and subsequent construction operations. Remove when no longer needed.

1.05 SUBSTITUTIONS AND PRODUCT OPTIONS

A. Products List

1. Within 30 days after Contract date, submit to Engineer a complete list of major products proposed to be used.

B. Contractor's Options

1. For products specified only by reference standard, select any product meeting that standard.

2. For products specified by naming one or more products or manufacturers and "or equal", Contractor must submit a request for substitutions of any product or manufacturer not specifically named.

3. Requests for substitutions of products and "or equal" by the Contractor shall be submitted in a timely manner so as not to adversely affect the construction schedule.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01620

STORAGE AND PROTECTION

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

Provide secure storage and protection for products to be incorporated into the work and maintenance and protection for products after installation and until completion of Work.

1.02 STORAGE

A. Store products immediately on delivery and protect until installed in the Work.

1. Store in accord with manufacturer's instructions, with seals and labels intact and legible.

B. Store products subject to damage by elements in substantial weather tight enclosures.

1. Maintain temperatures within ranges required by manufacturer's instructions.

2. Provide humidity control for sensitive products, as required by manufacturer's instructions.

3. Store unpacked products on shelves, in bins or in neat piles, accessible for inspection.

C. Exterior Storage

1. Provide substantial platform, blocking or skids to support fabricated products above ground to prevent soiling or staining.

a. Cover products, subject to discoloration or deterioration from exposure to the elements, with impervious sheet coverings. Provide adequate ventilation to avoid condensation.

b. Prevent mixing of refuse or chemically injurious materials or liquids.

D. Arrange storage in manner to provide easy access for inspection.

1.03 MAINTENANCE OF STORAGE

A. Maintain periodic system of inspection of stored products on scheduled basis to assure that:

1. State of storage facilities is adequate to provide required conditions.

2. Required environmental conditions are maintained on continuing basis.

3. Surfaces of products exposed to elements are not adversely affected.

   a. Any weathering of products, coatings and finishes is not acceptable under requirements of these Contract Documents.

B. Mechanical and electrical equipment which requires servicing during long term storage shall have complete manufacturer's instructions for servicing accompanying each item, with notice of enclosed instructions shown on exterior of package.

1. Equipment shall not be shipped until approved by the Engineer. The intent of this requirement is to reduce on-site storage time prior to installation and/or operation. Under no circumstances shall equipment be delivered to the site more than one month prior to installation without written authorization from the Engineer.

2. All equipment having moving parts such as gears, electric motors, etc. and/or instruments shall be stored in a temperature and humidity controlled building approved by the Engineer until such time as the equipment is to be installed.

3. All equipment shall be stored fully lubricated with oil, grease, etc. unless otherwise instructed by the manufacturer.

4. Manufacturer's storage instructions shall be carefully studied by the Contractor and reviewed with the Engineer. These instructions shall be carefully followed.

5. Moving parts shall be rotated a minimum of once weekly to insure proper lubrication and to avoid metal-to-metal "welding". Upon installation of the equipment, the Contractor shall start the equipment, at least half load, once weekly for an adequate period of time to insure that the equipment does not deteriorate from lack of use.

6. Lubricants shall be changed upon completion of installation and as frequently as required, thereafter during the period between installation and acceptance.

7. Prior to acceptance of the equipment, the Contractor shall have the manufacturer inspect the equipment and certify that its condition has not been detrimentally affected by the long storage period. Such certifications by the manufacturer shall be deemed to mean that the equipment is judged by the manufacturer to be in a condition equal to that of equipment that has been shipped, installed, tested and accepted in a minimum time period. As such, the manufacturer will guaranty the equipment equally in both instances. If such a certification is not given, the equipment shall be judged to be defective. It shall be removed and replaced at the Contractor's expense.

1.04 PROTECTION AFTER INSTALLATION

A. Provide protection of installed products to prevent damage from subsequent operations. Remove when no longer needed, prior to completion of work.

B. Control traffic to prevent damage to equipment and surfaces.

C. Provide coverings to protect finished surfaces from damage.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01700

CONTRACT CLOSEOUT

PART 1 GENERAL

1.01 REQUIREMENTS INCLUDED

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-8).

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

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

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

1.02 DISPOSAL REQUIREMENTS

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 televiewing 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 + 1/8 inch per 50 feet (or part thereof) of horizontal distance up to a maximum tolerance of + ½ inch.

15. The Contractor shall submit to the Owner/Engineer, properly prepared redline drawings marked up by the Contractor and survey data certified by a design professional (Engineer and/or Surveyor registered in the State of Florida), employed by the Contractor.

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, deliver Record Documents (redline drawings and survey drawing) to the Engineer.

B. The Contractor shall employ a Professional Engineer or Surveyor registered in the State of Florida to verify survey data. The Contractor shall supply the record documents to the Engineer for preparation of the record drawings. Record drawings shall be certified by the design professionals, the Engineer (licensed in Florida), as stipulated by the Land Development Ordinance and submitted on signed and dated mylar drawings together with a CD of the electronic files, AutoCad Release 12 or later for review and the use of the County in the following format:

The CD shall contain media in AutoCad Version 12 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.

C. All record drawing requirements must be submitted to the Engineer prior to starting the bacteria testing of water lines.

1. Accompany submittal with transmittal letter in duplicate, containing:

a. Date.
b. Project title and number.
c. Contractor's name and address.
d. Title and number of each Record Document.
e. 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. All valves, fire hydrants, manholes, water, reclaim 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 an easement, shall be located by elevation and by station and offset based on intersection PI'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.

B. Elevations shall be provided as listed above and 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.

C. Slopes for pipe and ditches shall be recalculated, based on actual field measured distances, elevations, pipe size and type shown. Cross section of drainage ditches and swales shall be verified.

D. 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.

E. Record drawings shall show bearings and distances for all right-of-way and easement lines, and property corners.

F. 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 the centerline of right-of-way to the facility.

G. 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.

H. Underdrain cleanouts for retention systems outside right-of-way shall be located by station and offset from an appropriate baseline.

I. Sanitary sewer mainline wyes shall be located from the downstream manhole. These dimensions shall be provided by on-site inspections or televiewing of the sewer following installation.

J. Elevations shall be provided on the top of operating nuts for water and force main valves at major intersections connecting to County and/or State roads at proposed or existing arterial highways and at drain crossings.

K. Allowable tolerance shall be + 6 inches for horizontal dimensions. Vertical dimensions such as the difference in elevations between manhole inverts shall have an allowable tolerance of + 1/8 inch per 50 feet (or part thereof) of horizontal distance up to a maximum of + ½ inch.

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 01721
REDLINE DRAWINGS

PART 1 GENERAL

1.01 SUMMARY

A. Contractor shall provide Redline Drawings to the Engineer for preparation of the Record Drawings.

1. The provisions of this Section apply to the maintaining, marking, recording, and submitting of Redline Drawings.

2. The Contractor shall maintain a set of Redline Drawings at the job site. These shall be kept legible and current and shall be available for inspection during normal working hours by the Owner/Engineer. Do not use redline drawings for construction purposes, protect from deterioration and loss in a secure, fire-resistive location. Show all changes or Work added on these Record Drawings in a contrasting color.

1.02 RELATED WORK

A. Section 01700, Contract Closeout.

B. Section 01720, Project Record Instruments

1.03 SUBMITTALS

A. Redline Drawings: At completion of all Work under this Contract, deliver Redline Drawings to the Engineer with transmittal, containing as a minimum, the following:

1. Date.
2. Project title and numbers.
3. Contractor's name and address. Include final list of all subcontractors.
4. Title and number of each record document.
5. Certification that each document as submitted is complete and accurate.
6. Contractor's signature or that of the Contractor’s authorized representative.

1.04 REDLINE DRAWINGS

A. The redline drawings shall be current and included with each month's pay estimate application, and subject to the Engineer's review for acceptability, as a prerequisite to monthly payment.

B. In particular, show changes in the Work in relation to way in which shown and specified

by original Contract Documents; and show additional information of value to Owner's records, but not indicated by original Contract Documents.

C. In showing changes in the Work, use the same legends as used on the original drawings. Indicate exact locations by dimensions and exact elevations by job datum. Give dimensions from a permanent point.

D. Mark whichever drawings are most capable of showing conditions fully and accurately.

E. Use a red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

F. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Do not conceal any work until required information is recorded.

G. Mark-up important additional information which was either shown schematically or omitted from original drawings.

H. Note related Change Order numbers where applicable.

I. Do not revise the prints by attaching the actual sketches issued by the Engineer. Where the work was installed exactly as shown on the Contract Drawings, the prints shall not be disturbed other than being marked "PROJECT RECORD".

J. Each sheet shall be clearly marked "PROJECT RECORD".

K. Review the completed Redline Drawings and ascertain that all data furnished on the prints is accurate and truly represents the work as actually installed.

L. The redline drawing prints, including those changed and unchanged, shall be submitted to the Engineer for compliance review.

M. Any deviations from the method of executing Redline Drawings as described above will be considered just cause for rejection by the Engineer and the Contractor will be required to conform and resubmit.

N. Maintain a clean, undamaged, updated set of blue or black line white-prints of Contract Drawings, including sheets issued as part of County authorized changes. The set shall be marked to scale by a competent draftsman to indicated the actual installation and/or location where the installation and/or location varies substantially from the Work as originally shown due to Addenda, Alternates, Change Orders, Field Orders, etc.

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.

Prepare operating and maintenance data as specified in this and as referenced in other pertinent sections of Specifications.

B. Instruct Owner's personnel in maintenance of products and equipment and systems.

C. 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.

a. 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

DIVISION 02
SITE WORK

SECTION 02001

SPECIAL PROVISIONS TO DIVISION 2

The following Special Provisions to Division 2 supplement and/or supercede the Manatee County Specifications included in Division 2.

SECTION 02220
EXCAVATION, BACKFILL, FILL AND GRADING FOR STRUCTURES

PART 1 GENERAL
1.02 QUALITY ASSURANCE

A. Testing Agency:

Delete the Following:

2. Compaction tests shall be taken every 500 feet, except in the road crossings or road shoulders. Tests are to be taken according to current FDOT Standards.

Add the Following:

2. Eight (8) compaction tests shall be taken on the tank subgrade and two (2) more for each additional structure. Compaction tests for pipe trench backfill shall be taken every 200 feet in 12" lifts.

PART 2 PRODUCTS

Delete the Following:

2.01 MATERIAL FOR CONTROLLED FILL

A. Composition: Only approved material free from organic matter and lumps of clay, shall be used for backfill. Excavated earth free from debris or organic material may be used for backfilling foundations or fill.

B. Crushed stone and shell shall meet or exceed current FDOT Standards.

Add the Following:

2.01 MATERIAL FOR STRUCTURAL FILL

A. Composition: Only approved material free from organic matter and consisting of granular soils with not more than 10 percent silty fines passing the No. 200 sieve and an organic content of not more than 2 percent conforming to USCS soil types SP or

SP-SM., shall be used for backfill. Excavated earth meeting the requirements stated above may be used for backfilling foundations or fill.

PART 3 EXECUTION

Delete the Following:

3.04 STRUCTURAL BACKFILL

B. A minimum of 1-1/2" layer of lean concrete shall be placed as a working mat for the concrete base slabs and footings.

Add the Following:

3.07 PREPARATION OF STRUCTURAL SUBGRADE

A. Upon completion of foundation excavation, the exposed soils shall be compacted to 98 percent of the Modified Proctor (ASTM D-1557) maximum dry density prior to the placement of reinforcing steel, concrete, or fill.

SECTION 02640
VALVES AND APPURTENANCES

PART 2 PRODUCTS

Add the Following:

2.20 LINE STOP

A. Line stop company shall be Furmanite Corporation, or approved equal.

END OF SECTION

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SECTION 02064

MODIFICATIONS TO EXISTING STRUCTURES, PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SCOPE OF WORK

Furnish all labor, materials, equipment and incidentals required to modify, alter and/or convert existing structures as shown or specified and as required for the installation of piping, mechanical equipment and appurtenances. Existing piping and equipment shall be removed and dismantled as necessary for the performance of facility alterations in accordance with the requirements herein specified.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 GENERAL

A. The Contractor shall cut, repair, reuse, excavate, demolish or otherwise remove parts of the existing structures or appurtenances, as indicated on the Contract Drawings, herein specified, or necessary to permit completion of the work under this Contract. The Contractor shall dispose of surplus materials resulting from the above work in an approved manner. The work shall include all necessary cutting and bending of reinforcing steel, structural steel, or miscellaneous metal work found embedded in the existing structures.

B. The Contractor shall dismantle and remove all existing equipment, piping, and other appurtenances required for the completion of the work. Where called for or required, the contractor shall cut existing pipelines for the purpose of making connections thereto. Anchor bolts for equipment and structural steel removed shall be cut off one inch below the concrete surface. Surface shall be finished as specified in the Contract Documents.

C. At the time that a new connection is made to an existing pipeline, additional new piping, extending to and including a new valve, shall be installed. Pipe anchorage, if required, shall also be installed as directed by the Engineer.

D. No existing structure, equipment, or appurtenance shall be shifted, cut, removed, or otherwise altered except

with the express approval of and to the extent approved by the Engineer.

E. When removing materials or portions of existing utility pipelines and/or structures or when making openings in walls and partitions, the Contractor shall take all precautions and use all necessary barriers and other protective devices so as not to damage the structures beyond the limits necessary for the new work, and not to damage the structures or contents by falling or flying debris. Unless otherwise permitted, line drilling will be required in cutting existing concrete.

F. Materials and equipment removed in the course of making alterations and additions shall remain the property of the Owner, except that items not salvageable, as determined by the Engineer and the Owner, shall become the property of the Contractor to be disposed of by him off the work site at his own place of disposal. Operating equipment shall be thoroughly cleaned, lubricated, and greased for protection during prolonged storage.

G. All alterations to existing utility pipes and structures shall be done at such time and in such manner as to comply with the approved time schedule. So far as possible before any part of the work is started, all tools, equipment, and materials shall be assembled and made ready so that the work can be completed without delay.

H. All workmanship and new materials involved in constructing the alterations shall conform to the General Specifications for the classes of work insofar as such specifications are applicable.

I. All cutting of existing concrete or other material to provide suitable bonding to new work shall be done in a manner to meet the requirements of the respective section of these Specifications covering the new work. When not covered, the work shall be carried on in the manner and to the extent directed by the Resident Project Representative.

J. Surfaces of seals visible in the completed work shall be made to match as nearly as possible the adjacent surfaces.

K. Non-shrink grout shall be used for setting wall castings, sleeves, leveling pump bases, doweling anchors into existing concrete and elsewhere as shown.

L. Where necessary or required for the purpose of making connections, the Contractor shall cut existing pipelines in a manner to provide an approved joint. Where

required, he shall use flanges, or provide Dresser Couplings, all as required.

M. The Contractor shall provide flumes, hoses, piping and other related items to divert or provide suitable plugs, bulkheads, or other means to hold back the flow of water or other liquids, all as required in the performance of the work under this Contract.

N. Care shall be taken not to damage any part of existing buildings or foundations or outside structures.

3.02 CONNECTING TO EXISTING PIPING AND EQUIPMENT

The Contractor shall verify exact location, material, alignment, joint, etc. of existing piping and equipment prior to making the connections called out in the Drawings. The verifications shall be performed with adequate time to correct any potential alignment or other problems prior to the actual time of connection. A Manatee County representative must be present for all tie-ins for a visual inspection.

3.03 REMOVAL AND ABANDONMENT OF ASBESTOS CEMENT PIPE AND APPURTENANCES

A. All work associated with the removal or abandonment of existing asbestos cement pipe and appurtenances shall be performed by a licensed asbestos abatement contractor or subcontractor registered in the State of Florida.

B. The asbestos abatement contractor or subcontractor shall contact the appropriate regulatory agencies prior to removal or abandonment of any asbestos material and shall obtain all required permits and licenses and issue all required notices. The Contractor shall be responsible for all fees associated with permits, licenses and notices to the governing regulatory agencies.

C. All work associated with removal or abandonment of asbestos cement pipe and appurtenances shall be performed in accordance with the standards listed below and all other applicable local, State, or Federal standards.

1. Florida Administrative Code, Chapter 17-251, "Asbestos".
2. National Emission Standards Hazardous Air Pollution (NESHAP), 40 CFR, Part 61, Subpart M, latest revision.
3. Occupational Safety and Health Act, 29 CFR
4. The Environmental Protection Agency (EPA) Asbestos Abatement Worker Protection Rule.
5. Florida Statute 455.300.

3.04 ASBESTOS CEMENT PIPE REMOVAL

A. All asbestos cement pipe sections shown on the Drawings to be removed, and all related valves, fittings and appurtenances shall be removed in their entirety and disposed of by the Contractor in accordance with this Section. After removal of the facilities, all trenches shall be backfilled in accordance with the Contract Documents. The cost of disposing of the removed materials shall be borne by the Contractor.

B. The Contractor shall make necessary provisions for the Engineer's representative to monitor all removal operations.

C. The cutting of existing asbestos-cement (A/C, aka "Transite") pipe shall be by hand saw only. No machine cutting shall be allowed. Removal of all portions of pipe shall be double bagged prior to shipment. Longer sections of pipe removed may be shipped without double bagging. An asbestos manifest form must accompany each and every shipment of such pipe or pipe material waste to the Manatee County Lena Road Landfill. Prior to each shipment, a minimum of 24 hours notice to the Landfill field office (Phone #748-5543) is required.

3.05 IN-PLACE GROUTING OF EXISTING PIPE

A. Where water and wastewater utility pipes are to be abandoned in place, they shall be filled with a sand/cement grout as specified herein. When such pipes are constructed with asbestos cement materials, the abandonment activities shall be performed by a licensed asbestos abatement contractor as specified in these Specifications.

B. Grout shall be injected within the pipe sections indicated on the Drawings. The ends of these sections shall be capped and/or plugged. The grouting program shall consist of pumping sand-cement grout with suitable chemical additives at pressures necessary to fill the pipe sections shown on the Drawings to prevent the potential for future collapse.

C. The pump used for grouting should be a continuous flow, positive displacement model with a pugmill type mixing vat having a minimum shaft speed of 60 rpm and incorporated as an integral part of the equipment. Alternate equipment may be used subject to the approval of the Engineer. The rate of pumping shall not exceed six (6) cubic feet per minute. The pumping pressures shall be in the range of 100 to 150 psi.

D. The Contractor shall provide standpipes and/or additional means of visual inspection as required by the Engineer to

determine if adequate grout material has filled the entire pipe section(s). The Contractor shall make necessary provisions for the Engineer's representative to monitor all grouting operations.

E. All pipe to be abandoned shall be capped or plugged with a fitting or material that will prevent soil or other material from entering the pipe. All caps and plugs shall be subject to approval by the Engineer.

END OF SECTION

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SECTION 02100

SITE PREPARATION

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section covers clearing, grubbing and stripping of the project site and/or along the pipeline route.

B. The Contractor shall clear and grub all of the area within the limits of construction or as required, which includes, but is not limited to utility easements. The width of the area to be cleared shall be reviewed by the Engineer prior to the beginning of any clearing.

C. The Contractor's attention is directed to any Soil Erosion and Sediment Control Ordinances in force in Manatee County. The Contractor shall comply with all applicable sections of these ordinances.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEARING

The surface of the ground, for the area to be cleared and grubbed shall be completely cleared of all timber, brush, stumps, roots, grass, weeds, rubbish and all other objectionable obstructions resting on or protruding through the surface of the ground. However, trees shall be preserved as hereinafter specified unless otherwise designated by the Engineer. Clearing operations shall be conducted so as to prevent damage to existing structures and installations and to those under construction, so as to provide for the safety of employees and others. Soil erosion control devices such as hay bales and silt fences shall be installed to satisfy all Federal, State and County requirements.

3.02 GRUBBING

Grubbing shall consist of the complete removal of all stumps, roots larger than 1-1/2 inches in diameter, matted roots, brush, timber, logs and any other organic or metallic debris not suitable for foundation purposes, resting on, under or protruding through the surface of the ground to a depth of 18 inches below the subgrade. All depressions excavated below the original ground surface for or by the removal of such objects, shall be refilled with

suitable materials and compacted to a density conforming to the surrounding ground surface.

3.03 STRIPPING

In areas so designated, topsoil shall be stockpiled. Topsoil so stockpiled shall be protected until it is placed as specified. The Owner shall have the option to receive all excess topsoil materials. The Contractor shall pay all equipment and labor cost to deliver excess top soil material to a remote site chosen by the Owner within a five mile radius of the construction site. Should Owner not choose to receive any or all excess topsoil materials, the Contractor shall dispose of said material at no additional cost to Owner.

3.04 DISPOSAL OF CLEARED AND GRUBBED MATERIAL

The Contractor shall dispose of all material and debris from the clearing and grubbing operation by hauling such material and debris off site. The cost of disposal (including hauling) of cleared and grubbed material and debris shall be considered a subsidiary obligation of the Contractor; the cost of which shall be included in the prices bid for the various classes of work.

3.05 PRESERVATION OF TREES

Those trees which are not designated for removal by the Engineer shall be carefully protected from damage. The Contractor shall erect such barricades, guards and enclosures as may be considered necessary by him for the protection of the trees during all construction operation.

3.06 PRESERVATION OF DEVELOPED PRIVATE PROPERTY

A. The Contractor shall exercise extreme care to avoid unnecessary disturbance of developed private property adjacent to proposed project site. Trees, shrubbery, gardens, lawns and other landscaping, which are not designated by the Engineer to be removed, shall be replaced and replanted to restore the construction easement to the condition existing prior to construction.

B. All soil preservation procedures and replanting operations shall be under the supervision of a nursery representative experienced in such operations.

C. Improvements to the land such as fences, walls, outbuildings and other structures which of necessity must be removed, shall be replaced with equal quality materials and workmanship.

D. The Contractor shall clean up the construction site across

developed private property directly after construction is completed upon approval of the Engineer.

3.07 PRESERVATION OF PUBLIC PROPERTY

The appropriate paragraphs of these Specifications shall apply to the preservation and restoration of public lands, parks, rights-of-way, easements and all other damaged areas. This includes, but is not limited to the trimming of trees damaged by contractor's equipment.

END OF SECTION

SECTION 02220

EXCAVATION, BACKFILL, FILL AND GRADING FOR STRUCTURES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Structural excavation shall consist of the removal of material for the construction of foundations for structures and other excavation designated on the drawings or in these specifications.

B. Structural excavation and backfill shall consist of furnishing material, if necessary and placing and compacting backfill material around structures to the lines and grades designated on the drawings, as specified or directed by the Engineer.

C. Structural excavation and backfill shall include the furnishing of all materials, equipment and other facilities which may be necessary to perform the excavations, place and compact the backfill, install sheeting and bracing, and carry out any necessary dewatering. It shall also include the wasting or disposal of surplus excavated material in a manner and in locations approved by the Engineer.

D. The Contractor is responsible for the protection of every tree which is scheduled to remain in the project area. This includes trees which may or may not be shown on the plans. Every tree shall be adequately protected in place at no additional cost to the County. This includes, but is not limited to, protecting the root systems and adjusting grades as necessary for tree/root protection.

1.02 QUALITY ASSURANCE

A. Testing Agency:

1. In place soil compaction tests shall be performed by a qualified testing laboratory.

2. Compaction tests shall be taken every 500 feet, except in the road crossings or road shoulders. Tests are to be taken according to current FDOT Standards.

B. Reference Standards:

1. American Society for Testing and Materials (ASTM):

a. ASTM D1557, Moisture-Density Relations of Soils Using 10-lb. (4.5-kg) Rammer and 18-in. (457-mm) Drop.

1.03 JOB CONDITIONS

A. The Contractor shall provide, operate and maintain all necessary pumps, discharge lines, well points, etc., in sufficient number and capacity to keep all excavation, bases, pits, etc., free from seepage, sanding or running water at all times throughout the period of construction.

B. The Contractor shall assume all responsibility for the security of the excavation required, employing bracing, lining or other accepted means necessary to accomplish same.

C. Excavated areas shall be cleared of all debris, water, slush, muck, clay and soft or loose earth and shall be conditioned to the entire satisfaction of the Engineer.

D. All excavated material unsuitable for use or which will not be used shall be disposed of in a manner consistent with State and County regulation.

E. All unsuitable organic materials, roots, logs, etc., found during excavation shall be removed by the Contractor and the trench shall be refilled with suitable material.

PART 2 PRODUCTS

2.01 MATERIAL FOR CONTROLLED FILL

A. Composition: Only approved material free from organic matter and lumps of clay, shall be used for backfill. Excavated earth free from debris or organic material may be used for backfilling foundations or fill.

B. Crushed stone and shell shall meet or exceed current FDOT Standards.

2.02 UNSUITABLE MATERIAL

Unsuitable material shall be defined as highly organic soil per ASTM D2487 Group PT. This includes, but is not limited to, such items as topsoil, roots, vegetable matter, trash, debris, and clays that cannot be dried sufficiently to obtain specified compaction.

PART 3 EXECUTION

3.01 INSPECTION

A. The Contractor shall verify that work preceding the affected work of this Section has been satisfactorily completed.

B. Conditions adversely affecting the work of this Section shall be corrected to the satisfaction of the Engineer.

3.02 REMOVAL OF UNSUITABLE MATERIALS

A. The Contractor shall remove unsuitable material from within the limits of the Work.

B. Materials meeting requirements for controlled fill shall be stockpiled as necessary and in such a manner satisfactory to the Engineer.

C. All material excavated shall be placed so as to minimize interference with public travel and to permit proper access for inspection of the work.

3.03 EXCAVATION

A. When concrete or shell subbase footing is to rest on an excavated surface, care shall be taken not to disturb the natural soil. Final removal and replacement of the foundation material and subbase compaction to grade shall not be made until just before the concrete or masonry is placed.

B. When any structural excavation is completed, the Contractor shall notify the Engineer who will make an inspection of the excavation. No concrete or masonry shall be placed until the excavation has been approved by the Engineer.

C. The elevations of the footing bottom and the base slab as shown on the Drawings, shall be considered as approximate and the Engineer may order in writing, such changes in dimensions or elevations of the footings and slab base as necessary to secure satisfactory foundations.

D. All excavation shall be made within an area bounded by lines five feet outside and parallel to the exterior walls of the structure to allow for correct forming, shoring and inspection of foundation work. Pouring of concrete against earth side walls shall not be permitted.

E. If the ground is excavated below the grade called for by the Drawings or becomes unstable due to the Contractor's carelessness or operations, the ground shall be excavated

to undisturbed native soil before continuing concreting operations.

F. If in the opinion of the Engineer, the material at or below the normal grade of the bottom of the trench is unsuitable for pipe or structure foundation, it shall be removed to the depth directed by the Engineer and if so directed, replaced by crushed stone or washed shell.

3.04 STRUCTURAL BACKFILL

A. Structural backfill shall not be placed until the footings or other portions of the structure or facility have been inspected by the Engineer and approved for backfilling.

B. A minimum of 1-1/2" layer of lean concrete shall be placed as a working mat for the concrete base slabs and footings.

C. Fill shall be placed in uniform layers not more than 12" thick and compacted to a minimum of 98 percent of the maximum density determined by ASTM D1557, Method A or C, or as directed by the Engineer. The Contractor shall securely tamp the backfill with pneumatic rammer around all wall foundations. The method of compaction shall be satisfactory to the Engineer.

D. Compaction of structural backfill by ponding and jetting shall be permitted when, as determined by the Engineer: the backfill material is of such character that it will be self-draining when compacted; foundation materials will not soften or be otherwise damaged by the applied water; no damage from hydrostatic pressure will result to the structure. Ponding and jetting within two feet below finished subgrade shall not be permitted in roadway areas. At the discretion of the Engineer, ponding and jetting may be permitted with compaction layers not to exceed four feet. The work shall be performed without damage to the structure or embankment and in such a manner that water will not be impounded.

E. Surplus material not used on-site shall be removed and disposed of off-site by the Contractor. In no case shall surplus material be deposited on adjacent lands. Fill used for grading shall be placed in layers not to exceed 12 inches in thickness and shall be compacted to a density equal or greater to that of the surrounding natural ground.

3.05 BACKFILLING AROUND STRUCTURES

A. Common fill and structural fill are specified for use as backfill against the exterior walls of the structures. Fill shall be placed in layers having a maximum thickness

of eight (8) inches in loose state and shall be compacted sufficiently to prevent settlement. If compaction is by rolling or ramming, material shall be wetted down as required. Where material can be suitably compacted by jetting or puddling, the Contractor shall use one of these methods. No boulders shall be allowed to roll down the slopes and hit the walls.

B. Backfilling shall be carried up evenly on all walls of an individual structure simultaneously. A variation of two (2) feet in elevation will be the maximum allowable. No backfill shall be allowed against walls until the walls and their supporting slabs, if applicable, have attained sufficient strength. Backfilling shall be subjected to approval by the Engineer.

C. In locations where pipes pass through building walls, the Contractor shall take the following precautions to consolidate the refill up to an elevation of at least one foot above the bottom of the pipes:

1. Place structural fill in such areas for a distance of not less than three feet either side of the center line of the pipe in level layers not exceeding 6-inches in depth.

2. Wet each layer to the extent directed and thoroughly compact each layer with a power tamper to the satisfaction of the Engineer.

3. Structural fill shall be of the quality specified under Part 2 of this Section.

D. The surface of filled areas shall be graded to smooth true lines, strictly conforming to grades indicated on the grading plan. No soft spots or uncompacted areas shall be allowed in the work.

E. Temporary bracing shall be provided as required during construction of all structures to protect partially completed structures against all construction loads, hydraulic pressure and earth pressure. The bracing shall be capable of resisting all loads applied to the walls as a result of backfilling.

3.06 FIELD QUALITY CONTROL

A. The density of soil in place shall be a minimum of 98 percent in accordance with ASTM test 1557-70T, Method A or C.

END OF SECTION

SECTION 02221

TRENCHING, BEDDING AND BACKFILL FOR PIPE

PART 1 GENERAL

1.01 SCOPE OF WORK

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

B. Prior to commencing work, the Contractor shall examine the site and review test borings if available, or undertake his own subsurface investigations and take into consideration all conditions that may affect his work.

C. The Contractor is responsible for the protection of every tree which is scheduled to remain in the project area. This includes trees which may or may not be shown on the plans. Every tree shall be adequately protected in place at no additional cost to the County. This includes, but is not limited to protecting the root systems and adjusting grades as necessary for tree/root protection.

1.02 PROTECTION

A. Sheeting and Bracing in Excavations:

1. In connection with construction of underground structures, the Contractor shall properly construct and maintain cofferdams. These shall consist of: sheeting and bracing as required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below that necessary for proper construction and to protect adjacent structures, existing yard pipe and/or foundation material from disturbance, undermining, or other damage. Care shall be taken to prevent voids outside of the sheeting, but if voids are formed, they shall be immediately filled and rammed.
2. Trench sheeting for pipes: no sheeting is to be withdrawn if driven below, mid-diameter of any pipe and no wood sheeting shall be cut off at a level lower than one foot above the top of any pipe unless otherwise directed by the Engineer. During the progress of the work, the Engineer may direct the Contractor in writing to leave additional wood sheeting in place. If steel sheeting is used for trench sheeting, removal shall be as specified above, unless written approval is given for an alternate method of removal.
3. All sheeting and bracing not left in place shall be carefully removed in such a manner as not to endanger the construction or other structures, utilities, existing piping, or property. Unless otherwise approved or indicated on the Drawings or in the Specification, all sheeting and bracing shall be removed after completion of the piping or structure, care being

taken not to disturb or otherwise injure the pipeline or finished masonry. All voids left or caused by withdrawal of sheeting shall be immediately refilled with sand by ramming with tools specifically made for that purpose, by watering, or as may otherwise be directed.

4. The Contractor shall construct, to the extent he deems it desirable for his method of operation, the cofferdams and sheeting outside the neat lines of the pipeline trench or foundation unless otherwise indicated on the Drawings or directed by the Owner/Engineer. Sheeting shall be plumb and securely braced and tied in position. Sheeting, bracing and cofferdams shall be adequate to withstand all pressures to which the pipeline or structure will be subjected. Pumping, bracing and other work within the cofferdam shall be done in a manner to avoid disturbing any construction of the pipeline or the enclosed masonry. Any movement or bulging which may occur shall be corrected by the Contractor at his own expense so as to provide the necessary clearances and dimensions.
5. Drawings of the cofferdams and design computations shall be submitted to the Engineer and approved prior to any construction. However, approval of these drawings shall not relieve the Contractor of the responsibility for the cofferdams. The drawings and computations shall be prepared and stamped by a Registered Professional Engineer in the State of Florida and shall be in sufficient detail to disclose the method of operation for each of the various stages of construction, if required, for the completion of the pipeline and substructures.

B. 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.
4. Wellpoints may be required for dewatering the soil prior to final excavation for deeper in-ground structures or piping and for maintaining the lowered groundwater level until construction has been completed to avoid the structure, pipeline, or fill from becoming floated or otherwise damaged. Wellpoints shall be surrounded by suitable filter sand and no fines shall be removed by pumping. Pumping from wellpoints shall be continuous and standby pumps shall be provided.
5. The Contractor shall furnish all materials and equipment to perform all work required to install and maintain the proposed drainage systems for handling groundwater and surface water encountered during construction of structures, pipelines and compacted fills.

6. Where required, the Contractor shall provide a minimum of two operating groundwater observation wells at each structure to determine the water level during construction of the pipeline or structure. Locations of the observation wells shall be at structures and along pipelines as approved by the Engineer prior to their installation. The observation wells shall be extended to 6 inches above finished grade, capped with screw-on caps protected by 24" x 24" wide concrete base and left in place at the completion of this Project.
7. Prior to excavation, the Contractor shall submit his proposed method of dewatering and maintaining dry conditions to the Engineer for approval. Such approval shall not relieve the Contractor of the responsibility for the satisfactory performance of the system. The Contractor shall be responsible for correcting any disturbance of natural bearing soils for damage to pipeline or structures caused by an inadequate dewatering system or by interruption of the continuous operation of the system as specified.
8. As part of his request for approval of a dewatering system, the Contractor shall demonstrate the adequacy of the proposed system and wellpoint filter sand by means of a test installation. Discharge water shall be clear, with no visible soil particles in a one quart sample. Discharge water shall not flow directly into wetlands or Waters of the State as defined by FDEP and SWFWMD.
9. During backfilling and construction, water levels shall be measured in observation wells located as directed by the Engineer.
10. Continuous pumping will be required as long as water levels are required to be below natural levels.

PART 2 PRODUCTS

2.01 MATERIALS

A. General

1. Materials for use as fill and backfill shall be 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. Structural Fill

1. Structural fill shall be used below spread footing foundations, slab-on-grade floors and other structures as backfill within three feet of the below grade portions of structures.
2. Structural fill material shall be a minimum of 60 percent clean sand, free of organic, deleterious and/or compressible material. Minimum acceptable density shall be 98 percent of the maximum density as determined by AASHTO T-180. Rock in excess of 2-1/2" in diameter shall not be used in the fill material. If the moisture content is improper for attaining the specified density, either water shall be added or material

shall be permitted to dry until the proper moisture content for compaction is reached.

C. Base Course

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

D. Common Fill

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.

E. Crushed Stone

1. Crushed stone may be used for pipe bedding, manhole bases, as a drainage layer below structures with underdrains and at other locations indicated on the Drawings.
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. Fill shall be brought up in substantially level lifts throughout the site, starting in the deepest portion of the fill. The entire surface of the work shall be maintained free from ruts and in such condition that construction equipment can readily travel over any section. Fill shall not be placed against concrete structures until they have attained sufficient strength.
4. Fill shall be dumped and spread in layers by a bulldozer or other approved method. During the process of dumping and spreading, all

roots, debris and stones greater in size than specified under Materials, shall be removed from the fill areas. The Contractor shall assign a sufficient number of men to this work to insure satisfactory compliance with these requirements.

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

3.02 COMPACTION

A. Structural fill, limerock base course and screened limerock in open areas, shall be placed in layers not to exceed nine inches in depth as measured before compaction. Each layer shall be compacted by a minimum of six coverages (3 passes each way) with the equipment described below, to at least 98 percent of the maximum density, as determined by AASHTO T-180. 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. Compaction equipment in open areas shall consist of a medium-heavy vibrator roller (minimum static weight of 10 tons) operated at resonant frequency and at a speed of 2 fps or less or other compaction equipment approved by the Engineer.

D. Areas adjacent to pipelines, structures and other confined areas inaccessible to the vibrator roller shall be compacted with a manually operated sled-type vibratory compactor. The Contractor shall also conform to additional backfill requirements at pipelines and structures as specified in the Contract Documents. Compaction of the fill by such means shall be to the same degree of compaction as obtained by the rubber-tired equipment, and the Engineer may make the necessary tests to determine the amount of compactive effort necessary to obtain equal compaction. Unless such tests indicate that modifications may be made, the fill compacted by mechanical compactors shall be placed in 6-inch layers and thoroughly tamped over the entire surface.

Compaction equipment is subject to approval by the Engineer.

E. It is the intention that the fill materials with respect to moisture be used in the condition they are excavated insofar as this is practicable. Material which is too wet shall be spread on the fill area and permitted to dry, assisted by harrowing if necessary, until the moisture content is reduced to allowable limits.

F. If the Engineer shall determine that added moisture is required, water shall be applied by sprinkler tanks or other sprinkler systems, which will insure uniform distribution of the water over the area to be treated and give complete and accurate control of the amount of water to be used. If too much water is added, the area shall be permitted to dry before compaction is continued.

G. The Contractor shall supply all hose, piping, valves, sprinklers, pumps, sprinkler tanks, hauling equipment and all other materials and equipment necessary to place the water in the fill in the manner specified.

3.03 TRENCH EXCAVATION AND BACKFILLING

A. Excavation for all trenches required for the installation of pipes and electrical ducts shall be made to the depths indicated on the Drawings and in such manner and to such widths as will give suitable room for laying the pipe or installing the ducts within the trenches.

B. Rock shall be removed to a minimum 6" clearance around the bottom and sides of all the pipe or ducts being laid.

C. Where pipes or ducts are to be laid in limerock bedding or encased in concrete, the trench may be excavated by machinery to or just below the designated subgrade provided that the material remaining in the bottom of the trench is no more than slightly disturbed.

D. Where the pipes or ducts are to be laid directly on the trench bottom, the lower part of the trenches shall not be excavated to grade by machinery. The last of the material being excavated manually, shall be done in such a manner that will give a flat bottom true to grade so that pipe or duct can be evenly supported on undisturbed material. Bell holes shall be made as required.

E. Backfilling over pipes shall begin as soon as practicable after the pipe has been laid, jointed and inspected and the trench filled with suitable compacted material to the mid-diameter of the pipe.

F. Backfilling over ducts shall begin not less than three days after placing concrete encasement.

G. All backfilling shall be prosecuted expeditiously and as detailed on the Drawings.

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

I. The filling shall be carried up evenly on both sides with at least one man tamping for each man shoveling material into the trench.

J. The remainder of the trench above the compacted backfill, as just described above, shall be filled and thoroughly compacted by rolling, ramming, or puddling, as the Engineer may direct, sufficiently to prevent subsequent settling.

3.04 GRADING

A. Grading shall be performed at such places as are indicated on the Drawings, to the lines, grades and elevations shown or as directed by the Engineer and shall be made in such a manner that the requirements for formation of embankments can be followed. All unacceptable material encountered, of whatever nature within the limits indicated, shall be removed and disposed of as directed. During the process of excavation, the grade shall be maintained in such condition that it will be well drained at all times. When directed, temporary drains and drainage ditches shall be installed to intercept or divert surface water which may affect the prosecution or condition of the work.

B. If at the time of excavation it is not possible to place any material in its proper section of the permanent pipeline structure, it shall be stockpiled in approved areas for later use.

C. Minute adjustments in lines or grades may be made if found necessary as the work progresses, due to discrepancies on the Drawings or in order to obtain satisfactory construction.

D. Stones or rock fragments larger than 2-1/2" in their greatest dimensions shall not be permitted in the top 6" of the subgrade line of all dikes, fills or embankments.

E. All fill slopes shall be uniformly dressed to the slope, cross-section and alignment shown on the Drawings, or as directed by the Engineer.

F. In cuts, all loose or protruding rocks on the back slopes shall be barred loose or otherwise removed to line or finished grade of slope. All fill slopes shall be uniformly dressed to the slope, cross section and alignment shown on the Drawings or as directed by the Engineer.

G. No grading is to be done in areas where there are existing pipelines that may be uncovered or damaged until such lines which must be maintained are relocated, or where lines are to be abandoned and removed, all required valves are closed and drains plugged at manholes.

END OF SECTION

3/05/97

SECTION 02223

EXCAVATION BELOW GRADE AND CRUSHED STONE OR SHELL REFILL

PART 1 GENERAL

1.01 SCOPE OF WORK

A. If in the opinion of the Engineer, the material at or below the normal grade of the bottom of the trench is unsuitable for pipe or structure foundation, it shall be removed to the depth directed by the Engineer and replaced by crushed stone or washed shell.

PART 2 PRODUCTS (NOT USED)

PART 3 MATERIALS

3.01 EXCAVATION AND DRAINAGE

A. Whatever the nature of unstable material encountered or the groundwater conditions, trench stabilization shall be complete and effective.

B. Should the Contractor excavate below the grade shown on the Contract drawings because of negligence or for his own convenience; due to failure in properly dewatering the trench; disturbs the subgrade before dewatering is sufficiently complete; he shall be directed by the Engineer to excavate below grade. The work of excavating below grade and furnishing and placing the approved refill material shall be performed at the Contractor's expense.

3.02 REFILL

A. Should the material at the level of trench bottom consist of fine sand, sand and silt or soft earth, the subgrade material shall be removed as directed by the Engineer and the excavation shall be refilled with crushed stone or washed shell.

END OF SECTION

5/24/95(Rev.)

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

The Contractor shall prevent damage to existing fencing, trees, landscaping, natural features, bench marks, pavement and utility lines. Damage shall be corrected at no cost to the Owner.

PART 2 PRODUCTS

A. Topsoil: Shall be friable loam free from subsoil, roots, grass, excessive amount of weeds or other organics, stones, and foreign matter; acidity range (pH) of 5.5 to 7.5; containing a minimum of 4 percent and a maximum of 25 percent organic matter. The Contractor may use topsoil stockpiles on site if they conform to these requirements.

PART 3 EXECUTION

3.01 SUB-SOIL PREPARATION

A. The Contractor shall rough grade sub-soil systematically to allow for a maximum amount of natural settlement and compaction. Uneven areas and low spots shall be eliminated. Debris, roots, branches or other organics, stones, and sub-soil shall be removed by the Contractor and disposed of in a manner consistent with the latest Manatee County Standards as well as any affected regulatory agency. Should contaminated soil be found, the Contractor shall notify the Engineer.

B. The Contractor shall cut out areas to sub-grade elevation to stabilize base material for paving and sidewalks.

C. The Contractor shall bring sub-soil to required profiles and contour graces gradually; and blend slopes into level areas.

D. The Contractor shall slope the structure grade a minimum of two (2) inches in ten (10) feet unless indicated otherwise on the Drawings.

E. The Contractor shall cultivate sub-grade to a depth of 3 inches where the topsoil is to be placed. He shall repeat cultivation in areas where equipment use has compacted sub-soil.

F. The Contractor shall not make grade changes which causes water to flow onto adjacent lands.

3.02 PLACING TOPSOIL

A. The Contractor shall place topsoil in areas where seeding, sodding and planting is to be performed. He shall place from 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. The Contractor shall use topsoil in a dry state as determined by the Engineer. He shall place the material during dry weather.

C. The Contractor shall use fine grade topsoil eliminating rough and low areas to ensure positive drainage. He shall maintain levels, profiles and contours of the sub-grades.

D. The Contractor shall remove stone, roots, grass, weeds, debris, and other organics or foreign material while spreading the material.

E. The Contractor shall manually spread topsoil around trees, plants and structures to prevent damage which may be caused by grading equipment.

F. The Contractor shall lightly compact and place the topsoil.

3.03 SURPLUS MATERIAL

A. The Contractor shall remove surplus sub-soil and topsoil

from site at his expense.

B. The Contractor shall leave stockpile areas and entire job site clean and raked, ready for landscaping operations.

END OF SECTION

12/08/94(Rev.)

SECTION 02276

TEMPORARY EROSION AND SEDIMENTATION CONTROL

PART 1 GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of the design, provision, maintenance and removal of temporary erosion and sedimentation controls as necessary.

B. Temporary erosion controls include, but are not limited to: grassing, mulching, netting, watering, and the reseeding of on-site surfaces and spoil and borrow area surfaces, interceptor ditches at ends of berms and other such work at those locations which will ensure that erosion during construction will be either eliminated or maintained within acceptable limits as established by the Owner/Engineer.

C. Temporary sedimentation controls include, but are not limited to: silt dams, traps, barriers, and appurtenances at the foot of sloped surfaces which shall ensure that sedimentation pollution will be either eliminated or maintained within acceptable limits as established by the Owner/Engineer.

D. The Contractor is responsible for providing effective temporary erosion and sediment control measures during construction or until final controls become effective.

1.02 REFERENCE DOCUMENTS

A. South Florida Building Code and Standard Building Code.

B. FDEP/COE Dredge and Fill Regulations and/or Permit as applicable.

C. SWFWMD Permit Regulations and/or Permit as applicable.

D. Florida Stormwater, Erosion and Sedimentation Control Inspector's Manual.

PART 2 PRODUCTS

2.01 EROSION CONTROL

A. Netting - fabricated of material acceptable to the Owner.

B. Seed and sod.

2.02 SEDIMENTATION CONTROL

A. Bales - clean, seedfree cereal hay type.

B. Netting - fabricated of material acceptable to the Owner.

C. Filter stone - crushed stone conforming to Florida Dept of Transportation specifications.

D. Concrete block - hollow, non-load-bearing type.

E. Concrete - exterior grade not less than one inch thick.

PART 3 EXECUTION

3.01 EROSION CONTROL

A. Minimum procedures for grassing shall be:

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 SEDIMENTATION CONTROL

A. The Contractor shall install and maintain silt dams, traps, barriers, and appurtenances as shown on the approved descriptions and working drawings. Deteriorated hay bales and dislodged filter stone shall be replaced by the Contractor at his expense.

3.03 PERFORMANCE

A. The Contractor, at his own expense, shall immediately take whatever steps are necessary to correct any deficiencies of the temporary erosion and sediment control measures employed if they fail to produce results or do not comply with the requirements of the State of Florida or any other federal, governmental or regulatory agency.

END OF SECTION

12/8/94(Rev.)

SECTION 02355

LUMBER LEFT IN PLACE

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish and install shoring and sheeting as necessary to provide adequate safety.

PART 2 PRODUCTS

2.01 MATERIALS

Wood for shoring and sheeting shall be green, rough cut hardwood planking.

PART 3 EXECUTION

3.01 INSTALLATION

A. The Contractor shall furnish, install and maintain sheeting and bracing required to support the sides of excavations, to prevent any movement which could in any way diminish the width of the excavation below which is necessary for proper construction and to protect adjacent structures from undermining or other damage. If the Engineer determines that insufficient or improper supports have been provided, he may order additional supports to be installed at the expense of the Contractor. Compliance with such orders shall not relieve or release the Contractor from his responsibility for the sufficiency of such supports. Care shall be taken to prevent voids outside of the sheeting. Should voids form, they shall be immediately filled and rammed.

B. The Contractor shall embed and leave in place all sheeting, bracing and other related items as shown on the Contract Drawings. The Owner/Engineer may direct that sheeting and bracing timber be cut off at a specified elevation. No additional payment or compensation shall be made for this work.

C. Sheeting and bracing not left in place shall be removed carefully in such manner as not to endanger other structures, utilities, property, or proposed construction.

D. The Owner/Engineer may order sheeting and bracing to be left in place; however, this shall not relieve the Contractor from liability for damages to persons or property due to negligence or the failure on the part of the Contractor to leave in place sufficient sheeting and bracing to prevent any caving or moving of the ground.

E. The Contractor shall receive no payment other than that included in the pipe bid item price for any timber used for sheeting bracing, or other related items.

END OF SECTION

SECTION 02485

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

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.

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.

PART 2 PRODUCTS

2.01 MATERIALS

A. Fertilizer

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 quantitive analysis card attached to each bag or other container. Fertilizer shall be uniform in composition, dry and free flowing delivered to sites in original unopened containers bearing manufacturer's statement or guarantee.

B. Seeding/Grassing

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

C. Sodding

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. 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

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

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 that 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

Areas to be seeded or sodded shall be finish graded, raked, and debris removed. Soft spots and uneven grades shall be eliminated. The Engineer shall approve the finish grade of all areas to be seeded or sodded prior to seed or sod application.

C. Protection

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

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 LANDSCAPE MAINTENANCE

Any existing landscape items damaged or altered during construction by the Contractor shall be restored or replaced as directed by the Engineer.

Maintain landscape work 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

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 02575

PAVEMENT REPAIR AND RESTORATION

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials, equipment, obtain County or State right-of-way permits and incidentals required and remove and replace pavements over trenches excavated for installation of water lines and appurtenances as shown on the Contract Drawings.

1.02 GENERAL

A. The Contractor shall take before and after photographs.

B. The Contractor shall repair in a manner satisfactory to the County or State, all damage done to existing structures, pavement, driveways, paved areas, curbs and gutters, sidewalks, shrubbery, grass, trees, utility poles, utility pipe lines, conduits, drains, catch basin, flagstones, or stabilized areas or driveways and including all obstructions not specifically named herein, which results from this Project.

C. The Contractor shall keep the surface of the backfilled area of excavation in a safe traffic bearing condition and firm and level with the remaining pavement until the pavement is restored in the manner specified herein. All surface irregularities that are dangerous or obstructive to traffic are to be removed. The repair shall conform to applicable requirements of Manatee County Transportation Department requirements for pavement repair and as described herein, including all base, subbase and asphalt replacement.

D. All materials and workmanship shall meet or exceed the County requirements and as called for in the Contract Documents and nothing herein shall be construed as to relieve the Contractor from this responsibility.

E. All street, road and highway repair shall be made in accordance with the FDOT and County details indicated on the Drawings and in accordance with the applicable requirements and approval of affected County and State agencies.

PART 2 PRODUCTS

2.01 PAVEMENT SECTION

A. Asphaltic concrete shall consist of asphalt cement, coarse aggregate, fine aggregate and mineral filler conforming to FDOT Type S-III Asphalt. Pavement replacement thickness shall match that removed but in no case shall be less than 1-1/2" compacted thickness. All asphalt concrete pavement shall be furnished, installed and tested in accordance with FDOT Specifications for Road and Bridge Construction.

B. Asphalt or crushed concrete or approved equal base material shall be furnished and installed under all pavement sections restored under this Contract. Asphalt base shall have a minimum 6" compacted thickness, meet requirements for FDOT ABC III (Minimum Marshall Stability of 1000) and be furnished, installed and tested in accordance with the requirements of the FDOT Standards. Crushed concrete base shall be 10" minimum compacted thickness. Crushed concrete aggregate material shall have a minimum LBR of 140 compacted to 99% T-180 AASHTO density. Asphalt base and crushed concrete base are acceptable. Other bases shall be submitted for approval.

C. Prime and tack will be required and applied in accordance with Section 300 - FDOT Specifications: Prime and Tack Coat for Base Courses.

PART 3 EXECUTION

3.01 CUTTING PAVEMENT

A. The Contractor shall saw cut in straight lines and remove pavement as necessary to install the new pipelines and appurtenances and for making connections to existing pipelines.

B. Prior to pavement removal, the Contractor shall mark the pavement for cuts nearly paralleling pipe lines and existing street lines. Asphalt pavement shall be cut along the markings with a rotary saw or other suitable tool. Concrete pavement shall be scored to a depth of approximately two (2) inches below the surface of the concrete along the marked cuts. Scoring shall be done by use of a rotary saw, after which the pavement may be broken below the scoring with a jackhammer or other suitable equipment.

C. The Contractor shall not machine pull the pavement until it is completely broken and separated along the marked cuts.

D. The pavement adjacent to pipe line trenches shall neither be disturbed or damaged. If the adjacent pavement is disturbed or damaged, irrespective of cause, the Contractor shall remove and replace the pavement. In addition, the base and sub-base shall be restored in accordance with these Specifications, Florida Dept. of Transportation Standard Specifications and as directed by the Engineer.

3.02 PAVEMENT REPAIR AND REPLACEMENT

A. The Contractor shall repair, to meet or exceed original surface material, all existing pavement cut or damaged by construction under this Contract. He shall match the original grade unless otherwise specified or shown on the Drawings. Materials and construction procedures for base course and pavement repair shall conform to those of the Florida Dept. of Transportation.

B. The Contractor's repair shall include the preparation of the subbase and base, place and maintain the roadway surface, any special requirements whether specifically called for or implied and all work necessary for a satisfactory completion of this work. Stabilized roads and drives shall be finished to match the existing grade. Dirt roads and drives shall have the required depth of backfill material as shown on the Contract Drawings.

C. The width of all asphaltic concrete repairs shall extend the full width and length of the excavation or to the limits of any damaged section. The edge of the pavement to be left in place shall be cut to a true edge with a saw or other approved method so as to provide a clean edge to abut the repair. The line of the repair shall be reasonably uniform with no unnecessary irregularities.

3.03 MISCELLANEOUS RESTORATION

Sidewalks cut or damaged by construction shall be restored in full sections or blocks to a minimum thickness of four inches. Concrete curb or curb and gutter shall be restored to the existing height and cross section in full sections or lengths between joints. RCP pipe shall be repaired or installed in accordance with manufacturer's specifications. Grassed yards, shoulders and parkways shall be restored to match the existing sections with grass sod of a type matching the existing grass.

3.04 SPECIAL REQUIREMENTS

The restoration of all surfaces, as described herein, disturbed by the installation of pipelines shall be completed as soon as is reasonable and practical. The complete and final restoration of both paved and shell

stabilized roads within a reasonable time frame is of paramount importance. To this end, the Contractor shall, as part of his work schedule, complete the restoration of any area of road within five weeks after removing the original surface. Successful leak testing shall be performed prior to restoring any area of road. All restoration and replacement or repairs are the responsibility of the Contractor.

3.05 CLEANUP

After all repair and restoration or paving has been completed, all excess asphalt, dirt and other debris shall be removed from the roadways. All existing storm sewers and inlets shall be checked and cleaned of any construction debris.

3.06 MAINTENANCE OR REPAIR

All wearing surfaces shall be maintained by the Contractor in good order suitable for traffic prior to completion and acceptance of the work.

END OF SECTION

SECTION 02615

DUCTILE IRON PIPE AND FITTINGS

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required to install ductile iron pipe, restrained joint ductile iron pipe and cast iron or ductile iron fittings, complete, as shown on the Drawings and specified in these Standards.

B. Fittings are noted on the drawings for the Contractor's convenience and do not relieve him from laying and jointing different or additional items where required.

C. Newly installed pipe shall be kept clean and free of all foreign matter.

1.02 SUBMITTALS

A. The Contractor shall submit to the Engineer, within ten days after receipt of Notice to Proceed, a list of materials to be furnished, the names of the suppliers and the appropriate shop drawings for all ductile iron pipe and fittings.

B. The Contractor shall submit the pipe manufacturer's certification of compliance with the applicable sections of the Specifications.

PART 2 PRODUCTS

2.01 MATERIALS

A. Ductile iron pipe shall conform to AWWA C150 and AWWA C151. Thickness of pipe shall be Pressure Class 350. All ductile iron pipe used in above ground applications shall be Special Thickness Class 53. The pipe exterior coating shall be a standard 1 mil asphaltic coating per AWWA C151. All ductile iron pipe shall be clearly marked on the outside of the barrel to readily identify it. All pipe materials used in potable water systems shall comply with NSF Standard 61.

B. Unrestrained joint pipe shall be supplied in lengths not to exceed 21 ft. and shall be either the rubber-ring compression-type push-on joint or standard mechanical joint pipe as manufactured by the American Cast Iron Pipe Company, U.S. Pipe and Foundry Company, or an approved equal.

C. All fittings shall be pressure rated for 350 psi for sizes 4-24 inches and 250 psi for

sizes 30 inches and larger and shall meet the requirements of AWWA C110 or AWWA C153.

D. Rubber gaskets shall conform to AWWA C111 for mechanical and push-on type joints and shall be EPDM rubber for potable water and reclaimed water pipelines. Standard gaskets shall be such as Fastite as manufactured by American Cast Iron Pipe Company, or an approved equal.

E. Water Mains and Reclaimed Water Mains:

All ductile iron pipe used in water and reclaimed water systems shall have a standard thickness cement lining on the inside in accordance with AWWA C104. All ductile iron or gray iron fittings used in water and reclaimed water systems shall have standard thickness cement linings on the inside per AWWA C104 and asphaltic exterior coatings or they shall have factory-applied fusion bonded epoxy coatings both inside and outside in accordance with AWWA C550.

F. Sewer Mains:

All ductile iron pipe and all ductile iron and cast iron fittings used in wastewater sewer systems shall have a factory applied fusion bonded minimum dry film thickness 40-mil Protecto 401 or Amine Cured Novalac ceramic epoxy lining or minimum 60-mil Polybond Plus polyethylene lining with a fusion bonded epoxy primer layer on the inside in accordance with the manufacturer's specifications. The interior lining application is to be based on the manufacturer's recommendation for long-term exposure to raw sewage. To ensure a holiday-free lining, documentation must be provided, prior to shipment, showing each section of lined pipe has passed the holiday testing at production per ASTM G62 with a minimum 10,000 volt charge. The lining shall have a minimum ten year warranty covering failure of the lining and bond failure between liner and pipe.

G. Ductile iron or cast iron pipe and fittings used in sewer systems shall have either an asphaltic coating per AWWA C151 or a factory applied fusion bonded epoxy exterior coating.

H. Thrust restraint devices shall be provided at all horizontal and vertical bends and fittings, in casings under roads and railroads and at other locations as indicated on the construction drawings. Thrust restraint devices shall be either concrete thrust blocks or restraining glands as manufactured by Star Pipe Products, Stargrip 3000 and 3100, Allgrip 3600, or as manufactured by EBAA Iron Sales, Megaflange, 2000 PV, or other approved equal restraining gland products. Restrained joints, where used, shall be installed at bend and fitting locations and at pipe joint locations both upstream and downstream from the bends or fittings at distances as required by these Standards. Restrained joint pipe fittings shall be designed and rated for the following pressures:

350 psi for pipe sizes up to and including 24" diameter
250 psi for pipe sizes 30" diameter and above

2.02 DETECTION

A. Pipe shall have a 3-inch wide detectable metallic tape of the proper color placed directly above the pipe 12-inches below finished grade or a 6-inch detectable tape between 12-inches and 24-inches below finished grade.

B. Pipe shall have a No. 10 gauge solid, insulated wire of proper color installed along the pipe alignment as detailed in these standards.

2.03 IDENTIFICATION

A. Each length of pipe and each fitting shall be marked with the name of the manufacturer, size and class and shall be clearly identified as ductile iron pipe. All gaskets shall be marked with the name of the manufacturer, size and proper insertion direction.

B. Pipe shall be poly wrapped blue for water mains, purple (Pantone 522 C) for reclaimed water mains and green for sewer mains.

END OF SECTION

SECTION 02617

INSTALLATION AND TESTING OF PRESSURE PIPE

1.01 INSTALLING PIPE AND FITTINGS

A. The Contractor shall install all pipe in accordance with the recommendations of the pipe manufacturer and as specified herein.

B. The Contractor shall take care in handling, storage and installation of pipe and fittings to prevent injury to the pipe or coatings. All pipe and fittings shall be examined before installation and pipe which is deemed to be defective by the Owner/Engineer shall not be installed.

C. The Contractor shall thoroughly clean and keep thoroughly clean, all pipe and fittings prior to during and after installation.

D. The Contractor shall lay the pipe to the lines and grades shown on the Contract Drawings with bedding and backfill as shown on the Drawings or called out in the Contract Documents. Blocking under the pipe shall not be permitted except through casing sleeves.

E. The Contractor shall keep the open ends of all pipe closed with a tightly fitting plug when installation is not in progress or the potential exists for dirt or debris to enter the pipe.

F. The pipe or accessories shall not be dropped into the trench under any circumstances.

G. The Contractor shall construct all water mains pursuant to the provisions of "Recommended Standards for Water Works", Part 8, incorporated by reference in Rule 17-555.330(3), F.A.C.

1.02 PROCEDURE FOR TESTING WATER LINES, FORCE MAINS AND RECLAIMED WATER LINES

A. The Engineer must call in to schedule all testing. A 48-hour notice is needed prior to testing. A letter stating the reasons testing should be scheduled ahead of other jobs must accompany all emergency testing requests.

B. Engineer and Contractor must be present for all testing, except for testing tapping valves and sleeves.

C. All pressure pipe lines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipe lines shall be subjected to a hydrostatic pressure test for two (2) hours at full working pressure, but not less than 180 psi for water/reclaimed (150 psi for force main). Maximum length of pipe to be tested at one time is 2,600 feet. If line is longer than 2,600 feet and cannot be sectioned in 2,600 feet (max.) lengths, the allowable leakage will be figured at 2,600 feet.

D. Allowable leakage shall be determined by AWWA C600 table for hydrostatic tests. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof; to maintain the test pressure after the air in the pipe line has been expelled and the pipe has been filled with water.

E. All digging on the job site in the right-of-way must be completed before any testing of water or sewer. Any digging or boring across water or sewer lines after they have been tested may result in a retest of the lines at the County's request.

F. All water and sewer lines will be installed per approved construction plans by the County. If any revisions or changes are made after initial testing, lines will be re-tested at the County's request.

G. Disconnect water supply during test.

H. All force mains will be tested from the valves in the valve vault at the lift station to the point of connection whether it be against a valve on another force main or into a manhole.

I. All services to be aboveground during test. The services should be the correct length so they will be one (1) foot inside right-of-way line.

J. All fire hydrant gate valves to be open during test.

K. All visible leaks are to be repaired, regardless of the amount of leakage.

L. Check gauge pressure periodically during test. If test pressure drops to 175 psi for water/reclaimed lines or to 145 psi for force mains during test, the line must be repumped back to 180 psi for water/reclaimed (150 psi

force mains) and the amount of leakage measured. The test will continue on with the remaining time left. At the end of the test, the line must be repumped again back to 180 psi (150 psi for force main) and the amount of leakage measured and added to any previous leakage determined earlier in the test.

M. After the line passes the test, the pressure will be blown off from the opposite end of line from the gauge location. Fire hydrants, services and end-of-line blow offs will be opened to demonstrate they were on line during the test.

N. At end of test, the test gauge must return to zero. The pressure gauge must read 0 psi to a maximum of 300 psi in 5 psi increments.

O. The section of line being tested must be identified on the charge sheet. The length and size of pipe, the exact area being tested and the valves being tested against, must be identified. Use Station numbers if available.

P. A punch list must be made at the end of all tests.

Q. A copy of the charge sheet will be given to the Engineer and the Contractor at the end of the test.

1.03 INSPECTION/TESTING PROCEDURE COVERING BORED PIPE LINES OR CASING AND CONDUITS INSTALLED ACROSS PREVIOUSLY TESTED AND/OR COUNTY ACCEPTED WATER AND SEWER PIPE WITHIN DEVELOPMENT PROJECTS UNDER ACTIVE CONSTRUCTION

A. Prior to testing water and sewer lines, every effort will be made to install sleeves for underground utilities that will cross these water and sewer lines or services.

B. Where it has not been possible to pre-install sleeves prior to testing and bores or conduits are required, it is the responsibility of the utility company and/or their Contractor performing the work to provide Manatee County Utility Operations Department or the Engineer of Record with accurate horizontal and vertical as-built information of the sleeves, bores and conduits installed by said utility company. This applies to all bores and conduits crossing water and sewer lines.

C. Procedures to be followed for installation of conduits, pipe lines and bores that will cross, or be closer than 5'-0" horizontally and 18 inches vertically to, previously tested water and sewer lines that are still under the ownership of the developer/contractor.

1) Notify the owner and obtain the best as-built information available. Allow sufficient time for the owner to field locate the existing pipe lines.

2) Submit drawings of proposed location to the Owner and Manatee County Utility Operations Dept. Utility Locations Section for review.

3) Obtain a County Right-of-Way Use Permit if the work area is within a dedicated area of right-of-way.

4) Perform installation in the presence of a County representative. Call (941) 792-8811, ext. 5061 or ext. 5069 with at least two (2) working days notice.

5) Submit two (2) copies of as-built information to the Owner to incorporate into the record drawings to be submitted to the County.

6) Failure to follow steps 2) thru 5) will result in additional charges for retesting the previously tested water and sewer lines.

D. Procedures to be followed for installation of conduits, pipe lines and bores crossing or closer than 5'-0" horizontally and 18 inches vertically to previously tested water and sewer lines that have been previously accepted by Manatee County:

1) Obtain record drawing information from the County.

2) If roadway has been dedicated to Manatee County, obtain Right-of-Way Use Permit and copy the Project Management Department Locations Section with proposed location drawing.

3) Follow procedures in "Sunshine State One-Call", paying special attention to the requirements of Section VII.

E. Should water or sewer lines be damaged during the bore pipe line or casing installation, the cost of any repairs and retesting will be paid for by the utility company that installed the bore. The actual clearance between a bored casing crossing a water or sewer pipe should not be less than 18 inches.

END OF SECTION

SECTION 02622

POLYVINYL CHLORIDE (PVC) PIPE AND FITTINGS (AWWA SPECIFICATIONS C-900 & C-905)

PART 1 GENERAL

1.01 SCOPE OF WORK

The Contractor shall furnish all labor, materials, equipment and incidentals required to install the plastic piping, fittings and appurtenances complete and ready for use as specified in the Contract Documents and these Standards.

1.02 DESCRIPTION OF SYSTEM

The Contractor shall install the piping in the locations as shown on the Drawings.

1.03 QUALIFICATIONS

All plastic pipe, fittings and appurtenances shall be furnished by a single manufacturer who is fully experienced, reputable, qualified and specializes in the manufacture of the items to be furnished. The pipe and fittings shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications.

1.04 SUBMITTALS

A. The Contractor shall submit shop drawings to the Engineer including, but not limited to, dimensions and technical specifications for all piping.

B. The Contractor shall submit to the Engineer, samples of all materials specified herein.

C. The Contractor shall submit and shall comply with pipe manufacturer's recommendation for handling, storing and installing pipe and fittings.

D. The Contractor shall submit pipe manufacturer's certification of compliance with these Specifications.

1.05 TOOLS

The Contractor shall supply special tools, solvents, lubricants, and caulking compounds required for proper installation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Pressure Class-Rated Polyvinyl Chloride (PVC) Pipe

1. Pressure class-rated PVC pipe and accessories four to twelve inches (4"-12") in diameter, where shown or as specified on the Drawings, shall meet the requirements of AWWA Specification C-900 "Polyvinyl Chloride (PVC) Pressure Pipe". Pipe shall be Class 150, meeting requirements of Dimension Ratio (DR) 18 and shall have the dimension of ductile iron outside diameters. Each length of pipe shall be hydrotested to four (4) times its class pressure by the manufacturer in accordance with AWWA C-900.

2. PVC pipe 14" through 36" shall meet the requirements of AWWA Standard C-905, Polyvinyl Chloride (PVC) Water Transmission Pipe. Pipe 14" thru 24" for potable and reclaim water shall meet the requirements for dimension ratio (DR) 18. Each length of pipe shall be tested at twice the pressure rating (PR 235 psi) for a minimum dwell of 5 seconds in accordance with AWWA C-905. Fourteen inch (14") thru 36" PVC pipe for sewer force mains shall meet AWWA C-905 requirements for dimension ratio (DR) 21. Each length of pipe shall be tested at twice the pressure rating (PR 200 psi) for a minimum dwell of five seconds in accordance with AWWA C-905. Pipe shall be listed by Underwriters Laboratories. Provisions shall be made for expansion and contraction at each joint with an elastomeric ring, and shall have an integral thickened bell as part of each joint. PVC Class pipe shall be installed as recommended by the manufacturer. Pipe shall be furnished in nominal lengths of approximately 20 feet, unless otherwise directed by the Engineer. Pipe and accessories shall bear the NSF mark indicating pipe size, manufacturer's names, AWWA and/or ASTM Specification number, working pressure, and production code.

3. Gaskets for 16" diameter and larger pipe used for potable water pipe shall be EPDM (Ethylene-Propylene Dine Monomer).

4. PVC pipe 3" and less in diameter may be constructed using pipe conforming to ASTM D2241 with push-on joints. Pipe shall be 200 psi pipe-SDR 21 unless otherwise specified by the Engineer. This PVC pipe shall not be used for working pressures greater

than 125 psi.

5. Pipe shall be blue for potable water mains, green for sewage force mains and purple for reclaimed water mains. All potable water pipe shall be NSF certified and copies of lab certification shall be submitted to the Engineer.

6. Where colored pipe is unavailable, white PVC color coded spiral wrapped pipe shall be installed.

B. Joints

1. The PVC joints for pipe shall be of the push-on type unless otherwise directed by the Engineer so that the pipe and fittings may be connected on the job without the use of solvent cement or any special equipment. The push-on joint shall be a single resilient gasket joint designed to be assembled by the positioning of a continuous, molded resilient ring gasket in an annular recess in the pipe or fitting socket and the forcing of the plain end of the entering pipe into the socket, thereby compressing the gasket radially to the pipe to form a positive seal. The gasket and annular recess shall be designed and shaped so that the gasket is locked in place against displacement as the joint is assembled. The resilient ring joint shall be designed for thermal expansion or contraction with a total temperature change of at least 75 degrees F in each joint per length of pipe. The bell shall consist of an integral wall section with a solid cross section elastomeric ring which shall meet requirements of ASTM F-477. The thickened bell section shall be designed to be at least as strong as the pipe wall. Lubricant furnished for lubricating joints shall be nontoxic, shall not support the growth of bacteria, shall have no deteriorating effects on the gasket or pipe material, and shall not impart color, taste, or odor to the water. Gaskets shall be suitable for use with potable water, reclaimed water or sanitary sewer as applicable.

2. Restrained joints shall be provided at all horizontal and vertical bends and fittings, at casings under roads and railroads and at other locations shown on the Contract Drawings. PVC joints for pipe shall be restrained by the following methods: thrust blocks, restraining glands such as Certa-Lok Restraining Joint Municipal Water Pipe by the Certain Teed Corporation of Valley Forge, PA, or approved equal. All Grip, Star Grip by Star Products, MJR by Tyler

Pipe, Tyler, Texas. Restrained joint PVC pipe shall be installed in strict accordance with the manufacturer's recommendation.

C. Fittings

1. All fittings for class-rated PVC pipe shall be ductile iron with mechanical joints and shall conform to the specifications for ductile iron fittings, unless otherwise directed. Class 200, C-900 PVC fittings are allowable for sewage force main applications up to and including 12" diameter only. DR ratio shall be the same as the pipe.

2. The manufacturer of the pipe shall supply all polyvinyl chloride accessories as well as any adapters and/or specials required to perform the work as shown on the Drawings and specified herein. Standard double bell couplings will not be accepted where the pipe will slip completely through the coupling.

PART 3 EXECUTION

3.01 INSTALLATION

The Contractor shall install the plastic pipe in strict accordance with the manufacturer's technical data and printed instructions. Direct bury pipe shall have 3" detectable metallic tape of the proper color placed directly above the pipe 12" below finished grade or 6" detectable tape between 12" and 24" below grade.

3.02 INSPECTION AND TESTING

A. All pipe lines shall remain undisturbed for 24 hours to develop complete strength at all joints. All pipe lines shall be subjected to a hydrostatic pressure test for two (2) hours at full working pressure, but not less than 180 psi for water/reclaimed (150 psi for force main). All visible leaks shall be repaired and retested for approval by the County. Prior to testing, the pipe lines shall be supported in a manner approved by the Engineer to prevent movement during tests.

END OF SECTION

SECTION 02640

VALVES AND APPURTENANCES

PART 1 GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall furnish all labor, materials, equipment and incidentals required and install complete and ready for operation all valves and appurtenances as shown on the Drawings and as specified herein.

B. All valves and appurtenances shall be of the size shown on the Drawings and, to the extent possible, all equipment of the same type on the Project shall be from one manufacturer.

C. All valves and appurtenances shall have the name of the manufacturer and the working pressure for which they are designed cast in raised letters upon some appropriate part of the body.

D. All valves shall have a factory applied, fusion bonded epoxy coating on interior and exterior.

E. The equipment shall include, but not be limited to, the following:

1. Gate valves (Sec. 2.01)
2. Pressure Sustaining and Check Valves (Sec. 2.02)
3. Ball Valves for PVC Pipe (Sec. 2.03)
4. Butterfly Valves (Sec. 2.04)
5. Plug Valves (Sec. 2.05)
6. Valve Actuators (Sec. 2.06)
7. Air Release Valves (Sec. 2.07)
8. Valves Boxes (Sec. 2.08)
9. Corporation Cocks (Sec. 2.09)
10. Flange Adapter Couplings (Sec. 2.10)
11. Flexible Couplings (Sec. 2.11)
12. Hose Bibs (Sec. 2.12)
13. Slow Closing Air and Vacuum Valves (Sec. 2.13)
14. Surge Anticipator Valve (Sec. 2.14)
15. Check Valves (Sec. 2.15)
16. Hydrants (Sec. 2.16)
17. Restraining Clamps (Sec. 2.17)
18. Tapping Sleeves and Tapping Valves (Sec. 2.18)
19. Single Acting Altitude Valves (Sec. 2.19)

1.02 DESCRIPTION OF SYSTEMS

All of the equipment and materials specified herein are intended to be standard for use in controlling the flow of potable water, reclaim water, wastewater, etc., depending on the applications.

1.03 QUALIFICATIONS

All of the types of valves and appurtenances shall be products of well established reputable firms who are fully experienced and qualified in the manufacture of the particular equipment to be furnished. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable. Valves shall be as covered under mechanical devices in Section 8 of ANSI/NSF Standard 61.

1.04 SUBMITTALS

A. Submit to the Engineer within 30 days after execution of the contract a list of materials to be furnished, the names of the suppliers and the date of delivery of materials to the site.

B. Complete shop drawings of all valves and appurtenances shall be submitted to the Engineer for approval in accordance with the Specifications.

1.05 TOOLS

Special tools, if required for normal operation and maintenance shall be supplied with the equipment.

PART 2 PRODUCTS

2.01 GATE VALVES

A. All buried valves shall have cast or ductile iron three (3) piece valve boxes.

B. Where indicated on the drawings or necessary due to locations, size, or inaccessibility, chain wheel operators shall be furnished with the valves. Such operators shall be designed with adequate strength for the valves with which they are supplied and provide for easy operation of the valve. Chains for valve operators shall be galvanized.

C. Where required, gate valves shall be provided with a box cast in a concrete slab and a box cover. Length of box shall include slab thickness. Box cover opening shall be for valve stem and nut. Valve wrenches and extension stems shall be provided by the manufacturer to actuate the valves. The floor box and cover shall be equal to those manufactured by Rodney Hunt Machine Company,

Orange, Massachusetts, Clow, DeZurik or approved equal.

D. Gate valves with 3"-20" diameters shall be resilient seated, manufactured to meet or exceed the requirements of AWWA C509 and UL/FM of latest revision and in accordance with the following specifications. Valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

E. The valves shall have a non-rising stem of stainless steel or of cast, forged, or rolled bronze as shown in AWWA C509. Stem seals shall be provided and shall be of the O-ring type, two above and one below the thrust collar.

F. The sealing mechanism shall consist of a cast iron gate fully encapsulated with an EPDM Elastomer coating. The Elastomer type shall be permanently indicated on the disc or body of the valve. The resilient sealing mechanism shall provide zero leakage at the water working pressure when installed with the line flow in either direction.

G. The valve body, bonnet, and bonnet cover shall meet or exceed all the requirements of AWWA C509 latest edition. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating. Wrench nut shall be provided for operating the valve.

H. Valves shall be suitable for an operating pressure of 200 psi and shall be tested in accordance with AWWA C509.

I. All bonnet bolts, nuts and studs shall be stainless steel.

2.02 PRESSURE SUSTAINING AND CHECK VALVE

A. Pressure sustaining and check valve shall be pilot operated diaphragm actuated valve with cast iron body, bronze trim, and 125-pound flanged ends. The valve shall be hydraulically operated, diaphragm type globe valve. The main valve shall have a single removable seat and a resilient disc, of rectangular cross section, surrounded on three and a half sides. The stainless steel stem shall be fully guided at both ends by a bearing in the valve cover, and an integral bearing in the valve seat. It shall be sleeved at both ends with delrin. No external packing glands are permitted and there shall be no pistons operating the main valve or any controls. The valve shall be equipped with isolation cocks to service the pilot system while permitting flow if necessary. Main valve and all pilot controls shall be manufactured in the United States of America. Valve shall be single chamber type, with seat cut to 5 degrees taper.

B. Valve shall maintain a minimum (adjustable) upstream pressure to a preset (adjustable) maximum. The pilot system shall consist of two direct acting, adjustable, spring loaded diaphragm valves.

C. Valve shall be cast iron (ASTM A48) with main valve trim of brass (QQB-B-626) and bronze (ASTM B61). The pilot control valves shall be cast brass (ASTM B62) with 303 stainless steel trim. Valve shall be similar in all respects to CLA-VAL Company, Model 692G-01ABKG, as manufactured by CLA-VAL Company, Winter Park, Florida, or similar pressure sustaining and check valve as manufactured by Golden Alderson; or approved equal.

2.03 BALL VALVES FOR PVC PIPE

A. Ball valves for PVC pipe shall be of PVC Type 1 with union, socket, threaded or flanged ends as required. Ball valves shall be full port, full flow, all plastic construction, 150 psi rated with teflon seat seals and T-handles. PVC ball valves shall be as manufactured by Celanese Piping Systems, Inc., Wallace and Tiernan, Inc., Plastiline, Inc., or approved equal.

B. All valves shall be mounted in such a position that valve position indicators are plainly visible when standing on the floor.

2.04 BUTTERFLY VALVES

A. Butterfly valves shall conform to the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designated C504, except as hereinafter specified. Valves, except as specified hereinafter, shall be Class 150A or B, except that valves furnished downstream of the high service pumps shall be Class 250 and equal to those manufactured by Henry Pratt Company, DeZurik, Kennedy, or approved equal. The valve discs shall be constructed of cast iron conforming to ASTM A-48, Class 40, ASTM A-126, Class B or ductile iron conforming to ASTM A536, Grade 65-45-12 for Class 150 or less. Ductile iron conforming to ASTM A536, Grade 65-45-12 shall be provided for all Class 250 valves. All valves shall be leak tested at 200 psi.

B. The face-to-face dimensions of flanged end valves shall be in accordance with Table 2 of above mentioned AWWA Specification for short-body valve. Adequate two-way thrust bearings shall be provided. Flange drilling shall be in accordance with ANSI B16.1.

C. Valve seats shall be an EPDM elastomer. Valve seats 24 inches and larger shall be field adjustable and replaceable without dismounting operator disc or shaft and without removing the valve from the line. All retaining segments and adjusting devices shall be of corrosion resistant material with stainless Nylock screws and be capable of the 1/8-inch adjustment. Valves 20 inches and smaller shall have bonded or mechanically restrained seats as outlined in AWWA C 504. Where the EPDM seat is mounted on the valve body, the mating edge of the valve disc shall be 18-8 stainless steel or

Nickel-Chrome, 80-20%. Where the EPDM seat is mounted on the valve disc, the valve body shall be fitted with an 18-8 stainless steel seat offset from the shaft, mechanically restrained and covering 360 degrees of the peripheral opening or seating surface.

D. The valve body shall be constructed of ductile iron or close grain cast iron per ASTM A126, Class B with integrally cast hubs for shaft bearing housings of the through boss-type. Butterfly valves of the "wafer" or "spool" type will not be accepted.

E. The valve shaft shall be turned, ground, and polished constructed of 18-8, ASTM A-276, Type 304 stainless steel and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. Shaft shall be of either a one piece unit extending full size through the valve disc and valve bearing or it may be of a stub shaft design. Shaft bearings shall be teflon or nylon, self-lubricated type.

F. All valves shall be subject to hydrostatic and leakage tests at the point of manufacture. The hydrostatic test for Class 250 valves shall be performed with an internal hydrostatic pressure equal to 500 psi applied to the inside of the valve body of each valve for a period of five minutes. During the hydrostatic test, there shall be no leakage through the metal, the end joints or the valve shaft seal. The leakage test for the Class 250 valves shall be performed at a differential pressure of 230 psi and against both sides of the valve. No adjustment of the valve disc shall be necessary after pressure test for normal operation of valve. The Class 150 valves shall be tested in conformance with AWWA C-504.

G. In general, the butterfly valve operators shall conform to the requirements of Section 3.8 of the AWWA Standard Specifications for Rubber Seated Butterfly Valves, Designation C504, insofar as applicable, and as herein specified.

H. Gearing for the operators shall be totally enclosed in a gear case in accordance with paragraph 3.8.3 of the above mentioned AWWA Standard Specification.

I. Operators shall be capable of seating and unseating the disc against the full design pressure of velocity, as specified for each class, into a dry system downstream and shall transmit a minimum torque to the valve. Operators shall be rigidly attached to the valve body.

J. The manufacturer shall certify that the required tests on the various materials and on the completed valves have been satisfactory and that the valves conform with all requirements of this Specification and the AWWA standard.

K. Where indicated on the Drawings, extension stems, floor

stands, couplings, stem guides, and floor boxes as required shall be furnished and installed.

2.05 PLUG VALVES

A. All plug valves shall be eccentric plug valves capable of sustaining 150 psi in either direction without leaking.

Exception: Single direction plug valves may be used if it is clearly demonstrated they will never be required to resist pressure in both directions either in service or during pipe line testing.

B. Plug valves shall be tested in accordance with current AWWA Standard C-504-80 Section 5. Each valve shall be performance tested in accordance with paragraph 5.2 and shall be given a leakage test and hydrostatic test as described in paragraphs 5.3 and 5.4. The manufacturer shall furnish certified copies of reports covering proof of design testing as described in Section 5.5.

C. Plug valves shall be of the non-lubricated eccentric type with resilient faced plugs and shall be furnished with end connections as shown on the Plans. Flanged valves shall be faced and drilled to the ANSI 150 lb. standard. Mechanical joint ends shall be to the AWWA Standard C111-72. Bell ends shall be to the AWWA Standard C100-55 Class B. Screwed ends shall be to the NPT standard.

D. Plug valve bodies shall be of ASTM A126 Class B Semi-steel, 31,000 psi tensile strength minimum in compliance with AWWA Standard C507-73, Section 5.1 and AWWA Standard C504-70 Section 6.4. Port areas for valves 20-inches and smaller shall be 80 percent of full pipe area. Valves 24 inch and larger shall have a minimum port area between 80 and 100 percent of full nominal pipe area. All exposed nuts, bolts, springs, washers, etc. shall be zinc or cadmium plated. Resilient plug facings shall be of Hycar or Neoprene.

E. Plug valves shall be furnished with permanently lubricated stainless steel or oil-impregnated bronze upper and lower plug stem bushings. These bearings shall comply with current AWWA Standards.

2.06 VALVE ACTUATORS

A. General

1. All valve actuators shall conform to Section 3.8 of the AWWA Standard Specification and shall be either manual or motor operated.

2. Actuators shall be capable of seating and unseating the disc against the full design pressure and velocity, as specified for each class, into a dry system downstream, and shall transmit a minimum torque to the valve. Actuators shall be rigidly

attached to the valve body.

3. Butterfly valve actuators shall conform to the requirements of Section 3.8 of the AWWA Standard specifications for Rubber Seated Butterfly Valves, Designated C504, insofar as applicable and as herein specified.

B. Manual Actuators

1. Manual actuators shall have permanently lubricated, totally enclosed gearing with handwheel and gear ratio sized on the basis of actual line pressure and velocities. Actuators shall be equipped with handwheel, position indicator, and mechanical stop-limiting locking devices to prevent over travel of the disc in the open and closed positions. They shall turn counter-clockwise to open valves. Manual actuators shall be of the traveling nut, self-locking type and shall be designed to hold the valve in any intermediate position between fully open and fully closed without creeping or fluttering. Actuators shall be fully enclosed and designed to produce the specified torque with a maximum pull of 80 pounds on the handwheel or chainwheel. Actuator components shall withstand an input of 450 foot pounds for 30" and smaller and 300 foot pounds for larger than 30" size valves at extreme actuator positions without damage. Valves located above grade shall have handwheel and position indicator, and valves located below grade shall be equipped with a two inch (2") square AWWA operating nut located at ground level and cast iron extension type valve box. Valve actuators shall conform to AWWA C504, latest revision.

C. Motor Actuators (Modulating)

1. The motor actuated valve controller shall include the motor, actuator unit gearing, limit switch gearing, limit switches, position transmitter which shall transmit a 4-20 mA DC signal, control power transformer, electronic controller which will position the valve based on a remote 4-20 milliamp signal, torque switches, bored and key-wayed drive sleeve for non-rising stem valves, declutch lever and auxiliary handwheel as a self-contained unit.

2. The motor shall be specifically designed for valve actuator service using 480 volt, 60 Hertz, three phase power as shown, on the electrical drawings. The motor shall be sized to provide an output torque and shall be the totally enclosed, non-ventilated type. The power gearing shall consist of helical gears fabricated from heat treated alloy steel forming the first stage of reduction. The second reduction stage shall be a single stage worm gear. The worm shall be of alloy steel with

carburized threads hardened and ground for high efficiency. The worm gear shall be of high tensile strength bronze with hobbed teeth. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout. Preference will be given to units having a minimum number of gears and moving parts. Spur gear reduction shall be provided as required.

3. Limit switches and gearing shall be an integral part of the valve control. The limit switch gearing shall be made of bronze and shall be grease lubricated, intermittent type and totally enclosed to prevent dirt and foreign matter from entering the gear train. Limit switches shall be of the adjustable type capable of being adjusted to trip at any point between fully opened valve and fully closed valve.

4. The speed of the actuator shall be the responsibility of the system supplier with regard to hydraulic requirements and response compatibility with other components within the control loop. Each valve controller shall be provided with a minimum of two rotor type gear limit switches, one for opening and one for closing. The rotor type gear limit switch shall have two normally open and two normally closed contacts per rotor. Gear limit switches must be geared to the driving mechanism and in step at all times whether in motor or manual operation. Provision shall be made for two additional rotors as described above, each to have two normally open and two normally closed contacts. Each valve controller shall be equipped with a double torque switch. The torque switch shall be adjustable and will be responsive to load encountered in either direction of travel. It shall operate during the complete cycle without auxiliary relays or devices to protect the valve, should excessive load be met by obstructions in either direction of travel. The torque switch shall be provided with double-pole contacts.

5. A permanently mounted handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operations, but must be responsive to manual operation at all times except when being electrically operated. The motor shall not rotate during hand operation nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve operator will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. This movement from motor operation to handwheel operation shall be accomplished by a positive

declutching lever which will disengage the motor and motor gearing mechanically, but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running. The gear limit switches and torque switches shall be housed in a single easily accessible compartment integral with the power compartment of the valve control. All wiring shall be accessible through this compartment. Stepping motor drives will not be acceptable.

6. The motor with its control module must be capable of continuously modulating over its entire range without interruption by heat protection devices. The system, including the operator and control module must be able to function, without override protection of any kind, down to zero dead zone.

7. All units shall have strip heaters in both the motor and limit switch compartments.

8. The actuator shall be equipped with open-stop-close push buttons, an auto-manual selector switch, and indicating lights, all mounted on the actuator or on a separate locally mounted power control station.

9. The electronics for the electric operator shall be protected against temporary submergence.

10. Actuators shall be Limitorque L120 with Modutronic Control System containing a position transmitter with a 4-20MA output signal or equal.

D. Motor Actuators (Open-Close)

1. The electronic motor-driven valve actuator shall include the motor, actuator gearing, limit switch gearing, limit switches, torque switches, fully machined drive sleeve, declutch lever, and auxiliary handwheel as a self-contained unit.

2. The motor shall be specifically designed for valve actuator service and shall be of high torque totally enclosed, nonventilated construction, with motor leads brought into the limit switch compartment without having external piping or conduit box.

   (a) The motor shall be of sufficient size to open or close the valve against maximum differential pressure when voltage to motor terminals is 10% above or below nominal voltage.

   (b) The motor shall be prelubricated and all bearings shall be of the anti-friction type.

3. The power gearing shall consist of helical gears fabricated from heat treated steel and worm gearing. The worm shall be carburized and hardened alloy steel with the threads ground after heat treating. The worm gear shall be of alloy bronze accurately cut with a hobbing machine. All power gearing shall be grease lubricated. Ball or roller bearings shall be used throughout.

4. Limit switches and gearing shall be an integral part of the valve actuator. The switches shall be of the adjustable rotor type capable of being adjusted to trip at any point between fully opened valve and fully closed valve. Each valve controller shall be provided with a minimum of two rotor type gear limit switches, one for opening and one for closing (influent valves require additional contacts to allow stopping at an intermediate position). The rotor type gear limit switch shall have two normally open and two normally closed contacts per toro. Additional switches shall be provided if shown on the control and/or instrumentation diagrams. Limit switches shall be geared to the driving mechanism and in step at all times whether in motor or manual operation. Each valve actuator shall be equipped with a double torque switch. The torque switch shall be adjustable and will be responsive to load encountered in either direction of travel. It shall operate during the complete cycle without auxiliary relays or devices to protect the valve should excessive load be met by obstructions in either direction of travel. Travel and thrusts shall be independent of wear in valve disc or seat rings.

5. A permanently mounted handwheel shall be provided for manual operation. The handwheel shall not rotate during electric operation except when being electrically operated. The motor shall not rotate during hand operation, nor shall a fused motor prevent manual operation. When in manual operating position, the unit will remain in this position until motor is energized at which time the valve actuator will automatically return to electric operation and shall remain in motor position until handwheel operation is desired. Movement from motor operation to handwheel operation shall be accomplished by a positive declutching lever which will disengage the motor and motor gearing mechanically, but not electrically. Hand operation must be reasonably fast. It shall be impossible to place the unit in manual operation when the motor is running.

6. Valve actuators shall be equipped with an integral reversing controller and three phase overload

relays, Open-Stop-Close push buttons, local-remote-manual selector switch, control circuit transformer, three-phase thermal overload relays and two pilot lights in a NEMA 4X enclosure. In addition to the above, a close coupled air circuit breaker or disconnect switch shall be mounted and wired to the valve input power terminals for the purpose of disconnecting all underground phase conductors.

7. The valve actuator shall be capable of being controlled locally or remotely via a selector switch integral with the actuator. In addition, an auxiliary dry contact shall be provided for remote position feedback.

8. Valve A.C. motors shall be designed for operation on a 480 volt, 3-phase service. Valve control circuit shall operate from a fuse protected 120 volt power supply.

9. Motor operators shall be as manufactured by Limitorque Corporation, Type L120 or approved equal.

2.07 AIR RELEASE VALVES

The air release valves for use in water or force mains shall be installed as shown on the Drawings. The valves shall have a cast iron body cover and baffle, stainless steel float, bronze water diffuser, Buna-N or Viton seat, and stainless steel trim. The fittings shall be threaded. The air release valves shall be Model 200A or 400A as manufactured by APCO Valve and Primer Corporation, Schaumburg, Illinois; or approved equal.

2.08 VALVE BOXES

1. Buried valves shall have cast-iron three piece valve boxes or HDPE adjustable valve boxes. Cast iron valve boxes shall be provided with suitable heavy bonnets and shall extend to such elevation at or slightly above the finished grade surface as directed by the Engineer. The barrel shall be two-piece, screw type, having a 5-1/4 inch shaft. The upper section shall have a flange at the bottom with sufficient bearing area to prevent settling and shall be complete with cast iron covers. Covers shall have “WATER”, “SEWER”, or “RECLAIM”, as applicable, cast into the top.

2. All valves shall have actuating nuts extended to within four (4) feet of the top of the valve box. All valve extensions will have a centering guide plate two (2) inches maximum below the actuating nut. The valve extension shall be fastened to the existing nut with a set screw. Valve boxes shall be provided with a concrete base and a valve nameplate engraved with lettering 1/8-

inch deep as shown on the Drawings.

3. HDPE adjustable valve boxes shall be one complete assembled unit composed of the valve box and extension stem. All moving parts of the extension stem shall be enclosed in a housing to prevent contact with the soil. Valve box assembly shall be adjustable to accommodate variable trench depths.

4. The entire assembly shall be made of heavy wall high density polyethylene. All exterior components shall be joined with stainless steel screws. The valve box top section shall be adaptable to fit inside a valve box upper section.

5. The stem assembly shall be of a telescoping design that allows for variable adjustment length. The stem material shall be of plated steel square tubing. The stem assembly shall have a built-in device that keeps the stem assembly from disengaging at its fully extended length. The extension stem must be torque tested to 1000 foot pounds. Covers shall have “WATER”, “SEWER” or “RECLAIMED” clearly and permanently impressed into the top surface.

2.09 CORPORATION COCKS

Corporation cocks for connections to cast-iron, ductile iron or steel piping shall be all brass or bronze suitable for 180 psi operating pressure and similar to Mueller Co. H-10046 or approved equal by Clow Corp., and shall be of sizes required and/or noted on the Drawings.

2.10 FLANGE ADAPTER COUPLINGS

Flange adapter couplings shall be of the size and pressure rating required for each installation and shall be suitable for use on either cast iron or ductile iron pipe. They shall be similar or approved equal to Dresser Company, Style 128. All couplings shall have a sufficient number of factory installed anchor studs to meet or exceed a minimum test pressure rating of 230 psi minimum.

2.11 FLEXIBLE COUPLINGS

Flexible couplings shall be either the split type or the sleeve type as shown on the Drawings.

1. Split type coupling shall be used with all interior piping and with exterior pipings noted on the Drawings. The couplings shall be mechanical type for radius groove piping. The couplings shall mechanically engage and lock grooved pipe ends in a positive couple and allow for angular deflection and contracting and expansion.

2. Couplings shall consist of malleable iron, ASTM

Specification A47, Grade 32510 housing clamps in two or more parts, a single chlorinated butyl composition sealing gasket with a "C" shaped cross-section and internal sealing lips projecting diagonally inward, and two or more oval track head type bolts with hexagonal heavy nuts conforming to ASTM Specification A 183 and A194 to assemble the housing clamps. Bolts and nuts shall be hot dipped galvanized after fabrication.

3. Victualic type couplings and fittings may be used in lieu of flanged joints. Pipes shall be radius grooved as specified for use with the Victaulic couplings. Flanged adapter connections at fittings, valves, and equipment shall be Victaulic Vic Flange Style 741, equal by Gustin-Bacon Group, Division of Certain-Teed Products, Kansas City, Kansas, or approved equal.

4. Sleeve type couplings shall be used with all buried piping. The couplings shall be of steel and shall be Dresser Style 38 or 40, as shown on the Drawings, or equal. The coupling shall be provided with hot dipped galvanized steel bolts and nuts unless indicated otherwise.

5. All couplings shall be furnished with the pipe stop removed.

6. Couplings shall be provided with gaskets of a composition suitable for exposure to the liquid within the pipe.

7. If the Contractor decides to use victaulic couplings in lieu of flanged joints, he shall be responsible for supplying supports for the joints.

2.12 HOSE BIBS

Hose bibs shall be 3/4" or 1" brass, polished chromium plated brass, with vacuum breaker as noted on the drawings.

2.13 SLOW CLOSING AIR AND VACUUM VALVES

A. The Contractor shall furnish and install slow closing air and vacuum valves as shown on the Drawings which shall have two (2) independent valves bolted together. The air and vacuum valve shall have all stainless steel float, guided on both ends with stainless shafts. The air and vacuum valve seat shall be Buna-N to insure drop tight closure. The Buna-N seat shall be fastened to the cover stainless shoulder screws in a manner to prevent distortion of the seat. The float shall be guided at both ends with stainless steel bushings.

B. The valve cover shall have a male lip designed to fit into the body register for accurate alignment of the

float into the Buna-N seat. The valve cover shall have 250-pound class flanged outlet connection.

C. The surge check valve shall be bolted to the inlet of the air and vacuum valve and consist of a body, seat, disc, and compression spring. A surge check unit shall operate on the interphase between the kinetic energy and relative velocity flows of air and water, so that after air passes through, and water rushes into the surge check, the disc starts to close, reducing the rate of flow of water into the air valve by means of throttling orifices in the disc to prevent water hammer in the air valves. The surge check orifices must be adjustable type for regulation in the field to suit operating conditions. Valve shall be rated for 250-pound class working pressure.

D. The complete slow closing air and vacuum valve with air release valve shall have been flow tested in the field, substantiated with test data to show reduction of surge pressure in the valve. Flow test data shall be submitted with initial shop drawings for approval.

E. Valve exterior to be painted Red Oxide, Phenolic TT-P86, Primer or approved equal for high resistance to corrosion.

F. All materials of construction shall be certified in writing to conform to ASTM specifications as follows:

Air Valve Cover, Body, and Surge Check Body	Cast Iron	ASTM A48, Class 30
Float	Stainless Steel	ASTM A240
Surge Check Seat and Disc	Stainless Steel	ASTM A582
Air Valve Seat	Buna-N	
Spring	Stainless Steel	T302

2.14 SURGE ANTICIPATOR VALVES

A. Surge anticipator valves shall be furnished for the pumping systems as shown on the Drawings. The valve shall be hydraulically operated, pilot controlled, and diaphragm or piston actuated. The main valve shall be cast iron conforming to ASTM A48 with bronze trim conforming to ASTM B61 and flanged ends conforming to ANSI B161.1. The main valve shall be globe type with a single removable seat and a resilient disc.

B. The diaphragm actuated valve shall have a stainless steel stem guided at both ends by a bearing in the valve cover and an integral bearing surface in the seat. No external

packing glands shall be permitted. The valve shall be fully serviceable without removing it from the line. The pilot system shall be of noncorrosive construction and provided with isolation cocks.

C. The piston actuated valve shall operate on the differential piston principle. The valve piston shall be guided on its outside diameter. The valve shall be able to operate in any position and shall be fully serviceable without removing it from the line. The pilot system shall be provided with isolation cocks, and be of noncorrosive materials of construction.

D. The valve shall be designed specifically to minimize the effects of water hammer, resulting from power failure at the pumping station, or from normal stopping and starting of pumping operators. The valve shall open hydraulically on a down surge, or low pressure wave created when the pump stops, remain open during the low pressure cycle in order to be open when the high pressure wave returns. The high pressure pilot shall be adjustable over a 20 to 200 psi range and the low pressure pilot shall be adjustable over a 15 to 75 psi range. The valve shall be the 250 Class.

2.15 CHECK VALVES

A. Check valves for cast iron and ductile iron pipe lines shall be swing type and shall meet the material requirements of AWWA Specification C508. The valves shall be iron body, bronze mounted, single disc, 175 psi working water pressure and nonshock. Valves shall be as manufactured by Mueller, Clow, American, Kennedy, M&H, or approved equal.

B. When there is no flow through the line, the disc shall hang lightly against its seat in practically a vertical position. When open, the disc shall swing clear of the waterway.

C. Check valves shall have bronze seat and body rings, extended bronze hinge pins and bronze nuts on the bolts of bolted covers.

D. Valves shall be so constructed that disc and body seat may easily be removed and replaced without removing the valve from the line. Valves shall be fitted with an extended hinge arm with outside lever and weight. Weights provided and approved by the Engineer shall be installed.

2.16 HYDRANTS

Hydrants shall be AVK Series 27 DRX Barrel (nostalgic style with stainless steel bolts) Kennedy Type K-81, American Darling B-84-B or Mueller Super Centurian A423, or approved equal and shall conform to the "Standard Specification for Fire Hydrants for Ordinary Water Works

Service", AWWA C502, and UL/FM certified, and shall in addition meet the specific requirements and exceptions which follow:

1. Hydrants shall be according to manufacturer's standard pattern and of standard size, and shall have one 4-1/2" steamer nozzle and two 2-1/2" hose nozzles.

2. Hydrant inlet connections shall have mechanical joints for 6" ductile-iron pipe.

3. Hydrant valve opening shall have an area at least equal to that area of a 5-1/4" minimum diameter circle and be obstructed only by the valve rod. Each hydrant shall be able to deliver 500 gallons minimum through its two 2-1/2" hose nozzles when opened together with a loss of not more than 2 psi in the hydrants.

4. Each hydrant shall be designed for installation in a trench that will provide 5-ft. cover.

5. Hydrants shall be hydrostatically tested as specified in AWWA C502.

6. Hydrants shall be rated at 200 psi.

7. All nozzle threads shall be American National Standard.

8. Each nozzle cap shall be provided with a Buna N rubber washer.

9. Hydrants shall be so arranged that the direction of outlets may be turned 90 degrees without interference with the drip mechanism and without the mechanism obstructing the discharge from any outlet.

10. Hydrants must be capable of being extended without removing any operating parts.

11. Hydrants shall have bronze-to-bronze seatings as per AWWA C502-85.

12. Hydrant main valve closure shall be of the compression type opening against the pressure and closing with the pressure. The resilient seat material shall meet the requirements of AWWA C-509 and shall preferably be EPDM Elastomer.

13. Internal and below ground iron parts (bonnet, nozzle section and base) shall have a fusion bonded epoxy coating per AWWA C550. Aboveground external hydrant parts (cap, bonnet and nozzle section) shall be either epoxy coated together with a UV resistant polyester coating or have two shop coats

of paint per AWWA C502. The lower stand pipe or barrel shall be protected with asphaltic coatings per AWWA C502.

14. Exterior nuts, bolts and washer shall be stainless steel. Bronze nuts may be used below grade.

15. All internal operating parts shall be removable without requiring excavation.

2.17 RESTRAINING CLAMPS

Restraining clamp assemblies as detailed in the drawings for use at hydrant connections to water mains, or at fittings where shown on the Drawings, shall be as manufactured by American Cast Iron Pipe, Star Pipe Products, U.S. Pipe; or approved equal.

2.18 TAPPING SLEEVES AND GATE VALVES

A. Tapping valves shall meet the requirement of AWWA C500. The valves shall be flanged, shall be mechanical joint outlet with nonrising stem, designed for vertical burial and shall open left or counterclockwise. Stuffing boxes shall be the "O-ring" type. Operating nut shall be AWWA Standard 2" square for valves 2" and up. The valves shall be provided with an overload seat to permit the use of full size cutters. Gaskets shall cover the entire area of flange surfaces and shall be supplied with EPDM wedges up to 30" diameter.

B. Tapping sleeves and saddles shall seal to the pipe by the use of a confined "O" ring gasket, and shall be able to withstand a pressure test of 180 psi for one hour with no leakage in accordance with AWWA C110, latest edition. A stainless steel 3/4" NPT test plug shall be provided for pressure testing. All bolts joining the two halves shall be stainless steel and shall be included with the sleeve or saddle. Sleeves and saddles shall be protected from corrosion by being fusion applied epoxy coated, or be made of 18-8 Type 304 stainless steel. Saddle straps shall be 18-8 Type 304 stainless steel.

2.19 SINGLE ACTING ALTITUDE VALVES

A. Function

1. The altitude control valve shall be of the single acting type, closing off tightly when the water reaches the maximum predetermined level in the tank to prevent overflow; and opening to permit replenishing of the tank supply when the water level drops approximately 6" to 12" below the maximum level.

2. A hand operated valve in the power water line to the top of the piston shall permit adjustment of the speed of valve closing. The tank water level

control shall be by means of a diaphragm operated, spring loaded, three way pilot which directs power water to or from the top of the main valve piston. The three way pilot shall be of bronze construction. The diaphragm surface exposed to the tank head shall be not less than 57 sq. inches. It shall be possible to adjust the spring above the diaphragm for water level control approximately 20% above or below the factory setting.

B. Description

1. The main valve shall operate on the differential piston principle such that the area on the underside of the piston is no less than the pipe area on the upper surface of the piston is of a greater area than the underside of the piston.

2. The valve piston shall be guided on its outside diameter by long stroke stationary Vee ports which shall be downstream of the seating surface to minimize the consequences of throttling. Throttling shall be done by the valve Vee ports and not the valve seating surfaces.

3. The valve shall be capable of operating in any position and shall incorporate only one flanged cover at the valve top from which all internal parts shall be accessible. There shall be no stems, stem guides, or spokes within the waterway. There shall be no springs to assist the valve operation.

C. Construction

1. The valve body shall be of cast iron ASTM A-126 with flanges conforming to the latest ANSI Standards. The valve shall be extra heavy construction throughout. The valve interior trim shall be bronze B-62 as well as the main valve operation.

2. The valve seals shall be easily renewable while no diaphragm shall be permitted within the main valve body.

3. All controls and piping shall be of non-corrosive construction.

4. A visual valve position indicator shall be provided for observing the valve piston position at any time.

D. Figure Number

The valves shall be the 20" Globe type (Fig. 3200-D) as manufactured by GA Industries of Mars, Pennsylvania, or approved equal.

PART 3 EXECUTION

3.01 INSTALLATION

A. All valves and appurtenances shall be installed in the location shown, true to alignment and rigidly supported. Any damage occurring to the above items before they are installed shall be repaired to the satisfaction of the Engineer.

B. After installation, all valves and appurtenances shall be tested at least two hours at the working pressure corresponding to the class of pipe, unless a different test pressure is specified. If any joint proves to be defective, it shall be repaired to the satisfaction of the Engineer.

C. Install all floor boxes, brackets, extension rods, guides, the various types of operators and appurtenances as shown on the Drawings that are in masonry floors or walls, and install concrete inserts for hangers and supports as soon as forms are erected and before concrete is poured. Before setting these items, the Contractor shall check all plans and figures which have a direct bearing on their location and he shall be responsible for the proper location of these valves and appurtenances during the construction of the structures.

D. Pipe for use with flexible couplings shall have plain ends as specified in the respective pipe sections.

E. Flanged joints shall be made with high strength, low alloy Corten bolts, nuts and washers. Mechanical joints shall be made with mild corrosion resistant alloy steel bolts and nuts. All exposed bolts shall be painted the same color as the pipe. All buried bolts and nuts shall be heavily coated with two (2) coats of bituminous paint comparable to Inertol No. 66 Special Heavy.

F. Prior to assembly of split couplings, the grooves as well as other parts shall be thoroughly cleaned. The ends of the pipes and outside of the gaskets shall be moderately coated with petroleum jelly, cup grease, soft soap or graphite paste, and the gasket shall be slipped over one pipe end. After the other pipe has been brought to the correct position, the gasket shall be centered properly over the pipe ends with the lips against the pipes. The housing sections then shall be placed. After the bolts have been inserted, the nuts shall be tightened until the housing sections are firmly in contact, metal-to-metal, without excessive bolt tension.

G. Prior to the installation of sleeve-type couplings, the pipe ends shall be cleaned thoroughly for a distance of 8". Soapy water may be used as a gasket lubricant. A follower and gasket, in that order, shall be slipped over

each pipe to a distance of about 6" from the end.

H. Valve boxes with concrete bases shall be installed as shown on the Drawings. Mechanical joints shall be made in the standard manner. Valve stems shall be vertical in all cases. Place cast iron box over each stem with base bearing on compacted fill and the top flush with final grade. Boxes shall have sufficient bracing to maintain alignment during backfilling. Knobs on cover shall be parallel to pipe. Remove any sand or undesirable fill from valve box.

3.02 HYDRANTS

A. Hydrants shall be set at the locations designated by the Engineer and/or as shown on the Drawings and shall be bedded on a firm foundation. A drainage pit on crushed stone as shown on the Drawings shall be filled with gravel or crushed stone and satisfactorily compacted. During backfilling, additional gravel or crushed stone shall be brought up around and 6" over the drain port. Each hydrant shall be set in true vertical alignment and shall be properly braced. Concrete thrust blocks shall be placed between the back of the hydrant inlet and undisturbed soil at the end of the trench. Minimum bearing area shall be as shown on the plans. Felt paper shall be placed around the hydrant elbow prior to placing concrete. CARE MUST BE TAKEN TO INSURE THAT CONCRETE DOES NOT PLUG THE DRAIN PORTS. Concrete used for backing shall be as specified herein.

B. When installations are made under pressure, the flow of water through the existing main shall be maintained at all times. The diameter of the tap shall be a minimum of 2" less than the inside diameter of the branch line.

C. The entire operation shall be conducted by workmen thoroughly experienced in the installation of tapping sleeves and valves, and under the supervision of qualified personnel furnished by the manufacturer. The tapping machine shall be furnished by the Contractor if tap is larger than 12" in diameter.

D. The Contractor shall determine the locations of the existing main to be tapped to confirm the fact that the proposed position for the tapping sleeve will be satisfactory and no interference will be encountered such as the occurrence of existing utilities or of a joint or fitting at the location proposed for the connection. No tap will be made closer than 30" from a pipe joint.

E. Tapping valves shall be set in vertical position and be supplied with a 2" square operating nut for valves 2" and larger. The valve shall be provided with an oversized seat to permit the use of full sized cutters.

F. Tapping sleeves and valves with boxes shall be set vertically or horizontally as indicated on the Drawings

and shall be squarely centered on the main to be tapped. Adequate support shall be provided under the sleeve and valve during the tapping operation. Sleeves shall be no closer than 30" from water main joints. Thrust blocks shall be provided behind all tapping sleeves. Proper tamping of supporting earth around and under the valve and sleeve is mandatory. After completing the tap, the valve shall be flushed to ensure that the valve seat is clean.

3.03 SHOP PAINTING

Ferrous surfaces of valves and appurtenances shall receive a coating of rust-inhibitive primer. All pipe connection openings shall be capped to prevent the entry of foreign matter prior to installation.

3.04 FIELD PAINTING

All metal valves and appurtenances specified herein and exposed to view shall be painted.

3.05 INSPECTION AND TESTING

Completed pipe shall be subjected to hydrostatic pressure test for two hours at 180 psi. All leaks shall be repaired and lines retested as approved by the Engineer. Prior to testing, the pipelines shall be supported in an approved manner to prevent movement during tests.

END OF SECTION

SECTION 02999

MISCELLANEOUS WORK AND CLEANUP

PART 1 GENERAL

1.01 SCOPE OF WORK

A. This Section includes items and operations which are not specified in detail as separate items, but may be sufficiently described as to the kind and extent of work involved. The Contractor shall furnish all labor, materials, equipment and incidentals necessary to complete all work under this Section.

B. The work of this Section may include, but is not limited to the following:

1. Restoration of roads, sidewalks, driveways, curbing and gutters, fences, guardrails, lawns, shrubbery and any other existing items damaged or destroyed.

2. Crossing utilities.

3. Relocation of existing water, reclaim water, or sewer lines less than four inches diameter, water and sanitary sewer services, low pressure gas lines, telephone lines, electric lines, cable TV lines as shown on the Contract Drawings.

4. Restoring easements (servitudes) and rights-of-way.

5. Clean up.

6. Incidental work (project photographs, testing, shop drawings, traffic control, record drawings, etc.).

7. Excavation and Embankment - As defined in the Florida Department of Transportation Standard Specifications for Road and Bridge Construction (1991 Edition or latest revision).

1.02 SUBMITTAL OF LUMP SUM BREAKDOWN

Contractor shall submit to the Owner/Engineer, a breakdown of the lump sum bid for Miscellaneous Work and Cleanup Item in the Proposal within 10 days after date of Notice to Proceed.

1.03 WORK SPECIFIED UNDER OTHER SECTIONS

All work shall be completed in a workmanlike manner by competent workmen in full compliance with all applicable sections of the Contract Documents.

PART 2 PRODUCTS

2.01 MATERIALS

Materials required for this Section shall equal or exceed materials that are to be restored. The Contractor may remove and replace or reuse existing materials with the exception of paving.

PART 3 EXECUTION

3.01 RESTORING OF ROADS, CURBING, FENCES AND GUARDRAILS

A. The Contractor shall protect existing curbing. If necessary, curbing shall be removed from joint to joint and replaced after backfilling. Curbing damaged during construction because of the Contractor's negligence or convenience, shall be replaced with curbing of equal quality and dimension at no cost to the Owner.

B. At the locations necessary for the Contractor to remove, store and replace existing fences and guardrails during construction, the sections removed shall be only at the direction of the Engineer. If any section of fence is damaged due to the Contractor's negligence, it shall be replaced at no cost to the Owner with fencing equal to or better than that damaged and the work shall be satisfactory to the Engineer.

C. Guardrails in the vicinity of the work shall be protected from damage by the Contractor. Damaged guardrails shall be replaced in a condition equal to those existing.

D. Road crossings shall be restored in accordance with the Contract Documents and current FDOT Standards. Compensation for road restoration shall be included under the Road Restoration Bid Item if specified or under Miscellaneous Cleanup if it is not specified.

3.02 CROSSING UTILITIES

This item shall include any extra work required in crossing culverts, water courses, drains, water mains and other utilities, including all sheeting and bracing, extra excavation and backfill, or any other work required or implied for the proposed crossing, whether or not shown on the Drawings.

3.03 RELOCATIONS OF EXISTING GAS LINES, TELEPHONE LINES, ELECTRIC LINES AND CABLE TV LINES

The Contractor shall notify the proper utility involved when relocation of these utility lines is required. The Contractor shall coordinate all relocation work by the utility so that construction shall not be hindered.

3.04 RESTORING THE EASEMENTS AND RIGHTS-OF-WAY

The Contractor shall be responsible for all damage to private property due to his operations. He shall protect from injury all walls, fences, cultivated shrubbery, pavement, underground facilities, including water, sewer and reclaimed water lines and services, or other utilities which may be encountered along the easement. If removal and replacement is required, it shall be done in a workmanlike manner, at his expense, so that the replacement are equivalent to that which existed prior to construction.

END OF SECTION

DIVISION 03
CONCRETE WORK

SECTION 03010

CONCRETE WORK

PART 1 GENERAL

1.01 DESCRIPTION OF WORK

The extent of concrete work is shown on the Drawings.

1.02 RELATED WORK

A. Section 01340 - Project Data, Samples and Shop Drawings

1.03 SUBMITTALS

A. Manufacturer's Data: For information only, submit manufacturer's specifications with application and installation instructions for proprietary materials and items, including reinforcement and forming accessories, admixtures, patching compounds, waterstops, joint systems, curing compounds and others as requested by the Engineer.

B. Shop Drawings: Submit shop drawings for fabrication, bending and placement of concrete reinforcement. Comply with ACI 315 showing bar schedules, stirrup spacing, diagrams of bent bars, arrangements of concrete reinforcement. Include special reinforcement required at openings through concrete structures.

C. Laboratory Test Reports: Submit laboratory test reports for concrete materials and mix design test as specified.

1.04 REFERENCE STANDARDS

Comply with the provisions of the following codes, specifications and standards, except as otherwise shown or specified:

A. ACI 301 "Specifications for Structural Concrete for Buildings"

B. ACI 305 "Hot Weather Concreting"

C. ACI 306 Standard Specification for Cold Weather Concreting"

D. ACI 311.4R "Guide for Concrete Inspection"

E. ACI 315 "Manual Of Standard Practice For Detailing Reinforced

Concrete Structures"

F. ACI 318 "Building Code Requirements for Reinforced Concrete"

G. ACI 347 "Recommended Practice for Concrete Formwork"

H. ACI 304 "Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete"

I. ACI 540R "Guide to Sealing Joints in Concrete Structures"

J. Concrete Reinforcing Steel Institute, “Manual of Standard Practice”

K. Where local building code requirements exist, comply with provisions of such codes, which are more stringent than the preceding codes and standards.

1.05 QUALITY ASSURANCE

A. Workmanship: The Contractor is responsible for correction of concrete work, which does not conform to the specified requirements, including strength, tolerances and finishes. Correct deficient concrete as approved by the Engineer. All defects shall be repaired to Owner's satisfaction.

B. Construction Tolerances

1. Variation from Grade: For grades shown for slabs, do not exceed 1/4 inch in 10 feet, 3/8 inch in 20 foot maximum, nor 3/4 inch in 40 feet or more.

2. Variation from Linear Building Line: For position shown in plan do not exceed 1/2 inch in 20 foot maximum, nor one inch in 40 feet or more.

3. Variation in Cross-Sectional Dimensions: For thickness of slabs, do not exceed minus 1/4 inch nor plus 1/2 inch.

1.06 TESTING AND MIX DESIGN

A. Testing Before Construction: Employ concrete testing laboratory, acceptable to the Owner, at Contractor's expense to perform material evaluation tests and to design concrete mixes.

B. Tests for Concrete Materials

1. Test aggregates by the methods of sampling and testing of ASTM C33.

2. For Portland cement, sample the cement and determine the properties by the

methods of test of ASTM C-150.

3. Certificates of material properties and compliance with specified requirements may be submitted in lieu of testing, when acceptable to the Engineer.

4. Proportioning and Design of Mixes

   a. Prepare design mixes for each type of concrete. Use an independent testing facility acceptable to the Owner for preparing and reporting proposed mix designs.

   b. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project for each class of concrete required, complying with ACI 211.1.

c. Submit written reports to the Engineer of each proposed mix for each class of concrete at least 15 days prior to start of work. Do not begin concrete production until mixes have been approved by the Engineer.

5. Laboratory Trial Batches

   a. When laboratory trial batches are used to select concrete proportions, prepare test specimens in accordance with ASTM C192 and conduct strength tests in accordance with ASTM C39, as specified in ACI 301.

   b. Establish a curve showing relationship between water-cement ratio (or cement content) and compressive strength with at least three points representing batches which produce strengths above and below that required. Use not less than three specimens tested at 28 days, or an earlier age when acceptable to the Engineer, to establish each point on the curve.

6. Field Experience Method

   a. When field experience methods are used to select concrete proportions, establish proportions as specified in ACI 301.

   b. Strength data for establishing standard deviation will be considered suitable if the concrete production facility has certified records consisting of at least thirty consecutive tests in one group or the statistical average for two groups totaling thirty or more tests, representing similar materials and projects conditions.

c. Standard Deviation: If standard deviation exceeds 600 psi or if no suitable records are available, select proportions to produce an average strength of at least 1200 psi greater than the required compressive strength of concrete.

d. After sufficient experience and test data become available from the job, using ACI214 methods of evaluation, the standard deviation may be reduced when the probable frequency of an average of three consecutive tests below required compressive strength will not exceed one in one hundred.

7. Adjustment to Concrete Mixes

a. Mix design adjustments may be requested by the Contractor when characteristics of materials, job conditions, weather, test results, or other circumstances warrant; at no additional cost to the Owner and as accepted by the Engineer.

b. Laboratory test data for revised mix designs and strength results must be submitted to and accepted by the Engineer before using in the work.

8. Compressive Strength: 4,000 PSI (minimum)

9. Admixtures: Use air-entraining admixture in all concrete, unless otherwise shown or specified. Add air-entraining admixture at the manufacturer's prescribed rate to result in concrete at the point of placement having air content by volume within the following limits:

a. 6% to 9% for maximum aggregate 1/2 inch and under.

b. 4% to 6% for maximum aggregate over 1/2 inch through 1-1/2 inch.

c. 2.5% to 4.5% for maximum aggregate over 1-1/2 inch.

10. Slump Limits: Proportion and design mixes to result in concrete slump at the point of placement as follows:

a. Ramps and Sloping Surfaces: Not more than 4 inches.

b. Reinforced Foundation Systems: Not less than 3 inches and not more than 5 inches.

c. All Other Concrete: Not less than 3 inches and not more than 6 inches.

11. Testing During Construction

    a. Employ at Owner's expense a testing laboratory.

    b. The following quality control testing is required during construction:

    c. Sampling Fresh Concrete: ASTM C172, except modified for slump to comply with ASTM C94.

    d. Slump: ASTM C143; one test for each concrete load at point of discharge; and one for each set of compressive strength test specimens; additional tests when concrete consistency seems to have changed.

    e. Compressive Strength: ASTM C39; one set of 4 standard cylinders (ASTM C31) for each 50 cubic yards or fraction thereof, of each concrete class placed in any one day or for each 5,000 square feet of surface area placed; 1 specimen tested at 7 days, 2 specimens tested at 28 days, and one specimen retained in reserve for later testing if required.

    f. When the total quantity of a given class of concrete is less than 50 cubic yards, or the quantity of concrete for any single structure is less than 10 cubic yards, the Engineer may waive compressive strength testing, but such action shall not relieve the Contractor from responsibility for furnishing concrete of the required strength.

    g. The strength level of concrete will be considered satisfactory if the averages of all sets of three consecutive strength test results equal or exceed the specified strength and no individual strength test result falls below the specified strength by more than 500 psi.

    h. Air Content: ASTM C231, pressure method or ASTM C173; one for each set of compressive strength test specimens.

    i. Additional Tests: When test results indicate specified concrete strengths and other characteristics have not been attained, perform additional testing to determine the extent to which deficiencies exist. Additional testing program is to be performed by a testing laboratory and acceptable to the Engineer. Where cored cylinders are utilized to determine adequacy of concrete, comply with ASTM C42. It is the Contractor's responsibility to pay for additional testing.

PART 2 PRODUCTS

2.01 FORM MATERIALS

A. Forms for Exposed Finish Concrete: Unless otherwise shown or specified, construct all formwork for exposed concrete surfaces with plywood, metal, metal-framed plywood-faced or other acceptable panel-type materials, to provide continuous, straight, smooth, exposed surfaces. Furnish in largest practicable sizes to minimize number of joints and to conform to joint system shown on Drawings. Provide form material with sufficient thickness to withstand pressure of newly-placed concrete without bow or deflection.

Where plywood is used in form-work, provide material complying with U.S. Product Standard PS-1 "A-C or B-B High Density Overlaid Concrete For", Class I, unless otherwise acceptable to Engineer.

B. Forms for Unexposed Finish Concrete: Form concrete surfaces which will be unexposed in finished structure with plywood, lumber, metal or other acceptable material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Form Coatings: Provide commercial formulation form- coating compounds that will not bond with, stain nor adversely affect concrete surfaces, and will not impair subsequent treatments of concrete surfaces.

2.02 REINFORCING MATERIALS

A. Reinforcing Bars: ASTM A615, Grade 60 unless otherwise shown.

B. Steel Wire: ASTM A82, plain, cold-drawn, steel.

C. Welded Wire Fabric: ASTM A185, welded steel wire fabric.

D. Supports for Reinforcement: Provide supports for reinforcement including 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 recommendations, unless otherwise specified. Solid precast concrete block may be used for supporting footing and foundation mats against earth material. Wood, clay, brick and other non-standard devices will not be acceptable.

1. For slabs-on-grade, use supports with sand plates or horizontal runners where base materials will not support chair legs.

2. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are plastic protected.

2.03 CONCRETE MATERIALS

A. Portland Cement: ASTM C150, Type II, unless otherwise acceptable to Engineer.

Use only one brand of cement throughout the project, unless otherwise acceptable to Engineer.

B. Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source for all exposed concrete.

1. Fine Aggregate: Clean, sharp, natural sand from loam, clay, lumps or other deleterious substances.

2. Coarse Aggregate: Clean, uncoated, crushed granite or similar hard stone processed from natural rock or stone, and containing no clay, mud, loam or foreign matter.

3. Maximum Aggregate Size: 1-1/4 inches.

C. Water: Clean, fresh, and safely drinkable by humans.

D. Air-Entraining Admixture: ASTM C260.

E. Fly Ash and Other Pozzodanic Materials: ASTM C618, Type C or Type F

2.04 RELATED MATERIALS

A. Grout: Ready mixed Portland cement, sand and water mixture conforming with materials and mix design of highest strength project-required concrete except for deletion of coarse aggregate.

B. Non-shrink Grout: Factory-premixed cementious material containing no corrosive material, which is non-shrink from time of placement and shows no expansion after final set when tested under ASTM C827, has an initial setting time of not less than 45 minutes, has a 24 hour compressive strength of not less than 4,000 psi under ASTM C109 for a trowelable mix, and is selected and applied in conformance with manufacturer's recommendations.

C. Waterstops: Provide flat, dumbbell type or center-bulb type waterstops at construction joints and other joints as indicated. Size to suit joints. Polyvinyl chloride as per CE CRD-C572.

D. Absorptive Cover: Burlap cloth made from jute or kenaf, weighing approximately nine ounces per square yard, complying with AASHTO M182, Class 2.

E. Moisture-Retaining Cover: One of the following, complying with ASTM C171.

1. Waterproof paper

2. Polyethylene film

3. Polyethylene-coated burlap

F. Membrane-Forming Curing Compound: ASTM C309, Type 1 unless other acceptable to Engineer.

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

2.05 CONCRETE MIXING

A. Ready-Mix Concrete: Comply with the requirements of ASTM C94, and as herein specified.

B. During hot weather, or under conditions contributing to rapid setting of concrete, a shorter mixing time than specified in ASTM C94 may be required.

C. When the air temperature is between 85oF and 90oF, reduce the mixing and delivery time from 1-1/2 hours to 75 minutes, and when the air temperature is above 90oF, reduce the mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.01 FORMS

A. Design, erect, support, brace and maintain formwork to support vertical and lateral loads that might be applied until such loads can be supported by the concrete structure. Construct formwork so concrete members structures are of correct size, shape, alignment, elevation and position.

B. Design formwork to be readily removable without impact, shock or damage to cast-in-place concrete surfaces and adjacent materials.

C. Construct forms complying with ACI 347, to sizes, shapes, lines and dimensions shown, and to obtain accurate alignment, location, grades, level and plumb work in finished structures. Provide for openings, offsets, sinkages, keyways, recesses,

moldings, rustications, reglets, chamfers, blocking, screeds, bulkheads, anchorages and inserts, and other features required in work. Use selected materials to obtain required finishes. Solidly butt joints and provide back-up at joints to prevent leakage of cement paste.

D. Fabricate forms for easy removal without hammering or prying against the concrete surfaces. Provide crush plates or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only. Kerf wood inserts for forming keyways, reglets, recesses, and the like, to prevent swelling and for easy removal.

E. Provide temporary openings where interior area of formwork is inaccessible for clean-out, for inspection before concrete placement, and for placement of concrete. Securely brace temporary openings and set tightly to forms to prevent loss of concrete mortar. Locate temporary openings on forms at inconspicuous locations.

F. Chamfer exposed corners and edges as shown, using wood, metal, PVC or rubber chamfer strips fabricated to produce uniform smooth lines and tight edge joints.

G. Form Ties: Factory-fabricated, adjustable-length, metal form ties, designed to prevent form deflection, to prevent spalling concrete surfaces upon removal, and to prevent passage of water along tie surface through concrete.

H. Provide ties so portion remaining within concrete is at least 1 inch inside concrete, and do not leave holes larger than one inch diameter in concrete surface.

I. 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.

J. Cleaning and Tightening: Thoroughly clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt or other debris just before concrete is placed. Retighten forms and bracing after concrete placement if required to eliminate mortar leaks and maintain proper alignment.

3.02 PLACING REINFORCEMENT

A. Comply with the specified codes and standards, and Concrete Reinforcing Steel Institute's recommended practice for "Placing Reinforcing Bars", for details and methods of reinforcement placement and supports, and as herein specified.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other materials, which reduce or destroy bond with concrete.

C. Accurately position, support and secure reinforcement against displacement by formwork, construction, or concrete placement operations. Locate and support reinforcing by chairs, runners, bolsters, spacers and hangers, as required.

D. Place reinforcement to obtain at least the minimum coverages 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.

E. Do not place reinforcing bars more than 2 inches beyond the last leg of continuous bar support. Do not use supports as bases for runways for concrete conveying equipment and similar construction loads.

F. Install welded wire fabric in lengths as long as practicable. Lap adjoining pieces at least one full mesh and lace splices with wire. Offset end laps in adjacent widths to prevent continuous laps in either direction.

3.03 JOINTS

A. Construction Joints: Locate and install necessary construction joints, which are not shown on the Drawings, so as not impair the strength and appearance of the structure, as acceptable to the Engineer.

B. Provide keyways in all construction joints in walls, slabs and between walls and footings; accepted bulkheads designed for this purpose may be used for slabs. Construct keyways 1-1/2 inches deep unless otherwise detailed.

C. Place construction joints perpendicular to the main reinforcement. Continue all reinforcement across construction joints, unless noted.

D. Waterstops: Provide waterstops in construction joints as indicated. Install waterstops to form a continuous diaphragm in each joint. Make provisions to support and protect waterstops during the progress of the work. Fabricate field joints in waterstops in accordance with manufacturer's printed instructions. Protect waterstop material from damage where it protrudes from any point.

E. Isolation Joints in Slabs-on-Ground: Construct isolation joints in slabs on ground as shown on the Drawings.

F. Control Joints in Slabs-on-Ground: Construct control joints in slabs-on-ground to form panels of patterns as shown. Use inserts 1/8 to 1/4 inch wide x 1/4 of the slab depth, unless otherwise shown.

G. Form control joints by inserting a pre-molded plastic, hardboard or fiberboard strip into the fresh concrete until the top surface of the strip is flush with the slab surface.

Tool slab edges round on each side of insert. After the concrete has cured, remove inserts and clean groove of loose debris.

3.04 INSTALLATION OF EMBEDDED ITEMS

A. General: Set and build into the work anchorage devices and other embedded items required for other work that is attached to, or supported by, cast-in-place concrete. Use setting drawings, diagrams, instructions and directions provided by suppliers of the items to be attached thereto.

B. Edge Forms and Screed Strips for Slabs: Set edge forms or bulkheads and intermediate screed strips for slabs to obtain the required elevations and contours in the finished slab surface. Provide and secure units sufficiently strong to support the types of screeds required. Align the concrete surface to the elevation of the screed strips by the use of strike-off templates or accepted compacting type screeds.

3.05 PREPARATION OF FORM SURFACES

A. Clean re-used forms of concrete matrix residue, repair and patch as required to return forms to acceptable surface condition. Coat the contact surfaces of forms with a form-coating compound before reinforcement is placed.

B. Thin form-coating compounds only with thinning agent of type, and in amount, and under conditions of the form-coating compound manufacturer's directions. Do not allow excess form-coating material to accumulate in the forms or to come into contact with concrete surfaces against which fresh concrete will be placed. Apply in compliance with manufacturer's instructions.

C. Coat steel forms with a non-staining, rust-preventative form oil or otherwise protect against rusting. Rust-stained steel formwork is not acceptable.

3.06 CONCRETE PLACEMENT

A. Pre-Placement Inspection: Before placing concrete, inspect and complete the formwork installation, reinforcing steel, and items to be embedded or cast-in. Notify other crafts to permit the installation of their work; cooperate with other trades in setting such work, as required. Moisten wood forms immediately before placing concrete, where form coatings are not used.

B. Coordinate the installation of joint materials and moisture barriers with placement of forms and reinforcing steel.

C. Construction Sequence: Before placing any concrete, complete blasting, heavy earthwork and other construction operations, which might cause damage to concrete structures.

D. General: Comply with ACI 304, and as herein specified. Deposit concrete continuously or in-layers of such thickness that no concrete will be placed on concrete, which has hardened sufficiently to cause the formation of seams or planes of weakness within the section. If a section cannot be placed continuously, provide construction joints as herein specified. Deposit concrete as nearly as practicable to its final location to avoid segregation due to rehandling or flowing.

E. Placing Concrete in Forms: Deposit concrete in forms in horizontal layers not 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.

F. Consolidate placed concrete by mechanical vibrating equipment supplemented by hand-spading, rodding or tamping. Use equipment and procedures for consolidation of concrete in accordance with ACI 309 recommended practices.

G. Do not use vibrators to transport concrete inside of forms. Insert and withdraw vibrators vertically at uniformly spaced locations not farther than the visible effectiveness of the machine. Place vibrators to rapidly penetrate the placed layer of concrete and at least 6 inches into the preceding layer. Do not insert vibrators into lower layers of concrete that have begun to set. At each insertion limit the duration of vibration to the time necessary to consolidate the concrete and complete embedment of reinforcement and other embedded items without causing segregation of the mix.

H. Placing Concrete Slabs: Deposit and consolidate concrete in a continuous operation, within the limits of construction joints, until the placing of a panel or section is completed.

I. Consolidate concrete during placing operations so that concrete is thoroughly worked around reinforcement and other embedded items and into corners.

J. Bring slab surfaces to the correct level with a straightedge and strike-off. Use bull floats or darbies to smooth the surface, leaving it free of humps or hollows. Do not disturb the slab surfaces prior to beginning finishing operations.

K. Maintain reinforcing in the proper position during concrete placement operations.

L. Cold Weather Placing: Protect concrete work from physical damage or reduced strength which could be caused by frost, freezing actions, or low temperatures, in compliance with ACI 306R and as herein specified.

M. Hot Weather Placing: When hot weather conditions exist that would seriously impair the quality and strength of concrete, place concrete in compliance with ACI

305R and as herein specified.

1. Cool ingredients before mixing to maintain concrete temperature at time of placement below 90oF. Mixing water may be chilled, or chopped ice may be used to control the concrete temperature provided the water equivalent of the ice is calculated to the total amount of mixing water.

2. Cover reinforcing steel with water-soaked burlap if it becomes too hot, so that the steel temperature will not exceed the ambient air temperature immediately before embedment in concrete.

3. Fog spray forms, reinforcing steel and sub-grade just before concrete is placed.

4. Do not use retarding admixtures without the written acceptance of the Engineer.

3.07 FINISH OF FORMED SURFACES

A. Concealed Surfaces: For formed concrete surfaces not exposed-to-view in the finished work, leave surface finish imparted by the form facing material used, with defective areas and form tie voids repaired and patched as specified, and fins and other projections exceeding 1/4 inch in height rubbed flush.

B. Visible Surfaces: For formed concrete surfaces expose-to-view, including those surfaces of water or other material holding structures visible when the structure is empty, or surfaces that are to be covered with a thin or flexible finish material bonded to the concrete, perform finish operations as specified above under "Concealed Surfaces", and in addition wet and rub entire surfaces with a carborundum stone of medium fineness until all form marks and other surface irregularities have been removed and a uniform surface appearance achieved. Do not create a plaster coating on concrete.

C. Unformed Visible Surfaces: At tops of walls, horizontal offsets and similar unformed surfaces occurring 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.

3.08 MONOLITHIC SLAB FINISHES

A. Float Finish: Apply float finish to monolithic slab surfaces that are to receive trowel finish and other finishes as hereinafter specified.

1. After screeding, consolidating and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has

disappeared or when concrete has stiffened sufficiently to permit operation of floats.

2. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units.

3. Check and level surface plane so that depressions between high spots do not exceed 6/16 inch under a 10 foot straightedge. Cut down high spots and fill low spots. Uniformly slope surfaces to drains.

4. Immediately after leveling, refloat surface to a uniform, smooth, granular texture.

B. Trowel Finish: Apply trowel finish to monolithic slab surfaces that are to be exposed-to-view, unless otherwise shown, and slab surfaces that are to be covered with resilient flooring, carpet, ceramic or quarry tile, paint or other thin film finish coating system.

1. After floating, begin the first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface.

2. Consolidate concrete surface by final hand- troweling operation, free of trowel marks, uniform in texture and appearance, and with a level surface plane so that depressions between high spots do not exceed 1/8 inch under a 10 foot straightedge.

3. Grind smooth surface defects which would telegraph through applied floor covering system.

C. Non-Slip Broom Finish: Apply non-slip broom finish to exterior concrete platforms, steps and ramps, and elsewhere as indicated.

1. Immediately after trowel finishing, slightly roughen concrete surface by brooming with fiber bristle broom perpendicular to main traffic route.

2. Coordinate required final finish with the Engineer before application.

3.09 CONCRETE CURING AND PROTECTION

A. General: Protect freshly placed concrete from premature drying, and excessive cold or hot temperature, and maintain without drying at a relatively constant temperature for a period of time necessary for hydration of cement and proper hardening.

1. Start initial curing as soon as free water has disappeared from concrete surface after placing and finishing. Weather permitting, keep continuously moist for not less than 7 days.

2. Begin final curing procedures immediately following initial curing and before concrete has dried. Continue final curing for at least seven days and in accordance with ACI 301 procedures. Avoid rapid drying at end of final curing period.

B. Curing Methods: Perform curing of concrete by one or more of the following methods as selected by the Contractor:

1. Moisture Curing

a. Provide moisture curing by covering concrete surface with specified absorptive cover, thoroughly saturating cover with water and keeping continuously wet. Place absorptive cover to provide coverage of concrete surfaces and edges, with 4 inch lap over adjacent absorptive cover.

b. Provide moisture-cover curing by covering concrete surfaces with moisture-retaining cover, 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 water-proof tape.

2. Membrane Curing

a. Provide membrane curing by applying compound to damp concrete surfaces as soon as film has disappeared. Apply uniformly in continuous operation by power-spray or roller equipment in accordance with manufacturer's directions. Recoat areas that are subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

b. Do not use membrane curing compounds on surfaces which are to be covered with a coating material applied directly to concrete or with a covering material bonded to concrete, such as other concrete, liquid floor hardener, waterproofing, dampproofing, membrane roofing, flooring, painting, and other coatings and finish materials, unless otherwise acceptable to the Engineer.

3. Curing Formed Surfaces: Cure formed concrete surfaces, including undersides of beams, supported slabs and other similar surfaces by moist

curing with forms in place for full curing period or until forms are removed. If forms are removed, continue curing by methods specified above, as applicable.

4. Curing Unformed Surfaces: Initially cure unformed surfaces, such as slabs, floor topping, and other flat surfaces by moist curing.

5. Final cure unformed surfaces, unless otherwise specified, by methods specified above, as applicable.

3.10 FORM REMOVAL

A. In all cases, time and sequence of concrete form removal is at Contractor discretion.

B. Formwork supporting weight of concrete, such as beams and slabs must remain in place at least 14 days and until concrete has attained minimum design 28 day compressive strength.

C. Formwork not supporting weight of concrete such as sides of beams, walls and columns, may be removed no sooner than 48 hours after placement of concrete or when concrete is sufficiently hard as not to be damaged by form removal operations.

3.11 RE-USE OF FORMS

A. Clean and repair surfaces of forms to be re-used in the work. Split, frayed, delaminated or otherwise damaged form facing material will not be acceptable. 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 lutein, and tighten forms to close joints. Align and secure joints to avoid offsets. Do not use "patched" forms for exposed concrete surfaces, except as acceptable to Engineer.

3.12 MISCELLANEOUS CONCRETE ITEMS

A. 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 herein specified, to blend with in-place construction. Provide other miscellaneous concrete filling shown or required to complete work.

B. Curbs: Provide monolithic finish to burbs by stripping forms while concrete is still green and steel-troweling surfaces to a hard, dense finish with corners, intersections and terminations slightly rounded.

C. 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 certified diagrams or templates of manufacturer furnishing machines and equipment.

D. Grout base plates and foundations as indicated, using specified non-shrink grout. Use non-metallic grout for exposed conditions, unless otherwise indicated.

3.13 CONCRETE SURFACE REPAIRS

A. Patching Defective Areas: Repair and patch defective areas with cement mortar immediately after removal of forms, but only when acceptable to Engineer. Cut out honeycomb, rock pockets, voids over 1/8 inch in any dimension and holes left by tie rods and bolts, down to solid concrete but, in no case to a depth of less than one inch. Make edges of cuts perpendicular to the concrete surface. Thoroughly clean, dampen with water and brush-coat the area to be patched with neat cement grout. Proprietary patching compounds may be used when acceptable to Engineer.

1. For exposed-to-view surfaces, blend white Portland cement and standard Portland cement so that, when dry, patching mortar will match color of surrounding surface. Provide test areas at inconspicuous location to verify mixture and color match before proceeding with patching. Compact mortar in place and strike-off slightly higher than surrounding surface.

2. Repair of Formed Surfaces: Remove and replace concrete having defective surfaces if defects cannot be repaired to satisfaction of Owner. Surface defects, as such, include color and texture irregularities, cracks, spalls, air bubbles, honeycomb, rock pockets and holes left by tie rods and bolts; fins and other projections on surface; and stains and other discolorations that cannot be removed by cleaning. Flush out form tie holes, fill with dry pack mortar, or precast cement core plugs secured in place with bonding agent.

3. Repair concealed formed surfaces, where possible, that contain defects that adversely affect the durability of the concrete. If defects cannot be repaired, remove and replace the concrete.

4. Repair of Unformed Surfaces: Test unformed surfaces, such as monolithic slabs, for smoothness and to verify surface plane to tolerances specified for each surface and finish. Correct low and high areas as herein specified. Test unformed surfaces sloped to drain for trueness of slope, in addition to smoothness, using a template having a required slope.

5. Repair finished unformed surfaces that contain defects which adversely affect durability of concrete. Surface defects, as such, include crazing, cracks in excess of 0.01 inch wide or which penetrate to reinforcement or completely

through non-reinforced sections regardless of width, spalling, pop-outs, honeycomb, rock pockets, and other objectionable conditions.

6. Correct high areas in unformed surfaces by grinding, after concrete has cured at least 14 days.

7. Correct low areas in unformed surfaces during, or immediately after completion of surface finishing operations by cutting out low areas and replacing with fresh concrete. Finish repaired areas to blend into adjacent concrete. Proprietary patching compounds may be used when acceptable to the Engineer.

8. Repair defective areas, except random cracks and single holes not exceeding one inch diameter, by cutting out and replacing with fresh concrete. Remove defective areas to sound concrete 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 brush with a neat cement grout coating or concrete bonding agent. Place patching concrete before grout takes its initial set. Mix patching concrete of same materials to provide concrete of the same type or class as original concrete. Place, compact and finish to blend with adjacent finished concrete. Cure in the same manner as adjacent concrete.

9. Repair isolated random cracks and single holes not over one inch in diameter by dry-pack method. Groove top of cracks and cut-out holes to sound concrete and clean of dust, dirt and loose particles. Dampen cleaned concrete surfaces and brush with neat cement grout coating or concrete bonding agent. Place dry-pack before cement grout takes its initial set. Mix dry-pack, consisting of one part Portland cement to 2½ parts fine aggregate passing a No. 16 mesh sieve, using only enough water as required for handling and placing. Compact dry-pack mixture in place and finish to match adjacent concrete. Keep patched areas continuously moist for not less than 72 hours.

10. Repair methods not specified above may be used, subject to acceptance of Engineer.

B. Agreement by the Engineer to permit repair or patching of concrete does not waive the Owner's authority to require complete removal and replacement of defective concrete pours should the patch not prove satisfactory to the Owner, due either to deficiency in strength, function or appearance.

END OF SECTION

DIVISION 05
METALS

SECTION 05500

MISCELLANEOUS METALS

PART 1 - GENERAL

1.01 SCOPE OF WORK

Furnish all labor, material, equipment, and incidentals required to install all miscellaneous metal as shown on the Drawings and specified herein.

1.02 RELATED WORK

A. Section 03010 – Concrete Work

B. Division 11 - Equipment

1.03 SUBMITTALS

A. Manufacturer's literature describing standard items.

B. Shop drawings showing materials, sizes, finishes, locations, attached hardware and fittings, and details for manufactured items and fabricated metalwork, including field erection details showing cuts, copes, connections, holes, thread fasteners and welds. Indicate welds, both shop and field, by symbols conforming to AWS standards. Indicate coatings or other protection against corrosion. Submittals in accordance with Section 01340, Shop Drawings, Project Data, and Samples.

C. Setting diagrams, erection plans, templates and directions for installation of backing plates, anchors, and other such similar items.

D. Material compliance certification with standards designated.

1.04 REFERENCE STANDARDS

A. Aluminum Association

1. AA 5052 - Aluminum Sheet and Plate, Rolled Rod and Bar and Drawn Tube

2. AA 6061 T6 - Aluminum Sheet and Plate

3. AA 6061 T5 - Aluminum Extruded Shapes

4. AA 6063 T6 - Aluminum Extruded Pipe

5. AA 5005 - Sheet and Plate

6. Finishes

   a. AA M31 - Mechanical Finish, Fine Satin
   b. AA C22 - Chemical Finish, Medium Matte
   c. AA A41 - Clear Anodic Coating, Class I

B. American Iron and Steel Institute (AISI)

1. AISI, Type 316 Stainless Steel Bolts, Bars and Shapes

2. AISI, Type 316 Stainless Steel Plate and Sheet

C. American National Standards Institute (ANSI)

1. ANSI A14.3 - Safety Requirement for Fixed Ladders

D. American Society for Testing and Materials (ASTM)

1. ASTM A36 - Specification for Structural Steel

2. ASTM A48 - Specification for Gray Iron Castings

3. ASTM A53 - Specification for Pipe, Steel, Black and Hot Dipped, Zinc Coated Welded and Seamless

4. ASTM A123 - Specification for Zinc (Hot Galvanized) Coatings on Iron and Steel Products

5. ASTM A153 - Specification for Zinc Coated (Hot Dip) on Iron and Steel Hardware

6. ASTM A167 - Standard Specification for Stainless and Heat Resisting Chromium - Nickel Steel Plate, Sheet, and Strip.

7. ASTM A269 - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service.

8. ASTM A276 - Standard Specification for Stainless and Heat-Resisting Steel Bars and Shapes.

9. ASTM A307 - Specification for Carbon Steel Externally Threaded Standard Fasteners

10. ASTM A312 - Standard Specification for Seamless and Welded Austenitic Stainless Pipe.

11. ASTM A325 - Specification for High-Strength Bolts for Structural Steel Joints

12. ASTM A366 - Standard Specification for Steel, Carbon, Cold-Rolled Sheet, Commercial Quality.

13. ASTM A611 - Specification for Steel, Cold-Rolled Sheet, Carbon, Structural

14. ASTM A653 - Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process

15. ASTM B26 - Standard Specification for Aluminum-Alloy and Castings.

16. ASTM B209 - Specification for Aluminum and Aluminum-Alloy Sheet and Plate

17. ASTM B211 - Standard Specification for Aluminum-Alloy Bar, Rod, and Wire.

18. ASTM B221 - Specification for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes

19. ASTM B241 - Standard Specification for Aluminum Alloy Seamless Pipe and Seamless Extruder Tube.

20. ASTM B429 - Specification for Aluminum-Alloy Extruded Structural Pipe and Tube

E. American Welding Society (AWS)

1. AWS “Structural Welding Code”, D1.1

2. AWS Specification for Arc Welding (Type E70XX) Welding Rods for Steel

F. ASME International (ASME)

1. ASME B18.2.1 Square and Hex Bolts and Screws Inch Series

G. SSPC: The Society of Protective Coatings (SSPC)

1. SSPC – Paint 20 – Paint Specification No. 20 Zinc-Rich Primers (Type I, "Inorganic" and Type II, "Organic")

H. National Fire Protection Association (NFPA)

1. 101 Life Safety Code

1.05 QUALITY ASSURANCE

A. The work of this section shall be completely coordinated with the work of other Sections. Verify at the site both the dimensions and work of other trades adjoining items of work in this section before fabrication and installation of items herein specified.

B. Furnish to the pertinent trades all items included under this section that are to be built into the work of other sections.

1.06 DELIVERY, STORAGE AND HANDLING

A. Identify and match-mark all materials, items and fabrications, for installation and field assembly.

B. Deliver items to job-site as complete units, wherever practicable, ready for installation or erection, with all anchors, hangers, fasteners and miscellaneous metal items required for installation.

C. Carefully handle and store materials, protected from weather, rusting and other damage.

D. Store structural shapes, pipes, tubes and sheets off the ground on suitable supports, with webs or flanged shapes vertical.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Shapes and Plates

1. Steel: ASTM A36

2. Nuts, Bolts, Rivets, Washers, and Anchorage Devices: ASTM A325 and AISC Specification referenced under Part 1.

3. Steel Sheets: Cold-rolled or hot-rolled carbon steel, ASTM A366, or ASTM A569.

4. Steel Pipe: ASTM A53, Standard Specifications for Pipe, Steel, Black and, Zinc-Coated, Welded and Seamless; Type S, Grade B, Schedule 40, black finish.

B. High-Strength, Low Alloy Corrosion - Resistant Steel:

1. Plates, shapes, and bars: ASTM A242 or A588.

2. Sheet and strip ASTM A606 Type A.

C. Stainless Steel

1. Type 316 unless otherwise indicated or specified.

2. Shapes and Bars: ASTM A276.

3. Plate, Sheet, and Strip: ASTM A167.

4. Tubing: ASTM A269.

5. Pipe: ASTM A312, Schedule 40S.

D. Aluminum

1. Plates, rolled or extruded shapes, sheets or castings conforming (unless otherwise permitted or indicated) to Aluminum Association alloy and temper designations.

2. Rolled structural shapes and plates 6061-T6.

3. Extruded structural shapes 6063-T5.

4. Castings 214.

5. Sheets Alclad 3003-H14 and 3003.

6. Bolts and nuts 2024-T4.

7. Pipe railings Schedule 40, ASTM, B241, 6063-T6.

8. Finishes (pipe railings only) - NAAMM AA-C22-A41 coating.

E. Fasteners: Provide hot-dip galvanized or stainless steel fasteners for exterior use of where built into exterior walls and pillars. Select fasteners for the type, grade, and

class required per the approval of the Engineer. Refer to Paragraph 2.2 for specific material requirements for anchors, bolts, and other fastening devices.

1. Bolts and nuts: Regular hexagon head type, ASTM A307, Grade A.

2. Lag bolts: Square head type, FS FF-B-561.

3. Machine screws: Steel, FS FF-S-92.

4. Masonry and concrete anchorage devices: Expansion shields FS FF-S325.

F. Galvanizing: Provide a zinc coating for those items specified to be galvanized as follows:

1. ASTM A153, for galvanizing steel hardware.

2. ASTM A123, for galvanizing assembled steel products.

G. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC – Paint 20

2.02 ANCHORS, BOLTS, AND FASTENING DEVICES

A. All necessary bolts, anchor bolts, nuts, washers, plates and bolt sleeves shall be furnished by the Contractor in accordance herewith. Anchor bolts shall have suitable washers and, where so required, their nuts shall be hexagonal.

B. Bolts, anchor bolts, nuts, screws, washers, and related appurtenances specified to be stainless steel shall be Type 316 stainless steel unless noted otherwise.

C. Expansion bolts shall be stainless steel unless otherwise specified.

D. Unless otherwise specified, stud, tap, and machine bolts, and nuts shall conform to the requirements of ASTM A307. Hexagonal nuts of the same quality of metal as the bolts shall be used. All threads shall be clean cut and shall conform to ANS B1.1 for Unified Inch Screw Threads (UN and UNR Thread Form I).

E. Bolts, anchor bolts, nuts, and washers, specified to be galvanized, shall be zinc coated, after being threaded, by the hot-dip process in conformity with ASTM A123, or ASTM A153, as is appropriate.

F. Anchor bolts and expansion bolts shall be set accurately. If anchor bolts are set before the concrete has been placed, they shall be carefully held in suitable templates of acceptable design. Where indicated on the Drawings, specified, or required,

anchor bolts shall be provided with square plates at least 4 in. by 4 in. by 3/8 in. or shall have square heads and washers and be set in the concrete forms with suitable sleeves, or both. If anchor or expansion bolts are set after the concrete has been placed, all necessary drilling and grouting or caulking shall be done by the Contractor and care shall be taken not to damage the structure or finish by cracking, chipping, spalling, or otherwise during the drilling and caulking.

2.03 ALUMINUM GRATING

A. Unless noted otherwise, grating shall have rectangular, 3/16-in minimum thickness, bearing bars spaced at 4-in on center. All grating panels shall be banded with a bar the same size as the bearing bars.

1. Grating shall not exceed the fabricator's maximum recommended span, and shall meet or exceed the following load and deflection criteria for the maximum span length at the opening being covered by the grating.

   a. The grating shall produce a deflection of 1/360 of the span or less under a uniform live load of 100 lbs/sq ft on the maximum span.

   b. The grating shall produce a deflection of 1/360 of the span or less under a concentrated live load of 300 lbs applied at the mid point of the maximum span.

2. Openings 2-in or greater in diameter/dimension and grating edges shall be banded with a bar of the same depth and thickness as the bearing bars. Cut bearing bars or cross bars shall be welded to the banding bar.

3. Provide trench grating with symmetrical cross bar arrangement.

4. Grating clamps, nuts, bolts, washers and other fastening devices for grating and grating supports shall be Type 316 stainless steel. Anchor blocks, when used, shall be of the same material as the grating. All grating shall be anchored to the supporting system using saddle clips.

B. Aluminum grating material shall be aluminum alloy 6063-T6 with a mill finish. Cross bars shall be attached to the bearing bars with interlocked swaged joints. The grating shall be Type BS by IKG Borden, Houston, TX; Type 19 SG-4 by Ohio Gratings, Inc., Canton, OH; type 19S4 by Seidelhuber Metal Products, San Carlos, CA or equal.

C. Metal frames and supports for grating shall be of the same material as the grating unless otherwise shown on the Drawings. Where aluminum supports are used, they shall be fabricated from aluminum alloy 6061-T6.

2.04 RAILINGS

A. Railing systems (handrail and guardrail) shall comply with the requirements of OSHA and Florida Building Code.

B. Aluminum railing systems shall be a welded or mechanically fastened, seamless, extruded aluminum pipe system. Rails shall be 6063-T6 alloy. Posts shall be 6061-T6 alloy. Splice and reinforcing sleeves, brackets, end caps, toeboards, etc., shall be aluminum alloy 6063-T6 or 6061-T6. Cast fittings shall be aluminum alloy No. 214. Railing system fastening hardware shall be Type 316 stainless steel. Aluminum shall have a mill finish, except as otherwise specified.

C. Railings shall be as shown on the Drawings, fabricated with 1-1/2-in nominal diameter pipe. Posts shall be Schedule 80 pipe minimum and rails and handrails shall be Schedule 40 pipe minimum. Posts and top rails shall be continuous. Spacing of posts shall not exceed 5-ft on center and shall be uniformly spaced except as otherwise shown on the Drawings. All railing posts shall be vertical.

D. Welds shall be circumferential welds ground smooth and even to produce a railing that is neat in appearance and structurally sound. Welding methods shall be in conformity with AWS standards for the materials being joined. All rails to post connections shall be coped and fastened by continuous welds. There shall be no burrs, sharp edges or protrusions on any weld on any part of the handrail system. After fabrication, the welds and surrounding area shall be cleaned and hand buffed to blend with the adjacent finish. All mechanical fasteners shall be unobtrusively located in countersunk holes with the top flush with the surface of the rail. Bends in the railing shall be as indicated by the Drawings. No distortion of the circular railing shape will be allowed. Bends and terminal sections shall be made without the use of fittings. Corner bends shall be mitered and welded bends.

E. Railing shall be assembled in sections as long as practical but shall not be greater than 24-ft in length. A field splice shall be used when an assembled section is to be attached to another section. Field splices shall be used in all railing panels that cross over structure expansion joints.

1. Field splices shall use internal splice sleeves located within 8-in of railing posts. The sleeve shall be welded to the rail on one side and fastened with a set screw to the rail on other side. The field splice shall be detailed to take the differential expansion between the railing system and the supporting structure.

2. When the field splice occurs in a railing panel crossing a structure expansion joint, the sleeve shall be welded to the rail on one side and be free to slide in the rail on other side. The field splice shall be detailed to take the same movement as the structure expansion joint.

F. The bases or supports for railing posts and handrail shall be the types indicated on the Drawings.

1. Where non-removable railing is set in concrete, the posts shall be placed in 2-1/2 in diameter formed concrete openings and firmly caulked with non-shrink nonmetallic grout. Collars shall be placed around the post bases and fastened in place with set screws on the side of the post away from the walkway. Posts shall be placed with the centerline 4-in from the edge of the concrete except that posts shall be set at the centerline of concrete curbs.

2. Where handrail is to be fastened to walls, the rails shall be provided with screwed wall flanges fastened to the walls with three 3/8-in stainless steel flat head machine screws.

G. Safety gates, for railing openings, shall be fabricated of matching pipe and rail material and configuration. The gates shall be self-closing gates with approved stop, latch and stainless steel closure spring and hinges.

H. Barrier chains, for railing openings, shall be fabricated of stainless steel chains. Chain shall be 1/4-in stainless steel links, with eleven links per foot as manufactured by Eastern Chain Works, Inc., NY; Lawrence Metal Products, Inc., or equal. Chains shall be fastened to the handrail posts with a 1/4-in diameter stainless steel eye bolt and the other end shall be connected to the other post by means of a heavy chromium plated bronze swivel eye slide harness snap and a similar eye bolt.

I. Toeboards shall be provided on all railing adjacent to a drop in elevation of 4-ft or more. Toeboards are not required on the inclined portion of stairway railings or where concrete or steel curbs, 4-in or more in height, are present. Toeboards shall be 4-in high plate with a minimum thickness of 1/4-in. Toeboards shall be positioned with a maximum clearance of 1/4-in from the floor and fastened to railing posts with 1/4-in stainless steel U-bolts, with J-bolts at corner posts and with clip angles and two 1/4-in stainless steel expansion bolts at walls.

J. All railings shall be properly protected by paper, or by an approved coating or by both against scratching, splashes or mortar, paint, or other defacements during transportation and erection and until adjacent work by other trades has been completed. After protective materials are removed, the surfaces shall be made clean and free from stains, marks, or defects of any kind.

2.05 STAIRS

A. Stair treads for aluminum stairs shall have abrasive non-slip nosing as approved.

B. Aluminum nosing at concrete stairs shall be Wooster Products, Inc.; Alumogrit Treads, Type 116; similar by Barry Pattern and Foundry Co.; Andco or equal.

Furnish with wing type anchors and flat head stainless steel machine screws, 12-in on center. Nosing shall also be used at concrete ladder openings. Nosing shall a single piece for each step extending to within 3-in at each side of stair or full ladder width. Set nosing flush with stair tread finish at concrete stairs. Furnish treads with heavy duty protective tape cover.

2.06 MISCELLANEOUS STAINLESS STEEL

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of welds shall be dressed flush and smooth. [Grind smooth continuous welds that will be exposed.] Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous stainless steel items shall include: beams, angles, bar racks and any other miscellaneous stainless steel called for on the Drawings and not otherwise specified.

2.07 MISCELLANEOUS ALUMINUM

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability. Holes shall be drilled or punched. Edges shall be smooth and without burrs. Fabricate supplementary pieces necessary to complete each item though such pieces are not definitely shown or specified.

B. Connections and accessories shall be of sufficient strength to safely withstand the stresses and strains to which they will be subjected. Exposed joints shall be close fitting and jointed where least conspicuous. Threaded connections shall have the threads concealed where practical. Welded connections shall have continuous welds or intermittent welds as specified or shown. The face of wells shall be dressed flush and smooth. Welding shall be on the unexposed side as much as possible in order to prevent pitting or discoloration of the aluminum exposed surface. Provide holes for temporary field connections and for attachment of the work of other trades.

C. Miscellaneous aluminum items shall include: beams, angles, closure angles, grates, hatches, floor plates, stop plates, stair nosings, and any other miscellaneous aluminum called for on the Drawings and not otherwise specified.

D. Angle frames for hatches, beams, grates, etc., shall be complete with welded strap anchors attached.

PART 3 - EXECUTION

3.01 GENERAL

A. Anchorage: Provide anchorage for fastening work securely in place. Set anchors in concrete as the work progresses and space not more than 2 feet on centers unless indicated otherwise. Sizes, kinds, and spacing of anchors not indicated or specified shall be as necessary for the purpose, as approved. Anchorage not otherwise specified or indicated includes slotted inserts, expansion shields, and powder-driven fasteners, when approved for concrete; toggle bolts and through bolts for masonry; machine and carriage bolts for steel; through bolts, lag bolts, and screws for wood. Provide inserts of suitable and approved types where required for support or anchorage of equipment and finish construction.

B. Fastenings: Do not use wood plugs in any material. Use nonferrous attachments for non-ferrous metal. Make exposed fastenings of compatible materials, generally matching in color and finish, and harmonizing with the material to which fastenings are applied. Conceal fastenings where practicable. Drill and punch to produce clean true lines and surfaces. Countersink metal work to receive hardware.

C. Threaded Connections: Make threaded connections tight so that threads are entirely concealed. Make bolted work tight and nick the threads or bush the stem to prevent loosening. Abutting bars shall be shouldered and headed, de-welled and pinned. Pass small bars through larger bars and pin. Rivet, bolt, and screw heads shall be flat and countersunk in exposed work and elsewhere as required. Carefully machine removable member and fit and secure by means of screws or bolts of proper size and approved spacing.

3.02 FABRICATION

A. All miscellaneous metal work shall be formed true to detail, with clean, straight, sharply defined profiles and smooth surfaces of uniform color and texture and free from defects impairing strength or durability.

B. Connections and accessories shall be sufficient strength to safely withstand stresses and strains to which they will be subjected. Steel accessories and connections to steel or cast iron shall be steel, unless otherwise specified. Threshold connections shall be made so that the threads are concealed by fitting.

C. Welded joints shall be rigid and continuously welded or spot welded as specified or shown. The face of welds shall be dressed flush and smooth. Exposed joints shall be close fitting and jointed where least conspicuous.

D. Welding of parts shall be in accordance with the Standard Code for Arc and Gas Welding in Building Construction of the AWS and shall only be done where shown, specified, or permitted by the Engineer. All welding shall be done only by welders certified as to their ability to perform welding in accordance with the requirements of the AWS Code. Component parts of built-up members to be welded shall be adequately supported and clamped or held by other adequate means to hold the parts in proper relation for welding.

E. Welding of aluminum work shall be on the unexposed side as much as possible in order to prevent pitting or discoloration.

F. All aluminum finish exposed surfaces, except as otherwise specified, shall have manufacturer's standard mill finish. Aluminum handrails shall be given an anodic oxide treatment in accordance with the Aluminum Association Specification AA-C22-A41.

G. All steel finish work shall be thoroughly cleaned, by effective means, of all loose mill scale, rust, and foreign matter before shipment and shall be given 1 shop coat of primer compatible with finish coats specified in Section 09941 - Field Painting after fabrication but before shipping. Paint shall be applied to dry surfaces and shall be thoroughly and evenly spread and well worked into joints and other open spaces. Abrasions in the field shall be touched up with primer immediately after erection.

H. Galvanizing, where required, shall be the hot dip zinc process after fabrication. Following all manufacturing operations, all items to be galvanized shall be thoroughly cleaned, pickled, fluxed, and completely immersed in a bath of molten zinc according to ASTM A653. The resulting coating shall be adherent and shall be the normal coating to be obtained by immersing the items in a bath of molten zinc and allowing them to remain in the batch until their temperature becomes the same as the bath. Coating shall be not less than 2 ounces per square foot of surface.

I. Zinc coating, which has been burned by welding, abraded, or otherwise damaged, shall be cleaned and repaired after installation. The damaged area shall be thoroughly cleaned by wire brushing and all traces of welding flux and loose or cracked zinc coating removed prior to painting. The cleaned area shall be painted with two coats of zinc oxide-zinc dust paint conforming to the requirements of SSPC – Paint 20. The paint shall be properly compounded with a suitable vehicle in the ratio of 1 part zinc oxide to 4 parts zinc dust by weight.

3.03 INSTALLATION

A. Install all items furnished except items to be embedded in concrete, which shall be installed under Division 3. Items to be attached to concrete or existing masonry after such work is completed shall be installed in accordance with the details shown. Fastening to wood plugs in masonry will not be permitted. All dimensions shall be verified at the site before fabrication is started.

B. Where aluminum contacts a dissimilar metal, apply a protective paint. Apply protective paint to both the aluminum metal components and to the dissimilar metal(s).

C. Where aluminum contacts masonry or concrete, apply a heavy coat of approved alkali resistant paint to the masonry or concrete.

D. Where items are cast into concrete, backpaint contact areas before setting.

END OF SECTION

DIVISION 09
FINISHES

SECTION 09941

FIELD PAINTING

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Appropriate paint type and color shall be purchased for construction of the new Clarifier 5 and associated RAS/WAS Pump Station, as well as modifications to the existing Clarifier 1 and 2 RAS/WAS Pump Station: new clarifier mechanism; new pumps, ductile iron piping, fittings, and valves; existing ductile iron piping, fittings, and valves; and any other metals requiring protective field coatings.

B. The prestressed concrete tank interior and exterior shall be prepared and painted per specification Section 13200, Prestressed Concrete Tank.

C. Furnish and apply required paints as specified below and in the Drawings.

D. Prepare, clean, and finish all surfaces specified, scheduled or otherwise indicated to be field painted. The terms "paint" and "coating" used herein include emulsions, enamels, paints, stains, varnishes, sealers, and other coatings, organic or inorganic, whether used as intermediate or finish coats.

E. Complete painting in accordance with Specifications, and paint manufacturer's current surface preparation and application instructions.

1.02 RELATED WORK

A. Section 02615 – Ductile Iron Pipe and Fittings

B. Section 05500 – Miscellaneous Metals

C. Division 11 - Equipment

1.03 REFERENCES

A. ASTM (American Society for Testing and Materials)

1) ASTM C 920 - Specification for Elastomeric Joint Sealants.
2) ASTM D 3960 - Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings.
3) ASTM D 4259 - Practice for Abrading Concrete.

4) ASTM E 337 - Standard Practice Test Method for Measuring Humidity with a Psychrometer.
5) ASTM D 4285 - Standard Test Method for Indicating Oil or Water in Compressed Air

B. ICRI (International Concrete Restoration Institute)

1) Gudeline No. 03732 - Selecting and Specifying Concrete Surface Preparation for Sealers, Coatings, and Polymer Overlays.

C. NACE International

1) Pub 6D-173 – "A Manual for Painter Safety"
2) Pub 6G-164 - "Surface Preparation Abrasives for Industrial Maintenance Painting"
3) NACE RP0188 - Standard Recommended Practice, Discontinuity (Holiday) Testing of Protective Coatings.

D. SSPC: The Society for Protective Coatings

1) Paint Application Specifications PA 1-64, No. 1 Shop, Field and Maintenance Painting.
2) SSPC-PA-3 - "A Guide to Safety in Paint Application"
3) SSPC-Guide 12 - Guide for Illumination of Industrial Painting Project.
4) SSPC-SP1- Surface Preparation: Solvent Wipe
5) SSPC-SP2 – Surface Preparation: Hand Tool Cleaning
6) SSPC-SP3 – Surface Preparation: Power Tool Cleaning
7) SSPC-SP6 – Surface Preparation: Commercial Blast Cleaning
8) SSPC-SP7 – Surface Preparation: Brush off Blast Cleaning
9) SSPC-SP10 - Surface Preparation: Near White Blast Cleaning
10) SSPC–SP11 - Surface Preparation: Power Tool Cleaning to Bare Metal
11) SSPC-SP12 - Surface Preparation and Cleaning of Steel and Other Hard Materials by High and Ultrahigh Pressure Water Jetting Prior to Recoating
12) SSPC-SP13 - Surface Preparation of Concrete
13) And other surface preparation standards as recommended by the paint system manufacturer for the specific application intended.

E. OSHA (Occupational Safety & Health Administration)

1) 1915.35 - Standards – 29 CFR – Painting

F. ANSI (American National Standards Institute)

1) ANSI/ASC 29.4 Exhaust Systems - Abrasive Blasting Operations – Ventilation and Safe Practice

1.04 SUBMITTALS

A. To aid in determining painting system acceptability and coating compatibility, submit following:

1) List of coating products proposed, giving brand, type and manufacturer. Include complete manufacturer data sheets for individual paints and the painting system.

2) Manufacturer's current printed surface preparation and application recommendations and product data sheets for each.

3) Material Safety Data Sheets (MSDS) for any materials brought on-site including all resurfacing system materials, solvents, and abrasive blast media.

4) Storage requirements including temperature, humidity, and ventilation for resurfacing system materials.

5) Field painting applicator's correspondence for determining compatibility of field coatings with primers and for selecting manufacturer producing field coats.

B. During Shop Drawing review, submit manufacturer's catalog of color chips and finishes for materials proposed. Owner shall select colors and finish from manufacturer’s full range.

1.05 PAINT STORAGE AND MIXING AREAS, AND WASTE DISPOSAL

A. Store paints and painter's materials only in area or areas designated solely for this purpose. Confine mixing, thinning, clean-up and associated operations, and storage of painting debris before authorized disposal, to these areas.

B. Do not use plumbing fixtures, piping or mechanical equipment for mixing or disposal of paint materials.

C. Transport water to paint area by approved temporary hose or piping.

D. Store waste temporarily in closed, nonflammable containers until final disposal. Keep no rubbish in painter's area longer than 24 hours.

1.06 DELIVERY, HANDLING, STORAGE, PROTECTION

A. Deliver materials to painter's area in original, unbroken, containers with name and analysis of product, manufacturer's name, and shelf life date. Do not use or retain contaminated, outdated, prematurely opened, or diluted materials.

B. Store coated items carefully. Avoid damaging or dirtying coatings, by contact with soil, pavement or other harmful contacts, which might necessitate special cleaning. Use suitable blocking during storage.

C. Do not expose primed surfaces to weather for more than six months before top coating. Allow less open time if recommended by coating manufacturer.

D. During surface preparation, cleaning and painting operations, protect all surfaces not to be painted.

E. Protect coated items, whether primed or finished, from damage due to shipping and handling.

F. Upon completion of field painting, ensure coatings are undamaged and in good condition. Make good damage or coating deterioration resulting from failure to observe foregoing requirements.

1.07 SAFETY

A. The Contractor's work forces should comply with the provisions outlined in the following documents:

SSPC-PA-3 "A Guide to Safety in Paint Application"
NACE Pub. "A Manual for Painter Safety"

B. The Contractor shall provide personnel with all safety equipment necessary to protect them during any phase of the work. This shall include, but not be limited to, safety glasses, goggles, earplugs, hard hats, steel toed work shoes, appropriate personal protective clothing, gloves, and plant approved escape respirators (where required).

C. Keep any flammable materials such as cleaning solvents, thinners, or resurfacing materials away from open flames, sparks or temperatures higher than 150^{o}F. Drums containing flammable materials will be grounded. No solvent in any quantity shall be allowed inside containment enclosures or permitted confined spaces at any time during resurfacing work.

D. Power tools are to be in good working order to avoid open sparking. No spark producing tools shall be utilized in restricted areas as indicated herein.

E. The Contractor shall fireproof all work areas by maintaining a clean work area and having Underwriter's Laboratories approved fire extinguishers on-hand. The Contractor shall furnish these fire extinguishers.

F. Workers doing abrasive blasting operations shall wear a fresh air supplied protective helmet and hood and personal protective clothing acceptable to industry standards and all government regulations.

G. Dispose of rags used for wiping up resurfacing materials, solvents, and thinners by drenching them with water and placing in a metal container with a tight fitting metal cover. Complete this disposal process at the end of each day. Final disposal of these materials is the Contractor's responsibility.

H. Matches, smoking, flames, or sparks resulting from any source including welding, must be remote from the work area during coating work. Smoking is permitted only in designated areas of the plant.

PART 2 - PRODUCTS

2.01 MATERIALS - GENERAL

A. Paint Coatings: Ready-mixed paints, both exterior and interior, shall be first-line (best quality grade) retail products. Use coatings on ferrous surfaces of protective paint coating quality.

B. Use products of one manufacturer in any one paint coating system; all coating materials compatible. Coatings for touch-up shall be same as original.

C. Thinners and additives shall be of types recommended by the paint manufacturer.

D. The use of lead-containing paint is not permitted.

2.02 COLORS

A. The finish color for surfaces to be painted shall be selected by the Owner. During Shop Drawing review, the Contractor shall submit manufacturer's catalog of color chips and finishes for materials proposed. The Owner shall select colors and finishes from manufacturer’s full standard range.

B. To provide contrast between successive coats, lightly tint each coat to distinguish it from preceding coats.

C. Unless otherwise indicated, for finish paint use gloss or semi-gloss on metal, and matte finish or flat on masonry and concrete.

2.03 COATING SCHEDULE

A. The following coating schedule was developed by selecting appropriate types of coatings for the various components to be coated. It shall be the Contractor's responsibility to review the following schedule and confirm with the coating supplier the most appropriate coating for the particular application.

B. Description of coating types includes minimum acceptable percent, by volume, of component solids. Brand identification is keyed to products of Tnemec Co., Inc., Kansas City, MO, to establish standard of quality or approved equal.

C. Omit primer on items with shop coat primer. All shop coats shall be touched up and allowed to dry before application of finish coats. Contractor shall verify that coatings are compatible with shop primer.

COATING SCHEDULE					
Location, Substrate & Service	Surface Preparation	Coating Name (Generic/Brand), Series Number, Dry Film Thickness (mils)			
		1st Coat	2nd Coat	3rd Coat	4th Coat
Clarifier Equipment Submerged Steel (Shop Primed with Modified Aromatic Polyurethane Primer, Tnemec Series 1 Omnithane, 2.5-3.5 mils DFT)	Touch up Shop Primer. Spot repair of damaged areas: Power Tool Cleaning, SSPC-SP3.	Spot Prime Bare Metal: Modified Aromatic Polyurethane Primer Tnemec Series 1 Omnithane 2.5-3.5 mils DFT	Hydrophobic Aromatic Polyurethane Tnemec Series 446 Perma-Shield MCU 5.0-7.0 mils DFT	Hydrophobic Aromatic Polyurethane Tnemec Series 446 Perma-Shield MCU 5.0-7.0 mils DFT	
Clarifier Equipment Non- Submerged Steel (Shop Primed with Modified Aromatic Polyurethane Primer, Tnemec Series 1 Omnithane, 2.5-3.5 mils DFT)	Touch up Shop Primer. Spot repair of damaged areas: Power Tool Cleaning, SSPC-SP3.	Spot Prime Bare Metal: Modified Aromatic Polyurethane Primer Tnemec Series 1 Omnithane 2.5-3.5 mils DFT	Polyamidoamine Epoxy Tnemec Series N69, Hi-Build Epoxoline II 3.0-5.0 mils DFT	Aliphatic Acrylic Polyurethane with factory added UV Blocker (designed for exterior exposure) Tnemec Series 73U 2.0-3.0 mils DFT	

COATING SCHEDULE					
Location, Substrate & Service	Surface Preparation	Coating Name (Generic/Brand), Series Number, Dry Film Thickness (mils)			
		1st Coat	2nd Coat	3rd Coat	4th Coat
Exterior of Aeration Basin Effluent Channel Extension Exterior of exposed cast-in-place concrete surfaces	Fill cracks, voids and other surface imperfections. Remove mortar droppings	Acrylic Emulsion White Tinting Base Tnemec Series 180 W.B. Tnemec – Crete 4 mils	Acrylic Emulsion White Tinting Base Tnemec Series 180 W.B. Tnemec – Crete 4 mils		
Interior of Aeration Basin Effluent Channel Extension Interior of exposed cast-in-place concrete surfaces	SSPC-SP13, including abrasive blast to remove all laitance & fines, open bugholes, and create a surface profile equal to ICRI CSP 4-CSP 5	Fill all voids and bugholes and re-surface concrete using Tnemec Series 218 MortarClad applied @ an average of 1/16".	Hydrophobic Aromatic Polyurethane Tnemec Series 446 Perma-Shield MCU 5.0-7.0 mils DFT	Hydrophobic Aromatic Polyurethane Tnemec Series 446 Perma-Shield MCU 5.0-7.0 mils DFT	
New Exposed Ductile Iron Piping, Fittings, Pumps, and Valves. Immersion (All shall be Shop Primed w/ Polyamide Epoxy, Tnemec Series 66 -1211 or Series N140-1211 (Red), Hi-Build Epoxoline, 3.0-5.0 mils)	Touch up Shop Primer. Spot repair of damaged areas: Power Tool Cleaning, SSPC-SP3.	Spot Prime Bare Metal: Modified Aromatic Polyurethane Primer Tnemec Series 1 Omnithane 2.5-3.5 mils DFT	Hydrophobic Aromatic Polyurethane Tnemec Series 446 Perma-Shield MCU 5.0-7.0 mils DFT	Hydrophobic Aromatic Polyurethane Tnemec Series 446 Perma-Shield MCU 5.0-7.0 mils DFT	
New Exposed Ductile Iron Piping, Fittings, Pumps, and Valves. Non-Immersion (All shall be Shop Primed w/ Polyamide Epoxy, Tnemec Series 66 -1211 or Series N140-1211 (Red), Hi-Build Epoxoline, 3.0-5.0 mils)	Touch up Shop Primer. Spot repair of damaged areas: Power Tool Cleaning, SSPC-SP3.	Spot Prime Bare Metal: Polyamidoamine Epoxy Tnemec Series N69, Hi-Build Epoxoline II 3.0-5.0 mils DFT	Polyamidoamine Epoxy Tnemec Series N69, Hi-Build Epoxoline II 3.0-5.0 mils DFT	Polyamidoamine Epoxy Tnemec Series N69, Hi-Build Epoxoline II 3.0-5.0 mils DFT	Aliphatic Acrylic Polyurethane Tnemec Series 73U Endura-Shield 2.5-3.5 mils DFT

COATING SCHEDULE					
Location, Substrate & Service	Surface Preparation	Coating Name (Generic/Brand), Series Number, Dry Film Thickness (mils)			
		1st Coat	2nd Coat	3rd Coat	4th Coat
Clarifier 1& 2 RAS/WAS Pump Station Existing Exposed Ductile Iron Pipe and Fittings NON-IMMERSION	Remove existing loose paint, grease, dirt, etc. by High Pressure Water Cleaning (Minimum 3000 PSI, 3-5 gallons per minute, potable water). Remove all remaining loose old coatings, loose rust, and rust stain by either Commercial Blast Cleaning, SSPC- SP6, or Power Tool Cleaning, SSPC-SP3. Scarify all sound remaining coatings by either Brush off Blast Cleaning (SSPC-SP7) or by Mechanical Abrasion.	Spot Prime Bare Metal: Polyamidoamine Epoxy Tnemec Series N69, Hi-Build Epoxoline II 3.0-5.0 mils DFT	Polyamidoamine Epoxy Tnemec Series N69, Hi-Build Epoxoline II 3.0-5.0 mils DFT		
Interior - New Exposed (Ferrous) Metals (Not Shop Primed)	Commercial Blast Cleaning, SSPC- SP6	Polyamidoamine Epoxy Tnemec Series N69, Hi-Build Epoxoline II 3.0-5.0 mils DFT	Polyamidoamine Epoxy Tnemec Series N69, Hi-Build Epoxoline II 3.0-5.0 mils DFT	Polyamidoamine Epoxy Tnemec Series N69, Hi-Build Epoxoline II 3.0-5.0 mils DFT	
Exterior - New Exposed (Ferrous) Metals (Not Shop Primed)	Commercial Blast Cleaning, SSPC- SP6	Polyamidoamine Epoxy Tnemec Series N69, Hi-Build Epoxoline II 3.0-5.0 mils DFT	Polyamidoamine Epoxy Tnemec Series N69, Hi-Build Epoxoline II 3.0-5.0 mils DFT	Aliphatic Acrylic Polyurethane with factory added UV Blocker (designed for exterior exposure) Tnemec Series 73U 2.5-4.0 mils DFT	

2.04 PAINT SCHEDULE

A. Coordinate, schedule and confirm the various cleaning, touch-up and finishing operations with the owner and the Owner. Ensure the transmission of materials data, color selections and coating system methods between the coating applicators. Take responsibility for not exceeding exposure and re-coat time limits.

PART 3 - EXECUTION

3.01 GENERAL

A. Hoisting, Scaffolding, Staging, and Planking:

1. Provide, set-up, and maintain all required hoists, scaffolds, and staging and planking, and perform all access related hoisting work required to complete the work of this section as indicated and specified.

2. Scaffolds shall have solid backs and floors to prevent dropping materials from there to the floors or ground below.

B. Environmental Requirements:

1. Comply with the Manufacturer's recommendations as to environmental conditions under which resurfacing system materials can be applied.

2. Do not apply resurfacing system materials when dust is in work site.

3. The Contractor shall provide all temporary lighting during the work.

C. Protection:

1. Cover or otherwise protect finish work or other surfaces not being resurfaced.

2. Erect and maintain protective tarps, enclosures and/or maskings to contain debris (such as dust or airborne particles resulting from surface preparation) generated during any and all work activities. This includes, but is not limited to, the use of dust/debris collection apparatus as required.

D. Thinners and Solvents:

The Contractor shall use only solvents and thinners as recommended by the Manufacturer.

3.02 INSPECTION

A. Examine surfaces scheduled to receive paint and finishes for conditions that will adversely affect execution, permanence or quality of work and which cannot be put into an acceptable condition through preparatory work.

B. Do not proceed with surface preparation or coating application until conditions are suitable.

C. Unacceptable surface conditions are defined for concrete as the presence of cracked surfaces or concrete deteriorated to a depth of greater than 1" or otherwise unable to withstand surface preparation as specified herein.

D. For steel surfaces, unacceptable surface conditions may include severe loss of structure, or conditions under which the specified surface preparation will damage the steel surface.

3.03 PREPARATION

A. Basic Steps:

1) Arrange to do all preparation and paint work in still, dry air and less than 80° F temperature.

2) Cleaning and resurfacing shall be scheduled so that dust and other contaminants from the cleaning process will not fall on wet, newly resurfaced areas.

3) Maintain all coating materials at manufacturer's recommended mixing and application temperatures for not less than 24 hours before use. Have clean, proper containers, spray equipment, applicators and accessory items ready for use before decanting or mixing paint materials.

4) Ensure proper coordination of materials to be applied hereunder with previous coatings on affected surfaces. Have all manufacturer's written directions on hand, and follow them strictly, except where otherwise specified.

B. Initial Cleaning/Decontamination. Before any paint application, carefully clean all surfaces to be coated of dust, dirt, grease, loose rust, mill scale, paint unsuitable for top coating, efflorescence, oil, moisture, foreign matter or conditions detrimental to coating bond and durability.

1) Following cleaning, apply preparatory treatment in strict accordance with manufacturer's written instructions.

2) If mechanical cleaning is used, oil and grease shall be removed before starting via an alkaline-based emulsifying detergent as recommended by the resurfacing material manufacturer.

3) When an alkaline-based emulsifying detergent is used, verify that the pH of the cleaned concrete surfaces to be coated is within the range of to 8 to 11. Application of coating materials outside this range will not be permitted without written approval from the Engineer.

4) Where mechanical cleaning is accomplished by blast cleaning, the abrasive used shall be washed, graded and free of contaminants that might interfere with the adhesion of the resurfacing materials (Reference SSPC-SP13/NACE No. 6).

5) Fill imperfections and holes in surfaces to be painted.

C. Sound existing coatings may remain, if they cannot easily be removed by the specified methods of surface preparation. The definition of sound coatings is: Coatings that cannot be removed using a dull putty knife. Sound remaining coatings must be scarified prior to overcoating with the specified coating system.

D. Metals:

1) Ferrous metals, including field welds and unprimed shop welds, without shop prime coats as follows:

a. Near White blast cleaned (SSPC-SP-10), for Type S service (in contact with process water/wastewater and sludges).

b. Commercial blast cleaned (SSPC-SP-6), for Type E service (non-immersed).

c. Power tool cleaned (SSPC-SP-3), for Type M and I service (confined areas or in vicinity of equipment)

d. Rusted areas cleaned (SSPC-SP-6)

e. Needle gun may be used for field welds and shop welds which occur in narrow, unprimed areas in an otherwise shop primed surface.

2) Ferrous metals with shop primers cleaned as previously specified, then:

a. Sanded to a smooth surface before under coating, for Type M or I service.

b. Prepared to meet manufacturer's recommendations for Type E or S service.

c. Building structural steel – Hand tool clean (SP-2) of nuts, bolts, welds, and normal abrasions followed by a touch-up coat of the shop primer material.

3) Bituminous coated metals for paint finish; clean of all dirt, grease, oil and foreign matter, and prime with a barrier coat to seal the bitumen and prevent bleeding and discoloration of finish.

4) Non-ferrous and galvanized metal surfaces for finish; Clean of all dirt, grease, oil, and foreign substances, wash thoroughly with grease solvent, then permit to dry. If paint will be applied, hand or power sand to abrade surface. Otherwise, apply one coat of vinyl-type wash, meeting Mil. Spec. MIL-P-15328C and apply next coat within 24 hours of wash priming.

D. Concrete:

1. Sandblast walls, remove all oil, release agents, dirt, dust, grease, paint, loose material and foreign matter. Remove latency, roughen smooth surfaces by brush sand blasting, remove fins and projections. All surfaces shall be clean and dry.

2. Repair imperfections and damaged areas with the specified epoxy cement.

3. Fill all voids, bugholes and other surface imperfections with Tnemec Series 218 MortarClad, and / or Series 219 MortarCast (per SSPC-SP 13).

4. Allow new mortar to cure for at least 14 days.

3.04 TOUCH-UP

A. Before applying field coat, touch-up abraded areas of shop coats with paint as specified in coating schedule. Apply an entire coat if necessary. Touch-up coats are in addition to, and not a substitute for first field finish coat. Clean deteriorated surfaces to bare metal before applying touch-up coat. Contractor is responsible for verifying that coatings are compatible with shop primer.

B. Damaged areas of ductile iron piping, fittings, and valves will be prepared by removing all contaminants and rust by Power Tool Cleaning (SSPC-SP3). Spot field surface preparation must not “polish” to steel surface. Surface must be properly “profiled” before application of any coatings. After preparation, damaged areas shall be primed as specified in coating schedule.

C. Equipment, motors, pumps, instrumentation panels, electrical switchgear, and similar items with shop coats, paint filler, enamel or other treatment customary with manufacturer; after installation, touch-up all scratches and blemishes before applying field coats.

3.05 APPLICATION

A. In general, apply minimum of one touch-up primer coat and one finish coat to all previously primed surfaces. The dry film thickness of each coat shall not be less than the manufacturer's minimum thickness for the specific application and painting system used. This requirement shall be strictly complied with and shall be routinely checked by the Contractor. Following careful inspection of surfaces not previously primed, prepare and clean as specified, apply proper prime coat and minimum of one primer coat and one finish coat. Refer to Paint Schedule.

B. Areas not to be coated shall be masked to prevent these surfaces from being oversprayed.

C. Conditions:

1) The Contractor must follow the minimum and maximum recoat limitation times and related temperature range restrictions between successive lifts for all products specified herein per Manufacturer's stated requirements.

2) Do not apply paints or other finish to wet or damp surfaces, except in accordance with instructions of manufacturer. Do not apply exterior paint during cold, rainy, or frosty weather, or when temperature is likely to drop to freezing. Avoid painting of surfaces while they are exposed to the sun.

3) Paint surfaces which have been cleaned, pre-treated, or otherwise prepared for painting with first field coat as soon as practicable after such preparation has been completed, but in any event prior to deterioration of prepared surface.

4) Coat blast cleaned metal surfaces immediately after cleaning, before any rusting or other deterioration or contamination of the surface occurs. Do not coat blast cleaned surfaces later than 8 hours after cleaning under ideal conditions or sooner if conditions are not ideal.

D. Methods:

1) Spraying with adequate apparatus may be substituted for brush and roller application of suitable paints and in locations suitable for spraying. So long as the minimum dry thickness and all other recommendations of the manufacturer as to application are complied with.

2) Prepare surfaces, mix and apply paint materials in strict accordance with manufacturer's printed instructions and recommendations, except where specifically directed otherwise. Control temperature of materials upon

mixing and application, surface temperature and condition, thinning and modifying.

3) Protect surfaces to be coated, before, during and after application unless ambient weather conditions are favorable.

E. Workmanship:

1) Spot prime with aluminum paints, all exposed nails and other ferrous metal on surfaces to be painted with water-thinned paints.

2) Apply coating materials to meet manufacturer's spreading rate and dry film thickness recommendations. Dry film thicknesses specified are constant for brush, spray, roller or other form of application.

a) Control thinning for spray use and to manufacturer's printed instructions, and produce specified dry film thickness on level surfaces, interior and exterior angles.

b) Record quantities of materials of each type, for each coat, used in each location.

3) Apply paints and coatings using skilled painters, brushed and/or rolled out carefully to a smooth even coating without runs or sags. Flow enamel evenly and smoothly. Allow each coat of paint to dry thoroughly, on the surface and throughout the film thickness, before the next coat is applied. High polymer coatings may be excepted from the drying requirement if recoat time is specified by manufacturer.

4) Finish surfaces: Uniform in finish and color, and free from flash spots and brush marks.

5) Accessory items, finish hardware, lighting fixtures, escutcheons, plates, trim and similar finish items not to be painted: Remove or carefully mask before painting adjacent surfaces. Carefully replace and reposition upon completion of adjacent painting and cleaning work.

3.06 PROTECTION AND CLEAN-UP

A. Protect all materials and surfaces painted or coated under this section, both before and after application. Also protect all adjacent work and materials by the use of sufficient drop cloths during the progress of this work. Upon completion of the work, clean up all paint spots, oil, and stains from floors, glass, hardware, and similar finished items.

END OF SECTION

DIVISION 11
EQUIPMENT

SECTION 11227

CLARIFIER EQUIPMENT
(105' Diameter Secondary Clarifier)

PART 1 - GENERAL

1.01 DESCRIPTION

A. One (1) clarifier mechanism designed and furnished for installation in a concrete tank. Tank dimensions shall be 105 feet diameter with a side water depth of 14 feet, free board, and bottom slope as shown on the drawings. Each mechanism shall be center column supported, center feed, peripheral overflow type with a center drive mechanism rotating a suspended cage with two rake arms supporting the PVC sludge pick up pipes attached.

B. The equipment furnished for each clarifier mechanism shall include: truss type walkway, center assembly with drive motor, center support/feed column with inlet openings, center cage, truss scraper arms with PVC sludge removal pipes, scraper blades and squeegees, sludge collection box with PVC sludge valves, skimmers, weirs, baffles and anchor bolts.

C. The equipment's purpose shall be to collect settled sludge from the tank floor and discharge it to sludge the withdrawal collection drum. Scum shall be discharged through the scum withdrawal pipe connected to the scum box.

D. Except where specifically indicated otherwise, all plates and structural members designated for submerged service shall have a minimum thickness of ¼-inch. 316 stainless steel anchor bolts, with necessary hex nuts and washers, shall be provided for all parts of the clarifier mechanism to be secured to the tank. All fasteners for the mechanism to be ASTM A 325 high strength and Grade 5 for secondary connections. All hand-rail bolts will be 304 stainless steel.

1.02 REFERENCES

A.	ASTM A 36		Structural Steel Specification
B.	ASTM A 325		Fastener Specification
C.	ASTM A 304		Bolt Specification
D.	ASTM A 316		Bolt Specification
E.	ASTM A 48		Cast Iron Specification

F.	ASTM A 536	Cast Iron Specification
G.	ANSI 4142	Heated Treated Steel Specification
H.	AGMA 6034-B92	Practice For Enclosed Cylindrical Worm Gear Speed Reducers and Gearmotors
I.	AGMA 2001-C95	Fundamental Rating Factors and Calculation Methods For Involute Spur and Helical Gear Teeth
J.	AWS	American Welding Society Current Standards

1.03 RELATED WORK

A. Section 05500 – Miscellaneous Metals

B. Section 09941 – Field Painting

C. Section 11234 – Centrifugal (RAS) Pumps

D. Section 11300 – Double Disc (WAS) Pumps

E. Section 11301 – Hose Pump (Scum)

F. Section 13200 – Prestressed Concrete Tank

G. Division 16 – Electrical

1.04 QUALITY ASSURANCE

A. The manufacturer shall modify his standard equipment to meet the minimum values specified for dimension, design and intent of this specification.

B. The complete machine shall be of sufficient strength to sweep in 2-inch grout on the tank bottom under its own power. Such grouting shall be done in strict accordance with the manufacturer's instruction.

C. Consideration shall be given to suppliers who have in operation at least twenty (20) similar clarifiers and have been supplying similar clarifier equipment for the past fifteen (15) years. Installation lists shall be available upon request.

D. Equipment shall be manufactured by EIMCO Water Technologies, or approved equal.

1.05 CONTRACTORS SUBMITTALS

A. The contractor shall submit complete shop drawings of all equipment furnished in this section.

B. The contractor shall submit to the "Engineer" for review and approval the supplier's calculations substantiating the output torque rating of the drive selected, including all gears and pinions in the drive train.

C. The calculations shall clearly specify the values used for the following design parameters for surface durability and strength ratings:

1. Worm and Worm Gear Diameters
2. Number of Pinions
3. Actual Face Width
4. Tooth Geometry Factor (I and J factors)
5. Load Distribution Factor
6. Allowable Contact Stress
7. Allowable Bending Stress
8. Pinion Pitch Diameter
9. Tooth Diametrical Pitch
10. Hardness Ratio Factor
11. Elastic Coefficient
12. Life Factor

D. The load distribution factors cm & km per AGMA 2001-C95 shall be calculated as defined but in no case shall the values be less than 1.32. The net face width for surface durability calculations shall not exceed the actual face width of the narrower of the two mating gears. For parameters which are material dependent, such as allowable contact stress, the calculations shall include a full description of the materials and heat treatment used.

E. The manufacturer shall submit design calculations substantiating the minimum deflections and stresses torques of the combined cage and rake arms as listed under the center cage and rake arm section of this specification.

1.06 DELIVERY

A. Fabricated assembles shall be shipped in the largest sections permitted by Carrier regulations, properly match-marked for ease of field erection. The units shall be erected and lubricated in strict accordance with the instructions of the manufacturer's field engineer.

PART 2 - PRODUCT

2.01 GENERAL

A. Each clarifier mechanism shall be of the center-drive type, supported on a stationary center support/feed column. The clarifier shall be designed to remove sludge uniformly from the bottom of the tank.

2.02 CENTER ASSEMBLY

A. The center assembly shall consist of the drive-unit with main bearing, suitable lubrication fittings, support points for the drive unit with main bearing and attachment points for the rotating center cage. The drive unit shall consist of a primary speed reducer which is driven by the electric motor, a roller chain, an intermediate gearset consisting of a worm and worm gear, and a low speed gearset consisting of a pinion and internal spur gear. The worm gear assembly shall be driven by a minimum 3/4 HP totally enclosed gear motor with 1.15 safety factor through roller chain and sprockets enclosed in a fabricated steel guard. Equipment shall be designed for use with 230/460 volt, 3 phase, 60 hertz supply. The gear box shall have an AGMA class II rating.

B. The drive unit main gear shall be designed for a momentary peak torque of 110,000 ft. lbs. Mechanism rated strength shall be 70,000 ft. lbs. (mechanism rated strength equals the output torque of the main spur gear at which the drive control indicator will register 100 percent load). The drive shall be rated to operate continuously at a minimum torque of 32,000 foot-pounds for twenty-four (24) hours per day for twenty (20) years at the specified output speed of 0.025 rpm.

C. The main gear and worm assembly shall be enclosed in a ASTM A48 cast iron housing and provided with adequate seals to protect the interior of the housing. Fabricated steel housings are not considered equal. Housing shall be designed such that gears and bearings are oil bath lubricated. For spur gear teeth which are not fully submerged in oil, the tooth mesh shall be designed to force lubricant to the upper portion of the tooth face. Housings must be provided with oil level sight gauges, oil fill and valved drain connections and valved condensate drain connections from the low points of the oil reservoir.

The main gear housing shall be bolted to the top of the stationary influent column and shall be capable of transmitting the mechanical design strength. The rotating center cage to which the rake arms are attached shall be bolted to the main gear.

D. The main gear material shall be cast iron - ASTM A536 grade 80-55-06 minimum, and shall have a minimum pitch diameter of 40 inches and shall be supported by and rotated upon the main bearing. The minimum spur gear tooth height shall be 6.0 inches. No exceptions are allowed to this requirement. Spur gear surface area

shall be a minimum of 753 square inches. Spur gear surface area is defined as the spur gear pitch diameter multiplied by the spur gear face width multiplied by 3.14.

E. The main gear shall be of solid one-piece construction. If split gear is utilized, mating sections shall be machined and a minimum of two (2) dowels on each side shall be used to insure proper alignment of the gear teeth. All bolts used shall be 316 stainless steel. For split gear construction, the allowable stress used in the calculations shall be reduced to 85 percent joint efficiency.

F. The main gear bearing shall be a radial-thrust type ball bearing with renewable strip liner races. The strip liner design shall be such that the B-10 life of the linear is a minimum of 20 years based on the specified mechanism speed and a uniformly distributed load on the rotating mechanism. Drives which do not use carbon corrected, vacuum degassed, high carbon steel liners (B-10 Life 250,000 hours) must provide two (2) complete spare bearing assemblies with the necessary seals as spare parts. Drives using integral bearing and gear assemblies must have replaceable bearing balls and liners independent of the gear without removing the gear.

G. The main bearing life shall be based upon the life to initial pitting of the linear element. Bearing diameter shall be a minimum of 45 inches.

H. The complete drive shall be assembled in the clarifier manufacturer shop and tested to assure the drive is running properly and to calibrate the drive control. A complete test report shall be sent to the Engineer verifying that the drive meets the quality assurance of the manufacturer and Engineer.

2.03 WORM, WORM GEAR AND PINION

A. The secondary reducer unit shall be constructed using ASTM A48 cast iron housing with a minimum pitch diameter worm gear of 21.5 inches. The worm shall be made of AISI 4142 heat treated steel ground and polished, driving a centrifugally cast manganese bronze worm gear. The worm and worm gear shall be designed based upon the requirements of AGMA standard 6034-E88 for the torque specified. Planetary gear units are not considered equal in design.

B. The pinion shall be constructed of steel, heat treated and precision cut to provide adequate tooth mesh for the values used in the calculations. The pinion must rotate in a lower taper roller bearing assembly and similar upper bearing encasement machined into the worm gear housing. The lower bearing pocket shall not be the collection point for condensation. Pinion shafts shall be one piece extending through the worm gear without intermediate couplings.

2.04 GEAR DESIGN AND RATING CRITERIA

A. Gearing shall be designed and rated using the criteria established by the following American Gear Manufacturers Association (AGMA) Standards:

AGMA 2001-C95 Fundamental Rating Factors and Calculation Methods For Involute Spur and Helical Gear Teeth

B. The output torque rating of the drive shall be based on the smaller of the two values determined from the above AGMA standard.

2.05 HOUSINGS

A. All gear housings shall be constructed using proper wall thickness' to resist the full drive peak loads without any deflections. The gear housing (turntable base) shall be designed with an integral, composite, side wall. The turntable side wall shall be built up sufficiently to ensure a secure oil bath compartment. A hardened raceway assembly, bolted to a flat plate, shall not serve as the oil containment barrier.

B. The main gear housing shall be designed with a condensate collection sump located beneath the main bearing assembly. The sump shall be the collection point for sediment, filings, condensate and other contaminants.

Before assembly, the base shall be thoroughly inspected for seep holes or inclusions and given a full hydrostatic test to ensure no leaks in the oil containment area. Copies of material certification sheets for the drive materials, as well as records of shop inspections shall be made available to the Engineer for review.

2.06 ALARM

A. An alarm horn shall be furnished by the equipment manufacturer and installed on the mechanism bridge by the contractor. The alarm shall be enclosed in a weatherproof housing with a non-corrodible industrial-type horn, relay, and reset button. The alarm unit shall be wired for operation on 110-volt, single-phase current.

2.07 OVERLOAD PROTECTION

A. The drive unit shall be equipped with an electrical- mechanical overload control device. The device shall be activated by thrust from the worm shaft. A calibrated spring will react to the worm thrust and allow axial movement of the worm shaft to activate a pointer. The pointer shall be covered by a plexiglass window providing a visual reading of the relative main gear output torque on a 0 to 100 percent graduated scale. The device shall also activate an alarm switch and motor cut-out switch. Exposed linkage bars, rods or revolving secondary worm gear housings will not be considered for this application.

B. The alarm and motor cut-out switches in the control device shall be factory calibrated and set to the required torque. The setting shall be as follows:

Alarm Torque set at 40 percent of Mechanical Design Strength.
Motor Cut-out set at 85 percent of Mechanical Design Strength.
Motor Back-up safety switch (or shear pin) set at 100 percent of Mechanical Design Strength.

C. The pointer, control switches, and electrical terminals shall be mounted in a waterproof enclosure that is integral to the worm gear housing. The enclosure shall be sealed to the housing to prevent moisture from entering either the overload device or drive unit. Amperage and current sensing devices will not be considered equal to the overload device specified.

2.08 CLARIFIER CONTROLLER

A. CONTROL PANEL

1. Provide clarifier control panel in NEMA 250, Type 4X 316SS enclosure mounted on handrail.
2. Enclosure to include stainless steel hidden hinges, quarter-turn latches, pad-lockable handle and high impact thermoplastic data pocket mounted on inside of door.
3. Provide “START” and “RESET” pushbuttons.
4. Provide “STOP” push-pull maintained stop mushroom head pushbutton.
5. Provide “SCUM SPRAY” on-off-auto selector switch.
6. Provide “on’, “off”, and “alarm” indication pilot lights.
7. Provide three (3) SPDT adjustable timers for scum trough spray system, hose pump delay start, and hose pump run. Timers shall be digitally adjustable from 0.1seconds to 9,990 hours with LCD displays.
8. Provide one 120VAC horn rated to provide 100dBa at 10’ in NEMA type 4X enclosure; Federal Signal Corporation Model 350, or approved equal.
9. Provide stainless steel mounting hardware.
10. Provide Allen Bradley relays and Allen Bradley Series 800T switches and LED indicator lamps, or approved equals.
11. Provide control transformer and wire components complete.
12. Pushbuttons, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type. Pilot lights shall be LED type.

B. CENTER ASSEMBLY DRIVE UNIT MOTOR STARTER

1. General: Factory-assembled combination controller with integral overcurrent protective device disconnecting means and magnetic motor starter unit. Select controller features to coordinate with ratings and characteristics of supply circuit and the actual motor to be controlled; required control sequence; duty

cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.

2. Motor Starter Units: FVNR (Full Voltage Non-Reversing), NEMA ICS 2, Class A, across the line.
3. Overcurrent Protective Device Disconnecting Means: Molded-case circuit breaker, UL 489 9, MCP (motor circuit protector) type with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.
4. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 10/20 (field selectable) tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.
5. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.

C. SEQUENCE OF OPERATIONS

1. When the scum skimmer arm passes over the limit switch located at the stationary scum trough, the signal will be sent to the adjustable delay start timer to energize the hose pump and the adjustable timing relay to open the scum trough spray system solenoid valve. The pump operation time will be determined by the adjustable run timers.
2. The platform alarm will be initiated on over-torque on the center assembly drive unit or a tripped signal from the hose pump starter. LED pilot lights on the clarifier controller will indicate which motor caused the alarm. A single reset pushbutton on the controller will silence the alarm from either condition.
3. The reversing operation capability at the hose pump will allow the hose to be cleared manually, when needed.

2.09 WALKWAY AND DRIVE PLATFORM

A. The clarifier shall be provided with a 36-inch wide truss walkway with truss side rails. The truss walkway shall be connected to and, supported by the drive platform at its inner end and supported on the opposite end by the tank wall. Walkway shall be designed to safely withstand all dead load plus a live load of 150 pounds per linear foot with a maximum deflection of l/360, over the entire span.

The horizontal and vertical truss sections shall be diagonally and laterally braced to resist the wind loads. The walkway surface shall be fiberglass grating**.**

B. A center drive platform shall be provided. The platform shall be a minimum of 8’-4” x 8’-9”. The flooring shall consist of 3/8-inch checkered aluminum floorplate

attached to a minimum of ¼-inch structural steel frame, with necessary stiffeners and supports, resting on the center assembly and provided with connections to the walkway. Handrails 42-inch high of 1 ½-inch diameter double-row horizontal 60063-T6 aluminum pipe, schedule 40 rails and schedule 80 posts, and stainless steel fasteners shall be placed around all sides of the operating platform. A 4-inch toe board shall be provided on the drive platform to keep tools from falling into basin.

2.10 CENTER CAGE AND RAKE ARMS

A. The center cage shall be of steel box truss construction, a minimum of 4'-0" square. It shall be provided with the connections for the two (2) sludge scraper rake arms and feedwell supports. The cage top shall be bolted to the main gear which shall rotate the cage with the attached arms and feedwell. The minimum structural angle size used for the cage and rake arms shall be 2-inch x 2-inch x ¼-inch.

B. The mechanism shall include two (2) full radius truss-type collection arms. Sludge draw-off pipes shall be located along the arms with blades and squeegees arranged to direct the settled solids to the draw-off pipes and to rake those solids not picked up by the pipes to the center sludge pocket.

C. The rake arms shall rotate in a clockwise direction at a maximum tip speed of 9 ft/min. Each rake arm shall be designed to withstand 55,000 foot-pounds of torque plus all dead loads at the AISC allowable stress.

D. Each rake arm shall be provided with five (5) withdrawal pipes of PVC per ASTM D3034 (Type 1 Grade 1). Elbows with fair curves for change of direction shall be provided as required. PVC pipes shall be arranged for each assembly with minimum trimming. The maximum total sludge return based on utilization of ten 8-inch diameter withdrawal pipes shall be 4,000 GPM for each clarifier. The withdrawal pipes shall be attached to the rake arms at their lower end by means of galvanized steel clamps and shall pass along the arms and vertically upward to the rotating sludge discharge well.

E. The torque cage shall be designed such that calculated stresses do not exceed the AISC allowable stress at 110,000 ft. lbs. load, and shall not exceed yield stress by more than 1/3 the AISC allowable stress. The manufacturer shall provide design calculations substantiating the design capacity of the torque cage and rake arm structure.

2.11 CENTER COLUMN

A. A 42-inch diameter x 1/2-inch wall thickness stationary center column shall be provided which shall serve as an influent pipe as well as the center support column for one end of the walkway and the rotating mechanism. One end shall have a support flange (1¼-inch minimum thickness) for bolting to the foundation, with a

minimum of eight (8) 1¼-inch diameter anchor bolts, and a similar flange at the top of the column for supporting the center assembly. Inlet openings for the influent flow and RAS shall be provided in the upper portion of the column. These openings shall not be less than 135 percent of the column area in sizing.

B. A minimum 20-inch diameter by ¼-inch wall thickness RAS sludge return pipe shall be provided within the center support column to convey the collected sludge. It shall extend from the sludge collection box to within 1 foot of the floor as shown on the contract drawings.

2.12 FEEDWELL

A. The feedwell size shall be 24 feet diameter x 7 feet 6 inches side depth. The feedwell side plate shall be fabricated from ¼-inch steel plate. The feedwell shall be supported by steel truss supports attached to the center rotating cage or be supported from the center drive platform.

B. The feedwell reinforcing rim angles, angle stiffeners and supporting brackets shall be structural steel members a minimum of ¼-inch. Eight (8) scum ports 4-inch high x 16-inch long shall be provided equally spaced around the feedwell periphery to allow scum to exit from the feedwell at water level. Scum ports shall be free to allow scum to escape at any time.

2.13 ENERGY DISSIPATING INLET (EDI)

A. The clarifier shall be equipped with an energy dispersion well located inside the rotating flocculation feedwell. The dispersion well shall be designed to dissipate the energy of the incoming flow by way of multiple baffled inlet ports equally spaced around the dispersion well.

B. The center dispersion well shall be a minimum of 12 feet diameter x 6 feet 3 inch deep including a bottom plate to within one inch of the center column. The well shall be constructed of 3/16-inch plate. EDI outlet ports equally spaced around the periphery shall be provided for energy dissipation. The outlet ports shall have adjustable gates.

C. The bottom plate of the EDI shall be provided with properly sized drain holes.

2.14 ROTATING SLUDGE COLLECTION DRUM

A. Inside the feedwell, and supported from the rotating cage, shall be provided a sludge collection box. It shall contain a sludge control valve for each sludge draw-off pipe. A neoprene seal shall be provided between the rotating sludge collection box and center column. A peripheral sludge collection ring shall be designed and provided to allow sludge pumping from within the ring.

Each control valve shall be fabricated from ASTM D3034 PVC piping with a minimum 3/8-inch thick top and bottom flanges. Valves shall be assembled using approved PVC welding, solvent welded assemblies will not be allowed. All mounting hardware to be 304 stainless steel. The manufacturer shall provide a control handle to operate the control valves. The handle shall be provided with a length of chain sufficient to attach to the platform handrail.

2.15 SURFACE SCUM SKIMMING EQUIPMENT

A. Each clarifier shall be equipped with two full radius skimmer arm assemblies to collect and discharge surface scum into a full radius scum trough cantilevered from the tank wall.

B. Each skimmer arm shall be either a structural steel truss assembly or a fabricated tube assembly connected to the center cage and cantilevered from the rotating feedwell. Tie rods shall be properly located to allow adjustment of the skimmer arm as well as to resist horizontal forces.

C. Each skimmer arm shall be equipped with a hinged ½-inch 60 durometer neoprene wiper blade extending the full width of the arm. The neoprene blade shall be fastened to the arm with stainless steel fasteners with steel back-up bars

D. The full radius scum trough shall be fabricated from ¼-inch steel plate and shall be supported from the tank wall as shown on the drawings. The trough and support structure shall be designed for all dead loads plus a 200 hundred pound point load at the feedwell end of the trough with no more than ½-inch deflection. The approach ramp of the trough shall be of radial design, having a tapered width and a variable slope that will enable the full length of the skimmer wiper to make simultaneous and continuous contact with the entire ramp along a radial line, at each revolution of the skimmer arm. The trough shall be 8 inches wide with a uniformly sloped bottom to allow scum to discharge toward the tank wall. Fabrication of the trough shall be true and free of warpage. A 6-inch schedule 40 pipe connection shall be provided for connection to the scum drain line.

E. The clarifier equipment manufacturer shall furnish a flush valve assembly for automatic flushing of the scum trough and scum pipe. The flush valve assembly shall be adjustable to allow 0 to 20 gallons of clarified effluent to enter the scum trough as the skimmer assembly passes over the scum box. The assembly shall consist of a stainless steel lever, UHMW seal plate and neoprene diaphragm mounted to the scum trough. The diaphragm shall be opened and closed by an easily adjustable, submerged actuation arm mounted to the rotating feedwell. The flush volume adjustment mechanism shall be above the water level and shall include at least three settings.

2.16 LIMIT SWITCHES AND SCUM SPRAY CONTROLS

A. One (1) limit switch shall be furnished and installed on the clarifier to indicate position of the clarifier skimmer mechanism relative to the scum box. Switch shall be form Z type, Model 43 100 D as manufactured by General Equipment & Manufacturing Co., or equal. Case shall be hermetically sealed, epoxy coated brass. Switch shall be furnished and installed with mounting brackets and hardware designed to detect passage of the clarifier scum mechanism.

B. Switch contacts shall be SPDT, 120 VAC, 10 amp, continuous rating.

C. One (1) adjustable reset cycle timer shall be furnished and installed which shall energize a 120 volt solenoid valve on each scum trough spray header. The solenoid valve shall de-energize after an adjustable time delay (0 - 10 minutes). The cycle timer shall be activated by the limit switch. Timers shall be Eagle Signals CE 500 series, or equal. Power supply shall be 120 VAC.

2.17 SCUM SPRAY SOLENOID

A. One (1) scum spray solenoid shall be furnished and installed by the Clarifier Supplier. The solenoid valve shall be 120 VAC energize to open, heavy duty and mounted in a NEMA 4X housing. Size of the solenoid valve shall be one inch.

2.18 SPRAY NOZZLES

A. Spray nozzles shall be constructed of Type 316 Stainless Steel, operate at a minimum pressure of 10 psi and connections shall be 1/2-inch NPT. All nozzles shall be capable of passing a maximum 1/8-inch diameter sphere. Nozzles shall be manufactured by Spraying Systems Co., Bete, Inc., Bex, Lechler, or equal.

B. Nozzles shall be of the number and located as shown on the drawings. Nozzles shall be Spraying Systems model number 1/2 GG-316SS25, or equal.

2.19 WEIRS AND BAFFLES

A. Effluent weirs shall consist of 10-inch deep x ¼-inch thick FRP sections with 3-inch deep 90 degree V-notches at 6-inch intervals. The weir section shall be fastened to the tank wall with FRP washers, stainless steel anchor bolts and hex nuts to allow vertical and radial adjustment. All joints between walls and weirs shall be given a seal coat of suitable waste resistant mastic by the erection contractor to prevent leakage.

B. The baffles shall consist of sections of 12-inch deep x ¼-inch thick FRP attached to the tank wall by FRP support brackets, stainless steel anchor bolts and hex nuts to enable vertical and radial adjustment.

2.20 PAINTING AND SURFACE PREPARATION

A. All non-submerged steel shall be sandblasted to SSPC-SP-6 specifications and given one coat of manufacturer's epoxy primer 2-3 MDFT. All submerged steel shall be sandblasted to SSPC-SP-10 specifications and given one coat of manufacturer's epoxy primer 2-3 MDFT.

B. Prior to assembly of the drive unit, the castings shall have been sandblasted and thoroughly cleaned to remove any foreign particles in the drive base. After assembly, the drive mechanism shall be solvent cleaned and power wire brushed as needed prior to application of manufacturer's standard primer.

C. Gear motors shall be furnished with manufacturer's standard enamel.

2.21 SPARE PARTS

A. The intent of this specification is to provide non- interrupted continuous operation for approximately 6-10 years. The manufacturer shall supply any spare parts that are required for the minimum time frame. As a minimum, the following parts are to be furnished:

1. All sight glasses or oil gauges.
2. One (1) set of neoprene skimmer wipers.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The equipment shall be erected in strict accordance with manufacturer's recommendations. A 2-inch layer of grout shall be applied to the tank floor, using screeds attached to the rake arms. The mechanism shall sweep the grout, consisting of a mixture of sand and cement accepted by the Engineer, under its own power.

3.02 SERVICE

A. The equipment manufacturer shall provide a service man properly trained in inspection and operation of the mechanism to approve the installation, certify torque, run the test and instruct the owner personnel on maintenance and operation.

This service shall be in the form of two (2) trips to the site and three (3), eight (8) hour days of service. Any additional service shall be provided by the contractor at his expense for improper installation or delayed check-out of operator training.

END OF SECTION

SECTION 11234

CENTRIFUGAL NON-CLOG WASTEWATER PUMPS
(Recycle Activated Sludge Pumps)

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and appurtenances required to install, complete, make ready for operation and field test the non-clog, centrifugal wastewater pumps including drive systems as shown on the drawings and specified hereinafter.

1.02 RELATED WORK NOT INCLUDED IN THIS SECTION

A. Section 02064 - Modifications to Existing Structures, Piping, and Equipment.

B. Section 02615 - Ductile Iron Pipe & Fittings

C. Section 02640 - Valves and Appurtenances

D. Section 05500 - Miscellaneous Metals

E. Section 09941 – Field Painting

F. Section 16269 - Variable Frequency Drive

G Section 17010 - Instrumentation

1.03 DESCRIPTION

A. All the equipment specified herein is intended to be standard equipment as modified by this specification for the uses described. All pumps will be used to pump raw wastewater under the conditions of service specified in paragraph 2.01.

1.04 QUALIFICATIONS

A. All pumps to be furnished under this section shall be product of a single manufacturer.

B. To assure unit responsibility, the motors and variable speed drive, if required, shall be furnished and coordinated by the pump manufacturer. The Contractor shall assume

responsibility for the satisfactory installation and operation of the entire pumping system including pumps, motors, variable speed drives, flex shafting and accessories.

C. All equipment furnished under this section shall be new and unused from manufacturers having a successful record of manufacturing servicing the equipment and systems specified herein for a minimum of five (5) years.

1.05 SUBMITTALS

A. Copies of all materials required to establish compliance with these specifications shall be submitted in accordance with the provisions of the General Conditions for approval prior to manufacturing. Submittals shall include a least the following:

1. Certified dimension prints showing all necessary details of construction including anchor bolt size and locations.

2. Descriptive literature, bulletins, and catalogs indicating the general description, specifications, and limitations.

3. Data on characteristics and performance of each size pump. Data shall include guaranteed performance curves based on actual laboratory tests of duplicate units which show compliance with the specified requirements for head, capacity, efficiency, NPSHR and brake horsepower at the rated speed. Performance curves for variable speed units shall show head and capacity in 100 rpm increments from minimum to maximum speed in addition to the above. Curves shall be plotted head versus capacity on 8-1/2"x11" sheets.

4. The weight of each major component along with the total weight of the equipment.

5. A complete bill of materials for all equipment showing materials of construction and part numbers.

6. A list of the manufacturer's recommended spare parts including gaskets, packing and seals.

7. Complete data on motors including performance characteristics described in Part 2.

8. Copies of all test results described in Part 3.

9. Complete master wiring diagrams, elementary or control schematics and suitable cabinet outline drawings showing dimensions, structural and mounting details.

B. In the event that it is impossible to conform with certain details of these specifications due to different manufacturing techniques, furnish complete descriptive data for all non-conforming aspects of the equipment including justification for the deviation.

1.06 OPERATING AND MAINTENANCE INSTRUCTIONS

Copies of an operating and maintenance manual for each size pump shall be furnished to the Engineer as provided for the General Requirements. The manuals shall be prepared specifically for the equipment furnished and shall include all required catalog cuts, drawings, equipment lists, descriptive text, instructions, and other materials required to instruct operating and maintenance personnel in the proper use, adjustment, operation and repair of the equipment furnished.

1.07 SUPERVISION

The Contractor shall arrange for the Pump Manufacturer to provide an authorized factory trained representative as required for the purpose of supervising installation, start-up, final field acceptance testing. Instruction of the Owner's operating personnel in the proper operation and maintenance of the equipment furnished under this section shall also be provided.

1.08 TOOLS AND SPARE PARTS

A. One (1) set of all special tools required for normal operation and maintenance shall be provided. All such tools shall be furnished in a suitable steel tool chest complete with lock and duplicate keys.

B. All spare parts shall be properly protected for long term storage and packed in containers which are clearly identified with indelible markings on the outside as to contents. The following spare parts shall be provided:

1. Two (2) sets of packing for each pump or two (2) sets of mechanical seals for each different size pump, whichever is applicable.

2. Two (2) complete sets of gaskets, "O"-rings, lip seals and related items for each different size pump.

3. Two (2) shaft sleeves for each different size pump.

4. Two (2) sets of wearing rings for each different size pump.

PART 2 - PRODUCTS

2.0 GENERAL DESCRIPTION

The pumps shall be centrifugal, non-clog, solids handling wastewater pump horizontally mounted, Model 611A as manufactured by Aurora Pump or approved equal.

2.01 CONDITIONS OF SERVICE

The following conditions of service shall be strictly adhered to:

Number of Units.....5
Type of Drive.....variable
Suction Size.....10 in, minimum
Sphere Size.....3 in, minimum
Design Capacity.....3,500 US gpm
Design Head.....21 ft
Efficiency at Design.....78 %, minimum
Rotative Speed.....700 RPM, maximum
Shut-off Head.....34.3 ft, minimum
NPSHR at Design.....15.6 ft, maximum
Secondary Capacity.....3,500 US gpm (at maximum RPM)
Secondary Head.....21 ft (at maximum RPM)

2.02 MATERIALS OF CONSTRUCTION

Casing.....ASTM A48 CL30, cast iron
Impeller.....ASTM A48 CL30, cast iron
Shaft.....AISI C1045, carbon steel
Sleeve.....AISI 440C, 450 BHN, HT SS
Bearing Frame.....ASTM A48 CL30, cast iron
Support Base.....ASTM A36, fabricated steel
Stuffing Box.....ASTM A48 CL30, cast iron
Packing Gland.....AL, leakage accumulator type
Impeller Wear Ring.....AISI 420, 350 BHN, HT SS
Casing Cover Wear Ring….AISI 420, 350 BHN, HT SS
Suction Cover.....ASTM A48 CL30, cast iron
Casing Cover.....ASTM A48 CL30, cast iron
Suction Elbow.....ASTM A48 CL30, cast iron
Lantern Ring.....Teflon, split type
Fasteners.....Cadmium plated steel
Nameplates.....stainless steel

2.03 CASING

The casing shall be of the end suction volute type having sufficient strength and thickness to withstand all stress and strain from service at full operating pressure and load. The casing shall be of the centerline discharge type for ease of installation and piping alignment. A handhole shall be provided in the casing for convenient access to the impeller and interior parts. The inner contours of the handhole shall match the volute shape of the casing interior. 1/2 inch NPT suction and discharge gauge connections along with 3/4 inch NPT drain and vent connections shall be provided. The casing shall be accurately machined and bored for register fits with the suction and casing covers. Suction and discharge connections shall be 125#, flat face flanges in accordance with ANSI B16.1. Suction and discharge orientation shall be as shown on the drawings.

2.04 IMPELLER

The impeller shall be cast in one piece and dynamically balanced to prevent excessive vibration. It shall be specifically designed to pump raw wastewater and have the largest size sphere capacity possible to prevent clogging. The impeller shall be keyed to tapered shaft and firmly held in place by a grade 5, zinc dichromate plated, strained and hardened impeller fastener sealed with a gasket against the hub. The fastening arrangement shall be such that the impeller cannot be loosened by torque from either forward or reverse rotation and prevent leakage of the pumped fluid from entering the threads causing corrosion.

2.05 SHAFT SLEEVES

Where the pump shaft passes through the stuffing box, it shall be protected from abrasion and corrosion by an easily renewable shaft sleeve. The shaft sleeve shall have a slip fit with a machined relief to prevent adhesion to the shaft. The sleeve shall be positively driven by a woodriff key to prevent relative rotation. It shall have a minimum Brinnel Hardness of 450, heat treated and ground to close tolerances. The passage of pumped fluid from the casing under the sleeve shall be prevented by "O"-ring packing or other approved means between the shaft sleeve face and impeller hub. The shaft sleeve shall extend from the impeller hub through the stuffing box and gland.

2.06 WEARING RINGS

Each pump shall be fitted with removable case and impeller wear rings. The wear rings shall be of the face type securely fastened to the suction cover and impeller eye hub by stainless steel recessed allen head screws to facilitate easy replacement. The impeller and case wear rings shall be interchangeable parts to prevent mismatches.

2.07 STUFFING BOX

The stuffing box shall be cast integrally with the casing cover and designed for a minimum of five (5) rings of braided, graphite impregnated, Teflon packing and a lantern

ring. A glass filled, TFE, machined, split type lantern ring shall be provided for water sealing. The lantern ring shall be drilled for easy removal and suitably positioned to assure uniform distribution of the sealing medium. The stuffing box shall have two (2) 1/2 inch NPT connections 180 degrees apart located at the lantern ring for seal water flushing connections. The stuffing box shall be designed and machined to provide an integral throttle bushing to reduce infiltration of the pumped fluid and reduce stuffing box pressure.

The stuffing box shall be designed and machined so that mechanical seals will interchange with the packing at a future date. Each packing box shall be equipped with a horizontally split, removable, gland. The stuffing box adapter bracket shall accumulate the gland leakage and provide a 3/4 inch NPT drain connection. Drain piping shall be installed by the Contractor from the pump to the floor drain shown on the drawings.

2.08 SHAFT

The pump shaft shall be accurately machined and ground to size. The shaft shall have sufficient strength and cross section to transmit the maximum required torque at the maximum RPM without distortion providing a maximum shaft deflection at the stuffing box face of .003 inches. The shaft shall be drilled and tapped on the centerline at the coupling end for use of a lifting eyebolt. It shall be keyed at both the coupling end and impeller end for an adequately sized square key. The impeller end of the shaft shall have a three degree taper to match the impeller bore to facilitate easy removal of the impeller.

2.09 BEARING FRAME

Each pump shall have a bearing frame rigidly fixed to the casing with machined registered fits to maintain alignment. Each bearing frame shall contain both radial and thrust bearings. The bearings shall be anti-friction ball or roller type of ample capacity to carry all loads imposed under continuous operation without overheating. All bearings shall be designed and rated in accordance with the Anti-friction Bearing Manufacturer's Association Standards. The minimum B-10 life provided shall be 100,000 hours. Grease lubrication and relief shall be provided so that excessive grease pressure will not cause damage. Axial adjustment of the impeller clearance shall be accomplished by external jacking screws to maintain clearance between the impeller and case wearing rings over the life of the pump. The bearing frame shall be designed so that the complete rotating assembly may be removed for maintenance without disturbing the suction or discharge connections.

2.10 BASEPLATE

Each pump shall be mounted on a fabricated steel or steel drip rim base of sufficient strength and stiffness to support the entire pump and motor unit without excessive distortion or vibration. Anchor bolt holes shall be provided to securely fasten the base to the concrete floor pad shown on the drawings. Drip rim bases shall have a drip rim on each side of the base to collect any leakage or condensation. The drip rim shall be

continuously welded to the base over the entire length. 3/4 inch NPT drain connections shall be provided at each end of the drip rim for connection to drain piping. Grout holes shall be provided in each base for the application of non-shrink grout.

2.11 COUPLINGS

Each pump shall be furnished with a flexible coupling between the pump and motor. Each coupling shall be of the all metal hub type with a flexible rubber insert. Couplings shall be dynamically balanced and rated 25% greater than the maximum load imposed by the pump. Couplings shall be as manufactured by Falk, Woods or approved equal. The coupling shall be locked to the pump and motor shafts by square keys and set screws. A suitable coupling guard shall be provided for each unit in accordance with OSHA regulations.

2.12 MOTORS

The electric motors shall be severe duty squirrel cage induction type, invertor duty rated, horizontal, "T" frame. The nameplate horsepower rating shall be completely non-overloading throughout the entire range of pump performance for the particular impeller trim regardless of service factor. The motors shall have grease lubricated bearings with a minimum B-10 bearing life of 50,000 hours per AFBMA. Each motor, in addition to the above, shall have the characteristics:

NEMA Design.....B
Voltage..... 460
Hertz.....60
No. of Phases.....3
Service Factor.....1.15
Insulation.....Class F
Temperature Rise.....Class B
Ambient Temperature….40 degrees C
Elevation.....3000 maximum (ft. above sea level)
Enclosure.....TEFC
Horsepower...25 hp
Maximum RPM.....700 RPM

2.14 SURFACE PREPARATION AND PAINTING

Surface preparation and painting shall be as specified in Section 09941, Field Painting.

PART 3 - EXECUTION

3.01 INSPECTION AND FACTORY TESTS

A. The Engineer shall have the right to inspect or witness test any material or equipment to be furnished, under this section, prior to their shipment from point of manufacture. The Engineer shall be notified at least ten (10) working days in advance of any testing in order to exercise or waive the right to witness any testing.

B. Each centrifugal wastewater pump furnished under these specifications shall be tested at the factory in accordance with the latest edition of the Hydraulic Institute Standards for both hydrostatic pressure and performance. Certified copies of all test reports shall be submitted to the Engineer for approval prior to shipment.

C. Each pump shall be tested at the full load speed of the respective driver for head, capacity, brake horsepower and efficiency from shut-off to 150% of design capacity. In addition, for variable speed units, one (1) pump of each service shall be tested at the minimum design conditions plus three (3) equally spaced speeds between the minimum and maximum conditions.

D. Tests on all motors shall be conducted in accordance with IEEE Standards. All test results shall be submitted to the Engineer for approval prior to shipment.

1. Each motor shall be given a short commercial test which includes the following:

    a. No load running current
    b. High potential
    c. Winding resistance

3.02 INSTALLATION AND ACCEPTANCE TESTS

A. The pumping units shall be installed in accordance with the instructions of the manufacturer and as shown on the drawings by the Contractor.

B. Installation shall include furnishing the required oil and grease for initial operation. The grades of oil and grease shall be in accordance with the manufacturer's recommendations.

C. Furnish the services of an authorized factory representative to inspect the final installation, perform initial start-up and supervise the field acceptance tests of the equipment.

D. Field acceptance testing shall be conducted after the installation of all equipment has been completed and the equipment operated for an initial period to make all necessary adjustments and corrections. Each pumping unit shall be tested to determine satisfactory operation and compliance with these specifications in the presence of the

Engineer or his representative. All expenses for conducting the field acceptance tests shall be borne by the Contractor

END OF SECTION

SECTION 11295

COPLASTIX SLIDE GATES

PART 1 - GENERAL

1.01 SCOPE OF WORK:

A. The work to be performed under this Section shall include furnishing all labor, materials, tools and equipment necessary to install and test all stop, slide and weir gates, consisting of, but not limited to frames, discs, seals, stems, operators, floor stands, stem guides, anchorage, and all other appurtenances, in place and complete, as manufactured by Ashbrook Corporation, Houston, Texas.

B. The Contractor shall furnish all labor, materials, equipment, and incidentals required, consisting of, but not limited to frames, discs, seals, stems, operators, floor stands, stem guides, anchorage, and all other appurtenances, and install complete and ready for operation all gates and appurtenances as shown on the Drawings and as specified herein.

C. All gates and appurtenances shall be of the size shown on the Drawings and, to the extent possible, all equipment of the same type on the Project shall be from one manufacturer.

D. The equipment shall include, but is not be limited to, the following Schedules:

Gate Schedule			
Location	**Type**	**Size (W x H)**	**Mounting**
Clarifier 5 Influent Sump in Aeration Basin Effluent Channel	Slide – Upward Opening	4’-0” x 6’-3”	Channel

1.02 RELATED WORK

A. Section 01340 – Shop Drawings, Project Data and Samples

B. Section 03010 – Concrete Work

C. Section 05500 – Miscellaneous Metals

1.03 SUBMITTALS:

A. Materials and Shop Drawings:

1. Copies of all materials required to establish compliance with the specifications shall be submitted to the Engineer. Submittals shall include the following:

a. Certified shop and erection drawings and data regarding slide and weir gates.

b. Literature on drawings describing the equipment and showing all-important details of construction and dimensions.

B. Operating Instructions: Operating and maintenance instructions for each type of slide and weir gate shall be furnished to the Engineer.

C. Installation: The manufacturer shall provide installation instructions. The installation and adjustment of gates, operators and all accessories shall be in full accordance with these instructions. The slide and weir gates shall be installed by the best practices and methods.

1.04 REFERENCE STANDARDS

The following publications listed below form a part of this Specification to the extent referenced. The publications are referred to in the text by basic designation only.

A. American Water Works Association (AWWA), C501-87 Standard for Cast Iron Slide Gates.

B. American Society for Testing and Materials (ASTM) Publications.

1. D635-81 Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position

2. D648-82 Test Method for Deflection Temperature of Plastics Under Flexural Load

3. NASA CR-1457, "Manual for Structural Stability Analysis of Sandwiched Plates and Shells" et al.

1.05 QUALITY ASSURANCE

A. All of the types of gates and appurtenances shall be products of fully experienced, reputable and qualified in the manufacturing of the equipment furnished and who has

been building said equipment for a minimum period of ten (10) years. The equipment shall be designed, constructed and installed in accordance with the best practices and methods and shall comply with these Specifications as applicable.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Delivery at Site

1. All materials, which will not be installed the same day as delivered to the site, shall be stored in the appropriate manner in the original manufacturer's packaging. Each package shall have an identifying mark and a complete list showing contents. Loose items with no original packaging shall be boxed to protect the products from scratches, abrasion, or breakage.

B. Protection Prior to Installation

1. All products shall be protected from excessive heat and from moisture during storage and handling.

2. All plastic materials shall be stored out of direct sunlight.

1.07 WARRANTY AND GUARANTEE

The Manufacturer shall guarantee the slide and weir gates, when installed and operated as recommended by the Manufacturer with a documented maintenance program, trouble-free operation for a period of ten (10) years. If the Owner or Engineer is not completely satisfied with the performance of the product, the Manufacturer shall remedy the problem at no cost or refund the materials and installation cost upon the return of the equipment The Manufacturer shall guarantee the following:

A. Leakage shall be no more than that allowed by the AWWA C501 Standard during the guarantee period.

B. Door (disc) shall be free of sticking or binding as judged by the Engineer (move freely via operator provided) with no exercising required. Gate operators are to be warranted by the operator manufacturer.

1.08 OTHER

A. All gates shall be fully assembled in their frames except for operators, guides, stem-extension, and stem covers or concrete-mounted pedestals. Where shipping constraints require it, frame may be partially assembled such that the top may be easily mounted to the bottom containing the disc.

B. Where square-to-circular or bell-lip conversion is required the Contractor shall provide a bell-end pipe insert of suitable diameter and water stop.

C. J. Bulb seals attached to the Disc / mounted to the frame, or any seal that needs replacement in less than 10 years shall not be acceptable. No part of the seal shall protrude into the clear opening.

PART 2 - PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Slide gates shall be designed for the seating and unseating heads as listed in the gate schedules. Slide and weir gates shall conform to the AWWA C501. Conformance to AWWA C501 applies to discs and frames with a safety factor of five (5) with regard to tensile, compressive and shear strength and with the requirement that all gates will yield no more leakage than shown in Section 6.8 (AWWA) Field Leakage Test. Calculations shall be submitted to show conformance. Materials of construction shall be suitable for the environment in which the slide and weir gates shall be installed and operated.

A. Reinforced Plastic Stop, Slide and Weir Gates – General: 316L Stainless Steel frames, reinforced plastic slide (disc) as specified herein. FRP, GRP, plastic coated steel or externally reinforced slide (disc) shall not be acceptable.

B. Slide (Disc): Shall be constructed from a reinforced rigid composite plastic material, having a minimum thickness of 1/8-inch. Slide (disc) shall have an internal matrix of carbon steel of suitable strength for the specified service. The slide (disc) outer surface skins shall be a homogeneous plastic material having extremely high tensile and impact strength, be nontoxic and shall be stabilized against ultraviolet light. The plastic material shall be an Aramid fiber from the KEVLAR family of fibers, and shall have the following minimum properties and shall be designed to limit the deflection to a maximum of 1/1000 of the span under design head conditions based upon horizontal support members only. Manufacturer shall submit drawings and comprehensive design criteria to substantiate that the required deflection figure for each door has been achieved. Comprehensive safety factor calculations shall include bending moments, buckling stress, and bonding stress with thermal expansion factors suitable for reference in NASA CR-1457, "Manual for Plates and Shells". et al. Safety factors shall be calculated for the disc under maximum head, and shear at the disc/seal interface. No substitute of fiber type will be acceptable.

PROPERTIES TABLE

Tensile Strength	12,500
Young's Modulus	1,200,000 psi
Flexural Strength	18,000 psi
Flexural Modulus	1,400,000 psi
Compressive Strength	11,000 psi
Impact Strength	40.3×10^{6} erg
Water Absorption	0.38 %
Specific Gravity	1.72
Coefficient of Thermal Expansion	1.6×10^{-5} per C
Heat Distortion Point	80 degrees C ASTM D648
Low Temperature Impact Strength	93% @ -20 C
Notch Sensitivity	Not notch sensitive
Weathering Properties	Excellent
Fire Resistance	Class 1 Spread of Flame, Rating BS476: Part 1: 1953 self-extinguishing, ASTM D635 - 56R
Chemical Resistance	Organics, Alkaline, Ozone (2 to 3 PPM)

Rigid Polyurethane foam shall be used as filler between the steel grid reinforcing system and shall be a min. of 7 LB density/cu.ft.

C. Seals: The sealing arrangement for the reinforced plastic slide and weir gates shall comprise of sealing faces and side guides constructed of ultra high molecular weight polyolefin having an extremely low coefficient of friction and backing constructed of highly resilient expanded neoprene. Guides and seating of the gate shall be easily adjustable (min. 5/8-inch). All moving contact surfaces shall be compatible to each other there by minimizing sticking / jamming and making the operation easy. Leakage rates shall be one-half (½) that allowed by AWWA C501.

2.02 FASTENERS:

A. Shall be 316 stainless steel. All anchor bolts, assembly bolts, screws, nuts, etc. shall be of ample section to safely withstand the forces created by operation of the gate while subjected to the heads specified.

2.03 STEMS:

A. All stems shall be the rising types. The entire stem, including extension stem, shall be Type 316 Stainless Steel. The sections of extension stems shall be joined together by solid couplings, threaded and keyed to the stems. All couplings of the same size shall be interchangeable. Stems shall be furnished with adjustable, polyethylene bushed stem guides, spaced as necessary to maintain a slenderness ratio L/R of less than 200.

Stems shall be of ample cross section to prevent distortion and shall have stub acme threads. Stems shall be designed to withstand tensile and compressive loads that occur under maximum operating conditions. Design for compressive loading shall meet AISC code where K=1 with a minimum safety Factor of 2 to 1. These requirements exceed AWWA standards. Stems shall be cold rolled with a double start stub acme thread and a finish of 32 microns or less. Stems shall be fixed to the disc by a threaded and keyed assembly into a lifting nut attached to the disc in a lifting bracket, which is bolted to the disc.

2.04 LIFTING DEVICE

A. Operation of the gate will be by means of an anti-friction handwheel benchstand. Maximum effort on the handwheel shall not exceed 40 pounds pull to open or close the gate. The lift mechanism must be capable of withstanding, without damage, an effort up to 80 pounds. The hoist nut shall be bronze and be supported by roller bearings. A lubrication fitting shall be provided for lubrication of the hoist bearings without disassembly of the hoist. Suitable seals shall be provided to prevent entry of foreign matter. The direction of the handwheel rotation to open the gate shall be clearly and permanently marked on the hoist.

2.05 MANUFACTURER

A. Slide gates shall be Coplastix as manufactured by Ashbrook Corporation, Houston, Texas, or equivalent.

PART 3 – EXECUTION

3.01 INSTALLATION

A. Installation of all gates and guides shall be done by the Contractor in a manner acceptable to the Manufacturer and Owner. It shall be the responsibility of the Contractor to handle, store, and install the equipment specified in this Section in strict accordance with the Manufacturer's drawings and recommendations. Frames and guides shall be installed in a true vertical plane with 90-degree corners.

3.02 INSPECTION AND TESTING

A. Furnish the services of a factory representative for one (1) day who has complete knowledge of proper operation and maintenance to inspect the final installation and supervise a test run of the equipment.

B. Maximum gate leakage shall be as defined in the General Design Criteria of this Specification, herein. If gates, operators, and appurtenances do not meet specified requirements, corrective measures shall be taken by the Contractor, or

the equipment shall be removed and replaced with equipment that satisfies the conditions specified.

END OF SECTION

SECTION 11300

DOUBLE DISC SLUDGE PUMPS
(Waste Activated Sludge Pumps)

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish all labor, materials, equipment and incidentals required to install double disc sludge pumps as specified herein and as shown on the drawings. Pumps shall be complete pump unit consisting of pump, v-belt drive arrangement, and motor all completely assembled on fabricated steel base and shall conform to the pump requirements described herein.

1.02 RELATED WORK

A. Division 2 – Piping, Valves, and Appurtenances

B. Section 03310 – Concrete Work

C. Section 05500 - Miscellaneous Metals

D. Division 16 - Electrical Work

1.03 QUALITY ASSURANCE

A. The equipment manufacturer shall be experienced in manufacturing pumping equipment of this technology as specified and that have a record of successful in-service performance. Manufacturer must have at least twenty (20) similar facilities in operation and have a history of manufacturing this equipment for at least ten (10) years. Upon request, submit evidence of manufacturing experience and installations.

B. The pumps shall undergo factory testing and all curves certified. This testing will confirm the pumps will meet the capacity and head requirements at the pump speeds specified based on water. The testing and tolerances shall be as specified by the Hydraulics Institute Standards.

C. All equipment must strictly conform to the requirements herein. If there are any exceptions they must be clearly listed. If the equipment is approved for use on this project and is found at any time in the future that exceptions were not listed, the engineer shall have the right to reject the equipment or require the manufacturer to modify the equipment to bring it into compliance at no increase in cost to the contract.

D. The equipment shall be 100 percent manufactured in the U.S. and all spare parts shall be available for same day shipment and next day delivery. The manufacturer shall maintain a fully equipped shop facility to perform all operations including welding, fabrication, assembly and testing. These integrated operations provide the level of quality necessary for the equipment specified. All materials shall be designed to withstand the stresses encountered in fabrication, erection and operation. All equipment shall be of corrosion resistant materials or shall be suitably protected by the supplier with corrosion resistant industrial coatings approved by the Engineer.

1.04 SUBMITTALS

A. The contractor shall submit complete shop drawings in accordance with Section 01340 of all equipment furnished in this section. Complete assembly, foundation, and installation drawings, with detailed specifications and data covering materials used, drive unit, parts, devices, and other accessories forming a part of the equipment furnished shall be submitted in accordance with the submittals section. The data and specifications for each shall include detailed information on the pump to include:

Pump
Manufacturer
Type and model
RPM at rated condition
Size of suction and discharge flanges
Complete performance curves
Net weight of pump and baseplate
Base and anchor bolt details
Data on pressure sensor and switch assemblies

Motor
Manufacturer
Type, model, and enclosure
Rated size of motor, hp an service factor
Temperature rise and insulation rating
Full load rotative speed
Net weight
Efficiency at full, ¾, and ½ load
Full load current
Locked rotor current
Overall dimensions and base details
Power factor at no load and at full load

B. Operation and Maintenance Manuals: Copies of an operating and maintenance manual for each size pump shall be furnished to the Engineer as provided for in Section 01730. The manuals shall be prepared specifically for this installation. Complete with manufacturer's instructions for equipment installation, equipment function, start-up procedures, operation, preventative maintenance, servicing and

troubleshooting.

1.05 WARRANTY

A. The equipment shall be warranted for a period of two (2) year against defects in workmanship and materials under normal use, operation and service. If the equipment should fail during the warranty period due to a defective part, it shall be replaced and the units restored at no expense to the owner.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. The pump(s) shall be a 4-inch Simplex Double Disc Model 4DDSX30 as manufactured by Penn Valley Pump Co., Inc of Warrington, Pennsylvania or approved equal.

2.02 OPERATING CONDITIONS

Pump Tag Number	
Number of Units	Four (4)
Material Being Pumped	WAS
Maximum Percent Solids	1.5
Maximum Capacity - Each Pump (GPM)	100
Minimum Capacity - Each Pump (GPM)	50
Rated Discharge Head in Feet	20
Maximum Discharge Head in Feet	120 ft. head (maximum TDH)
Suction & Discharge Port Size	4”, 150 lbs., flanged
Drive Type	V-belt and pulley arrangement
Maximum Pump Speed (RPM)	250
Minimum Motor Horsepower	5
Maximum Motor Speed (RPM)	1200
Service Factor	1.15
Motor Enclosure	TEFC
Motor Electrical	230-460/3 Ph/60 Htz

2.03 PUMP COMPONENTS

A. Each pump shall be a simplex heavy duty, Double Disc, positive displacement type, with Class 30 Cast Iron Housings. The pump shall consist of three (3) housings horizontally split to allow access to the internal components. The pump shall incorporate a repair-in-place hinged design that allows the pump to be serviced and discs replaced without removal of the pump or disturbing the suction and discharge

piping. The discharge housing shall contain the mounting lugs and be bolted directly to the mounting frame. The discharge, intermediate and suction housings shall incorporate an integral hinge arrangement that allows the suction and intermediate housings to be lowered and removed. The hinges shall be connected to each other with a quick release ball detent pin allowing for easy pin removal.

B. The pump(s) shall be capable of providing 0.30 gallons per revolution at 60ft head when operating at 300 RPM. The pumps shall be capable of operating dry for an indefinite period of time without damage. The pumps shall be capable of self-priming up to 14-inch Hg and 25-inch Hg when fully primed.

C. The pumping action shall be achieved by two (2) reciprocating discs attached to high tensile aluminum connecting rods driven by a rotating eccentric shaft. The suction and discharge discs shall be universal and interchangeable with each other to increase the commonality of spare parts and eliminate confusion. The discs shall be of integral design and constructed of high tensile neoprene with multiple layers of fabric for longevity and strength. Each disc shall be mounted to the connecting rod by a stub shaft constructed of hardened high tensile stainless steel. The reciprocating action of the discs shall also perform the duty of valves. Pumps that require internal check valves for operation shall not be acceptable.

D. Sealing of the pump fluid chamber shall be achieved by flexible trunnions. The trunnion construction shall be of fabric-reinforced neoprene and shall be capable of withstanding pressures from 0 to 110 PSI on an intermittent basis. Maximum operating pressure is 100' TDH. Pump designs utilizing packing glands, mechanical seals or water seal systems will not be acceptable.

E. The swan neck entry port to the suction housing shall be a two (2) piece design allowing for mounting of the suction connection in 90 degree increments and provide easy access for clack replacement. The upper swan neck shall be provided with a 2-inch NPT connection to allow mounting of the suction pulsation dampener. The entry port shall be a full 4-inch diameter with a minimum opening of 12.56 square inches to minimize debris buildup and blockages. The seating surface for the clack valve shall be machined on the mounting face of the swan neck. Designs that require an individual plate with smaller diameter opening shall not be acceptable. The clack valve shall be integrally mounted to the swan neck to facilitate access and replacement. The clack valve shall be manufactured of neoprene construction with multiple layers of fabric encapsulating a rigid core. The clack valve shall incorporate an integral O-ring seal for positive sealing.

F. The bearing drive assembly shall consist of two (2) aluminum modular pedestals designed to provide accurate bearing alignment, superior bearing loading and ease of assembly. The drive shaft shall be a minimum 1-3/8-inch diameter and capable of withstanding a dead head situation. The shaft shall be constructed of hardened high-tensile stainless steel and shall be mounted on four (4) self-aligning, sealed bearings. The eccentric cams shall be constructed of high tensile, cast bronze alloy and shall be

pinned to the shaft by spirol drive pins to allow for the absorption of reciprocating loads generated by the pumping action. Pump drive assemblies that utilize keyways and setscrews will not be acceptable. All drive bearings must be completely sealed with no provisions for scheduled grease lubrication. No grease fittings shall be supplied for the bearings.

G. The pump shall be driven through a V-belt and drive assembly consisting of a 2 groove Type B arrangement. The pulley ratios shall be sized to provide the maximum pump speed listed in the pump schedule in this section and to provide the required torque generated between the pump and motor.

H. Pump shall be provided with OSHA approved guards and covers. The V-belt drive cover and pump drive assembly cover shall be manufactured from 304 stainless steel material.

I. Each pump and V-Belt assembly shall be mounted on a common SS304 sub base. Base design shall have raised cross-members on the suction and discharge end to allow for complete wash-out and draining without trapping liquid. Each sub base shall be manufactured from 2-inch SS304 square tubing. Base shall be sufficient gusseted, reinforced and braced to withstand all shock loads and resist all wearing and buckling during pump operation. Tubing ends shall be capped with black plastic plugs for neat appearance.

   Refer to Drawings for Sub base configurations.

J. Pulsation dampeners shall be provided on the suction and discharge lines. The dampeners shall be 6-inch diameter SCH 40 carbon steel pipe with fully welded end caps. The suction dampener shall mount directly to the suction swan neck through the 2-inch NPT connection. The discharge dampener shall be a separate piece with 4-inch ASA 150# flanged connections. The dampeners shall be pressure tested to 60 psi for leaks. Each dampener shall be provided with a 1-inch half coupling located at the top. This connection shall be suitable for the vacuum and pressure switch assembly or the ball valve/quick dis-connect assembly should a switch not be specified. The discharge dampener shall be supplied with a 1 ½-inch NPT coupling and plug in the bottom to act as a drain/sample port. Bladder type and three-piece assemblies using connecting rods and gasket shall not be acceptable.

2.04 MOTOR

A. The motor shall be adequately sized to withstand the loads during starting and pump operation. The horsepower and motor speeds shall conform to the specifications as outlined in the pump schedule in this section. Motor shall be Baldor Super-E Severe Duty, premium efficient, inverter ready per NEMA STD MG1 Part 31.4.4.2 with epoxy coated cast iron frame or equal. Motor shall be VFD compliant.

2.05 SUCTION VACUUM PROTECTION

A. The pump manufacturer shall provide a suction vacuum sensor and switch assembly to mount on the suction pulsation dampener. The sensor shall be a PVP420, Red Valve 42/742 or equal 1-inch NPT isolation pressure sensor with 316 stainless steel body and EPDM elastomeric sensing tube. The process pressure is sensed through the 360-degree elastomeric tube and glycerin transfers pressure to the gauge and switch. The gauge and switch shall be attached to the sensor with 316 stainless steel fittings. The vacuum assembly shall be fitted with 2.5-inch stainless steel 30-inch Hg – 30 psi gauge and Ashcroft, Barksdale, or equal adjustable vacuum switch set at 10-inch Hg. The units shall be capable of being cleaned in place by simply using the process pressure through a 316 stainless steel isolation valve mounted to the top of the sensor. The opposite end of the valve shall be fitted with a universal, quick acting coupling, suitable for compressed air. This valve connection will be suitable to charge the dampener with compressed air.

2.06 DISCHARGE PRESSURE PROTECTION

A. The pump manufacturer shall provide a discharge pressure sensor and switch assembly to mount on the discharge pulsation dampener. The sensor shall be a PVP420, Red Valve 42/742 or equal 1-inch NPT isolation pressure sensor with 316 stainless steel body and EPDM elastomeric sensing tube. The process pressure is sensed through the 360- degree elastomeric tube and glycerin transfers pressure to the gauge and switch. The gauge and switch shall be attached to the sensor with SS316 fittings. The discharge assembly shall be fitted with a 2.5-inch stainless steel 0-60 psi pressure gauge and shall be fitted with Ashcroft, Barksdale, or equal, adjustable switch preset at 30 psi. The units shall be capable of being cleaned in place by simply using the process pressure through a 316 stainless steel isolation valve mounted to the top of the sensor. The opposite end of the valve shall be fitted with a universal, quick acting coupling, suitable for compressed air. This valve connection will be suitable to charge the dampener with compressed air.

2.07 SPECIAL TOOLS AND SPARE PARTS

A. Provide the following factory recommended spare parts, one (1) set total consisting of:

Two (2) Discs
Two (2) Trunnions
One (2) Complete set of gaskets
One (1) Clack valve

B. No special tools shall be required for disassembly, maintenance or repair.

2.08 FINISHES

A. All cast iron and carbon steel components shall be finished with manufacturer's standard industrial grade primer 2 – 3 mils DFT and industrial enamel top-coat 2 – 3 mils DFT.

B. All stainless steel and aluminum surfaces will remain unpainted. All weld splatter shall be removed and all welds ground smooth for a neat appearance.

PART 3 - EXECUTION

3.1 FIELD REPRESENTATIVES SERVICES

A. The equipment manufacturer shall furnish a qualified field service representative for the purpose to inspect the equipment after installation and to supervise its initial operation. The manufacturer's representative shall inspect the installation and shall provide a written certification that the pump is installed in accordance with the manufacturers requirements. In addition to the time required to verify pump installation the following shall be provided:

1. __1/2__ man-day(s) for the classroom services
2. __1__ man-day(s) for start-up

3.2 INSTALLATION

A. Install all items in accordance with the manufacturer's recommendations as indicated and specified.

B. Dowel to frame after alignment in the field to facilitate realignment after disassembly.

C. Install and align on a concrete pad as shown in the drawings.

D. Brace all piping at suction and discharge connections to withstand all shock loads and vibration.

3.3 ACCEPTANCE TESTS

A. Furnish labor, piping, equipment and material for conducting the tests.

B. Give each pump a running test in the presence of Engineer demonstrating its ability to operate without vibration or overheating and deliver its rated capacity under specified conditions. Specifically the following items shall be measured at five (5) points over the entire operating range:

1. Discharge Head
2. Suction Head
3. Capacity
4. Pump Speed
5. Amperage draw

C. Correct all defects or replace defective equipment, revealed and noted during tests. Make necessary adjustments at the time of tests at the expense of contractor.

D. Repeat tests if necessary to obtain results acceptable to engineer.

END OF SECTION

SECTION 11301

HOSE PUMP
(Scum Pump)

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish all labor, materials, equipment and incidentals required to install peristaltic hose-type pumps for scum transfer as specified herein and as shown on the drawings. Pumps shall be complete pump unit, driven as indicated in the process pump schedule located below, and shall conform to the pump requirements described herein. The hose pump shall be suitable for exterior installation.

1.02 RELATED WORK

A. Division 2 – Piping, Valves, and Appurtenances

B. Section 03310 – Concrete Work

C. Section 05500 - Miscellaneous Metals

D. Section 11227 – Clarifier Equipment

E. Section 11302 - Waste Activated Sludge Pumps

F. Division 16 - Electrical Work

1.03 QUALITY ASSURANCE

A. The pump specified under this section is to be manufacturer's standard catalog product, manufactured by a company with no less than ten years experience in the manufacture of such equipment. Upon request by the engineer, the manufacturer shall provide proof of such experience by providing installation lists, brochures, catalog cuts, etc.

B. Shop tests as specified.

C. Pump manufacturer must provide pumps and accessories, which are integral to pump operation, and specified herein as a coordinated package, regardless of manufacturer. This includes pumps, gear reducers, motors, pulsation dampeners, leak detectors, control panels/drives and other such accessories specified under this section as the responsibility of the pump supplier. Equipment specified herein that is not supplied by the pump manufacturer, as an integrated package will be rejected.

D. Pump manufacturer must have at least five operating installations in the United States of the size specified and in the same service as specified for a period of at least three years.

E. Services of a factory trained technician:

1. One eight (8) hour day of instruction and operator training shall be provided by pump manufacturer.

2. Technician must be factory certified and specifically trained on the type of equipment specified. Technician must have a minimum of five (5) years direct experience on the size and type of equipment specified. The services of a manufacturer's sales representative will not be accepted to fulfill this requirement.

3. Pumps shall be assembled in compliance within ISO9002 standards.

1.04 SUBMITTALS

A. Submit the following:

1. A copy of this specification section with related addenda to this section shall be submitted with each paragraph check-marked to designate specification compliance or marked to indicate deviation from the specification. If deviations are indicated, these items shall be circled with a detailed written justification for the deviation and any resultant changes required for the proper coordination of this equipment into the system.

2. Certified shop drawings.

3. Data regarding pump and motor characteristic and performance inclusive of guaranteed performance curves showing equipment meets the specified requirements of head, capacity, and horsepower.

4. Certified factory test data showing metering accuracy and repeatability from a minimum of 10 machined hoses of the sizes specified with each hose operating for a minimum of 500 hrs each.

5. Provide characteristic curves for variable speed pumps for both actual maximum pump speed and for speed required to obtain minimum pump flow specified.

6. Shop drawings for all accessory items.

7. Dimensional drawings inclusive of recommended location of anchor bolts.

8. Manufacturer's literature as needed to supplement certified data.

9. Operating and maintenance instruction and parts lists.

10. Certified results of vacuum testing

11. Certified bearing life.

12. Schematic control and power wiring.

13. Recommendations for long and short term storage.

14. Use tag numbers for all equipment as indicated and specified.

15 Recommended location and mounting of pulsation dampening devices.

16. Qualifications of factory trained technician and the number of service man-days provided.

17. P/100 ratio calculation.

18. Provide certification that the pump's materials of construction are compatible with the product being pumped

1.05. DELIVERY, STORAGE & HANDLING

A. Shipping

1. Ship equipment, material, and spare parts complete, except where partial disassembly is required by transportation regulations or for protection of components.

2. Pack all spare parts in containers bearing labels clearly designating the contents.

3. Deliver spare parts at the same time as pertaining equipment.

4. Pumps shall be shipped with hoses installed. In the event long term on site storage is anticipated, pumps may be shipped with hoses uninstalled for field installation by the Contractor prior to startup if so requested by the Contractor/Engineer at time of submittal approval.

B. Receiving

1 Contractor to inspect and inventory items immediately upon delivery to site and is responsible for storing and safeguarding equipment, material, instructions, and spare parts in accordance with manufacturer's written instructions.

PART 2 - HOSE PUMP

2.01 MANUFACTURERS

A. Watson-Marlow/Bredel Pumps of Wilmington, MA, or approved equal.

2.02 PUMP PROCESS SCHEDULE

Pump Model	Watson-Marlow/Bredel SPX65 Hose Pump
Quantity	One (1)
Fluid Type/concentration Viscosity Specific Gravity Fluid Temperature Solid Content	 Water - Secondary Clarifier contents with scum and other floatables. SG = 1.0 Temperature equals ambient. Solids content is less than 0.5%.
Capacity GPM	20
Pump RPM	11
Suction Pressure Max Positive Static Head	 8 ft
Max Discharge Pressure (PSI)	25
Minimum Port Size	2.5”
Pump Model	SPX65
Pump Pitch Diameter	29.4”
Displacement/Revolution (gal)	1.77
P/100 Ratio (Theoretical Max Number of Occlusions/100 Gallons Pumped)	114
Pump Flange Size (ASA 150#)	2.5”
Insert Material	316 Stainless Steel
Max Motor HP	5
Power (VAC, Phase, Frequency)	230/460VAC, 3 phase, 60 Hz
Hose Material	Natural Rubber
Orientation (Facing Pump)	See Construction Drawings

2.03 PUMP CONSTRUCTION

A. Pump

1. General

a. Horizontal, Positive displacement peristaltic hose pump.

b. Capable of operating in either direction without flow variation.

c. Capable of running dry without damage to pump or hose.

d. Capable of pulling 95% of full vacuum

e. Repeatability: ± 1% accurate

f. Valveless/Glandless design with no dynamic seals in contact with the pumped product.

g. Pump shall be capable of being rotated in 90-degree increments for four (4) different port-mounting configurations.

h. Direct Coupled gear drive arrangement as specified herein.

i. Pump hardware shall be galvanized steel.

2. Hose and Lubricant

a. Hose shall be manufactured of three-layer elastomer with an extruded inner wetted layer compatible with the process fluid, four layers of nylon reinforcement for 25mm-100mm hoses and two layers of nylon reinforcement for 10mm and 15mm, and a Natural Rubber outer layer. Hose outside diameter shall be machined to maintain a wall thickness within + 0.25 mm tolerance for 25mm-100mm and + 0.4 mm for the 10mm and 15mm hoses. The hose external surface shall have a surface roughness of Ra 8± 4m. Hoses must have a smooth extruded internal surface and have tolerance controlled through machining. Hoses that do not meet these minimum requirements are not acceptable.

b. Minimum Static Burst Pressure rating of 800 psi for the 25mm-100mm hoses and 1090 psi for the 10mm and 15mm hoses.

c. 53-68 shore A durometer.

d. Hose must be replaceable without cover or pump removal.

e. Pump housing shall contain a NSF-listed food-grade glycerin based hose lubricant blended to provide a medium for cooling and lubrication.

f. Provide a threaded drain plug at the lowest point of the pumping chamber to allow the complete drainage of lubricant.

3. Pump Housing , Rotor, and Internal Bearing Frame

a. Housing construction: Pump housing shall be cast iron and shall be supplied with an internal bearing hub to support the rotor on its own bearings. Provide a threaded drain plug at the lowest point of the pumping chamber to allow complete drainage of lubricant.

1. 10-15 mm pumps: Cast Iron ASTM A48 Class 40 (DIN GG25)

2. 25-100 mm pumps: Cast Iron ASTM A48 Class 25

b. Pump rotor

1. Rotor shall be cast iron with two pressing shoes located 180 degrees apart. To perfectly match the pump to the process conditions and eliminate slip, shoe occlusion must be adjustable. Rotors incorporating rollers or fixed occlusion shoes are unacceptable.

i. 25-100 mm pumps: Cast Iron rotor ASTM A48 Class 25 with adjustable, shimmable shoes constructed of epoxy or extruded aluminum as recommended by the manufacturer. Shims shall be constructed of 316 Stainless Steel with a shim thickness of 0.5mm. The specified manufacturing tolerance of the hose, when compressed, shall not exceed the occlusion setting of one shim.

ii. 10-15 mm pumps: Cast Iron rotor ASTM A48 Class 45B (DIN GG30) with integrally mounted shoes. Occlusion adjustment shall be made through availability of two alternative rotors with High and Low pressure occlusion settings. Manufacturer shall supply the rotor applicable for the conditions in the Pump Schedule.

c. Internal Bearing Frame

1. Pump rotor shall be independently supported on its own set of heavy duty ball bearings such that the bearings are located directly under the rotor's load. Bearings shall be supported by the bearing hub located within the pump housing and shall be sealed via a dynamic seal. Bearings shall be sealed and greased for life. Pumps which use pump lubricant to lubricate the bearings, external bearing frames which allow overhung loading and

require long coupling configurations, or close coupling where the rotor is not supported by pump bearings are not acceptable.

2. Gearing shall be direct coupled to the back of the pump housing and shall be completely isolated from the process fluid and pump fluid through the sealed bearing hub. Gear unit and drive components shall be serviceable without removal of the pump rotor.

4. Flanged Connectors

   a. Supply pump with flanged inlet and outlet to ANSI/ASA 150# standards with wetted inserts compatible with the process fluid as indicated in the Process Pump Schedule. Flange construction:

      i. SPX10-15: 316 Stainless Steel

      ii. SPX25-100: 15 micron min galvanized steel, (Engineer to specify if 316SS option is desired in lieu of galvanized steel)

   b. Pump hose shall extend from the pumping chamber to allow visual confirmation of hose/flange insert connection. Flange insert shall be secured to the pump hose via a single band clamp. Securing the hose using multiple clamps or internal compression fittings that cannot be visually verified as secure without disassembly of the pump is not acceptable.

   c. Flange supports shall be of one piece construction and shall secure to the pump housing via two or four bolts to maintain a compression seal between the pump housing and hose. Flange support construction:

      i. SPX10-15: 316 Stainless Steel

      ii. SPX25-100: 15 micron min galvanized steel, (Engineer to specify if 316SS option is desired in lieu of galvanized steel)

5. Pump Cover

   a. Pump cover shall be constructed of Cast Iron

      i. 10-15mm pumps: ASTM A48 class 40

      ii. 25-32 mm pumps: ASTM A48 class 25

      iii. 40-100 mm pumps: ASTM A245 class 36

   b. Viewing Window: Equip cover with a viewing window constructed of PMMA to allow clear visual confirmation of direction of rotation. Window shall be

marked with a minimum lubricant registration mark for proper indication of lubricant level when pump is stationary. For 25-100 mm pumps with adjustable shoes, the window shall be large enough to replace pressing shoes and allow shim adjustment without removing pump cover.

c. Cover Mounting: 25-100 mm pump covers shall be bolted along the perimeter to the pump housing and shall seal via a captive quadring seal. 10-15 mm pumps shall bolt to the pump housing with no more than four bolts and shall be sealed via a gasket seal.

6. Frame

a. Support frame shall be torsion free and constructed of formed hot dipped galvanized steel with a coating thickness of 15 microns. Welded steel or modular adjustable frames are not acceptable.

7. High lubricant leak detector

a. Provide a float type magnetic reed switch located near the top of the pump to detect leakage of pumped product into the pump housing.

b. Supply sensor Normally Closed with the ability for field adjustment to Normally Open
c. Pump manufacturer to supply switch only. Contractor is responsible for alarm and relay to turn pump off unless otherwise specified herein.

d. Float switch shall be rated to the following maxima:
Vmax = 240VAC, Imax = 1 Amp, Pmax = 50VA

8. Revolution Sensor

a. Provide inductive type sensor to detect rotor revolutions. Mount sensor on the rear of the pump housing for 25mm-100mm pumps and between the suction and discharge ports on the 10mm and 15mm pumps.

b. Pump manufacturer to supply sensor only. Contractor is responsible for any additional equipment which may be required to integrate this into their control system.

c. Inductive sensor actuates a non-maintained NO switch when triggering device passes the sensor. When inductive sensor is powered and pump is in operation a pulse waveform is generated.

d. Inductive sensor shall be rated to the following maxima:
Vmax = 30VDC, Imax = 150 mA, Pmax = 4.5VA

2.04 PUMP DRIVE SYSTEM

A. Direct Coupled Gearing with Fully Protected Drive mounting

1. Provide gearing with Fully Protected Drive direct-coupled mounting to the pump housing.

   a. The gearbox shall bolt directly to the pump housing which shall include a buffer zone between the gearing and pumphead to prevent gearbox contamination from pump fluid or lubricant in the event of a hose lubricant seal failure. The pump's internal bearing hub shall be vented through the rear of the pump housing to allow visual detection in the event of a hose lubricant seal failure.

   b. Close coupled pump designs which utilize the gearbox to seal the pump housing and expose the gearbox to lubricant or pumpage are not acceptable.

   c. Long coupled pumps which require external couplings, coupling alignment, and coupling guards are not acceptable.

2. Design gear reduction to match output speed requirement of the pump using two or three-stage gearing and matching torque rating of pumping equipment. Gearing shall be classified for continuous heavy shock duty, 24 hr duty with a minimum of 1.4 service factor.

   a. 10-32 mm pumps: helical gearing with cast iron housing

   b. 40-100 mm pumps: ultra compact, high torque planetary gearing with cast iron housing

B. Motors

1. Provide premium efficient, TEFC or TENV, squirrel-cage induction motors, NEMA C face, conforming to the latest applicable requirements of NEMA, IEEE, ANSI, and NEC standards.

2. Provide motor HP in accordance with Process Pump Schedule.

3. Motors are to be designed for continuous duty for 3-phase, 230/460VAC operation, NEMA Design B with torque and starting currents in accordance with NEMA MG1-1993-12.35 and 12.38. Ratings to be based on a 40 degree C ambient 3,300 feet altitude or lower operation with a maximum temperature rise of 80 degree by resistance C at 1.0 service factor (and 90 degree C rise 1.15 service factor).

4. Motors shall be furnished with Class F insulation utilizing materials and insulation systems evaluated in accordance with IEEE 117 classification tests. Motors shall have 1.15 service factor but shall be selected for operation within their full load rating without applying the service factor.

5. Bearings shall be selected to provide L10 rating of 100,000 hrs minimum for C-face flexible coupled applications. For frame sizes 56-140, bearings shall be permanently lubricated. For frame sizes 180 and larger, proved capped grease fitting.

6. For frame sizes 180 and larger, motor enclosure including frame, end brackets locking bearing inner caps, fan guard, and conduit box and cover shall be cast iron, ASTM Type A48, Class 25 or better. Conduit box shall be diagonally split with tapped NPT threaded conduit entrance hole, neoprene conduit box cover gasket, neoprene lead seal gasket between box and motor frame, and ground lug. For frame sizes 56-140, motor enclosure, fan guard, conduit box, and cover shall be carbon steel. End shield shall be constructed of aluminum. Conduit box shall be top mounted with F1/F2 conduit entrance holes, grounding lug, and neoprene conduit box gasket between box and motor frame.

7. External cooling fan on TEFC motors shall be corrosion resistant, non-sparking, bi-directional, keyed, clamped, and shouldered on the motor shaft.

8. Motor rotor construction shall be die cast aluminum, fabricated copper, or their respective alloys. Motor shall have copper windings.

9. Motor leads shall be nonwicking type permanently numbered for identification.

10. All motors shall be premium efficient with minimum efficiencies exceeding NEMA MG1-1993 Table 12-10. Motor efficiency shall be determined in accordance with NEMA MG1-1993-2.58.1 and full load efficiency labeled on motor nameplate in accordance with NEMA MG1-1993-12.58.2

11. Motors shall suitable for use with PWM type variable frequency drives. Motors frame size 56-180 shall be rated for 10:1 constant torque continuous duty over 6-60 Hz. Larger frame motors shall be rated for 4:1 constant torque continuous duty over 15-60 Hz.

12. Acceptable Manufacturers - Reliance Electric or approved equal.

2.05 PULSATION DAMPENERS

A. Inlet Pulsation Accumulators

1. Accumulator shall be chargeable, the appendage type, and consist of a two part housing and bell shaped flexible bladder.

a) For flooded suction applications, provide chargeable accumulator with one-way air inlet valve to prevent product backflow, pressure gauge, and air fill valve. Plastic accumulators shall be rated to 150 psi working pressure. Metal accumulators shall be rated to 300 psi working pressure.

b) For suction lift applications provide chargeable accumulator with ball valve, Venturi valve, and 30in-30psi compound gauge. Plastic and metal accumulators shall be rated to a maximum of 30 psi.

2. Suction Accumulator shall be designed for vertical tee mounting into the suction line. Contractor shall provide an appropriate flanged tee with vertical leg for mating to pulsation accumulator and horizontal legs for mating to suction source piping and pump inlet piping. For 10 mm pump, provide flow through type accumulator which shall not require a separate tee.

Pump	Model	150# Flanged Inlet	Housing Material	Bladder
10 mm	Sentry III	1/2" Flow through	316SS	Neoprene
15- 25 mm	Sentry II	¾"	316SS	Neoprene
32-65 mm	Sentry I	2"	316SS	Neoprene
80-100 mm	Sentry IV	3"	316SS	Neoprene

3. Contractor shall install suction accumulators in accordance with the manufacturer's instructions and air-charge the accumulators in accordance with the process requirements as recommended by the manufacturer.

4. Suction accumulators shall be mounted within three feet of the pump inlet port.

5. No other equipment shall be installed between the suction accumulator and pump.

6. Manufacturer by Blacoh, Sentry Model

B. Discharge Pulsation Dampeners

1. Dampener shall be chargeable, the appendage type, and consist of a two part housing and bell shaped flexible bladder.

a) Provide chargeable dampener with one-way air inlet valve to prevent product backflow, pressure gauge, and air fill valve. Plastic dampeners shall be rated to 150 psi working pressure. Metal dampeners shall be rated to 300 psi working pressure.

2. Dampener shall be designed for vertical tee mounting into the discharge line. Contractor shall provide an appropriate flanged tee with vertical leg for mating to pulsation dampener and horizontal legs for mating to destination discharge piping and pump discharge piping. For 10 mm pump, provide flow through type dampener which shall not require a separate tee.

Pump	Model	150# Flanged Inlet	Housing Material	Bladder
10 mm	Sentry III	1/2" Flow through	316SS	Neoprene
15- 25 mm	Sentry II	¾"	316SS	Neoprene
32-65 mm	Sentry I	2"	316SS	Neoprene
80-100 mm	Sentry IV	3"	316SS	Neoprene

3. Contractor shall install discharge pulsation dampeners in accordance with the manufacturer's instructions and air-charge the dampener in accordance with the process requirements as recommended by the manufacturer.

4. Pulsation Dampener shall be mounted within three feet of the pump discharge port. No other equipment shall be installed between the discharge pulsation dampener and pump.

5. Manufacturer by Blacoh, Sentry Model

2.06 MOTOR STARTER

A. Provide a NEMA contactor full-voltage reversing motor starter, circuit breaker and fuses in a NEMA 4X 316SS enclosure, with stainless steel mounting hardware and the following components:

1. Provide running and pump fault indication lamps
2. Provide start, stop, reset and overload reset push button switches
3. Provide forward/reverse and local/off/remote manual switches.
4. Provide through the door handle mechanism mounted on the front door to operate the circuit breaker.
5. Provide screw connection terminal blocks
6. Provide heavy duty watertight/oiltight Cutler-Hammer relays, switches and LED indicator lamps.
7. Provide control transformer and wire components complete.

2.07 PAINTING

A. Provide pump assembly primed and finish painted within manufacturer's standard paint specification

1. Primer Coat
   a. Two pack (component) epoxy resin primer

   b. Dry thickness 20-40 micron

2. Finish Coat
   a. Two pack (component) acrylate isocyanate combination

b. Dry thickness 20-40 micron

c. Color- RAL 3011 brown red

2.08 SPARE PARTS

A. Provide spare parts that are identical to and interchangeable with parts installed. Furnish and deliver the following spare parts for each pump:

1. Two replacement hoses

2. Two hose lubricant refills

2.09 SHOP TESTING

A. Non-witnessed Inlet Vacuum Testing

1. Test assembled Pump running on air.

2. Run test for a minimum of 30 seconds and record vacuum reading which must meet or exceed 28" Hg Vacuum.

3. In the event that specified tests indicate that the pump does not meet specifications, Engineer has the right to require complete tests for the pump at no additional cost to the owner.

4. Repeat tests until specified results are obtained.

5. Correct or replace promptly all defects or defective equipment revealed by or noted during tests at no additional cost to the Owner.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Contractor shall install items in accordance with manufacturer's printed instructions and as indicated and specified.

B. Contractor shall install pumping equipment on a concrete pad and make final alignments thereon.

C. Contractor shall install accessories in accordance with manufacturer's written instructions.

D. Contractor shall prove the pump's suction and discharge port connections to process lines are nonleaking and made in a free supported state without need to apply vertical or horizontal pressure to align piping with pump nozzles

3.02 FIELD TESTING

(By Contractor with assistance of Manufacturer's Field Service Technician)

A. After installation of pumping equipment, and after inspection, operation, testing, and adjustment have been completed by the Contractor in the presence of the Manufacturer's Field Service Technician, Contractor shall conduct running test for each pump in the presence of the Engineer to determine its ability to operate within the performance limits specified and to deliver its rated capacity within the pressure requirements specified. Contractor shall provide labor, piping, equipment, and materials necessary for conducting all field tests.

B. Make all adjustments necessary to place equipment in specified and working order at the time of above tests.

C. Test pumps on product only.

D. Promptly correct or replace all defective equipment revealed by or noted during tests at no additional cost to the Owner and repeat tests until specified results acceptable to Engineer are obtained.

END OF SECTION

DIVISION 13
SPECIAL CONSTRUCTION

SECTION 13200
PRESTRESSED CONCRETE TANK

PART 1 GENERAL

1.01 SCOPE OF WORK

A. Furnish all labor, materials, equipment, and incidentals required to construct a prestressed circular concrete tank, open top, 105 feet in diameter, 16 feet in height, having a minimum usable capacity of approximately 900,00 gallons for wastewater clarification, providing 2.0 feet of freebond as shown on the Drawings and described herein.

B. Furnish all labor, materials, equipment, and incidentals required to install accessories for the tank as shown on the Drawings and described herein.

1.02 RELATED WORK

A. Section 01600 - Material and Equipment
B. Section 02001 – Special Provisions to Division 2
C. Section 02100 – Site Preparation
D. Section 02220 - Excavation, Backfill, Fill and Grading for Structures
E. Section 02221 – Trenching Bedding, and Backfill for Pipe
F. Section 02223 - Excavation Below Grade and Crushed Stone or Shell Refill
G. Section 02615 – Ductile Iron Pipe and Fittings
H. Section 05500 – Miscellaneous Metals
I. Section 09941 – Field Painting
J. Section 11227 – Clarifier Equipment
K. Section 16601 – Lightning Protection System

1.03 REFERENCES

A. ACI 372R-03 – Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures.

B. AWWA D110-04 – Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks.

1.04 SUBMITTALS

A. Shop Drawings: Provide complete plan, elevation, and sectional views showing critical dimensions including:

1. Size, location and number of all reinforcing bars.

2. Thickness of all parts of the tank structure including floor, core wall, and covercoat.

3. Prestressing schedule including number and placement of prestressing wires on the tank wall and total applied force per foot of wall height.

4. Location and details of all accessories required.

5. Minimum size of shop drawings shall be 18-inch by 24-inch.

B. Product Data: Submit concrete design mixes including ingredient proportions, minimum cementitious content, and water/cementitious ratio in accordance with these specifications.

C. Design Data: Submit structural calculations for the tank, signed and sealed by a professional engineer in accordance with Section 1.05 C. of these specifications.

D. Paint System. Submit painting system product information including data sheets, preparation and application recommendations, storage and handling requirements, and color chips.

E. Test Reports: Submit concrete strength reports for 7-day and 28-day breaks.

F. Warranty Document: Submit warranty document in Owner's name in accordance with Section 1.06A of these specifications.

G. Project Record Documents: Record actual location layout and final elevations and configuration of tank and accessories on shop drawings and submit 5 signed and sealed copies to the Engineer after construction of the tank is complete.

1.05 QUALITY ASSURANCE

A. Tank Construction Company: Shall be a firm with ten years of experience in the design and construction of wire-wound, circular prestressed composite tanks with satisfactory evidence that it has the skill, reliability, and financial stability to build and guarantee the tank in accordance with the quality required by these specifications. The company constructing the tank shall have built completely in its own name in the past five years, and be presently responsible for, a minimum of five (5) prestressed composite tanks of equal or greater size than that required for this project which meet these specifications and are now providing satisfactory service.

B. Construction: The entire tank, including all portions of the floor, wall, sump and launderer shall be built by the tank construction company, using its own trained personnel and equipment.

C. Design: All design work for the tank shall be performed by a professional engineer with no less than five years of experience in the design and construction of circular prestressed composite tanks. The professional engineer shall be a full-time staff member of the tank construction company and shall be licensed to work in the state where the project is located.

D. The steel shell design and epoxy injection procedure (covered by U.S. Patent 5,150,551) shall have been used in the ten tanks required in the tank construction company's experience record.

1.06 WARRANTY

A. Provide warranty for workmanship and materials on the complete structural portion of the tank for a five-year period from date of acceptance of the work. In case leakage or other defects appear within the five-year period, the tank construction company shall promptly repair the tank at its own expense upon written notice by the Owner that such defects have been found. Leakage is defined as a stream flow of liquid appearing on the exterior of the tank, the source of which is from the inside of the tank. The tank construction company shall not be responsible for, nor liable for, any subsurface condition.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURER

A. The tank construction company shall be the Crom Corporation, Gainesville, Florida, or approved equal.

2.02 PERFORMANCE

A. The design shall be in conformance with applicable portions of American Concrete Institute (ACI) 372R-03 Design and Construction of Circular Wire- and Strand-Wrapped Prestressed Concrete Structures, AWWA D110-04 Wire- and Strand-Wound, Circular, Prestressed Concrete Water Tanks, and currently accepted engineering principles and practices for the design of such facilities.

B. Capacity: 900,000 Gallons (usable)

C. Dimensions: Inside Diameter: 105 feet Sidewall Depth. 16 feet

D. Earthquake Design: Fixed percentage method as specified in AWWA D110-04, Section 4.1.

E. The thickness of the core wall shall be calculated so as to accept the initial compressive forces applied by prestressing, hydrostatic stresses induced by contents, and other applicable loads such as soil backfill and wind.

F. Backfill loads shall not be used in the design of the core wall to counteract hydraulic loads or provide residual compression in the wall.

G. Concrete:

1. Use Type I / II cement.

2. A maximum of 20 percent of cementitious material may be fly ash for all concrete mixes.

3. Floor Concrete: Minimum 4000 psi compressive strength at 28 days, maximum ¾-inch aggregate, 5 percent +/-1 percent air content, 4-inch +/-1-inch slump, soft broom finish.

4. Pipe Encasement: Minimum 2500 psi compressive strength at 28 days, maximum ¾ inch aggregate, 5 percent +/-1 percent air content, 4-inch +/-1-inch slump.

H. Shotcrete:

1. Use Type I / II cement.

2. A maximum of 20 percent of cementitious material may be fly ash for all concrete mixes.

3. Core Wall Shotcrete: Minimum 4000 psi compressive strength at 28 days, 4-inch +/-1-inch slump.

4. Covercoat Shotcrete: Minimum 3500 psi compressive strength at 28 days, 4-inch +/-1-inch slump.

5. Allowable compressive stress due to final prestressing force, fg:

a. 1250 psi + 75t psi/in. with 0.45 f'g maximum (where f'g is defined as compressive strength required for final prestressing force and t is the thickness of the core wall in inches).

b. Maximum of 2000 psi.

6. Allowable compressive stress due to initial prestressing force, fgi:

   a. 1250 psi + 75t psi/in. with 0.5 f'gi maximum or less (where f'gi is defined as compressive strength at time initial prestressing force is applied and t is the thickness of the core wall in inches).

   b. Maximum of 2250 psi.

I. Prestressing Wire:

1. The prestressing wire shall conform to the requirements of ASTM A821, Type B.

2. Wire size shall be 0.162-inch (8 gauge), 0.192-inch (6 gauge) or larger, but no larger than 0.250-inch.

3. Working stress for the tank wall, fs shall be a maximum of 115,000 psi

4. Allowable design tensile stress before losses, fsi shall be 145,600 psi or no greater than 0.63 fu.

5. Ultimate tensile strength, fu shall be, 231,000 psi or greater for 8 gauge wire, 222,000 psi or greater for 6 gauge.

J. Non-prestressed Mild Reinforcing Steel:

1. Allowable design tensile stress, fs shall be a maximum of 18,000 psi.

2. Yield strength of reinforcing steel, fy shall be 60,000 psi.

2.03 FLOOR

A. Concrete membrane floors shall be a minimum of 4-inch thick and have a minimum thickness of 8-inch of concrete over all pipe encasements and around sumps.

B. A minimum percentage of 0.60 percent reinforcing steel shall be used in the membrane floor. The minimum percentage shall apply to all thickened sections and shall extend a minimum of 2 feet into the adjacent membrane floor.

2.04 CORE WALL

A. The core wall shall be constructed of shotcrete, encasing a steel diaphragm, continuous the full wall height without horizontal splices.

B. The thickness of the core wall shall be calculated so as to accept the initial compressive forces applied by prestressing, backfill, and other applicable loads, but in no case be less than 3½-inch thick.

C. Horizontal sections of the wall shall form true circles without flat areas, excessive bumps or hollows.

D. Interior and exterior surfaces of the core wall shall be water cured for a minimum of 7 days or until prestressing begins.

E. To compensate for bending moments, shrinkage, differential drying, and temperature stresses, the following reinforcing steel shall be incorporated in the core wall.

1. The top 2 feet of core wall shall have not less than 1 percent circumferential reinforcing.

2. The bottom 3 feet of core wall shall have not less than 1 percent circumferential reinforcing.

3. Inside Face:

a. 26 gauge steel shell diaphragm continuous the full wall height without horizontal splices.

b. Additional vertical and horizontal reinforcing steel bars as required by design computations.

4. Outside Face:

a. Vertical reinforcing steel: Minimum of #4 bars at 12-inch center to center.

b. Additional vertical and horizontal reinforcing steel bars as required by design computations.

2.05 STEEL SHELL DIAPHRAGM

A. A 26 gauge steel tank shell, complying with ASTM A-1008 for Commercial Quality Cold Rolled Steel, shall be used throughout the core wall, providing a waterstop. The steel shell diaphragm shall be encased and protected with shotcrete no less than 1-inch thick at all places.

B. The steel shell is to be formed and erected so that a mechanical key is created between the shotcrete and diaphragm.

C. The sheets of steel diaphragm shall be continuous from top to bottom of wall; horizontal joints or splices will not be permitted.

D. All vertical joints in the diaphragm shall be sealed watertight by epoxy injection in accordance with U.S. Patent No. 5,150,551.

E. Epoxy injection shall be carried out from bottom to top of wall, using a pressure pumping procedure, after the steel shell has been fully encased, inside and outside, with shotcrete.

F. The sealant shall conform to the requirements of ASTM C881, Type III, Grade 1, and shall be 100 percent solids, moisture insensitive, low modulus epoxy system. When pumped, maximum viscosity of the epoxy shall be 10 poises at 77°F.

G. The epoxy sealant shall be suitable for bonding to concrete, shotcrete, and steel.

H. In all tanks designed to use a waterstop at the floor/wall joint, the steel shell diaphragm shall be epoxy bonded to this waterstop.

I. No nail or other holes shall be made in the steel for erection or other purposes except for inserting pipe sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an approved epoxy sealant.

2.06 SHOTCRETE

A. All shotcrete shall be applied by or under direct supervision of experienced nozzlemen certified by the American Concrete Institute (ACI) as outlined in ACI certification publication CP-60.

B. Shotcrete mixes shall have a minimum of 1 part cementitious material to 3 parts of sand.

C. Each shotcrete layer shall be broomed prior to final set to effect satisfactory bonding of the following layer.

D. No shotcrete shall be applied to reinforcing steel or diaphragm that is encrusted with overspray.

E. No less than ⅛-inch thick shotcrete shall separate reinforcing steel and prestressing wire.

F. Up to 20 percent of cementitious materials may by fly-ash.

2.07 HORIZONTAL PRESTRESSING

A. Circumferential prestressing of the tank shall be achieved by the application of cold-drawn, high-carbon steel wire complying with ASTM 821 Type B, placed under high tension. A substantial allowance shall be made for prestressing losses due to shrinkage and plastic flow in the shotcrete and due to relaxation in the prestressing steel.

B. Placement of the prestressing steel wire shall be in a continuous and uniform helix of such pitch as to provide in each lineal foot of core wall height an initial force and unit compressive stress equal to that shown on the design drawings. Splicing of the wire shall be permitted only when completing the application of a full coil of wire or when removing a defective section of wire.

C. Areas to be prestressed will contain not less than 10 wires per foot of wall for 8 gauge and 8 wires per foot of wall for 6 gauge. A maximum of 24 wires per layer per foot for 8 gauge and 20 wires per layer per foot for 6 gauge will be allowed. Shotcrete shall be used to completely encase each individual wire and to protect it from corrosion. To facilitate this encasement, the clear space between adjacent wires is to be no less than one wire diameter.

D. Prestressing shall be accomplished by a machine capable of continuously inducing a uniform initial tension in the wire before it is positioned on the tank wall. Tension in the wire shall be generated by methods not dependent on cold working or re-drawing of the wire. In determining compliance with design requirements, the aggregate force of all tensioned wires per foot of wall shall be considered rather than the force per individual wire, and such aggregate force shall be no less than that required by the drawings.

E. The tank construction company shall supply equipment at the construction site to measure tension in the wire after it is positioned on the tank wall. The stress measuring equipment shall include: electronic direct reading stressometer accurate to within 2 percent, calibrated dynamometers and a test stand to verify the accuracy of the equipment.

F. After circumferential prestressing wires have been placed, they shall be protected by encasement in shotcrete. This encasement shall completely encapsulate each wire and permanently bond the wire to the tank wall.

G. When multiple layers of wire are required, shotcrete cover between layers shall be no less than ⅛-inch thick.

H. After all circumferential prestressing wires have been placed, a shotcrete cover having a thickness of no less than 1-inch shall be placed over the prestressing wires.

2.08 WALL OPENINGS

A. When it is necessary for a pipe to pass through the tank wall, the invert of such pipe or sleeve shall be no less than 18-inch above the floor slab, and the prestressing wires required at the pipe elevation shall be distributed above and below the opening leaving an unbanded strip around the entire tank.

B. Unbanded strips shall have a vertical dimension of no more than 36-inch unless an axi-symmetric shell analysis is performed to account for shear and moments caused by displacement of the prestressing wires into adjacent bands.

C. All wall pipes and sleeves passing through the wall shall be sealed to the steel shell diaphragm by epoxy injection.

2.09 TANK ACCESSORIES

A. The tank construction company shall furnish, install, and guarantee the tank accessories.

B. Through-wall pipe sleeves shall be Type 316 stainless steel sleeves with neoprene modular-seal units using stainless steel tightening bolts.

2.11 PAINTING

A. Exterior paint system shall consist of the following:

1. Apply one coat of Thoroseal on walls only.

2. Allow Thoroseal to cure for at least 3 days.

3. Apply two coats of Tnemec Series156 Enviro-Crete Modified Waterborne Acrylate on walls and dome at 4.0 to 6.0 mils DFT per coat after tank has been hydrostatically tested. All surfaces must be clean and dry prior to application.

4. Color shall match existing clarifiers.

B. Interior paint system shall consist of the following:

1. Allow new concrete to cure for at least 28 days.

2. All concrete surfaces shall be prepared by brush-off blast clean per SSPC-SP 13 to establish a surface profile equal to ICRI CSP 3 to 4.

3. Apply one coat of Tnemec Series 46H-413 Tneme-Tar, Coal Tar Epoxy, 16.0 to 20.0 mils DFT per coat to floor and walls.

4. Allow coating to cure for 10 days, or per manufacturer's recommendations, before placing tank into service.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify elevations, placement and grading for tank prior to starting tank construction.

3.02 INSTALLATION

A. Tank Floor:

1. The floor shall be vibratory screeded to effect consolidation of concrete and proper encasement of floor reinforcing steel.

2. The floor shall be continuously water cured until tank construction is completed.

B. Tank Wall:

1. The wall shall be constructed in a predesigned manner utilizing steel shell diaphragm, layers of shotcrete and prestressing wire.

2. The diaphragm shall be protected against damage before, during, and after erection. Nail or other holes shall not be permitted in the steel shell for erection or other purposes except for inserting wall pipes or sleeves, reinforcing steel, bolts, or other special appurtenances. Such penetrations shall be sealed with an approved epoxy sealant.

3. Interior and exterior portions of the shotcrete wall shall be water cured for a minimum of 7 days or until prestressing is started.

C. Prestressing: The initial tension in each wire shall be read and recorded to verify that the total aggregate force is no less than that required by the design. Averaging or estimating the force of the wire on the wall shall not be considered satisfactory evidence of correct placement of prestressing wires.

3.03 FIELD QUALITY CONTROL

A. Inspection and Testing:

1. Concrete and Shotcrete Testing: Test all concrete and shotcrete used in the tank structure in accordance with ACI C31/ C39. One set of cylinders shall be made per 50 cubic yards. Each set shall contain five cylinders. Test one cylinder at 7 days, two cylinders at 28 days, and hold two.

2. Hydrostatic Testing: Test completed tank for liquid tightness by filling tank to its side water depth including the launderer with reclaimed water provided by Owner.

3.04 CLEANING

A. Clean interior and exterior of tank to remove debris, construction items, and equipment.

END OF SECTION

DIVISION 16
ELECTRICAL

SECTION 16010

BASIC ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1. 01 SUMMARY

A. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1. 02 DEFINITIONS

A. "Contract Documents" shall be understood to include the Contract Specifications, Contract Drawings, official addenda, official revision bulletins, and all other official documents.

B. "Electrical equipment and materials" shall be understood to include all electrical related equipment, apparatus, components, devices, assemblies, materials, accessories, and appurtenances.

C. "Owner" shall be understood to include the Owner's Designated Representative.

D. "Provide" shall be understood as "furnish and install."

1. 03 BASIC REQUIREMENTS

A. Contractor's Charge: It shall be this Contractor's responsibility to complete the Work of this project as conveyed in these Contract Specifications and on the Contract Drawings.

B. Site Inspection: Prior to the bid, the Contractor shall thoroughly inspect the Project Site and shall become familiar with project areas and existing site conditions.

C. Hazardous Materials/Conditions: Advise the Owner and Engineer/Architect in writing of any suspected hazardous materials and hazardous conditions discovered during the course of the Work. Make this notification as soon as the discovery is made.

D. General: Installations shall conform to the requirements of NFPA 70, NFPA 101, and IEEE C2, unless more stringent requirements are indicated herein or elsewhere on the Contract Drawings.

E. Workmanship: All work must be performed in a neat and workmanlike manner by a licensed journeyman electrician or a certified apprentice working under the direct supervision of a licensed journeyman electrician, and shall present a neat and professional appearance when complete.

F. Electrical Equipment and Materials: Listed and labeled as defined in NFPA 70,

Article 100, by a Nationally Recognized Testing Laboratory meeting the requirements of OSHA 29 CFR 1910.

G. Electrical Equipment and Materials described in these specifications and on the Contract Drawings establish the minimum standards for quality and style, shall be the basis of the bid, and shall be new unless otherwise indicated as existing. Manufacturer names are indicated as basis of design, or suggested alternate manufactures. Alternates shall be considered upon approval of the engineer.

H. Electrical Equipment and Materials shall be installed in accordance with the manufacturer's recommendations using the best methods known to the trade.

I. Onsite Storage: Onsite storage of electrical equipment and materials, and tools will be at the Owner's discretion and the Contractor's risk. The Contractor shall follow the pathways as directed by the Owner for the movement of electrical equipment and materials, and tools in and out of the building, and to and from the project areas. Such pathways will be established by the Owner, and are subject to change at the Owner's discretion.

J. Delivery, Storage, and Handling: Equipment and materials shall be visually inspected by the Contractor when received and prior to acceptance from conveyance. Stored items shall be protected from the environment in accordance with the manufacturer's published instructions. Damaged items shall be replaced at the Contractor's expense. Stored items shall be protected from theft.

K. Maintenance of Work Areas: The Contractor shall maintain all work areas in a neat and orderly fashion. The Contractor shall employ means as necessary including, but not necessarily limited to, dust curtains, to prevent the migration of dust, dirt, and debris from the immediate project areas to other areas accessible to the public and/or other building occupants. The Contractor shall clean all work areas of dust, dirt, and debris at the end of each workday and more frequently if directed to do so by the Owner.

L. Protection: The Contractor shall make every effort to ensure a safe work environment for his employees, contractors, and agents, and for the public. The Contractor shall follow the applicable requirements and recommendations of OSHA. All exposed energized equipment, components, and wiring shall be shielded from accidental contact by employees, workers and building visitors. In no case shall exposed energized equipment, components, or wiring be left unprotected or unguarded. The Contractor shall provide all warning apparatus and materials required to cordon off the Project Site from those not directly associated with the Project including, but not necessarily limited to, warning tape and barriers, cones, signs, and dust curtains. The placement and erection of warning apparatus and materials shall be coordinated with, and to the satisfaction of the Owner and/or Engineer/Architect.

M. Installations: The Contract Drawings indicate the extent and the general location and arrangement of equipment, conduit, and wiring. The Contractor shall become familiar with all details of the Work and verify all dimensions in the field so that equipment and materials shall be properly located and readily accessible. The

Contractor shall sequence, coordinate, and integrate the various elements of electrical equipment and materials and comply with the following:

1. Verify all dimensions by field measurement.
2. Coordinate the installation of electrical equipment and materials with other building systems, features, and components.
3. Sequence, coordinate, and integrate the installation of electrical equipment and materials for efficient flow of the Work.
4. Install electrical equipment and materials to conform with approved submittal data to the greatest extent possible. Conform to the arrangements indicated on these drawings recognizing that portions of the work are shown only in diagrammatic form.
5. Any confusing, conflicting, or unclear information on these drawings shall be referred to the Engineer/Architect prior to the bid for his resolution. By failing to refer confusing, conflicting, or unclear information in the Contract Documents to the Engineer/Architect for his resolution prior to the bid, the Contractor thereby acknowledges the Contract Documents as error free.
6. In general, install electrical equipment and materials level and plumb, parallel and perpendicular to building lines and features.
7. Install electrical equipment and materials to facilitate servicing and maintenance, and repair or replacement of component parts. To the greatest extent possible, connect electrical equipment for ease of disconnecting with a minimum of interference with other installations.

N. Power Outages: The Contractor shall schedule power outages as required to complete the Work of this Project. The number and duration of power outages shall be kept to an absolute minimum. Power outages must be coordinated and scheduled with the Owner with a minimum of fourteen-(14) calendar days advance notice.

O. Temporary Power and Lighting:

P. Permits / inspections: Obtain (arrange, apply, pay for, and maintain) and post all required construction permits. Obtain (arrange, apply, and pay for) inspection of all electrical work performed under this Contract.

Q. Quality Control: Upon completion of the Work, but prior to the punchlist inspection, the Contractor shall complete the following:

1. General: Verify that all electrical equipment is installed, operational, and fully functional in accordance with the manufacturer's requirements and tolerances.
2. Connections and Terminals: Verify all electrical connectors and terminals have been tightened in accordance with the manufacturers published torque-tightening values. If manufacturers torque values are not indicated, use those specified in UL 486A and UL 486B.

R. Facilitate Punchlist Inspection: The Contractor shall make one journeyman

electrician available to accompany the Engineer/Architect during the punchlist inspection. The journeyman electrician shall assist the Engineer/Architect including, but not necessarily limited to, the removing of equipment covers to facilitate inspection of equipment interiors. The punchlist inspection shall be scheduled by the Engineer/Architect with a minimum of 7 calendar days advance notice following the Contractor's notification of his successful checkout and testing of the completed installations. During the punchlist inspection, the Engineer/Architect will survey the completed installations for compliance with Contract Requirements. Subsequent to the punchlist inspection, the Engineer/Architect will compile a list of installation deficiencies. The Owner's notification to the Contractor of Final Acceptance will not be issued until all installation deficiencies have been corrected to the satisfaction of the Owner and/or Engineer/Architect.

S. Record Drawings: The Contractor shall maintain at the site a clean undamaged set of blue or black-line white prints of the Contract Drawings. This record set drawings shall be marked to show the actual installation, and where the actual installation varies substantially from the Work as originally shown. Mark whichever drawings are most capable of showing conditions fully and accurately. Give particular attention to concealed elements that would be difficult to measure and record at a later date. Mark record drawings with red erasable pencil; use other colors to distinguish between variations in separate categories of the Work.

END OF SECTION

SECTION 16020

INSTALLATION OF UNDERGROUND ELECTRICAL DUCT BANKS, CONDUIT, MANHOLES AND HANDHOLES

PART 1 GENERAL

1. 01 DESCRIPTION OF WORK

A. This item shall consist of underground electrical ducts or conduits installed in accordance with this specification at the locations and in accordance with the dimensions, designs, and details shown in the Contract Drawings for the new feeder system work. It shall also include all concrete encasement, mandrelling, installation of pull wires and duct markers, capping, core drilling, and the testing of the installation as a completed raceway system ready for the installation of cables, to the satisfaction of the Engineer.

This item shall also include furnishing and installing manholes and handholes at locations shown on the Drawings, including cable pulling rings, cable racks, bell ends, ground rods, grounding non-current carrying metal parts, core drilling existing manholes, handholes and light bases and shall also include adjusting of existing duct markers.

All trenching, backfilling, removal and restoration of all paved areas shall be covered under another section of this Specification.

1. 02 RELATED WORK

A. Carefully examine all of the Contract Documents for requirements that affect the work of this section.

1. 03 QUALITY ASSURANCE

A. Codes and Standards: Comply with provisions of following codes, specifications, and standards except where more stringent requirements are shown or specified:

1. National Board of Fire Underwriter's National Electrical Code, latest edition.
2. Underwriter's Laboratories, Inc., Standards for Cabinets and Boxes, Service Equipment, and Rubber-Covered Wires and Cables.
3. National Electrical Manufacturer's Association Standards.
4. All applicable state and local codes or ordinances.
5. Insulated Power Cable Engineer's Association Standards.
6. Occupational Safety and Health Regulations.
7. Institute of Electrical and Electronics Engineers' Standards.

B. Federal material requirements shall comply with the following:

Number	Title
A 48-76	Gray Iron Castings
A 120-79	Pipe, Steel, Black or Hot-Dipped, Zinc Coated (Galvanized) Welded and Seamless, for ordinary uses
A 123-78	Zinc (hot-galvanized) on Products Fabricated from Rolled, Pressed and Forged Steel Shapes, Plates, Bars, and Strip
A 615-79	Deformed and Plain Billet-Steel Bars for Concrete Reinforcements

1. 04 SHOP DRAWINGS

A. Shop drawings and design calculations showing precast concrete electrical handholes and/or manholes, if used, reinforcement size and location, inserts, grout holes, bolt holes, slab, wall and roof openings shall be submitted to the Engineer for approval.

PART 2 PRODUCTS

2. 01 MATERIALS

A. All equipment and materials covered by referenced specifications shall be subject to acceptance through manufacturer's certification of compliance with the acceptable specification when so requested by the Engineer.

2. 02 STEEL CONDUIT

A. Rigid steel conduit and fittings shall be galvanized and conform to the requirements of Underwriters Laboratories Standard 6514 and 1242. Rigid steel conduit installed underground without concrete encasement shall be PVC coated. All PVC coated conduits and fittings installed underground shall be coated with 40-mil polyvinyl chloride, bonded to the conduit with an epoxy primer. PVC coated conduits shall conform to NEMA RN1-1980 (Type 40).

2. 03 PVC CONDUIT

A. PVC conduit shall be schedule 40 and shall conform to NEMA TC2. Fittings shall match conduit type and material and shall be provided by the same manufacturer as the conduit. Cement for connections of conduit and fittings shall be approved by the manufacturer of the conduit.

2. 04 CONCRETE

A. Concrete shall conform to the requirements for Portland cement concrete, using 1-

inch maximum size coarse aggregate, of Section 03010 “Concrete Work” of this Specification.

2. 05 CAST-IN-PLACE ELECTRICAL MANHOLES AND HANDHOLES

A. Manholes and handholes shall be constructed in accordance with the details shown on the drawings. Precast units may be substituted for cast-in-place. Shop drawings must be provided and establish the ability of the precast units to support required loadings. Frames and covers shall be of the manufacturer and type as indicated on the Drawings. Covers shall be imprinted with the work “ELECTRIC” or shall be imprinted as shown or called for on the Drawings.

Ground rods for the electric manhole shall be as shown on the Drawings. Non-current carrying metal parts in the manholes, including metallic sheathes of cables shall be connected to the ground rods with bare copper conductors.

PART 3 EXECUTION

3. 01 GENERAL

A. The Contractor shall install underground ducts, manholes and handholes at the approximate locations indicated in the Contract Drawings. The Engineer may indicate specific locations as the work progresses. Ducts shall be of the size, material, and type indicated in the Contract Drawings or Specifications. Where no size is indicated in the Contract Drawings or Specifications, the ducts shall be not less than 4 inches inside diameter. All duct lines shall be laid so as to grade toward handholes, manholes, vaults, and duct ends for drainage. Grades shall be at least 3 inches per 100 feet. On runs where it is not practicable to run the grade all one way, the duct lines shall be graded from the center in both directions toward manholes, handholes, or duct ends. Pockets or traps where moisture may accumulate shall be avoided.

B. The Contractor shall utilize large radius sweeps for all duct and conduit direction changes and for all elbows entering concrete slabs. The minimum inside radius shall be 30" for all ducts and conduits larger than 1-½” nominal.

C. The Contractor shall mandrel each duct. An iron-shod mandrel, not more than ¼-inch smaller than the bore of the duct shall be pushed through each duct by means of jointed conduit rods. The mandrel shall have a leather or rubber gasket slightly larger than the duct hole.

D. Any non-metallic ducts which terminate in concrete walls of new manholes or handholes shall terminate in bell ends, flush with the inside wall. Non-metallic ducts which terminate in concrete walls of existing manholes or handholes shall be brought through the wall in core drilled holes, trimmed flush with the inside wall, grouted into place.

E. All new ducts and conduits installed and all empty/spare extended ducts shall be

provided with a ¼ inch polyprophylene monofilament rope for pulling the permanent wiring. Sufficient length shall be left in manholes or handholes to tie the drag wire back to prevent it from slipping back into the duct.

F. All ducts shall be securely fastened in place during construction and progress of the work and shall be plugged to prevent seepage of grout, water, or dirt. Any duct section having a defective joint shall not be installed.

G. All nonmetallic ducts installed under paved areas shall be encased in a concrete envelope.

H. Where turf is well established and the sod can be removed, it shall be carefully stripped and properly stored.

3. 02 DUCTS ENCASED IN CONCRETE

A. Unless otherwise shown in the plans, concrete-encased ducts shall be installed so that the top of the concrete envelope is not less than 24 inches below the finished subgrade where installed under paved areas, and not less than 18 inches below finished grade in unpaved areas. Ducts, conduits and duct banks, which terminate in infield areas, but not in manholes or handholes shall extend beyond the pavement edge at least 5 feet and shall have keyed ends to provide for future extension. Trenches for concrete-encased ducts shall be opened the complete length between bases, manholes, handholes, etc., before concrete is laid so that if any obstructions are encountered, proper provisions can be made to avoid them. All ducts for concrete encasements shall be supported on plastic spacers designed for the purpose. Spacer bases shall be installed on wooden planks. The wooden planks shall be installed on a base of 3" of compacted sand in the bottom of the trench. Where two or more ducts are encased in concrete, the contractor shall space them not less than 1½ inches apart (measured from outside wall to outside wall) using spacers applicable to the type of duct. As the duct laying progresses, concrete not less than three inches thick shall be placed around the sides and top of the duct bank. Couplings shall be installed flush with the edge of the concrete encasement where it is required to terminate the duct bank in earth.

B. When pouring ducts for consecutive days, between each day's pour shall be a reinforced joint. When pouring ducts for future extensions, there shall be a keyed joint with no reinforcement as detailed on the Drawings. All costs for keying and reinforcing bars are considered incidental to the Item.

C. When specified, the Contractor shall reinforce the bottom, side and top of concrete encasements with steel reinforcing mesh or fabric or other approved metal reinforcement. When directed, the Contractor shall supply additional supports where the ground is soft and boggy.

3. 03 DUCTS OR CONDUITS WITHOUT CONCRETE ENCASEMENT

A. Trenches for single duct lines shall be not less than 12 inches nor more than 16 inches wide, and the trench for 2 or more ducts installed at the same level shall be

proportionately wider. Trench bottoms for ducts without concrete encasement shall be made to conform accurately with the grade so as to provide uniform support for the duct along its entire length.

B. A layer of fine earth material, at least 4 inches thick (loose measurement) shall be placed in the bottom of the trench as bedding for the duct. The bedding material shall consist of soft sand or other fine fill, and it shall contain no particles that would be retained on a ¼ inch sieve. The bedding material shall be tamped until firm.

C. Unless otherwise shown in plans, ducts for direct burial shall be installed so that the tops of all ducts are at least 18 inches below the finished grade.

D. When two or more ducts are installed in the same trench without concrete encasement, they shall be spaced not less than 2 inches apart (measured from outside wall to outside wall) in a horizontal direction and not less than 6 inches apart in a vertical direction.

E. Trenches shall be opened the complete length between bases, manholes, etc., before duct is installed so that if any obstructions are encountered, proper provisions can be made to avoid them.

F. Where steel conduits terminate in an unpaved area for transition to direct burial installation, the end of the conduit shall be equipped with an insulated throat, threaded, grounding bushing and shall be connected to the equipment ground.

3. 04 CORE-DRILLED HOLES

A. Certain conduit runs will originate or terminate at existing manholes or light bases. It will be necessary to core-drill into these units to complete the runs. Core-drilled holes into existing manholes or handholes will have the annular space between the conduit and the cored hole filled with mortar.

3. 05 REAMING EXISTING DUCTS

A. In the event that:

1. There are no empty spare ducts that can be utilized,

2. There are no abandoned cables which can be removed,

3. There are no existing cables which can be consolidated to obtain a spare duct:

a. When directed by the engineer the Contractor may utilize a mechanical reamer or high-pressure water to ream out the blisters and debris from the duct to make it ready to receive new cables.

3. 06 ABANDONED DUCT

A. When a duct bank is to be abandoned in place, these conduits shall be sealed with grout in the manhole where they originate.

3. 07 COMPLETION OF THE WORK

A. After completion of work in any manhole or handhole, both new and existing, the manhole or handhole shall be left in a clean condition satisfactory to the Engineer, regardless of the cause of the debris required to be cleaned.

Number	Title
W-C-571	Fire-Conduit and Fittings; Nonmetal, Rigid, (Asbestos-Cement or Clay Cement), (for Electrical Purposes)
W-C-575	Conduit and Fittings; Nonmetallic, Rigid, Bituminized Fiber; Laminated Wall
W-C581	Conduit and Fittings; Nonmetallic, Rigid, (Bituminized Homogeneous Fiber)
W-C-1094	Conduit and Fittings; Nonmetallic, Rigid, (Plastic)
W-C-581	Conduit, Metal, Rigid; and Coupling, Elbow, and Nipple, Electrical Conduit, Zinc Coated

END OF SECTION

SECTION 16050

BASIC ELECTRICAL MATERIALS AND METHODS

PART 1 GENERAL

1. 01 SUMMARY

A. This Section includes the following:

1. Electrical Enclosures.
2. Receptacles.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Concrete equipment bases.
6. Electrical demolition.
7. Cutting and patching for electrical construction.
8. Touchup painting.

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1. 02 SUBMITTALS

A. Product Data: For electricity-metering equipment.

B. Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.

C. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1. 03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

1. 04 COORDINATION

A. Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

B. Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

PART 2 PRODUCTS

2. 01 ELECTRICAL ENCLOSURES

A. All outdoor electrical enclosures and panels shall be NEMA 250, Type 4X 316SS unless specifically indicated otherwise on plans.

2. 02 RECEPTACLES

A. Single and double receptacles shall be 20 ampere, 125 volts, back and side wired, with grounded pole.

B. Receptacle shall be enclosed in rain-tight cast iron alloy device box and include die cast metal constructed receptacle cover designed to maintain Nema type 3R rating “while-in-use”.

C. Products: Provide products by one of the listed manufacturers:

1. Appleton

2. Crouse-Hinds

3. Thomas & Betts

D. Provide device plates for each and every outlet box requiring same, and of the type required for the service and device involved; furnish in gangs as necessary. Plates and screws shall be the product of the same manufacturer of the devices installed. Finish of the plates shall be 0.04 stainless steel, finish 302 satin unless otherwise noted.

E. Ground-Fault Interrupter: Provide heavy-duty duplex receptacles, ground-fault circuit interrupters; feed-thru type, capable of protecting connected downstream receptacles on single circuit, grounding type UL-rated Class A, Group 1, 20-amperes rating, 120-volts, 60 Hz; with solid-state ground-fault sensing and signaling; with 5 miliamperes ground-fault trip level; equip with 20-ampere plug configuration, NEMA 5-20R.

F. Receptacles installed outdoors or within 6'-0" from plumbing fixtures and waterpipes shall be ground fault circuit interrupter type.

2. 03 SUPPORTING DEVICES

A. Material: Cold-formed steel, with corrosion-resistant coating acceptable to authorities having jurisdiction.

B. Metal Items for Use Outdoors or in Damp Locations: Hot-dip galvanized steel.

C. Slotted-Steel Channel Supports: Flange edges turned toward web, and 9/16-inch diameter slotted holes at a maximum of 2 inches o.c., in webs.

D. Slotted-Steel Channel Supports: Comply with Division 5 Section "Metal Fabrications" for slotted channel framing.

1. Channel Thickness: Selected to suit structural loading.

2. Fittings and Accessories: Products of the same manufacturer as channel supports.

E. Raceway and Cable Supports: Manufactured clevis hangers, riser clamps, straps, threaded C-clamps with retainers, ceiling trapeze hangers, wall brackets, and spring-steel clamps or click-type hangers.

F. Pipe Sleeves: ASTM A 53, Type E, Grade A, Schedule 40, galvanized steel, plain ends.

G. Cable Supports for Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug for nonarmored electrical cables in riser conduits. Plugs shall have number and size of conductor gripping holes as required to suit individual risers. Body shall be constructed of malleable-iron casting with hot-dip galvanized finish.

H. Expansion Anchors: Carbon-steel wedge or sleeve type.

I. Toggle Bolts: All-steel springhead type.

J. Powder-Driven Threaded Studs: Heat-treated steel.

2. 04 ELECTRICAL IDENTIFICATION

A. Identification Devices: A single type of identification product for each application category. Use colors prescribed by ANSI A13.1, NFPA 70, and these Specifications.

B. Raceway and Cable Labels: Comply with ANSI A13.1, Table 3, for minimum size of letters for legend and minimum length of color field for each raceway and cable size.

1. Type: Preprinted, flexible, self-adhesive, vinyl. Legend is overlaminated with a clear, weather- and chemical-resistant coating.

2. Color: Black letters on orange background.

3. Legend: Indicates voltage.

C. Colored Adhesive Marking Tape for Raceways, Wires, and Cables: Self-adhesive vinyl tape, not less than 1 inch wide by 3 mils thick.

D. Underground Warning Tape: Permanent, bright-colored, continuous-printed, vinyl tape with the following features:

1. Not less than 6 inches wide by 4 mils thick.

2. Compounded for permanent direct-burial service.

3. Embedded continuous metallic strip or core.

4. Printed legend that indicates type of underground line.

E. Tape Markers for Wire: Vinyl or vinyl-cloth, self-adhesive, wraparound type with preprinted numbers and letters.

F. Color-Coding Cable Ties: Type 6/6 nylon, self-locking type. Colors to suit coding scheme.

G. Engraved-Plastic Labels, Signs, and Instruction Plates: Engraving stock, melamine plastic laminate punched or drilled for mechanical fasteners 1/16-inch minimum thickness for signs up to 20 sq. in. and 1/8-inch minimum thickness for larger sizes. Engraved legend in black letters on white background.

H. Interior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Preprinted, aluminum, baked-enamel-finish signs, punched or drilled for mechanical fasteners, with colors, legend, and size appropriate to the application.

I. Exterior Warning and Caution Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145. Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch, galvanized-steel backing, with colors, legend, and size appropriate to the application. 1/4-inch grommets in corners for mounting.

J. Fasteners for Nameplates and Signs: Self-tapping, stainless steel screws or No. 10/32 stainless-steel machine screws with nuts and flat and lock washers.

2. 05 TOUCHUP PAINT

A. For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

B. Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

C. Color shall be as directed by Owner.

PART 3 EXECUTION

3. 01 ELECTRICAL EQUIPMENT INSTALLATION

A. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

B. Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

C. Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

D. Right of Way: Give to raceways and piping systems installed at a required slope.

3. 02 RACEWAY AND CABLE INSTALLATION

A. Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

B. Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Locate horizontal raceway runs above water and steam piping.

C. Use temporary raceway caps to prevent foreign matter from entering.

D. Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

E. Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

F. Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

2. Space raceways laterally to prevent voids in concrete.

3. Install conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.

4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.

G. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches of slack at each end of the pull wire.

H. Install telephone and signal system raceways, 2-inch trade size (DN53) and smaller, in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.

I. Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

J. Set floor boxes level and trim after installation to fit flush to finished floor surface.

3. 03 WIRING METHODS FOR POWER, LIGHTING, AND CONTROL CIRCUITS

A. Feeders: Type THHN/THWN insulated conductors in raceway.

B. Underground Feeders and Branch Circuits: Type THWN or single-wire, Type UF insulated conductors in raceway.

C. Branch Circuits: Type THHN/THWN insulated conductors in raceway.

D. Branch Circuits: Type THHN/THWN insulated conductors in raceway where exposed. Metal-clad cable where concealed in ceilings and gypsum board partitions.

E. Branch Circuits: Type THHN/THWN insulated conductors in raceway where exposed. Armored or nonmetallic sheathed cable where permitted by authorities having jurisdiction and where concealed in ceilings and gypsum board partitions.

F. Remote-Control Signaling and Power-Limited Circuits: Type THHN/THWN insulated conductors in raceway for Classes 1, 2, and 3, unless otherwise indicated.

3. 04 WIRING INSTALLATION

A. Install splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

B. Install wiring at outlets with at least 12 inches of slack conductor at each outlet.

C. Connect outlet and component connections to wiring systems and to ground. Tighten electrical connectors and terminals, according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

3. 05 ELECTRICAL SUPPORTING DEVICE APPLICATION

A. Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

B. Dry Locations: Steel materials.

C. Support Clamps for PVC Raceways: Click-type clamp system.

D. Selection of Supports: Comply with manufacturer's written instructions.

E. Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb (90-kg) design load.

3. 06 SUPPORT INSTALLATION

A. Install support devices to securely and permanently fasten and support electrical components.

B. Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

C. Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

D. Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

E. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

F. Install 1/4-inch- diameter or larger threaded steel hanger rods, unless otherwise indicated.

G. Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Simultaneously install vertical conductor supports with conductors.

J. Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

K. Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

L. Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

M. Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.

6. Steel: Welded threaded studs or spring-tension clamps on steel.
   a. Field Welding: Comply with AWS D1.1.
7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3. 07 IDENTIFICATION MATERIALS AND DEVICES

A. Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

B. Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

C. Self-Adhesive Identification Products: Clean surfaces before applying.

D. Identify raceways and cables with color banding as follows:
1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot (15-m) maximum intervals in straight runs, and at 25-foot (8-m) maximum intervals in congested areas.
3. Colors: As follows:
   a. Fire Alarm System: Red.
   b. Security System: Blue and yellow.
   c. Telecommunication System: Green and yellow.

E. Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

F. Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

G. Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:
1. Phase A: Black.

2. Phase B: Red.

3. Phase C: Blue.

H. Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

1. Phase A: Brown.

2. Phase B: Orange.

3. Phase C: Yellow.

4. Coordinate two paragraphs below with Drawings.

I. Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

J. Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3. 08 CUTTING AND PATCHING

A. Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

B. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

C. Provide additional means and materials that shall contain dust and debris.

3. 09 FIELD QUALITY CONTROL

A. Inspect installed components for damage and faulty work, including the following:

1. Raceways.

2. Building wire and connectors.

3. Supporting devices for electrical components.

4. Electrical identification.

5. Electrical demolition.

6. Cutting and patching for electrical construction.

7. Touchup painting.

3. 10 REFINISHING AND TOUCHUP PAINTING

A. Refinish and touch up paint. Paint materials and application requirements are specified in Division 9 Section "Painting."

1. Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.

2. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.

3. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

4. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3. 11 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 16060

GROUNDING AND BONDING

PART 1 GENERAL

1. 01 SUMMARY

A. This Section includes grounding electrodes and conductors, equipment grounding conductors and bonding. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

1. 02 SUBMITTALS

A. Data Sheets: Submit as a minimum the following information on each different item. The information shall be in the form of a manufacturer's standard data sheets.

1. Rod Electrodes.
2. Rod Material.
3. Dimensions.
4. Coupling Type.
5. Mechanical Connectors.
6. Material.
7. Connector Type.
8. Exothermic Connections.
9. Process Description.
10. Mold Types.
11. Weld Material.
12. Starting Material.
13. Ground Well.
14. Dimensioned Picture or Drawing of Grounding Well and Cover.
15. Well Pipe Material.
16. Well Cover Material and Legend.

B. Test Reports: Indicate overall resistance to ground and resistance of each electrode.

C. Manufacturer's Instructions: Include instructions for storage, handling, protection,

examination, preparation and installation of exothermic connectors.

1. 03 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100.

B. Comply with NFPA 70.

C. IEEE Std 81 – Guide.

D. UL 467 – Electrical Grounding and Bonding Equipment.

E. UL 486A – Wire Connectors and Soldering Lugs for Use with Copper Conductors.

F. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 PRODUCTS

2. 01 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Division 16 Section "600 Volt or Less Cable."

B. Material: Copper.

C. Equipment Grounding Conductors: Insulated with green-colored insulation.

D. Grounding Electrode Conductors: Stranded cable.

E. Underground Conductors: Bare, tinned, stranded, unless otherwise indicated.

F. Bare Copper Conductors: Comply with the following:

1. Solid Conductors: ASTM B 3.
2. Assembly of Stranded Conductors: ASTM B 8.
3. Tinned Conductors: ASTM B 33.

G. Copper Bonding Conductors: As follows:

1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4-inch in diameter.
2. Bonding Conductor: No. 4 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

H. Grounding Bus: Bare, annealed copper bars of rectangular cross section, with insulators.

2. 02 CONNECTOR PRODUCTS

A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.

B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.

C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2. 03 GROUNDING ELECTRODES

A. Ground Rods: Size: ¾" diameter by 120 inches. Copper clad steel sectional type with high strength steel core and electrolytic grade copper outer sheath, molten welded to the core with tapered point.

2. 04 EXOTHERMIC CONNECTIONS

A. UL 486A.

B. Process: Exothermic process that produces molecular bonding of connected items.

C. Approved for exposure or direct burial without degradation.

D. Use graphite molds of proper size and design for the weld and connected items.

E. Starting Weld material: Copper oxide and aluminum mixture with a minimum 3 percent tin.

F. Weld material: Aluminum, copper and iron oxides ignited only by spark ignitor designed for the purpose.

G. Miscellaneous: Provide tools and other devices required for a complete weld.

H. All welding material shall be of the same manufacturer.

2. 05 WIRE

A. UL 486A.

B. Materials: Copper, 98 percent conductivity; insulated copper for all feeders, branch circuits; bonding jumpers and transformer grounds; solid for #10 AWG and smaller, stranded for larger than #10 AWG. See Section 16123 for insulation types.

C. Foundation Electrodes: Bare, tinned, stranded copper #4/0 AWG.

D. Grounding Electrode Conductor: Insulated copper, size as indicated.

E. Counterpoise: Bare, tinned stranded, copper, #3/0 AWG.

2. 06 GROUNDING WELL

A. UL 467.

B. Well Pipe: 8-inch diameter by 36-inch long concrete pipe with belled end.

C. Well Cover: Cast iron with legend "GROUND" embossed on cover.

2. 07 GROUND BUS BARS

A. Building Master Ground Bar – MGB:

1. Tin plated copper ground bar.

2. ¼-inch thick.
3. 4-inch wide with two sets of holes drilled and tapped.
4. Minimum 4-foot long unless otherwise indicated on the Drawings.
5. Wall mounted on 2-inch insulated standoffs.

PART 3 EXECUTION

3. 01 APPLICATION

A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.

B. In raceways, use insulated equipment grounding conductors.

C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.

D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

E. Ground Rod Clamps at Test Wells: Use bolted pressure clamps with at least two bolts.

F. Ground Bus Bars: Install in each electrical and communication rooms and elsewhere as indicated.

1. Use insulated spacer; space 1 inch from wall and support from wall 6 inches above finished floor, unless otherwise indicated.
2. At doors, route the bus up to the top of the doorframe, across the top of the doorway, and down to the specified height above the floor.

3. 02 EQUIPMENT GROUNDING CONDUCTORS

A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.

B. Install insulated equipment grounding conductors in all raceways. Terminate each end on suitable lug, bus or bushing.

C. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for voice and data cables.

D. Metal Poles Supporting Outdoor Lighting Fixtures: Provide a grounding electrode in addition to installing a separate equipment grounding conductor with supply branch-circuit conductors.

E. Common Ground Bonding with Lightning Protection System: Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

F. Where expansion joints or telescoping joints occur, provide bonding jumpers.

G. Where flexible metallic conduit is employed, provide a green insulated grounding jumper installed in the flexible conduit.

H. Provide grounding bushings on all service and feeder raceways terminating within switchboards, motor control centers, panelboards, cabinets, and all other enclosures. Provide grounding conductors form such bushings to the frame of the enclosure and to the ground bus or equipment grounding strap.

I. Where paralleled conductors in separate raceways occur, provide grounding conductor in each raceway.

3. 03 COUNTERPOISE

A. Ground the steel framework of the structure with a driven ground rod at the base of every corner column and at intermediate exterior columns at distances not more than 60 feet apart. Provide a grounding conductor (counterpoise), electrically connected to each ground rod and to each steel column, extending around the perimeter of the building. Use tinned-copper conductor not less than No. 3/0 AWG for counterpoise and for tap to building steel. Bury counterpoise not less than 18 inches below grade and 24 inches from building foundation.

3. 04 INSTALLATION

A. Ground Rods: Install at least two rods, spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.

1. Drive ground rods until tops are 6 inches below finished floor or final grade, unless otherwise indicated. Proper driving studs and sleeves shall be used when driving ground rods. Water shall be continuously applied to the ground at point where the rod penetrates during the driving process.

2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Metal Water Service Pipe: Provide insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes by grounding clamp connectors. Where a dielectric main water

fitting is installed, connect grounding conductor to street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

E. Water Meter Piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with grounding clamp connectors.

F. Bond interior metal piping systems and metal air ducts to equipment grounding conductors of associated pumps, fans, blowers, electric heaters, and air cleaners. Use braided-type bonding straps.

G. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

H. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor in addition to test well shown on drawings.

3. 05 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.

1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.

2. Make connections with clean, bare metal at points of contact.

3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.

4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.

5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable. Use exothermic welded connections for connections to structural steel and for underground connections except those at test wells. Install at connections to ground rods and other electrodes. Comply with manufacturer’s written recommendations. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically

noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Connections at Test Wells: Use compression-type connectors on conductors and make bolted- and clamped-type connections between conductors and ground rods.

F. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A.

G. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

H. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3. 06 UNDERGROUND DISTRIBUTION SYSTEM GROUNDING

A. Manholes and Handholes: Install a driven ground rod close to wall and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before manhole is placed and provide a No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete. Seal floor opening with waterproof, non-shrink grout.

3. 07 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, and at ground test wells. Measure ground resistance not less than two full days after the last trace of precipitation, and without the soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance. Perform tests, by the fall-of-potential method according to IEEE Standard 81. Perform tests on each individual grounding electrode prior to connection to grounding system.

3. Provide drawings locating each ground rod and ground rod assembly and other grounding electrodes, identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location and include observations of weather

and other phenomena that may affect test results. Describe measures taken to improve test results.

a. Equipment Rated 500 kVA and Less: 10 ohms.

b. Equipment Rated 500 to 1000 kVA: 5 ohms.

c. Equipment Rated More Than 1000 kVA: 3 ohms.

d. Manhole Grounds: 10 ohms.

4. Excessive Ground Resistance: If resistance to ground exceeds specified values. Install additional rod electrodes or add additional sections of a sectional type rod as required to achieve specified resistance to ground.

END OF SECTION

SECTION 16123

600 VOLT OR LESS CABLE

PART 1 GENERAL

1. 01 SUMMARY

A. This Section includes requirements for insulated copper stranded conductors and associated connections for general power and control use at voltages below 600 volts.

B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and other Specification Sections, apply to the Work as if specified in this Section.

1. 02 REFERENCES

A. ASTM (American Society for Testing and Materials) - B3, B8.

B. NECA (National Electrical Contractors Association) – National Electrical Installation Standards.

C. NEMA WC 5 - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.

D. NEMA WC 26 - (1996) Wire and Cable Packaging.

E. NFPA 70 – (1999) National Electrical Code.

F. UL 83 - (1991; Rev. through Mar. 1996) Thermoplastic – Insulated Wires and Cables.

G. UL 486A – (1991; Rev. Oct. 1991) Wire Connectors and Soldering Lugs for Use with Copper Conductors.

H. UL 510 – (1994) Insulating Tape.

1. 03 QUALITY ASSURANCE

A. Listing and Labeling: Provide wire and cable that are Listed and Labeled as defined in NFPA 70, Article 100 and marked for specific types, sizes, and combinations of conductors and connected items.

B. Comply with NFPA 70. Products shall bear the UL label.

C. Perform work in accordance with codes and standards listed.

D. Wire shall be manufactured within 12 months prior to the date of delivery to the site.

1. 04 SUBMITTALS

A. Data Sheets: Submit as a minimum the following information on each different type

of wire and connector. The information shall be in the form of manufacturer's standard data sheets or drawings.

1. Wire and cable.
2. Conductor material.
3. Conductor gage or MCM.
4. Solid or stranded conductor.
5. Insulation material.
6. Insulation type designation.
7. Insulation temperature rating.

B. Wiring Connectors:

1. Connector type.
2. Connector material.
3. Voltage, amperage, and temperature ratings.
4. Conductor size ranges.
5. Tools required.
6. Picture of connector and tools.
7. Manufacturer's installation instructions.

C. Heat Shrink Material:

1. Type of material.
2. Wall thickness.
3. Voltage and temperature ratings.
4. Conductor size ranges.
5. Tools required.
6. Picture of material and tools.
7. Manufacturer's installation instructions.

D. Insulating Tape:

1. Type of material.
2. Thickness and width.
3. Wire pulling lubricants.
4. Type of material.
5. Types of conductor, insulation and conduit for which it is approved.

E. Megger Test Reports: Indicate values obtained.

F. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Codes and Standards.

1. 05 DELIVERY, STORAGE, AND HANDLING

A. Deliver wire and cables according to NEMA WC 26.

PART 2 PRODUCTS

2. 01 BUILDING WIRE AND CABLE

A. Description: UL 83, single conductor insulated wire.

1. Conductor: Copper; 98 percent conductivity; solid for 10 AWG or smaller; stranded for larger than 10 AWG as applicable.

2. Insulation Thermoplastic: 600 volts, NFPA 70, Type THHN/THWN-2, unless otherwise indicated; 90º C.

3. All building wire shall be of the same manufacturer. Do not mix wire of different manufacturer on the same project.

4. General: All wire shall be identified as required by NEC.

5. The insulation on wiring #8 or smaller shall have factory-colored insulation. For wire larger than #8, color-coding shall be colored tape wrapped around the insulation of each wire at each connection, splice and pull box. Each phase conductor of each branch circuit shall be of one color throughout the installation.

a. Color coding shall be as described in section 16050 "Basic Electrical Materials and Methods".

2. 02 CONTROL WIRE

A. Description: UL 83, single conductor insulated wire.

1. Conductor: Copper; stranded for all sizes.

2. Insulation: Thermoplastic; 600, NFPA 70 Type MTW unless otherwise indicated; 75º C or 90º C as applicable.

3. All control wire shall be of the same manufacturer.

4. Identification: Control wire shall be color-coded throughout. Each wire shall be identified at each terminal and junction point by permanently attaching wire markers indicated the terminal number, etc. Refer to Section 16050 – for Electrical Identification requirements.

2. 03 WIRING CONNECTORS

A. Solderless Spring-Wire Connectors: UL 486A, tool-applied, twist-on type with plastic caps; rated for conductor sizes and material.

B. Compression Connectors and Taps: Mechanical set screw type or tool-applied crimp type. Split bolt connectors are not acceptable.

2. 04 ACCESSORIES

A. Heat Shrink Material: Heavy wall tubing or caps; UL listed as waterproof.

B. Insulating Type: Vinyl type; minimum 7-mil; listed for use as primary insulation and splice jacketing on 600 volt wire and cable.

C. Wire Pulling Lubricants: Compatible with all conductor, insulation and conduit types.

PART 3 EXECUTION

3. 01 PREPARATION

A. Completely and thoroughly swab raceway where moisture and/or dirt has collected inside before installing wire.

B. Do not install wire in conduit, raceways, etc. until they are complete and sealed against the entry of moisture and/or debris.

3. 02 WIRING METHODS

A. Building wire, type THHN/THWN-2 insulation in raceway.

B. Use wiring methods in accordance with the appropriate article of NFPA 70.

C. Connect each circuit of a multi-circuit home run to a different phase.

D. Do not terminate more than one conductor in a single terminal of a lug or connector, unless noted otherwise for lighting control or other control applications.

E. Leave slack conductor at each connection and splice to allow for future additional connections.

3. 03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install all wiring in raceways. As standard practice, route control conductors in separate raceways from power conductors. When engineering consideration dictates, control conductors may be routed in power raceway under the following conditions:

1. All conductors must have insulation rated for the highest voltage rated insulation in the raceway.

2. The largest power conductor in the raceway is #4 or smaller.

C. Use conductor not smaller than #12 AWG for power and lighting circuits.

D. Use conductor not smaller than #14 AWG for control circuits.

E. Use #10 AWG conductors for 20 ampere, 120-volt branch circuits longer than 115

feet to the furthest outlet.

F. Use #10 AWG conductors for 20 ampere, 277-volt branch circuits longer than 265 feet to the furthest fixture.

G. Pull all conductors into raceway at the same time.

H. Use suitable wire pulling lubricant.

I. Use a pulling means such as tape, rope, grips, etc. that will not damage the wire, cable or conduit.

J. Neatly train and lace wiring inside boxes, equipment, cabinets, switchboards, and panelboards with nylon tie straps. Three phase circuits shall be grouped by circuit.

K. Clean conductor surfaces before installing lugs and connectors.

L. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.

M. Tighten set screws and bolts on connectors according to the manufacturer's torquing requirements.

N. Use compression connectors for copper conductor splices and taps, 8 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of the conductor.

O. Use insulated spring wire connectors with plastic caps for copper conductor splices and taps, #10 AWG and smaller.

P. Where splices and taps are made in junction boxes or handholes, etc. below grade, use tool-applied crimp type compression connectors. Insulate the conductors and the connector with heavy wall heat shrink material.

Q. For parallel conductors of a single phase, insure that conductor lengths are equal by actual length comparison before installation.

R. Provide phase testing for proper rotation of all motors.

S. Seal around cables penetrating fire-rated elements according to Division 7 Section "Firestopping."

T. Splices in raceways are not allowed. Splice only in junction or outlet boxes in accessible locations.

U. Wiring at Outlets: Install conductors at each outlet with at least 6 inches of slack.

V. Provide green colored conductor insulation for the entire length of the grounding conductors for wire size smaller than #6 AWG.

W. Provide white colored conductor insulation for the entire length of the neutral conductors for wire size smaller than #6 AWG.

3. 04 IDENTIFICATION

A. Identify wires and cables in accordance with Section 16050.

B. In pull or junction boxes where there is more than one circuit, identify each conductor with its panel and circuit number or other designation indicated on drawings.

3. 05 WIRING TEST

A. Measure the insulation resistance of all feeder conductors using a "Megger." The test voltage shall be 500 volts. Test the conductor without circuit loads applied. The minimum resistance value shall be 1,000,000 ohms.

3. 06 FIELD QUALITY CONTROL

A. Inspect wire for physical damage and proper connection.

B. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.

C. Verify continuity of each branch circuit conductor.

END OF SECTION

SECTION 16130

RACEWAYS

PART 1 GENERAL

1. 01 SUMMARY

A. This Section includes rigid metal conduit, intermediate metal conduit, flexible metal conduit, liquid light flexible metal conduit, electrical metallic tubing, rigid PVC conduit, fitting and conduit bodies.

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections apply to the work of this Section as if specified herein.

1. 02 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. LFMC: Liquidtight flexible metal conduit.

D. PVC: Polyvinyl chloride.

E. RGS: Rigid galvanized steel.

F. FMC: Flexible metal conduit.

G. EPT: Electrical polyvinyl chloride tubing.

1. 03 SUBMITTALS

A. Data Sheets: Submit as a minimum the following information for each type of conduit, conduit body, fitting and attachment device.

1. Conduit.
    a. Type of material.
    b. Thickness of material.
    c. Types of protective coatings on the outside and inside.
    d. Type of protective coating on threads, if applicable.
2. Conduit Bodies:
    a. Type of material.
    b. Type of cover material.
    c. Type of protective coatings, interior and exterior.
    d. Type of material for screws and gaskets.

3. Conduit Fittings:
   a. Type of materials such as bodies, gaskets, seals, etc.
   b. Threaded.
   c. Compression or set screw type.
   d. Liquid tight.
   e. Concrete tight.

1. 04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100. Products shall be the UL label.

B. Comply with NFPA 70.

C. ANSI C80.1: Rigid Steel Conduit, Zinc Coated.

D. ANSI C80.3: Electrical Metallic Tubing, Zinc Coated

E. ANSI C80.5: Rigid Aluminum Conduit.

F. ANSI C80.6: Intermediate Metal Conduit (IMC).

G. ANSI/NEMA FB I: Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit and Cable Assemblies.

H. NECA: "Standard Installations."

I. NEMA RN 1: Polyvinyl Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit.

J. NEMA TC 2: Electrical Polyvinyl Chloride (PVC) Tubing (EPT) and Conduit (EPC-40 and EPC-80).

K. NEMA TC 3 – PVC Fittings for Use with Rigid PVC Conduit and Tubing.

L. UL 1: Flexible Metal Conduit.

M. UL 6: Rigid Metal Conduit.

N. UL 6A: Rigid Aluminum Conduit.

O. UL 360: Liquid Tight Flexible Steel Conduit.

P. UL 514B: Fittings for Conduit and Outlet Boxes.

Q. UL 651: Schedule 40 and 80 Rigid PVC Conduit.

R. UL 797: Electrical Metallic Tubing.

S. UL 886: Outlet Boxes and Fittings for Use in Hazardous (Classified) Locations.

T. UL 1242: Intermediate Metal Conduit.

1. 05 COORDINATION

A. Coordinate layout and installation of raceways, and suspension system with other

construction that penetrates ceilings or is supported by them, including light fixtures, communication system, HVAC equipment, fire-suppression system, and partition assemblies.

1. 06 DELIVERY STORAGE AND HANDLING

A. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

B. The threads of rigid steel and IMC shall be protected by factory installed caps.

C. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2. 01 METAL CONDUIT

A. Rigid Steel Conduit (RSC): ANSI C80.1, RSC shall be threaded, hot dip galvanized inside and outside with a chromate coating outside. Threads shall be zinc coated after cutting. Elbows and nipples shall conform to the same specification.

B. Intermediate Metal Conduit (IMC): ANSI C80.6, IMC shall be threaded, hot dip or electro-galvanized outside with chromate coating. The inside shall be galvanized or coated with paint, zinc, enamel or other corrosion protection material that also provides a smooth, low friction surface. The threads shall be zinc coated after cutting. Elbows and nipples shall conform to the same specification.

C. Rigid Aluminum Conduit (RAC): ANSI C80.5, RAC shall be threaded.

D. Couplings: Couplings shall be threaded, aluminum and made by the same manufacturer as the conduit.

2. 02 PVC COATED METAL CONDUIT

A. Description: NEMA RN 1, conduit shall be rigid steel, hot dip galvanized inside and outside including the threads. The exterior surface shall be treated prior to coating. Both interior and exterior shall be coated with an epoxy acrylic primer. The exterior shall be coated with a minimum 40-mil thick PVC coating. The interior shall be coated with a nominal 2-mil thick urethane coating. The conduit shall be bendable without damage to either the PVC or urethane coating. The threads shall be coated with a nominal 2-mil thick clear urethane coating. Elbows and nipples shall conform to the same specification.

B. Couplings, Fittings and Conduit Bodies:

1. Couplings shall be galvanized steel and made by the same manufacturer as the conduit.

2. Fittings shall be malleable iron or steel.

3. Conduit bodies shall be copper free cast aluminum or malleable iron with

cast covers and stainless steel screws.

4. All couplings, conduit fittings and conduit bodies shall have the same exterior and interior coatings as specified for the conduit.

5. The exterior PVC material shall form a sleeve extending one pipe diameter or 2 inches, whichever is less, from each female opening of couplings, fittings and conduit bodies.

6. Clamps, U-bolts, and other devices used to secure the conduit shall be malleable iron or steel with the same PVC coating as the conduit.

7. Couplings, fittings, and conduit bodies shall be of the same manufacturer as the conduit.

2. 03 FLEXIBLE METAL CONDUIT

A. Description: UL 1, interlocked galvanized steel.

2. 04 LIQUID TIGHT FLEXIBLE METAL CONDUIT

A. Description: UL 360, interlocked galvanized steel with extruded PVC jacket.

2. 05 LIQUID TIGHT FLEXIBLE METAL CONDUIT (ALUMINUM)

A. Description: Aluminum core with PVC jacket.

2. 06 ELECTRICAL METALLIC TUBING (EMT)

A. Description: ANSI C80.3, EMT shall be hot dip or electro-galvanized on the outside with a chromate coating. The interior shall be coated with paint, zinc, enamel or other corrosion protection material that also provides a smooth low friction surface.

2. 07 NONMETALLIC CONDUIT

A. Description: PVC; Schedule 80 and 40.

B. Fittings: Fittings shall match conduit type and material and shall be provided by the same manufacturer as the conduit.

C. Cement for connections of conduit and fittings shall be approved by the manufacturer of the conduit.

2. 08 FITTINGS AND CONDUIT BODIES FOR METAL, EMT AND FLEXIBLE CONDUIT

A. Fittings:

1. All fittings, locknuts, bushings, etc. shall be malleable iron or steel.

2. For RAC, RSC or IMC, fittings shall be threaded type.

3. For EMT, fittings shall be compression type.

4. Locknuts shall have shape edges that bite into the enclosure when

tightened.

5. Bushings shall be high temperature plastic, with insulating throats and grounding lugs where applicable.

6. Hub fittings shall be two-piece, liquid-tight with high temperature, plastic, insulating throats.

7. Fittings used in concrete shall be UL listed as concrete tight.

8. Fittings used in exterior and other damp or wet applications shall be UL listed as liquid-tight.

9. Fittings for flexible metal conduit shall have insulated throats and grounding lugs where applicable.

10. Refer to the PVC coated metal conduit and nonmetallic conduit specifications for fittings used with those types of conduit.

11. Sealing bushings shall have molded neoprene sealing ring with predrilled holes for each conductor, PVC coated pressure discs, stainless steel screws and washers and locking ring where applicable.

B. Conduit Bodies: Conduit bodies shall be malleable iron or cast copper-free aluminum. They shall be threaded type with cast cover and solid gasket. Where used in dry interior applications, provide coated steel screws. Where used in exterior or other damp or wet applications, use stainless steel screws. Conduit bodies 1 ¼ inches and larger shall have rollers or wire guards.

C. Expansion Fittings: Expansion fittings shall be malleable iron or steel with insulator bushing, gaskets, washers, packing, etc. as required to provide a complete unit. Provide a braided copper bonding jumper. The fittings shall be rated for interior or exterior use as applicable.

D. Seal Fittings: Seal fittings shall be malleable iron or cast aluminum, threaded type with packing, sealing compound, plugs, etc. to provide a complete unit. Fittings shall be rated for interior or exterior use as applicable.

E. Deflection Fittings: Deflection fittings shall be hot dip galvanized ductile iron, threaded type with molded neoprene outer jacket, tinned braided copper bonding jumper, molded plastic inter sleeve, stainless steel clamping bands, etc. to provide a complete unit. The fitting shall be rated for interior or exterior use as applicable. Where fittings are used below grade, they shall be PVC coated as specified under PVC coated metal conduit fittings.

PART 3 EXECUTION

3. 01 INSTALLATION

A. Underground Installation:

1. Concrete Encased: Use schedule 40 PVC conduit.

2. Direct Buried: Use schedule 80 PVC conduit.

B. Outdoor Locations, Above Grade: Use coated rigid aluminum conduit and liquid-tight flexible aluminum conduit for connection to motors and control devices.

C. Wet and Damp Locations, Above Grade: Use PVC coated rigid aluminum conduit, flexible waterproof conduit for connection to motors and control devices.

D. Dry Locations:

1. Concealed in Concrete or Masonry Construction Above Grade, Columns, Walls and Above Suspended Ceilings: Use rigid steel conduit, intermediate metal conduit, and electrical metallic tubing.

2. Exposed: Use rigid aluminum, intermediate metal conduit, and electrical metallic tubing.

E. Locations Subject to Physical Damage: Use rigid aluminum conduit or intermediate metal conduit.

F. In Refrigerated or Hazardous Areas: Use rigid steel or intermediate metal conduit.

G. Service Entrance Conduit – Underground (600 volts or less): Use schedule 40 PVC with the underground portion encased in a minimum 3 inches of concrete and installed a minimum of 24 inches below grade. Convert PVC conduit to PVC coated rigid steel before rising through the floor slab or grade. The PVC coated rigid steel conduit shall extend a minimum of 6 inches above the floor or grade.

H. Flexible Metal Conduit: Flexible metal conduit shall be installed for:

1. Connections from the conduit system to recessed lighting fixtures, maximum 6 feet in length.

2. Connections to motors, maximum 2 feet in length.

3. Connections to electrical equipment subject to movement or vibration.

I. Liquid-Tight Flexible Metal Conduit: Liquid-tight flexible metal conduit shall be installed for:

1. Connections to motor equipment subject to movement or vibration where exposed to rain, spray, or a corrosive atmosphere.

2. Connections to equipment subject to oil or grease.

3. Connections to control equipment.

J. General Requirements:

1. Install conduit in accordance with NECA “Standard of Installation” and manufacturer’s written instructions.

2. Install nonmetallic conduit in accordance with manufacturer’s instructions.

3. Minimum Conduit Size: ¾-inch unless otherwise specified.

4. Verify routing and termination requirements and locations of conduit prior to rough-in.

5. Routing and termination of conduits shall be coordinated with structural, equipment, piping and ductwork to assure accessibility to junction and pull boxes.

6. Conduit routing shown on the drawings is diagrammatic unless otherwise dimensioned. Route conduit as specified and as required. Conduit offsets, risers, junction boxes, pull boxes, and fittings are not necessarily shown; however, provide these as required by the conditions involved and applicable codes for a correct and complete installation.

7. Finished Areas: Conceal conduits below floors, within slabs only where indicated, within walls, within pipe chases, above suspended ceilings, and within other building construction, unless otherwise indicated. Conduits shall be run in floor slabs except where otherwise indicated.

8. Unfinished Areas: Install above floor conduits exposed in areas where pipe chases or suspended ceilings are not indicated or concealing is otherwise impractical, in mechanical and electrical equipment rooms, and other unfinished areas.

9. Install conduits run exposed or concealed above ceilings or in walls in straight, level and plumb lines, parallel with and at right angles with beams, wall, ceilings and other building lines.

10. Route conduit in slabs above grade and in and under slabs on grade from point-to-point or shortest practical path.

11. Arrange conduit supports to prevent misalignment during wiring installation.

12. Support individual conduit using coated steel or malleable two-hole conduit straps, lay-in adjustable hangers, clevis hangers, threaded rods with conduit fasteners and split hangers.

13. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits. Each conduit shall be independently attached to the rack.

14. Fasten conduit supports to building structure. Do not fasten conduit supports to mechanical piping or ducts or their supports.

15. Do not support conduit with the tie wire or perforated pipe straps. Remove wire used for temporary supports.

16. Do not cross conduits in slab.

17. Conduit shall be installed a minimum of 12 inches from steam or hot water piping, flues or any other surface with a surface temperature exceeding 104º F (40º C) run in parallel with the conduit, and a minimum of 6 inches where run perpendicular to the conduit. Conduit shall be installed a minimum of 3 inches from cold or chilled water piping.

18. Cut conduit square using saw or pipecutter; ream and de-burr cut ends.

19. Bring conduit to shoulder of fittings; fasten wrench-tight.

20. When threads are cut in rigid steel or intermediate metal conduit in the field, the conduit and fittings shall be made up immediately. If there are any showing, they shall be coated with a corrosion resistant compound approved by the conduit manufacturer.

21. When threads are cut in PVC coated rigid steel conduit in the field, the threads shall be coated immediately with a corrosion resistant compound supplied by the conduit manufacturer. When the PVC coating of the conduit is removed or damaged for any reason, the exposed area shall be coated with a PVC compound supplied by the conduit manufacturer. Follow the manufacturer's instructions in applying compounds.

22. Solvent weld nonmetallic conduit and fittings using cement as approved by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fittings. Allow joint to cure as instructed by the manufacturer.

23. Use conduit hubs or watertight fittings to fasten conduit to metal boxes in damp and wet locations.

24. In general, install no more than equivalent of three 90° bends between pull or outlet boxes. For communication conduits, install no more than equivalent of two 90° bends between pull or outlet boxes. Make field-made bends and offsets with hickey or conduit bending machine. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot bender to fabricate or factory elbows for bends in metal conduit larger than 2-inch size. Do not install crushed or deformed conduits. Keep the legs of a bend in the same plane and the straight legs of offsets parallel. For banked runs, all bends and offsets shall be parallel.

25. Avoid moisture traps; provide junction box with drain fitting at low point in conduit system.

26. Provide approved adapters when PVC conduits are coupled to metallic conduits.

27. Where PVC is used underground, a PVC coated rigid steel elbow shall be provided at the point where the conduit turns up. The vertical portion of the riser shall be PVC coated rigid steel conduit.

28. Provide approved fittings that maintain conduit electrical continuity by bonding jumpers or other means to accommodate expansion and deflection where conduit crosses control and expansion joints.

29. Provide seal fittings on all conduits where they rise out of the ground or fill below slabs. If the conduit terminates in a floor mounted metal enclosure such as a switchboard, pull box, etc., provide a sealing bushing with a grounding bushing.

30. Provide seal fittings on all conduits that penetrate exterior walls or to or from interior spaces or other areas where conduit passes from one extreme

temperature or moisture situation to another such as walk-in refrigerators, freezers or wash down bays.

31. Install a pull rope in each empty conduit. Pull rope shall be monofilament plastic having a minimum 200-lb. tensile strength. Leave a minimum of 12 inches of slack at each end of the pull line and securely fasten pull rope to conduit.

32. Where conduits rise through floor slabs, curved portions or bends shall not be visible above the finished slab.

33. Support non-concrete encased underground conduits by laying with full length bearing on firm trench bottoms.

34. Support horizontal and vertical runs of conduit at intervals in accordance with the code for the types of conduit used. In addition, support each riser conduit at each building floor level.

35. Prior to wire pulling, use suitable caps to protect installed conduit against entrance of dirt and moisture and blow out or swab out conduits in which moisture or dirt has collected. Free clogged conduits of obstructions.

36. Ground and bond conduit under provisions of Section 16060 - Grounding and Bonding.

37. Identify conduit under provisions of Section within 16050 – Electrical Identification.

38. Provide all necessary sleeves for conduits and other electrical items passing through concrete and masonry construction where conduit and other electrical items are not installed prior to concrete beams shall be NPS steel pipe or rigid steel conduit, flush with finished concrete surfaces. Sleeves for all conduits passing through the floor shall be galvanized NPS pipe or galvanized rigid steel conduit extending two inches above finished floor, and flush with slab below.

39. Install conduit to preserve fire and smoke resistance rating of partitions and floors.

40. Route conduit through suitable roof flashing devices. Coordinate with roofing installation.

41. Provide insulating bushings on all feeder conduits.

42. Provide code size pull boxes, in accessible locations, in all conduits where the number and degree of bends exceed the code limitations and every 150 feet maximum for long straight runs.

43. All conduits that are stubbed out below grade shall have a threaded, watertight cap installed on the end.

44. Conduits shall be located so as not to hinder access to mechanical and electrical equipment through the ceiling tiles.

45. Exposed suspended conduits shall be located as to provide proper

headroom as required by OSHA regulations.

46. Conduit runs shall be complete before conductors are installed in them.

47. Tighten set screws of threadless fittings with suitable tools.

48. Terminations:

    a. Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against box. Use two locknuts, one inside and one outside box.

    b. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into hub so end bears against wire protection shoulder. Where chase nipples are used, align raceways so coupling is square to box; tighten chase nipple so no threads are exposed.

49. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches of slack at each end of pull wire.

50. Control System Raceways, 2-Inch Trade Size (DN 53) and Smaller: In addition to above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

51. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

    a. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.

    b. Where otherwise required by NFPA 70.

52. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches above the floor. Install screwdriver-operated, threaded plugs flush with floor for future equipment connections.

53. Flexible Connections: Use maximum of 72 inches of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use LFMC in damp or wet locations. Install separate ground conductor across flexible connections.

54. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying raceways to receptacle or fixture

ground terminals.

3. 02 EXCAVATION AND BACKFILL

A. Excavate and backfill as required for the electrical work (coordinate with utilities). Cut bottoms of trenches to the proper lines and grades to provide firm and continuous support for the underground electrical work, and to provide 24-inch MINIMUM depth or as required by the NEC if more than 24 inches from finished grade to tops of all exterior underground electrical work. Sheet and brace excavations as required to protect personnel and adjacent structures.

1. After the underground electrical work has been installed and approved, place all backfill in 8-inch maximum thickness loose layers, and compact each layer to at least the density of the adjacent undisturbed site soil, using pneumatic or other suitable power tampers. Mass backfilling (backfilling without tamping) is prohibited.

2. Warning tape for buried electrical work: Install detectable warning tape directly over every device by burying tape as close to the surface as possible, but no less than 6 inches beneath finish grade. One strip of warning tape shall be placed parallel and directly above the conduit. Where conduits are banked and the width of the conduit bank is over 12 inches, strips shall be placed parallel, on 12-inch centers, centered directly above the conduit bank.

B. Conduits Embedded in Slabs:

1. Conduits shall be installed in slabs only where indicated.

2. Install in middle third of the slab thickness where practical, and leave a minimum of 1-inch concrete covers.

3. Do not stack conduits.

4. Outside diameter of the conduit shall not exceed 1/3 of the slab thickness.

5. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.

6. Space raceways laterally to prevent voids in the concrete. Conduits shall be spaced no closer than 3 diameters on center except at cabinet locations.

7. Run conduit larger than 1-inch trade size parallel to or at tight right angles to main reinforcement. When at right angles to reinforcement, place conduit close to slab support.

3. 03 PROTECTION

A. Provide final protection and maintain conditions that ensure coatings, and finishes are without damage or deterioration at time of Substantial Completion.

1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.

2. Repair damage to PVC or paint finishes with matching touchup coating

recommended by manufacturer.

3. 04 CLEANING

A. After completing installation of exposed, factory-finished raceways, inspect exposed finishes and repair damaged finishes.

END OF SECTION

SECTION 16269

VARIABLE FREQUENCY CONTROLLERS

PART 1 GENERAL

1. 01 SCOPE OF WORK

A. This section provides specification requirements for adjustable frequency drives or variable speed drives (identified herein as AC Drives) for use with NEMA® MG31 inverter-duty motors or with NEMA asynchronous Design B motors having an appropriate output filter.

B. The manufacturer shall furnish, field test, adjust, and certify all installed AC Drives for satisfactory operation.

C. Any exceptions or deviations to this specification shall be indicated in writing and submitted with the quotation.

1. 02 REFERENCES

A. ANSI®/NFPA® 70 – National Electrical Code® (NEC®)

B. CSA® C22.2 No. 14-M91 – Industrial Control Equipment

C. IEC 61000 – Electromagnetic Compatibility

D. NEMA 250 – Enclosures for Electrical Equipment

E. NEMA ICS7 – Industrial Control and Systems Adjustable Speed Drives

F. NEMA ICS 7.1 – Safety Standards for Construction and Guide for Selection Installation and Operation of Adjustable Speed Drives

G. UL® 50 – Enclosures for Electrical Equipment

H. UL 98 – Disconnect Switches

I. UL 507 – Electric Fans

J. UL 508 – Industrial Control Equipment

K. UL 508C – Power Conversion Equipment

L. UL 991 – Safety Tests for Safety Related Controls Employing Solid State Devices

M. OSHA® 1910.95 – AC Drive Controller Acoustical Noise

N. IBC® – International Building Code®

O. ASCE/SEI 7® – Seismic Performance Requirements

P. ICC ES AC156 – Shake-Table Test Acceptance Criteria

1. 03 SUBMITTALS

A. Copies of the approval drawings shall be furnished for the engineer's approval prior to factory assembly of the AC Drives. These drawings shall consist of elementary power and control wiring diagrams and enclosure outline drawings. The enclosure drawings shall include front and side views of the enclosures with overall dimensions and weights, conduit entrance locations, and nameplate legends.

B. Standard catalog sheets shall be furnished for each different horsepower rated AC Drive, showing voltage, horsepower, maximum current ratings, and recommended replacement parts with part numbers.

1. 04 WARRANTY

A. An 18-month parts warranty shall be provided on materials and workmanship from the date of invoice from an authorized distributor.

1. 05 QUALITY ASSURANCE

A. The manufacturer of the AC Drive shall be a certified ISO 9001 facility.

B. The AC Drive and all associated optional equipment shall be UL Listed according to UL 508C Power Conversion Equipment or UL 508A Industrial Control Panel. A UL label shall be attached inside each enclosure as verification.

C. The AC Drive shall be designed, constructed, and tested in accordance with UL, CSA, NEMA, IBC, ASCE/SEI 7, and NEC standards.

D. Every power converter shall be quality assurance tested with an AC induction motor under load conditions and subjected to a dielectric voltage-withstand test, with all enclosed devices mounted and wired, prior to shipment.

E. Quality assurance documentation shall be furnished to verify successful completion upon written request of the engineer.

PART 2 PRODUCT

2. 01 MANUFACTURERS

A. The AC Drive shall be provided by Schneider Electric or prior approved equal. Substitutions must be submitted in writing three weeks prior to original bid date with supporting documentation demonstrating that the alternative manufacturer meets all aspects of the specifications herein.

B. Alternate control techniques, other than pulse width modulated (PWM) control, are not acceptable.

2. 02 GENERAL DESCRIPTION

A. The AC Drive shall convert the input AC mains power to an adjustable frequency and voltage as defined below and indicated on the drawings or motor control

schedules.

1. For AC Drives rated up to 500 hp, the AC Drive manufacturer shall use a 6-pulse bridge rectifier design with line reactors. The diode rectifiers shall convert fixed voltage and frequency, AC line power to fixed DC voltage. The power section shall be insensitive to phase rotation of the AC line.

B. The output power section shall change fixed DC voltage to adjustable frequency AC voltage. This section shall use insulated gate bipolar transistors (IGBT) or intelligent power modules (IPM) as required by the current rating of the motor.

2. 03 CONSTRUCTION

A. The AC Drive shall be mounted in a NEMA 250 Type 3R enclosure with an externally operated disconnect device.

B. A mechanical interlock shall prevent an operator from opening the AC Drive door when the disconnect is in the On position. Another mechanical interlock shall prevent an operator from placing the disconnect in the On position while the AC Drive door is open. It shall be possible for authorized personnel to defeat these interlocks.

C. Provisions shall be made for locking all disconnects in the Off position. Provisions for additional padlocking shall be made by the customer using an approved lockout/tagout device.

D. Provisions shall be made for accepting a padlock to lock the enclosure door.

2. 04 SEISMIC QUALIFICATION

A. A certificate of compliance shall be provided for all wall- and floor-mounted enclosures to the seismic provisions of the IBC (International Building Code) and ASCE/SEI 7 (American Society of Civil Engineers/Structural Engineering Institute Seismic Performance Requirements).

B. The seismic ratings shall meet the site specific requirements of the installed location as determined by the latest edition of: IBC, NFPA 5000, CBC (California Building Code), and ASCE/SEI 7.

C. Seismic code compliance testing shall be in accordance with ICC ES AC156 Shake-Table Test Acceptance Criteria protocol with an importance factor of at least 1.5.

D. All anchorage, lateral bracing, and mounting guidelines shall be specified with drive instruction documentation and/or markings.

E. The manufacturer shall exhibit a seismic qualification label on the equipment stating compliance to these requirements.

2. 05 MOTOR DATA

A. The AC Drive shall be sized to operate the following AC motors and shall be defined to match the load schedules and the type of connections used between the motor and the load, such as a direct connection or a power transmission

connection:

1. Motor horsepower rating(s) – See motor control schedules.
2. Motor full load ampere ratings coordinated to NEC2005 Table 430-250.
3. Motor utilization voltage 460 VAC.
4. Motor service factor 1.15.

2. 06 APPLICATION DATA

A. The AC Drive shall be sized to operate a variable torque load.

B. The speed range shall be from a minimum speed of 0.1 Hz to a maximum speed of 60 Hz.

2. 07 ENVIRONMENTAL RATINGS

A. The AC Drive shall meet IEC 60664-1 and NEMA ICS-1 Annex A standards.

B. The AC Drive shall be designed to operate in an ambient temperature of -10 to + 40 °C (+14 to 104 °F). Type 3R shall be designed to operate from -10 to +50 °C (+14 to 122 °F).

C. The storage temperature range shall be -25 to +65 ° C (-13 to +149 °F).

D. The maximum relative humidity shall be 95% at 40 °C (104 °F), non-condensing with no dripping water, conforming to IEC 60068-2-3.

E. The AC Drive shall be rated to operate at altitudes less than or equal to 3,300 feet (1000 meters) without derating. For altitudes above 3,300 feet (1000 meters), the manufacturer's derating factors shall apply.

F. The AC Drive shall conform to IEC 600721-3-3-3M3 Amplitude for Operational Vibration Specifications.

2. 08 RATINGS

A. The AC Drive shall be designed to operate from an input voltage of 460VAC plus or minus 10%.

B. The AC Drive shall operate from an input voltage frequency range of 47–63 Hz.

C. The displacement power factor shall not be less than 0.95 lagging under any speed or load condition.

D. The efficiency of the AC Drive at 100% speed and load shall typically not be less than 96%. Efficiency shall vary with the power rating of the AC Drive.

E. The variable torque rated AC Drive overcurrent capacity shall be 150% for one minute.

F. The output carrier frequency of the AC Drive shall be randomly modulated depending on the Drive rating for low noise operation. No AC Drive with an operable carrier frequency above 16 kHz shall be allowed.

G. The output frequency shall be from 0.1–200 Hz.

H. The AC Drive shall develop rated motor torque at 0.5 Hz (60 Hz base) in a sensorless flux vector (SVC) mode using a standard induction motor without an encoder feedback signal.

2. 09 PROTECTION

A. Upon power-up, the AC Drive shall automatically test for valid operation of memory, valid operation of option module, loss of analog reference input, loss of communication, dynamic brake failure, DC to DC power supply, control power, and the pre-charge circuit.

B. The AC Drive shall be UL Listed according to UL 508C for use on distribution systems with 100,000 A available fault current. The AC Drive shall have a coordinated short circuit rating designed to UL 508C and listed on the nameplate. UL 508A industrial panels shall be rated per the specification of the customer.

C. The AC Drive shall have protection against short circuits, protection between output phases and ground; and protection between the logic and analog outputs.

D. The AC Drive shall have minimum AC undervoltage power loss ride-through of 200 milliseconds. The AC Drive shall have the user-defined option of frequency fold-back to allow motor torque production to continue to increase the duration of the powerloss ride-through.

E. The AC Drive shall have a selectable ride-through function that shall allow the logic to maintain control for a minimum of one second without faulting.

F. The AC Drive shall have an auto restart function that shall provide programmable restart attempts for a fault condition other than a ground fault, short circuit, or internal fault condition. The programmable time delay before restart attempts shall be unlimited.

G. The AC Drive shall have a programmable deceleration mode for normal and fault conditions. The stop modes shall include freewheel stop, fast stop, and DC injection braking.

H. Upon loss of the analog process follower reference signal, the AC Drive shall enter a tripped condition and/or operate at a user-defined speed set between software programmed low-speed and high-speed settings.

I. The AC Drive shall have solid state I2t protection that is UL Listed and meets UL 508C as a Class 10 overload protection and meets IEC 60947. The minimum adjustment range shall be from 20–150 % of the nominal output current rating of the AC Drive.

J. A thermal switch with a user selectable pre-alarm shall provide the AC Drive with a minimum of 60 seconds delay before overtemperature fault.

K. The heatsink shall have bonded fin, moulded, or block-milled construction for maximum heat transfer.

L. The AC Drive shall have a fold-back function that shall automatically anticipate a controller overload condition and fold back the frequency to avoid a fault

condition.

M. The output frequency of the AC Drive shall be software enabled to fold back when the motor is overloaded.

N. There shall be three skip frequency ranges with hysteresis adjustment that can each be programmed independently, back to back, or overlapping.

2. 10 ADJUSTMENTS AND CONFIGURATIONS

A. The AC Drive shall self-configure to the main operating supply voltage and frequency. Operator adjustments shall not be required.

B. Upon power up, the AC Drive shall automatically send a signal to the connected motor. The stator resistance data shall be measured at rated current. The AC Drive shall automatically optimize the operating characteristics according to the stored data.

C. The AC Drive shall be factory preset to operate most common applications.

D. A choice of at least two types of acceleration and deceleration ramps shall be available in the AC Drive software: linear and S curve. Other product specific curves may be available.

E. The acceleration and deceleration ramp times shall be adjustable from 0.01 to at least 3,200 seconds.

F. The volts per hertz ratios shall be user selectable to meet variable torque loads, normal, and high-torque machine applications.

G. The memory shall retain and record run status and fault type of at least the past four faults.

H. Slip compensation shall be adjustable from 0–150%.

I. The software shall have an “Energy Saving” function that shall reduce the voltage to the motor when the variable torque setting is selected. A constant volts/hertz ratio shall be maintained during acceleration. The output voltage shall then automatically adjust to meet the torque requirement of the load.

J. The AC Drive shall offer programmable DC injection braking that will brake the AC motor by injecting DC current and creating a stationary magnetic pole in the stator. The level of current shall be adjustable between 10% and 100% of rated current and available from 1.0 to at least 20 seconds continuously. For continuous operation after 30 seconds, the current shall be automatically reduced to 50% of the nameplate current of the motor.

K. Sequencing logic shall coordinate the engage and release thresholds and time delays for the sequencing of the AC Drive output, mechanical actuation, and DC injection braking in order to accomplish smooth starting and stopping of a mechanical process.

2. 11 GRAPHIC DISPLAY TERMINAL INTERFACE

A. The graphic display terminal shall provide 8 lines of 240 by 160 pixels (in English) to control, adjust, and configure the ATV61 AC Drive or the ATV71 AC Drive. All electrical values, bar charts, configuration parameters, I/O assignments, application and activity functions, faults, local control, adjustment storage, self-test, and diagnostics shall be accessible through the terminal interface. There shall be a standard selection of six additional languages built into the operating software.

B. The AC Drive model number, torque type, software revision number, horsepower, output current, motor frequency, and motor voltage shall be listed on the drive identification display as viewed on the graphic display terminal.

C. At a minimum, the selectable outputs shall consist of speed reference, output frequency, output current, motor torque, output power, output voltage, line voltage, DC voltage, motor thermal state, drive thermal state, elapsed time, motor speed, machine speed reference, and machine speed.

D. The graphic display terminal shall consist of programmable function keys. The functions shall allow both operating commands and programming options to be preset by the operator. A hardware selector switch shall lock out the graphic display terminal from unauthorized personnel.

E. The graphic display terminal shall offer a simple to advanced user menu consisting of parameter setting, I/O map, fault history, and drive configuration. A software lock shall limit access to the main menu.

F. The navigation scheme shall provide the ability to scroll through menus and screens, select or activate functions, or change the value of a selected parameter.

G. An Escape key shall return a parameter to the existing value if an adjustment is not required and the value shall be displayed. The escape function shall also return to a previous menu display.

H. A Run key and a Stop key shall command a normal start and stop as programmed when the AC Drive is in keypad control mode. The Stop key must be active in all control modes.

I. A user interface shall be available that is a WINDOWS® based personal computer, serial communication link, or detachable graphic display terminal.

J. The keypad and all door-mounted controls must be NEMA 250 Type 3R rated.

2. 12 CONTROL

A. External pilot devices may be connected to a terminal strip for starting/stopping the AC Drive, speed control, and displaying operating status. All control inputs and outputs shall be software assignable.

B. A 2-wire or 3-wire control strategy shall be defined within the software. The 2-wire control shall allow automatic restart of the AC Drive without operator intervention after a fault or loss of power. The 3-wire control shall require

operator intervention to restart the AC Drive after a fault or loss of power.

C. The control power for the digital inputs and outputs shall be 24Vdc.

D. The internal power supply shall incorporate an automatic current fold-back function that protects the internal power supply if incorrectly connected or shorted. The transistor logic outputs shall be current limited to 220 mA and shall not be damaged if shorted or if excess current is pulled.

E. All logic connections shall be furnished on pull-apart terminal strips.

F. There shall be two software assignable analog inputs with interference filtering. The analog inputs shall be software selectable and shall consist of user-defined configurations: x-y mA or x-y V.

G. There shall be at least four software assignable logic inputs that shall be selected and assigned in the software. The logic input assignments shall consist of forward, reverse, jog, plus/minus speed, setpoint memory, preset speeds, auto/manual control, controlled stop, terminal or keypad control, output contactor, motor switching, and fault reset.

H. There shall be at least one software assignable analog output with interference filtering. The analog outputs can be selected and assigned in the software. The analog output assignments shall be proportional to the following motor characteristics: frequency, current, power torque, voltage, and thermal state. The output signal shall be user-defined configurations: x-y mA or x-y V.

I. Two voltage-free Form C relay output contacts shall be provided. One of the contacts shall indicate AC Drive fault status. The other contact shall be user assignable.

J. There shall be a hardware input/output extension module that also provides interlocking and sequencing capabilities. The module shall be fully isolated and housed in a finger-safe enclosure with pull-apart terminal strips. The module shall add four logic inputs, two analog inputs, two relay outputs, and one analog output. All of the inputs and outputs shall be user assignable in the software as previously defined.

K. The combination enclosure shall have the following optional 22mm door-mounted operators:

- Power On pilot light (red)
- Drive Run pilot light (green)
- Drive Fault pilot light (yellow)
- Hand-Off-Auto selector switch
- Manual speed potentiometer

2. 13 DYNAMIC BRAKING

A. Provisions shall be made to protect the dynamic brake resistor against overload and overcurrent due to dynamic brake switch failure. This protection must be resettable without replacement of fuses or other devices.

B. The dynamic brake resistor shall be provided and connected to existing terminals on the AC Drive. The resistor shall mount externally to the AC Drive enclosure. An insulated gate bipolar transistor (IGBT) shall be provided in the AC Drive to switch excess regenerative energy to the braking resistor. The braking resistor shall be of a size calculated to stop 6 times motor inertia at 1.5 per unit motor torque.

2. 14 DRIVE OUTPUT/BYPASS CONTACTORS

A. The AC Drive shall include mechanically or electrically interlocked output and bypass contactors complete with a Class 10/20 thermal overload relay, circuit breaker disconnect, control circuit transformer, and AFC/Off/Bypass selector switch.

B. When selected, the operator shall have full control of the bypass starter by operation of the AFC/Off/Bypass selector switch.

C. When selected in the automatic mode of operation, the bypass contactors shall be sequenced by the 120 V rated auto start contact provided by the user.

D. The drive output contactor for the bypass shall be sequenced to provide motor isolation during a drive ready state of operation.

E. A Isolation & Transfer shall be provided for 50 hp and above as indicated on the contract drawings for the emergency bypass mode.

PART 3 EXECUTION

3. 01 INSPECTION

A. Verify that the location is ready to receive work and the dimensions are as indicated.

B. The AC Drive equipment shall not be installed until the building environment can be maintained within the service conditions required by the manufacturer.

3. 02 PROTECTION

A. Before and during the installation, the AC Drive equipment shall be protected from site contaminants.

3. 03 INSTALLATION

A. Installation shall comply with manufacturer's instructions, drawings, and recommendations.

B. The AC Drive manufacturer shall provide a certified technical service representative to supervise the contractor's installation, testing, and start-up of the AC Drive(s) furnished under this specification for a maximum total of 1 day. The start-up service shall be quoted as a separate line item.

3. 04 TRAINING

A. An on-site training course of 1 training day shall be provided by an authorized representative of the AC Drive manufacturing plant and/or maintenance personnel and quoted as a separate line item.

END OF SECTION

SECTION 16410

ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 GENERAL

1. 01 SUMMARY

A. This Section includes individually mounted enclosed switches and circuit breakers used for the following:

1. Service disconnecting means.
2. Feeder and branch-circuit protection.
3. Motor and equipment disconnecting means.

B. Related Documents: Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Specification Sections, apply to this Section.

C. Related Sections include the following:

1. Division 16 Section "Wiring Devices" for attachment plugs, receptacles, and toggle switches used for disconnecting means.
2. Division 16 Section "Fuses" for fusible devices.

1. 02 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. RMS: Root mean square.

C. SPDT: Single pole, double throw.

1. 03 SUBMITTALS

A. Data Sheets: Submit as a minimum the following information on each different disconnect switch. The information shall be in the form of the manufacturer's standard data sheets.

1. Voltage rating.
2. Ampere rating.
3. Horsepower rating.
4. Number of poles.
5. Switch and contact materials.
6. Fuseclips.
7. Fuse type and ratings.

8. Handle; interlock and padlocking provisions.
9. Enclosure type.
10. Enclosure materials and finish.
11. Dimensioned picture or drawing of the switch.

B. Manufacturer's Instructions: Indicate application conditions and limitations for use stipulated by Product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of the switch.

1. 04 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100. Products shall bear the UL label.

B. Comply with NEMA AB 1 and NEMA KS 1.

C. Comply with NFPA 70.

D. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1. 05 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 PRODUCTS

2. 01 ENCLOSED SWITCHES

A. Fusible Switch Assemblies: NEMA KS 1, 600 volt, Type HD, horsepower rated, load interrupter enclosed knife switch with high conductivity copper current carrying parts, silver-tungsten type contact surfaces and externally operable handle interlocked to prevent opening front cover with switch ON position. Handle lockable in OFF position with two padlock provisions. Fuse clips: Positive pressure reinforced designed to accommodate Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, 600 volt, Type HD, horsepower rated, load interrupter enclosed knife switch with conductivity copper current carrying parts, silver-tungsten type contact surfaces and externally operable handle interlocked to prevent opening front cover with switch in ON position. Handle lockable in OFF position with two padlock provisions.

C. Ratings: The number of poles, switch ampere rating (Minimum size is 30A/3P) and fuse ampere rating shall be as indicated.

D. Fuses: UL Class RK1 unless otherwise indicated.

E. Enclosures: Surface mounted, code gauge steel with manufacturer's standard gray enamel finish.

1. Interior Dry Locations: NEMA Type 1.

2. Exterior Locations: NEMA Type 3R.

2. 02 ENCLOSED CIRCUIT BREAKERS

A. Molded-Case Circuit Breaker: NEMA AB 1, with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

a. Instantaneous trip.

b. Long- and short-time pickup levels.

c. Long- and short-time time adjustments.

d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. Molded-Case Switch: Molded-case circuit breaker without trip units.

B. Molded-Case Circuit-Breaker Features and Accessories: Standard frame sizes, trip ratings, and number of poles.

1. Lugs: Compression style suitable for number, size, trip ratings, and material of conductors.

2. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HACR for heating, air-conditioning, and refrigerating equipment.

2. 03 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor Locations: NEMA 250, Type 4X, 316 stainless steel.

2. Kitchen Areas: NEMA 250, Type 4X, stainless steel.

3. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.

2. 04 FACTORY FINISHES

A. Specify field-painting requirements in Division 9 Sections. Verify compatibility of factory finishes with field-applied coats.

B. Manufacturer's standard prime-coat finish ready for field painting.

PART 3 EXECUTION

3. 01 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3. 02 INSTALLATION

A. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

3. 03 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 16 Section "Electrical Identification."

B. Enclosure Nameplates: Identify each disconnect switch by attaching a laminated plastic nameplate cover to the drive which is clearly and permanently lettered with the description and location of the equipment controlled by the device and the circuit number and origin from which it is fed. The nameplate shall be black with ¼-inch minimum high white characters.

3. 04 CONNECTIONS

A. Install equipment grounding connections for switches and circuit breakers with ground continuity to main grounding bus.

B. Install power wiring. Install wiring between switches and circuit breakers, and control and indication devices.

C. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3. 05 FIELD QUALITY CONTROL

A. Prepare for acceptance tests as follows:

1. Test insulation resistance for each enclosed switch, circuit breaker,

component, and control circuit.

2. Test continuity of each line- and load-side circuit.

B. Testing: After installing enclosed switches and circuit breakers and after electrical circuitry has been energized, demonstrate product capability and compliance with requirements.

1. Procedures: Perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5 for switches and Section 7.6 for molded-case circuit breakers. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3. 06 ADJUSTING

A. Set field-adjustable switches and circuit-breaker trip ranges.

3. 07 CLEANING

A. On completion of installation, inspect interior and exterior of enclosures. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 16442

PANELBOARDS

PART 1 - GENERAL

1. 01 RELATED DOCUMENTS

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

1. 02 SUMMARY

A. This Section includes load centers and panelboards, overcurrent protective devices and associated auxiliary equipment rated 600 V and less for the following types:

1. Lighting and appliance branch-circuit panelboards.
2. Distribution panelboards.
3. Transient voltage surge suppressor panelboards.

B. Related Sections include the following:

1. Section 16182 "Circuit Breakers."

1. 03 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. RFI: Radio-frequency interference.

D. RMS: Root mean square.

E. SPDT: Single pole, double throw.

F. TVSS: Transient voltage surge suppressor.

1. 04 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, TVSS device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings. Include the following:

a. Enclosure types and details.

b. Bus configuration, current, and voltage ratings.

c. Short-circuit current rating of panelboards and overcurrent protective devices.

d. UL listing for series rating of installed devices.

e. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

C. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

D. Maintenance Data: For panelboards and components to include in maintenance manuals specified in Division 1. In addition to requirements specified in Division 1 Section "Contract Closeout," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.

2. Time-current curves, including selectable ranges for each type of overcurrent protective device.

1. 05 QUALITY ASSURANCE

A. Testing Agency Qualifications: Testing agency that is a member company of the InterNational Electrical Testing Association and that is acceptable to authorities having jurisdiction.

1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1. 06 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, and encumbrances to workspace clearance requirements.

PART 2 - PRODUCTS

2. 01 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1. Panelboards, Overcurrent Protective Devices, Controllers, Contactors, and Accessories:

a. Eaton Corp.; Cutler-Hammer Products.

b. General Electric Co.; Electrical Distribution & Control Div.

c. Siemens Energy & Automation, Inc.

d. Square D Co.

2. 02 FABRICATION AND FEATURES

A. Enclosures: Surface mounted cabinets. NEMA Type 1 for indoor; NEMA Type 4XSS for outdoor.

B. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.

C. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.

D. Finish: Manufacturer's standard enamel finish over corrosion-resistant treatment or primer coat.

E. Directory Card: With transparent protective cover, mounted inside metal frame, inside panelboard door.

F. Bus: Hard-drawn copper, 98 percent conductivity.

G. Main and Neutral Lugs: Mechanical type suitable for use with conductor material.

H. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment ground conductors; bonded to box.

I. Service Equipment Label: UL labeled for use as service equipment for panelboards with main service disconnect switches.

2. 03 PANELBOARD SHORT-CIRCUIT RATING

A. UL label indicating series-connected rating with integral or remote upstream devices. Include size and type of upstream device allowable, branch devices allowable, and UL series-connected short-circuit rating.

B. Fully rated to interrupt symmetrical short-circuit current indicated on the drawings.

2. 04 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Branch Overcurrent Protective Devices: Bolt on circuit breakers, replaceable without disturbing adjacent units.

B. Coordinate below with Drawings.

C. Doors: Front mounted with concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2. 05 DISTRIBUTION PANELBOARDS

2. 06 OVERCURRENT PROTECTIVE DEVICES

A. Molded-Case Circuit Breaker: NEMA Type 1 for indoor, NEMA Type 4XSS for outdoor; with interrupting capacity to meet available fault currents.

1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.

2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.

3. Electronic Trip Unit Circuit Breakers: RMS sensing; field-replaceable rating plug; with the following field-adjustable settings:

a. Instantaneous trip.

b. Long- and short-time pickup levels.

c. Long- and short-time time adjustments.

d. Ground-fault pickup level, time delay, and I^2t response.

4. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.

5. Integrally Fused Circuit Breakers: Thermal-magnetic trip element with integral limiter-style fuse listed for use with circuit breaker; trip activation on fuse opening or on opening of fuse compartment door.

6. GFCI Circuit Breakers: Single- and two-pole configurations with [**5**] [**30**]-mA trip sensitivity.

PART 3 - EXECUTION

3. 01 INSTALLATION

A. Install panelboards and accessories according to NEMA PB 1.1.

B. Mounting Heights: Top of trim 74 inches above finished floor, unless otherwise indicated.

C. Mounting: Plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish.

D. Circuit Directory: Create a directory to indicate installed circuit loads after balancing panelboard loads. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

E. Install filler plates in unused spaces.

3. 02 IDENTIFICATION

A. Panelboard Nameplates: Label each panelboard with engraved metal or laminated-plastic nameplate mounted with corrosion-resistant screws.

3. 03 CONNECTIONS

A. Install equipment grounding connections for panelboards with ground continuity to main electrical ground bus.

B. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3. 04 FIELD QUALITY CONTROL

A. Balancing Loads: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes as follows:

1. Measure as directed during period of normal system loading.

2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data-processing, computing, transmitting, and receiving equipment.

3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.

4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

B. Infrared Scanning: After Substantial Completion, but not more than 60 days after Final Acceptance, perform an infrared scan of each panelboard. Remove panel fronts so joints and connections are accessible to portable scanner.

1. Follow-up Infrared Scanning: Perform an additional follow-up infrared scan of each panelboard 11 months after date of Substantial Completion.

2. Instrument: Use an infrared scanning device designed to measure temperature or to detect significant deviations from normal values. Provide calibration record for device.

3. Record of Infrared Scanning: Prepare a certified report that identifies

panelboards checked and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3. 05 ADJUSTING

A. Set field-adjustable circuit-breaker trip ranges.

3. 06 CLEANING

A. On completion of installation, inspect interior and exterior of panelboards. Remove paint splatters and other spots. Vacuum dirt and debris; do not use compressed air to assist in cleaning. Repair exposed surfaces to match original finish.

END OF SECTION

SECTION 16444

MOTOR CONTROLLERS

PART 1 - GENERAL

1. 01 SUMMARY

A. This Section includes motor controllers rated 600V and less that are supplied as enclosed units.

B. Related Documents: The provisions and intent of the Contract, the General and Supplementary Conditions, and applicable provisions of Division 1 through Division 16 Specification Sections, apply to the Work of this Section as if specified herein.

1. 02 SUBMITTALS

A. General: Comply with the general requirements of the Contract governing submittals and the supplemental requirements specified in Specification Section 16010, "Electrical Work – Basic Requirements." Provide submittals for each different type product specified herein.

B. Field Tests Report: Submit Field Tests Report.

C. Operation and Maintenance Data: Submit operation and maintenance data as part of the Operation and Maintenance manuals specified in Specification Section 16010, "Electrical Work – Basic Requirements."

1. 03 EXTRA MATERIALS

A. General: Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents. Furnish the following extra materials:

1. Fuses: Three (3) of each type and rating.

2. Indicating Lights: Three (3) of each type and rating installed.

PART 2 - PRODUCTS

2. 01 GENERAL

A. Manufacturers: The following manufacturers may be capable of supplying acceptable products:

1. Eaton Corp.; Cutler-Hammer Products.

2. General Electric Co.; Electrical Distribution & Control Division.

3. Square D Co.

B. Coordination: Coordinate features, accessories, and functions of each enclosed controller and each accessory device with ratings and characteristics of supply circuit, motor, required control sequence, and duty cycle of motor and load. Coordinate features of each enclosed controller and each accessory device with pilot devices and control circuits to which they connect.

C. Enclosures:

1. Indoors:

a. Dry Locations: NEMA 250, Type 1 painted steel.

b. Wet Locations: NEMA 250, Type 4X 304 stainless steel.

2. Outdoors:

a. Non-Hazardous Locations: NEMA 250, Type 4X 304 stainless steel.

b. Hazardous Locations: NEMA 7CD, listed by the manufacturer as suitable for installation in Class I, Division 1 and 2, Group D classified hazardous environments.

3. Finish:

a. Painted Steel Enclosures: Manufacturer's standard gray enamel finish over corrosion-resistant treatment or primer coat.

b. Stainless Steel: Natural.

c. Cast: Natural.

2. 02 MANUAL ENCLOSED CONTROLLERS

A. Description: NEMA ICS 2, general purpose, Class A, with toggle action and overload element.

2. 03 MAGNETIC ENCLOSED CONTROLLERS

A. General: Factory-assembled combination controller with integral overcurrent protective device disconnecting means and magnetic motor starter unit. Select controller features to coordinate with ratings and characteristics of supply circuit and the actual motor to be controlled; required control sequence; duty cycle of motor, drive, and load; and configuration of pilot device and control circuit affecting controller functions.

B. Motor Starter Units: FVNR (Full Voltage Non-Reversing), NEMA ICS 2, Class A, across the line.

C. Overcurrent Protective Device Disconnecting Means: Molded-case circuit breaker,

UL 489 9, MCP (motor circuit protector) type with field-adjustable, short-circuit trip coordinated with motor locked-rotor amperes.

D. Adjustable Overload Relay: Dip switch selectable for motor running overload protection with NEMA ICS 2, Class 10/20 (field selectable) tripping characteristic, and selected to protect motor against voltage and current unbalance and single phasing. Provide relay with Class II ground-fault protection, with start and run delays to prevent nuisance trip on starting.

E. Control Circuit: 120 V; obtained from integral control power transformer with a control power transformer of sufficient capacity to operate connected pilot, indicating and control devices, plus 100 percent spare capacity.

2. 04 ACCESSORIES

A. Devices shall be factory installed in controller enclosure, unless otherwise indicated.

B. Pilot Relay: 20A, 120V rated DPDT contacts, plug-in type industrial control relay with coil voltage rating as required and mating modular socket. Pilot relays are to be wired into motor control circuits so as to interface external control power sources with the controller control power transformer as shown on the Drawings.

C. Pushbuttons, Pilot Lights, and Selector Switches: NEMA ICS 2, heavy-duty type. Pilot lights shall be LED type.

PART 3 - EXECUTION

3. 01 EXAMINATION

A. Examine surfaces to receive enclosed controllers for compliance with requirements, installation tolerances and other conditions affecting performance. Proceed with installation only after unsatisfactory conditions have been corrected.

3. 02 INSTALLATION

A. Install enclosed controllers in accordance with the manufacturer's published installation instructions.

B. Install enclosed controllers plumb and secure. Provide for mounting and anchoring of enclosed controllers in accordance with the requirements of Specification Section 16050, "Basic Electrical Materials and Methods." For wall mount enclosed controllers, mount on structural steel channels bolted to wall.

C. Provide for installation of control circuit devices and wiring as shown on the Drawings. Bundle, train, and support feeder and branch circuit and control circuit wiring in enclosed controllers.

D. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

E. Identify enclosed controllers in accordance with the requirements of Specification Section 16075, “Electrical Identification.”

F. Test installed enclosed controllers in accordance with the paragraph, “Field Tests” below.

3. 03 FIELD TESTS

A. Perform tests only after installed line- and load-side feeder/branch circuits and control circuits have been installed, tested and found to be in compliance with specified criteria.

B. After enclosed controller is installed, but prior to energizing line- and load-side feeder/branch circuits and control circuits, test the enclosed controller insulation resistance. Perform insulation resistance tests on enclosed controller in accordance with the manufacturer’s recommendations. Compare measured insulation resistance values with the minimum insulation resistance values specified by enclosed controller manufacturer. Tested enclosed controllers in which the measured insulation resistance value does not meet or exceed the minimum insulation resistance value specified by the manufacturer, shall be replaced in kind with new and retested.

C. After enclosed controller is installed, is found to be in compliance with manufacturer specified insulation resistance criteria, and line- and load-side feeder/branch circuits and control circuits are energized, perform each visual and mechanical inspection and electrical test indicated in NETA ATS, Section 7.5, 7.6, and 7.16. Certify compliance with test parameters. Correct malfunctioning enclosed controllers on-site, where possible, and retest to demonstrate compliance with specified criteria; otherwise, replace in kind with new and retest.

D. Prepare and submit Field Tests Report in accordance Specification Section 16010, “Electrical Work – Basic Requirements.” Attach a label or tag to each tested component indicating satisfactory completion of tests.

3. 04 ADJUSTING

A. Set field-adjustable circuit-breaker trip characteristics.

END OF SECTION

SECTION 16500

LIGHTING FIXTURES AND POLES

PART 1 GENERAL

1.01 WORK INCLUDED

A. The work included under this Section consists of furnishing and installing the lighting fixtures, including all related systems and accessories, as shown on the Drawings and hereinafter specified.

1.02 SUBMITTALS

A. Product Data: Submit manufacturer's product data on each lighting fixture, pole and pole foundation.

PART 2 PRODUCTS

2.01 MATERIALS

A. Products: Refer to Lighting Fixture Schedules on the Drawings for products.

B. Each lighting fixture shall have been tested and certified for proper operation by the fixture manufacturer for the type of environment and mounting on in which it is to be installed.

C. All high intensity discharge lamp ballasts shall be constant wattage or auto-regulator, high power factor type and internally fused.

D. All fixtures shall bear the UL label.

PART 3 EXECUTION

3.01 INSTALLATION

A. Lighting fixtures shall be installed as indicated on the Drawings.

B. No wiring splice or tap shall be located within an arm, stem, etc., used for support of lighting fixture. Wire shall be continuous from splice in outlet box to lamp socket, or to ballast terminals.

C. Coordinate with other electrical work as appropriate to properly interface installation of interior lighting fixtures with other work.

D. Fasten fixtures securely to indicate structural support and check to ensure that fixtures are plumb.

E. Lighting fixtures in suspended ceilings shall be supported from building structural members and NOT from ceiling suspension system.

3.02 ADJUST AND CLEAN

A. Clean interior lighting fixtures of dirt and debris upon completion of installation.

B. Protect installed fixtures from damage during remainder of construction period.

3.03 FIELD QUALITY CONTROL

A. Upon completion of installation of interior lighting fixtures, and after building circuitry has been energized, apply electrical energy to demonstrate capability and compliance with requirements. Where possible, correct malfunctioning units at site, then re-test to demonstrate compliance; otherwise, remove and replace with new units, and proceed with re-testing.

3.04 GROUNDING

A. Provide tight equipment grounding connections for each lighting fixture installation where indicated.

END OF SECTION

SECTION 16501
LAMPS

PART 1 GENERAL

1.01 WORK INCLUDED

A. The work included under this Section consists of furnishing and installing the lamps, including all related systems and accessories, as shown on the Drawings and hereinafter specified.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Products: Provide lamps by one of the following manufacturers:

1. General Electric Company.

2. G.T.E. Sylvania.

3. N.A. Phillips Company.

2.02 MATERIALS

A. High pressure sodium lamps shall be clear with a rated life of 20,000 hours. Lamps shall be operated through a ballast designed to the lamp wattage and supply voltage as indicated on the Drawings.

PART 3 EXECUTION

3.01 INSTALLATION

A. Lamps installed in lighting fixtures shall be as specified in the fixture schedule on the Drawings and as specified herein. All lamps shall be operating at the time of final inspection.

B. At the time of Final Acceptance, replace lamps in all lighting fixtures that are observed to be noticeably dimmed after Contractor's use and testing, as judged by Engineer. Furnish stock or replacement lamps amounting to 20% (but not less than one lamp in each case) of each type and size lamp used in each type fixture. Deliver replacement stock as directed to Department's storage space.

END OF SECTION

DIVISION 17
INSTRUMENTATION

SECTION 17010

INSTRUMENTATION

PART 1 GENERAL

1.01 DESCRIPTION

A. Provide elements of process instrumentation, auxiliary equipment, and supplies.

B. The requirements specified in the Conditions of the Contract, Division 1 apply to this Section.

C. Refer to Electrical sheets for Instrumentation, raceway and wiring. Refer to Mechanical sheets for sensors and control components.

D. The work at 5th clarifier shall include, but not necessarily be limited to:

1. Furnish and install two new strap-on transit time flowmeters with transmitters and 4-20 mA output as shown on the Construction Drawings.

1.02 RELATED WORK

A. Section 11234 – Centrifugal Pumps (RAS)

B. Section 11300 – Double Disc Pumps (WAS)

C. Division 16 - Electrical

1.03 SUBMITTALS

A. The submittals shall be in accordance with Division 1, Section 01340, as well as include the following:

1. Manufacturer's data.

2. Shop drawings.

3. Certificates of compliance.

4. Certified test reports.

5. Operation and maintenance manuals.

1.04 QUALITY ASSURANCE

A. Manufacturer. Instrumentation, control and monitoring equipment furnished shall be manufactured by a firm regularly and currently engaged in the design and manufacture of similar equipment. Equipment furnished shall be new and of current design.

B. Maintainability. Equipment shall be designed for ease of maintenance and repair, and access to critical parts shall not require a major disassembly. Internal field adjustments where permitted or required herein shall be easily accessible upon removal of a panel or cover.

C. Materials and Installation shall comply with the requirements of the referenced electrical codes and standards, and the codes and standards referred to shall be used for establishing the minimum quality of the materials and equipment supplied and installed. Equipment of the same type shall be a product of the same manufacturer. Capacities of equipment shall not be less than that indicated on the drawings or specified.

D. All exterior mounted instruments shall be furnished with appropriately sized rain shields.

PART 2 PRODUCTS

2.01 TRANSIT TIME FLOWMETER

A. Flowmeter shall be a transit time flowmeter, model Vantage 4400-AS1 by Eastech Badger, model DCT6088 by Thermo Scientific (formerly Polysonics), or approved equal.

B. Performance

1. Rangeability of 40 to 0.1 ft/sec

2. Turndown of 400:1

3. Repeatability of 0.25%

4. Accuracy of ±1% of actual flow

C. Sensors

1. Sensors shall be strap-on and shall not penetrate the pipe. Sensors shall be rated for buried and submerged.

2. A V-Shot style sensor mounting (i.e., mounting on only one side of pipe) shall be utilized. Flowmeter with sensors mounted on both sides of the pipe will not be accepted.

D. Transmitter

1. Transmitter shall be NEMA 4X.

3. Transmitter shall have one 4-20 mA output, one relay, and a RS232 serial interface.

4. Display shall be backlit LCD.

5. Data logging capability with non-volatile flash memory and storage up to 30,000 records.

E. Flowmeters shall be appropriate for 20" (RAS) and 6" (WAS) ductile iron pipe, wastewater, 100 psi max pressure, and unidirectional flow.

2.02 INSTRUMENT LOOP POWER SUPPLIES

A. An instrument loop power supply shall be provided for each loop, where required. The power supply shall be rated for 2.8 amps at 24 VDC and shall be output overload protected. Shall be factory wired for 120V AC, 60 Hz operation. The power supply shall be rated for operation in ambient conditions of 0-50 degrees C. Input protection shall be provided in the form of a 1 amp fuse or circuit breaker. Provide a Blown Fuse Indicator across the protective circuit for positive visual verification of an open condition. The power supply shall be a Model SPS 30-24/28 as manufactured by ACME or approved equal.

2.03 TRANSIENT PROTECTION/SURGE SUPPRESSION DEVICES

A. Surge and transient protection devices shall be provided for 4-20 mA loops where not provided by panel originating loop. They shall be two-stage units incorporating gas tube and electronic clamping. Either polarity in surges shall be equally protected. The protection devices shall provide long life, reliability and easy mounting. Surge protection devices for 4-20 mA loops shall add no more than 50 ohms to the circuit and provide impulse clamping levels of 100V maximum for line-to-line and 50V maximum for line-to-ground. Surge protection devices for instrument loops of 4-20 mA shall be Model 1669-02 as manufactured by Joslyn Electronic Systems Corporation.

PART 3 EXECUTION

3. 01 GENERAL

A. Install all system components in accordance with the Drawings, manufacturers' recommendations, and approved Shop Drawings. Provide all necessary interconnection, services, and adjustments necessary for a complete, operational and fully functional system.

B. All electrical work shall be accordance with NEC and Division 16 of these Specifications. Install all control wiring / cabling, without splices between terminal points. Group, bundle, train and route wires and cables, as required for a neat and professional looking wiring / cabling system in accordance with the best practice known to the industry.

C. All wires entering / exiting control enclosures shall be terminated on terminal blocks. All terminal blocks shall be permanently, legibly labeled with the unique identification number of the wire terminated thereon.

D. Maintain a minimum 6-inch separation between descrete I/O wiring and analog cabling / wiring. Provide separate plastic wireways to segregate discrete I/O wiring from analog I/O cabling / wiring.

E. Provide surge protection on all control and control power circuits routed outside of the control building. Surge protection shall be per data transmission equipment manufacturer's requirements. Surge protection shall consist of surge suppressors, transient protectors and optical isolated relays as applicable.

F. All field-mounted instruments shall be protected and isolated from vibration, temperature extremes, radiant heat, rain, sleet or falling water, and similar adverse conditions.

G. Field mounted elements shall be marked with data required for calibration such as location of adjustments, span, offset, zero suppression, and test voltages. If such data are not provided in permanent markings or on the manufacturer's nameplate, a durable tag or label shall be affixed in a protected location that will become readily visible in the normal course of servicing the instrument.

3. 02 EXAMINATION

A. Verify that systems are ready to receive work.

B. Commencing installation of Division 11 specified systems means the Division 11 Installer accepts existing conditions without exception.

3. 03 INSPECTION

A. Inspect work in progress for compliance with manufacturer specified tolerances.

3. 04 DELIVERY, STORAGE AND HANDLING

A. Provide factory shipping cartons for each piece of equipment and control device. Provide factory applied plastic end caps on each length of pipe and tube. Maintain cartons and end caps through shipping, storage and handling as required to prevent equipment and pipe-end damage, and to eliminate dirt and moisture from equipment and inside of pipe and tube. Store equipment and materials inside and protected from weather.

3. 05 IDENTIFICATION

A. Piping and Cabling / Wiring: Tag control piping and cabling / wiring at each end and at accessible junction points as specified herein, in accordance with Division 16. Develop and apply a logical alphanumeric identification scheme uniquely identify each wire / cable. The unique identification should relate the wire to the programmable logic controller, the I/O card and the type of device to which the wire is connected.

3. 06 WIRING

A. General: Provide surge protection on all discrete control, signal and power circuits routed outside of the Operations Building. Surge protection shall be per data transmission equipment manufacturer's requirements. Surge protection shall consist of surge suppressors, transient protectors and optically isolated relays as applicable.

3.07 EQUIPMENT TESTING AND CALIBRATION

A. General: Provide Construction Manager-approved operation and acceptance testing of the complete system. The Resident Engineer's representative will witness all tests.

B. Factory Tests and Calibration. All field-mounted elements shall be factory-tested by the manufacturer to assure satisfactory performance prior to shipment to the job site. Whenever possible, this shall include calibration to the actual range and conditions of use. Calibration shall be traceable to the National Bureau of Standards with an uncertainty not more than 1/2 of the specified or claimed accuracy of the instruments.

C. Field Calibration. Field mounted elements which were not calibrated to final working values of range, span, and zero suppression at the factory shall be so calibrated prior to or at the time of installation. This calibration shall meet the same requirements of accuracy and traceability required for factory testing above. The engineer shall be given 48 hours notice and the opportunity to witness this

calibration.

D. Field Test: When installation and field calibration is complete, verify transmission media operation before the system is placed on-line. Provide a detailed crosscheck of each sensor within the system by making a comparison between the reading at the sensor and a standard traceable to the National Bureau of Standards. Provide a crosscheck of each control point within the system by making a comparison between the control command and the field-controlled device. Submit the results of functional and diagnostic tests and calibrations to the Engineer for final system acceptance.

END OF SECTION

SUPPLEMENTAL INFORMATION
GEOTECHNICAL REPORT

TEST LAB INC.
GEOTECHNICAL & MATERIALS
ENGINEERING, TESTING & INSPECTION

March 27, 2009

URS Corporation Southern
7650 Courtney Campbell Causeway
Tampa, Florida 33607

Attention: Mr. David Wilcox, P.E.

Reference: Report of Subsurface Exploration
Southwest Water Reclamation Facility
5th Clarifier – 10 MGD
Manatee County, Florida
URS Job Number 12008492.00003
Test Lab Project No: 09-3474

Dear Mr. Wilcox:

As authorized, a subsurface exploration was performed for the proposed 10 MGD 5th clarifier structure planned for construction at the referenced site located in Manatee County, Florida. The proposed field exploration consisted of performing five (5) exploratory borings in the proposed Clarifier tank. However, due to limited accessibility the center boring was omitted and the outer four (4) borings were extended into the limestone strata. The following report briefly describes the field test procedures used for this study and presents the findings, an engineering evaluation of the subsurface conditions and geotechnical recommendations for the proposed structure.

The subsurface test data revealed varying conditions that will require special attention during the construction phase, to provide proper foundation support for the proposed structure. These recommendations are by no means the only possible solutions. However, in our professional opinion it appears to be the most practical.

The proposed construction area will require dewatering prior to excavation for and construction of the new structure. Upon completion of removal of the existing concrete foundation, the exposed materials can be excavated to proposed subgrade elevation. The excavated soils can be reused as structural fill material for backfill operations.

Upon completion of foundation excavation the exposed soils will need to be compacted to 98% of Modified Proctor (ASTM D-1557) maximum dry density prior to the placement of reinforcing steel and concrete. It is anticipated that the structure will settle approximately 3.75 inches and reference points will need to be established at the start of construction and monitored through the completion of construction, during the first water loading cycle and one (1) year there-after in one month increments.

The above recommendations are provided as an overview and should not be implemented without a complete review and understanding of the following report.

Test Lab, Inc. appreciates the opportunity to have been of service. If there are any questions concerning this investigation, or if we may be of any further assistance, please do not hesitate to contact us.

Respectfully submitted,

Test Lab, Inc.

Gilberto Ramos, P.E. 3/27/09
Florida Registration No. 48574

Copies Submitted: (3) Client

Appendix A: Site Plan
Appendix B: Boring Logs (B-1 thru B-4)
Soil Legend
Appendix C: Sieve Analysis
Appendix D: Atterburg Limits

1. EXPLORATION PROGRAM

Four (4) exploratory borings were performed with a truck-mounted CME-45B drilling rig at the locations shown on the accompanying Boring Location Plan, Appendix A. Conventional rotary drilling procedures were utilized along with a bentonite drilling fluid to stabilize the boreholes. Standard penetration tests were performed and split-barrel soil samples obtained at intervals of 2 feet to a depth of 10 feet and intervals of 5 feet thereafter. The following is a brief description of this field test procedure.

The exploratory borings were performed in accordance with ASTM Specification D-1586, entitled "Standard Method for Penetration Test and Split-Barrel Sampling of Soils." After drilling to the required depth and cleaning the bore hole, the sampler (2" O.D.) was driven 18 or 24 inches into the undisturbed soil by a 140-pound drop-hammer falling 30 inches. The number of blows required to drive the sampler the second and third 6-inch increments is known as the "Standard Penetration Resistance" (N). The numerals in parentheses below the 'N' values are the blow counts for each of the 6-inch increments that the split-barrel sampler was driven. The various soils encountered in the borings were visually classified in the field and representative soil samples obtained for further examination by a geotechnical engineer and laboratory testing. The soils encountered in the borings were classified utilizing the "Unified Soil Classification System." At the completion of the drilling operations, the boreholes were sealed and grouted in accordance with Southwest Florida Water Management District regulations.

The data obtained from the borings are presented on the accompanying logs, Appendix B. Also attached is a legend explaining the classification terms and symbols used on the logs.

2. SITE CONDITIONS

The Southwest Water Reclamation facility is generally located at 5101 65th Street West, Bradenton, Manatee County, Florida 34210, south of the intersection of Cortez Street West and 66th Street West in Bradenton, Manatee County, Florida. The site is located within Section 8, Range 17 E, and Township 35 S in Manatee County, Florida. The existing plant facility structures occupy the west, south, southeast and southwest portion of the property and the area to the north is undeveloped land. . Refer to Appendix A for the "Boring Location Plan," Sheet 1 of 1.

3. SUBSURFACE CONDITIONS

The following is a generalization of the subsurface conditions revealed during the field exploration.

Proposed Reclaimed Water Storage Tank (Borings B-1 through B-4)

Borings B-1 through B-4 typically encountered fill consisting of a concrete slab ranging in thickness from 9 to 13 inches, cohesionless soils consisting of firm light brown fine SAND with shell from existing subgrade elevation to a depth of 4 feet, underlain by dense to very firm dark gray-brown, gray-brown, dark brown fine SAND from 4 to 17 feet, very loose to loose light to gray-brown fine SAND with shell and cemented sand and silty fine SAND from 17 to 42 feet. Underlying the cohesionless material stiff to very stiff cohesive green-gray-brown and light gray-brown fine sandy CLAY was encountered from 42 to 67 feet. Beneath the cohesive soils, hard to very hard gray-brown fine sandy calcareous CLAY (Weathered Limestone) was encountered from 67 feet to boring terminal depths of 80 feet. Characteristically, the weathered limestone was more like soil than rock. It should be noted that losses of circulation of the drilling fluid occurred in borings B-1 and B-2 at depths of 48 feet. The losses of drilling fluid are attributed to the shell layer.

4. GROUND WATER CONDITIONS

The water table was encountered at depths ranging from 3.1 to 3.7 feet. Fluctuations of the water table should be expected during the year due to local amounts of rainfall, site development, tidal fluctuations and other factors. The United States Department of Agriculture "Soil Survey of Manatee County, Florida" indicates that the shallow soils at the northern end of the site are composed of EauGallie fine sands. According to the soil survey, seasonal high ground water for this type of soil can range between 10 and 40 inches below the existing ground elevation.

Based on the exploration data, our estimate of the normal seasonal high ground water conditions expected in the proposed construction area of the property are summarized in the following table.

Boring	Measured Water Depth Below Existing Grade	Estimated SHWT
B-1	3' 4"	1' 4"
B-2	3' 8"	1' 8"
B-3	3' 1"	1' 1"
B-4	3' 7"	1' 7"

5. LABORATORY TESTING

Four (4) soil samples obtained from the field testing program were selected for Atterburg Limits (ASTM D-1557) testing and six (6) samples were obtained for Particle Size Analysis of Soils (ASTM D-422-98). The following table summarizes the laboratory test results for the Atterburg Limits test results:

Boring #	Depth (ft)	W (%)	γ_d (pcf))	G_s	Atterberg Limit			Sand	Silt	<0.005 mm Clay	C_c	C_r
					LL	PL	PI					
B-1	76.0-72.0	-	-	-	38	28	10	-	-	-	-	-
B-2	52.0-57.0	-	-	-	240	66	74	-	-	-	-	-
B-3	42.0-47.0	-	-	-	68	25	43	-	-	-	-	-
B-4	47.0-52.0	-	-	-	38	25	13	-	-	-	-	-

The data obtained from the laboratory tests are presented in Appendix C and D.

6. STRUCTURE DESIGN DATA

The foundation conditions were evaluated by comparing the subsurface characteristics of this site with previously made correlations of such data and foundation stabilities that have been developed for similar conditions. The following presents discussion regarding the expected structural characteristics of the proposed tank.

Proposed Clarifier Tank

The new clarifier tank will be constructed on the north end of the property. The clarifier tank will have an approximate diameter of 105 feet. The new clarifier tank will bear approximately 7.5 feet (Elevation 10) below existing ground surface elevation and the bottom slab will slope down toward the middle to elevation 8.9 and a center 12 feet diameter sump drops down to elevation 3.9. The clarifier will have a total depth of approximately 17.5 feet at the perimeter and 23.6 feet at the center. The depth of water will range from 14 feet at the perimeter to 20.1 feet at the center. The clarifier will transmit a stress of approximately 1.0 ksf at the perimeter and 2.0 ksf at the center to the subgrade.

7. EVALUATION

A. General

The exploratory borings revealed variable subsurface conditions. The following sections will provide evaluations for the proposed Clarifier tank.

Proposed Clarifier Tank

The field exploration revealed one subsurface condition of concern. That is, the very loose soils encountered at 20 to 25 feet in borings B-2 and B-4. Based on these conditions the areas of the clarifier tank, exposed subgrade needs to be compacted with a heavy drum-type vibratory compactor to 98% of Modified Proctor maximum dry density and back fill the excavation with the fill materials compacted to 98% of Modified Proctor maximum dry density. A settlement monitoring program will need to be established prior to commencing construction and measurements reported on a regular basis. Dewatering will be required to a minimum depth of 3 feet below the excavation bottom.

8. RECOMMENDATIONS

A. General

The proposed construction area should be cleared of all construction debris from the demolition of the existing concrete slab. Any buried utility lines not needed for the new additions should be removed and the excavations backfilled with suitable, compacted soil as outlined in the "Fill Requirements" section of this report.

B. Site Preparation

Proposed Clarifier Tank

The cleared tank area should be excavated to subgrade elevation and to a minimum distance of seven (7) feet beyond the exterior foundation, a heavy drum-type compactor having a minimum static weight of 20,000 pounds. Proof-rolling of the tank area, to seven (7) feet beyond construction lines, should consist of at least 10 complete passes by the compaction equipment. It is recommended that the proof-rolling operation be observed under the supervision of the geotechnical engineer or his representative to provide assurance that the minimum recommended number of passes be applied. The compactor should be operated at a speed less than 1 mph. Compaction should continue until the soil 1 foot below the compaction surface attains a density of at least 98 percent of the maximum dry density as indicated by the Modified Proctor compaction test (ASTM D- 1557). Backfill the excavation in 12 inch loose lifts compacted to 98% of the maximum dry density as indicated by the Modified Proctor Compaction (ASTM D-1557).

9. Ground Water Control

Dewatering will be required during site preparation. Water can probably be controlled by well point pumping excavations. Well point dewatering, should extend to a minimum of 3 feet below the bottom of the excavation and the water elevation verified with piezometers.

10. Fill Requirements

Fill required for the project should be suitable material, which is placed in thin, properly compacted lifts. Material to be used for fill should be an inorganic soil of low plasticity, preferably a clean sand containing less than 10 percent of the material passing a No. 200 sieve. Fill beneath foundations and floor slabs should be compacted to at least 98 percent of the maximum Modified Proctor dry density.

The permissible thickness of fill lifts will depend upon both nature of the fill material and the type of compaction equipment used. When clean sand is used for fill, lifts up to 12 inches in thickness may be placed if heavy drum-type vibratory compaction equipment can be used, since vibratory compaction can not be used within 20 feet of existing structures, whereas lifts should be limited to a maximum of 8 inches in thickness if either the fill is slightly cohesive or medium-weight drum-type vibratory compaction equipment is used. In restricted working areas, such as when backfilling around foundations or in service line trenches beneath slabs-on-grade or pavement, light-weight manually-guided compaction equipment may be used. But when such light equipment is used, lifts of fill should be limited to a maximum of 4 inches in thickness.

11. Foundation Design

When the proposed construction areas have been prepared as recommended, a shallow foundation system may be used to support the structures. The buildings and/or tank foundations may be designed utilizing a maximum allowable net soil bearing pressure of 2,000 psf. Prior to the placement of foundation steel and concrete, the bottom of foundation excavations should be compacted to redensify the soil loosened by the excavation process.

Field density tests should be taken to verify that the subgrade is adequately proof-rolled and that all fill and backfill are properly placed and compacted. We would be pleased to provide the necessary engineering inspection and quality control testing of the subgrade preparation, backfill and fill densification, concrete and other construction materials, should you so desire.

12. Settlement Considerations

Settlement analyses and consolidation settlement were calculated for the proposed structure. Based on the site preparation and foundation design recommendations made in this report, it is estimated that the differential settlements within the structures should be less than 0.75 inch within 100 feet.

13. Field Settlement Observation Program

A field settlement observation program is necessary to ensure that the methods and equipment used are adequate and compatible and that mat foundations perform satisfactorily with the settlement calculations and are capable of safely and adequately supporting the design load. It is recommended that at least two locations for each proposed structure be marked to performed field settlement observations. It is recommended that the field settlement program be performed under the supervision of the geotechnical engineer or his representative. The field measurements need to be obtained by a licensed Registered Land Surveyor in the State of Florida and/or the surveyor's designee.

LIMITATIONS

This foundation study was undertaken for design purposes only. Generally accepted geotechnical engineering practices were utilized in the preparation of this report; and no other warranty, either expressed or implied, is made as to the professional advice provided. The report is based upon the design information provided as discussed in this report. Consequently, we can assume no responsibility for misinterpretation or misapplication of these recommendations unless given an opportunity to review any changes in either the design or location of the structure, which may affect their validity. This report has been prepared solely for the use of our client and may not contain sufficient information for other uses or for the purposes of other parties. Therefore, conclusions or recommendations based upon these data, but made by others are not our responsibility. The following are other limitations that are applicable to this report.

The borings were not located by a survey crew, but rather a representative of Test Lab, Inc. We made use of identifiable landmarks, and structures and used ninety-degree angles to make directional turns. The boring locations are accurate only to the degree implied by the method used.

The lines on the logs designating the interface between the various strata may only be approximate boundaries when the transition is gradual or could not be detected by the drilling operations.

The depth to the groundwater table measured at the site during the investigation is only indicative of the conditions at that time. The groundwater table may fluctuate significantly due to seasonal changes, variations in rainfall, and other factors not evident at the time of the investigation nor reported herein.

The engineering evaluation, opinions, conclusions and recommendations presented in this report are based upon the data obtained from the borings made at the locations indicated on the plan; and are only valid so long as the site and subsurface conditions remain unchanged. This report does not reflect any variations that may occur between these borings, except as may be discussed in the report. The nature and extent of subsurface variations at the site may not become evident until during construction. Such variations should be observed to note their nature and re-evaluate and modify, if necessary, the recommendations presented herein.

The site is underlain by limestone bedrock that is susceptible to dissolution and the subsequent development of karst features such as voids and sinkholes in the natural soil overburden. Construction in a sinkhole prone

area is therefore accompanied by some risk that internal erosion and ground subsidence could affect new structures in the future. It is not possible to investigate or design to completely eliminate the possibility of future sinkhole related problems. In any event, the owner must understand and accept this risk.

In view of the possibility of variations in subsurface conditions being encountered during construction, it is suggested that we be retained to perform on-site review of the site preparation and foundation phases of the construction. Otherwise, we can assume no responsibility for construction compliance with our site preparation recommendations.

APPENDIX A

General Notes

Z9

LEGEND

B- STANDARD PENETRATION TEST BORING

CAD DRAWING PROVIDED BY CLIENT

No.	Revision/Issue	Date

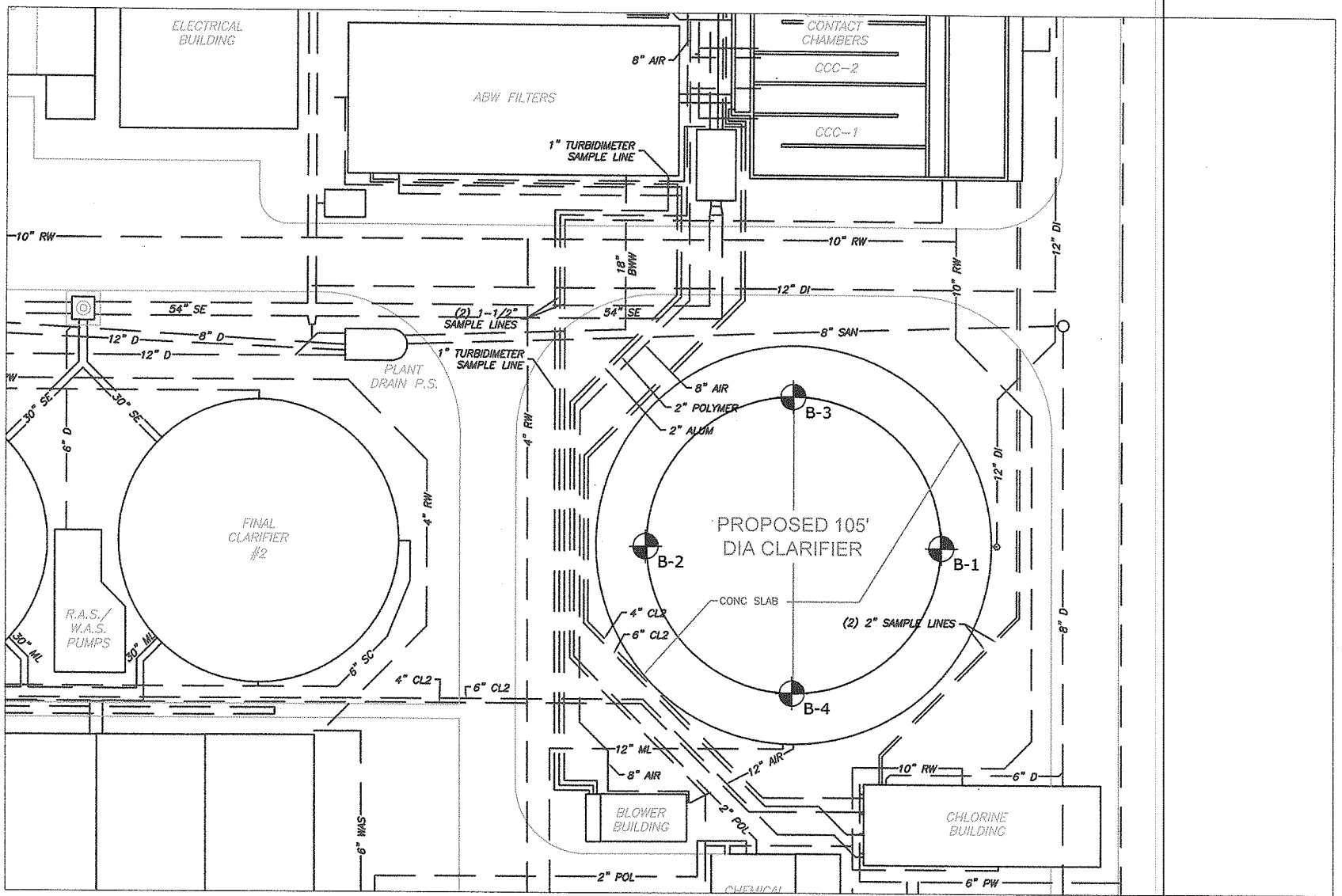
Firm Name and Address

TEST LAB INC.
GEOTECHNICAL & MATERIALS
ENGINEERING, TESTING & INSPECTION

Project Name and Address

SW Water Reclamation Facility
5th Clarifier - 10 MGD
Manatee County, Florida

Project	Sheet
09-3474	1 of 1
Date: March 18, 2009	
Scale: SCALE: NTS	



BORING LOCATION

APPENDIX B

PROJECT:
SW Wastewater Treatment Plant
Bradenton, Florida

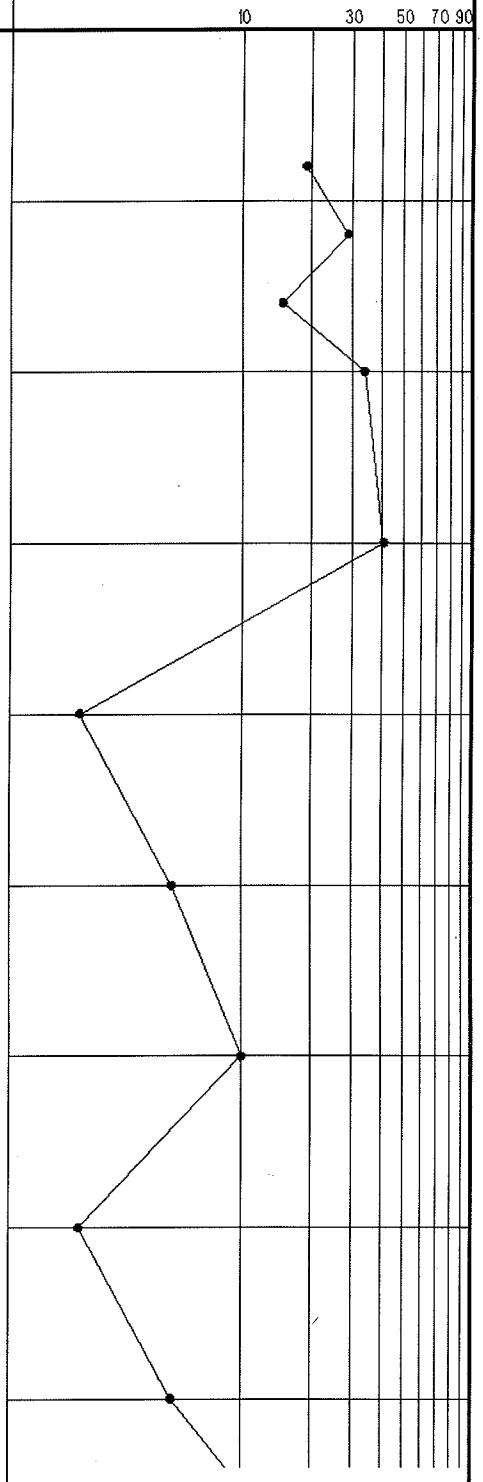
LOG OF BORING B-1

DRILLER: *J. Davis*
ELEVATION: *N/A*
DATE DRILLED: *2/26/09*
WATER LEVEL: *3'4" @ TOB*
DRILLING METHOD: *Mud Rotary*
BORING DEPTH: *80 Feet*

REMARKS: Water losses at 48 feet. Casing NW 40 feet in length. Hole collapsed due to shell. Bore hole grouted.

DEPTH (feet)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	'N' (blows/6 in.)
		concrete (9")	
		firm light brown fine SAND w/shell (fill)	
5		very firm gray-brown fine SAND	19 (3,9,10,12)
		firm gray-brown fine SAND	29 (12,14,15,17)
		dense light gray-brown fine SAND w/shell	15 (10,7,8,11)
10			34 (7,14,20,22)
		dense light gray-brown fine SAND w/shell	
15			41 (12,19,22)
		very loose light brown silty fine SAND w/trace of shell	
20			2 (2,1,1)
		loose light brown slightly silty fine SAND w/shell	
25			5 (2,2,3)
		loose gray-brown fine SAND w/shell	
30			10 (5,5,5)
		very loose light gray-brown silty fine SAND w/cemented sand	
35			2 (1,1,1)
		loose gray-brown silty fine SAND w/shell	
40			5 (5,2,3)

STANDARD PENETRATION TEST DATA (blows/ft)



TEST LAB, INC.

PROJECT:
SW Wastewater Treatment Plant
Bradenton, Florida

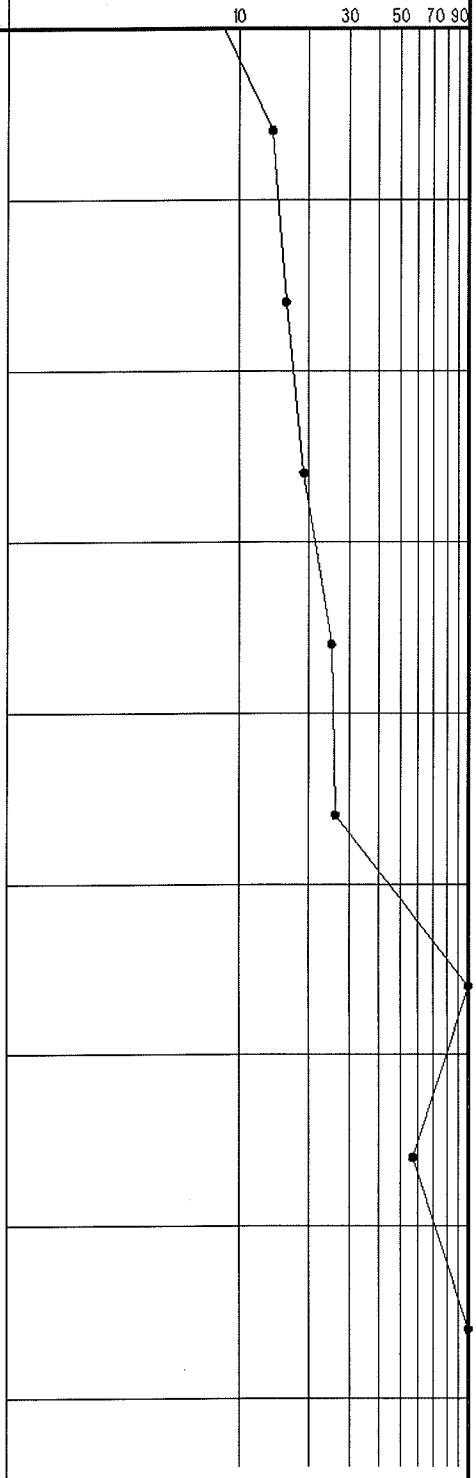
LOG OF BORING B-1

DRILLER: *J. Davis*
ELEVATION: *N/A*
DATE DRILLED: *2/26/09*
WATER LEVEL: *3'4" @ TOB*
DRILLING METHOD: *Mud Rotary*
BORING DEPTH: *80 Feet*

REMARKS: Water losses at 48 feet. Casing NW 40 feet in length. Hole collapsed due to shell. Bore hole grouted.

DEPTH (feet)	GEOLOGIC DESCRIPTION	'N' (blows/6 in.)
	stiff gray-brown fine sandy CLAY	14 (9,7,7)
47	very stiff gray-brown fine sandy CLAY	16 (14,8,8)
52	very stiff gray-brown fine sandy CLAY	19 (7,7,12)
57	very stiff gray-brown fine sandy CLAY	25 (10,12,13)
62	very stiff gray-brown fine sandy CLAY	26 (7,10,16)
67	very hard light gray-brown fine sandy calcareous clay w/limestone (WEATHERED LIMESTONE)	50=2"
72	very hard light gray-brown fine sandy calcareous clay (WEATHERED LIMESTONE)	57 (19,22,35)
77	very hard light gray-brown fine sandy calcareous clay (WEATHERED LIMESTONE)	100 (46,39,50=4")
	Boring terminated at 80'0"	
82		

STANDARD PENETRATION TEST DATA (blows/ft)



TEST LAB, INC.

PROJECT:
SW Wastewater Treatment Plant
Bradenton, Florida

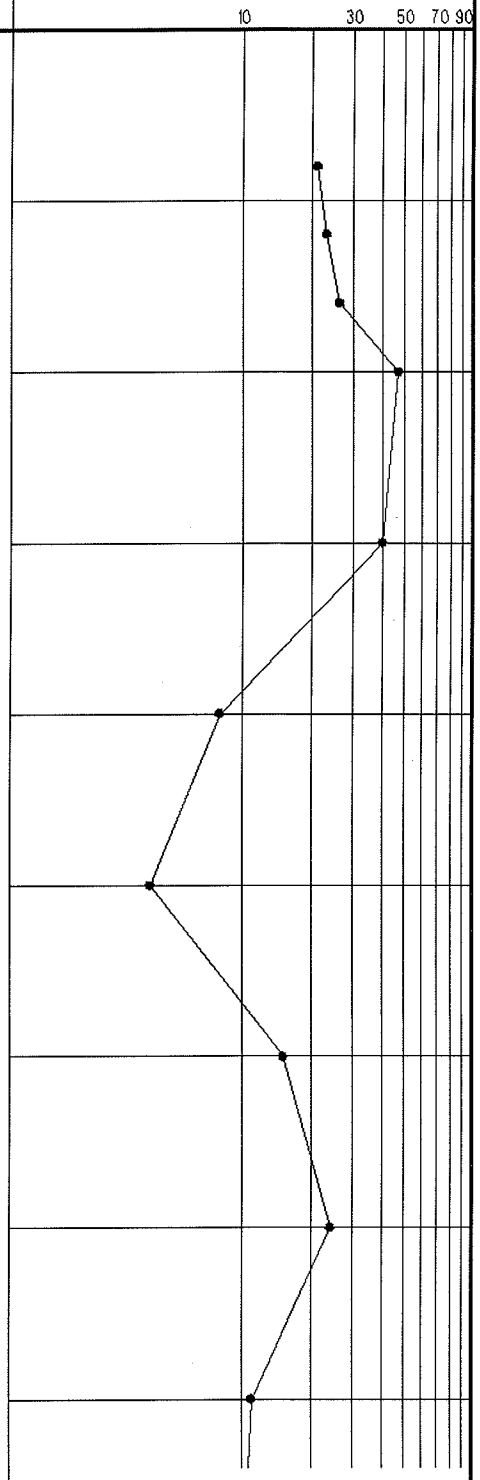
LOG OF BORING B-2

DRILLER: *J. Davis*
ELEVATION: *N/A*
DATE DRILLED: *2/18/09*
WATER LEVEL: *3'8" @ TOB*
DRILLING METHOD: *Mud Rotary*
BORING DEPTH: *80 Feet*

REMARKS: Water losses 100% at 48 feet. Casing NW 40 feet length. Bore hole grouted. Hole collapsed due to shell.

DEPTH (feet)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	'N' (blows/6 in.)
		concrete (13")	
		very firm light brown fine SAND w/trace of shell (fill)	
		dark gray-brown fine SAND	
5		very firm gray-brown fine SAND	21 (8,10,11,12)
		very frim gray-brown fine SAND	23 (6,12,11,10)
		dense gray-brown fine SAND w/trace of shell	26 6,12,14,26)
10			47 (12,23,24,32)
		dense gray-brown fine SAND w/trace of shell	
15			40 (12,17,23)
		loose gray-brown fine SAND w/trace of shell	
20			8 (6,4,4)
		very loose gray-brown silty fine SAND w/shell	
25			4 (3,2,2)
		firm light gray-brown silghtly silty fine SAND	
30			15 (6,8,7)
		shell	
35			24 (8,11,13)
		firm gray-brown silty fine SAND	
40			11 (4,6,5)

STANDARD PENETRATION TEST DATA (blows/ft)



TEST LAB, INC.

PROJECT:
SW Wastewater Treatment Plant
Bradenton, Florida

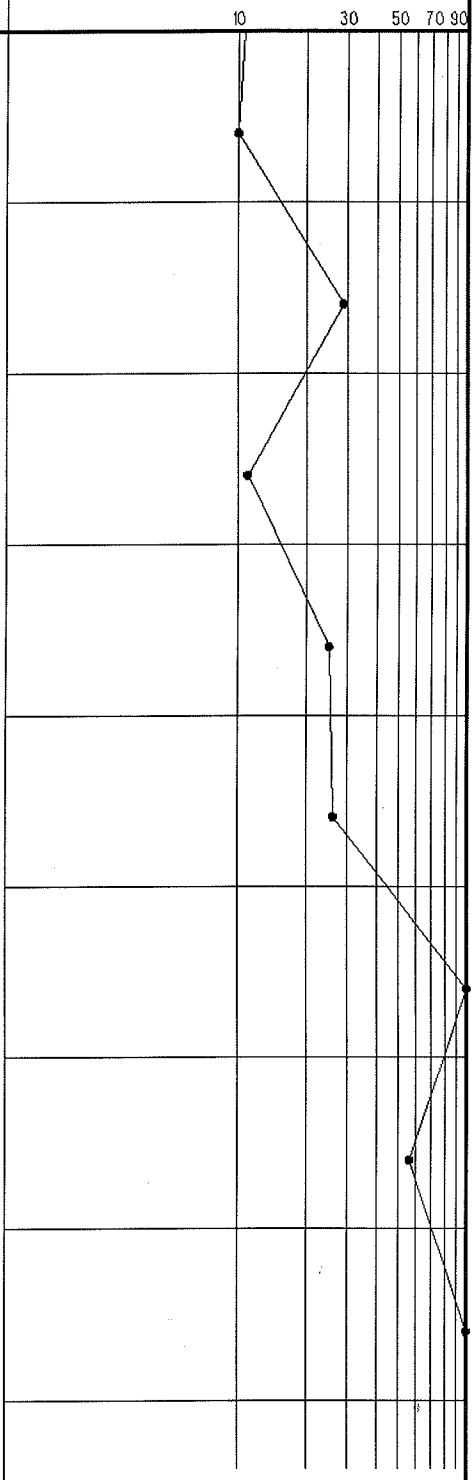
LOG OF BORING B-2

DRILLER: *J. Davis*
ELEVATION: *N/A*
DATE DRILLED: *2/18/09*
WATER LEVEL: *3'8" @ TOB*
DRILLING METHOD: *Mud Rotary*
BORING DEPTH: *80 Feet*

REMARKS: Water losses 100% at 48 feet. Casing NW 40 feet length. Bore hole grouted. Hole collapsed due to shell.

DEPTH (feet)	GEOLOGIC DESCRIPTION	'N' (blows/6 in.)
	stiff green-gray-brown fine sandy CLAY	10 (3,4,6)
47	gray-brown limestone	29 (17,9,20)
52	stiff dark green-gray-brown fine sandy CLAY	11 (3,4,7)
57	very stiff dark green-gray-brown fine sandy CLAY	25 (16,12,13)
62	very stiff dark green-gray-brown fine sandy CLAY	26 (7,11,15)
67	very hard light brown fine sandy calcareous clay (WEATHERED LIMESTONE)	50=1"
72	very stiff light gray-brown fine sandy calcareous clay w/trace of L.S (WEATHERED LIMESTONE)	56 (11,21,35)
77	very hard light gray-brown fine sandy calcareous clay w/trace of L.S. (WEATHERED LIMESTONE)	100 (7,25,50=4")
	Boring terminated at 80'0"	
82		

STANDARD PENETRATION TEST DATA (blows/ft)



TEST LAB, INC.

PROJECT:
SW Wastewater Treatment Plant
Bradenton, Florida

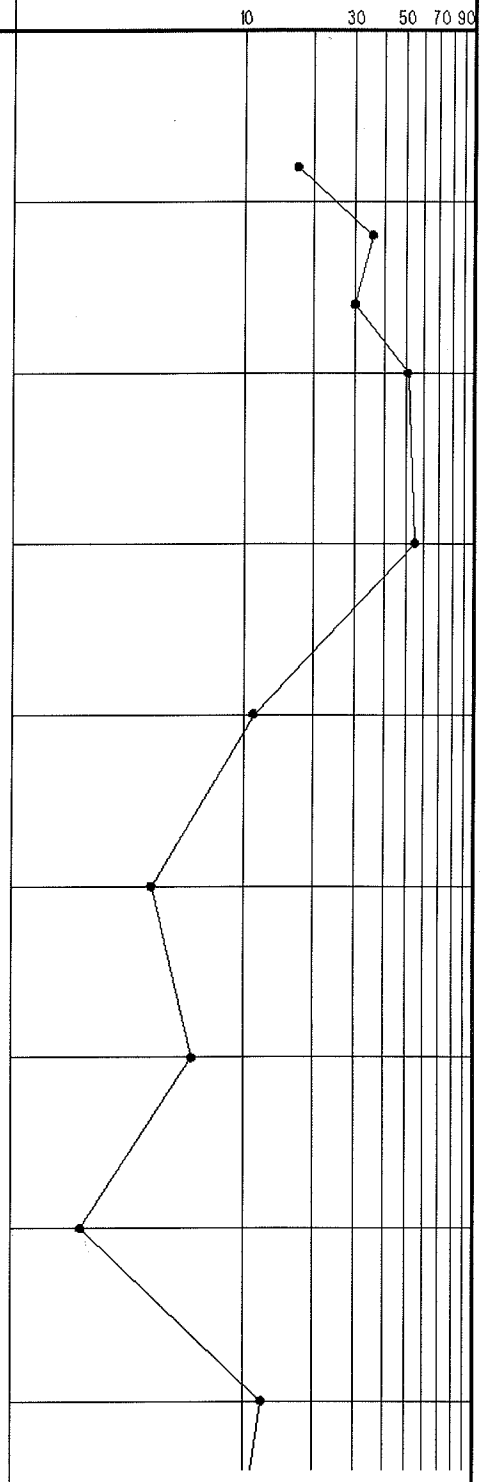
LOG OF BORING B-3

DRILLER: *J. Davis*
ELEVATION: *N/A*
DATE DRILLED: *2/19/09*
WATER LEVEL: *3'1" @ TOB*
DRILLING METHOD: *Mud Rotary*
BORING DEPTH: *80 Feet*

REMARKS: Casing NW 40 feet in length. Hole collapsed due to shell. Bore hole grouted.

DEPTH (feet)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	'N' (blows/6 in.)
		concrete (11")	
		firm light brown fine SAND w/shell (fill)	
5		dense gray-brown fine SAND	17 (5,7,10,10)
		very firm dark brown fine SAND	36 (12,17,19,23)
		very dense brown fine SAND w/shell	30 (12,17,13,9)
10			51 (13,21,30)
		very dense light gray-brown fine SAND w/shell	
15			55 (19,29,26)
		firm light gray-brown fine SAND w/cemennted sand	
20			11 (6,5,6)
		very loose light gray-brown fine SAND w/shell	
25			4 (4,1,3)
		loose light gray-brown fine SAND w/shell & cemented sand	
30			6 (1,2,4)
		very loose light gray-brown silty fine SAND w/trace of shell	
35			2 (1,1,1)
		firm light gray-brown silty fine SAND	
40			12 (4,8,4)

STANDARD PENETRATION TEST DATA (blows/ft)



TEST LAB, INC.

PROJECT:
SW Wastewater Treatment Plant
Bradenton, Florida

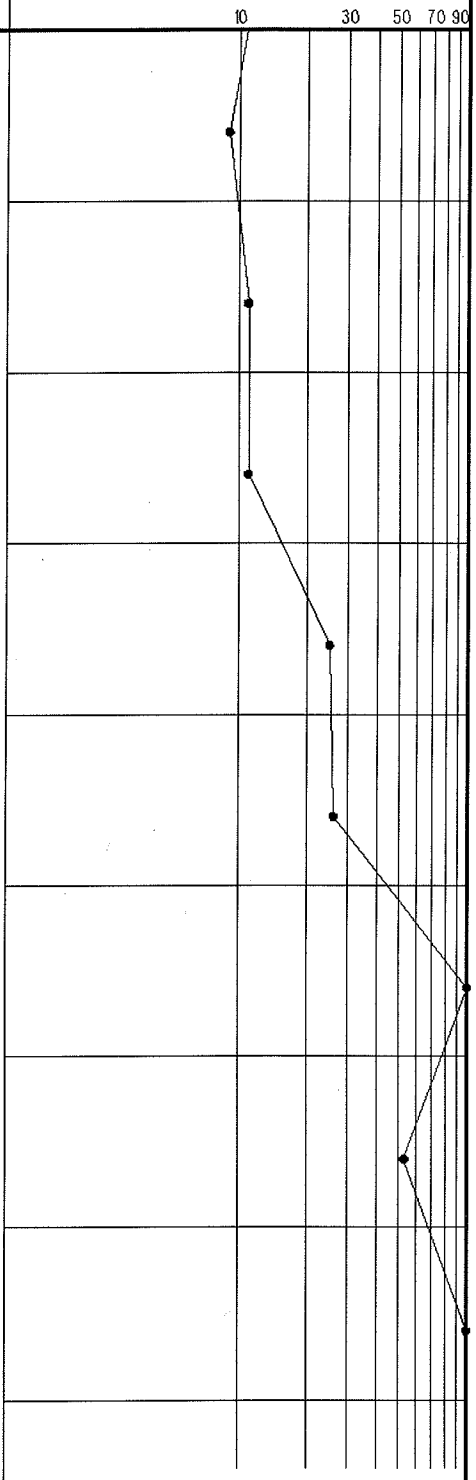
LOG OF BORING B-3

DRILLER: *J. Davis*
ELEVATION: *N/A*
DATE DRILLED: *2/19/09*
WATER LEVEL: *3'1" @ TOB*
DRILLING METHOD: *Mud Rotary*
BORING DEPTH: *80 Feet*

REMARKS: Casing NW 40 feet in length. Hole collapsed due to shell. Bore hole grouted.

DEPTH (feet)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	'N' (blows/6 in.)
		stiff gray-green-brown fine sandy CLAY	9 (3,3,6)
47		stiff light gray-brown fine sandy CLAY	11 (23,6,5)
52		stiff light gray-brown fine sandy CLAY	11 (5,5,6)
57		very stiff light gray-brown fine sandy CLAY	25 (10,12,13)
62		very stiff light gray-brown fine sandy CLAY	26 (8,11,15)
67		very hard gray-brown fine sandy calcareous clay (WEATHERED LIMESTONE)	50=4"
72		very hard light gray-brown fine sandy calcareous clay (WEATHERED LIMESTONE)	53 (20,22,31)
77		very hard light gray-brown fine sandy calcareous clay (WEATHERED LIMESTONE)	100 (27, 55=5")
		Boring terminated at 80'0"	
82			

STANDARD PENETRATION TEST DATA (blows/ft)



TEST LAB, INC.

PROJECT:
SW Wastewater Treatment Plant
Bradenton, Florida

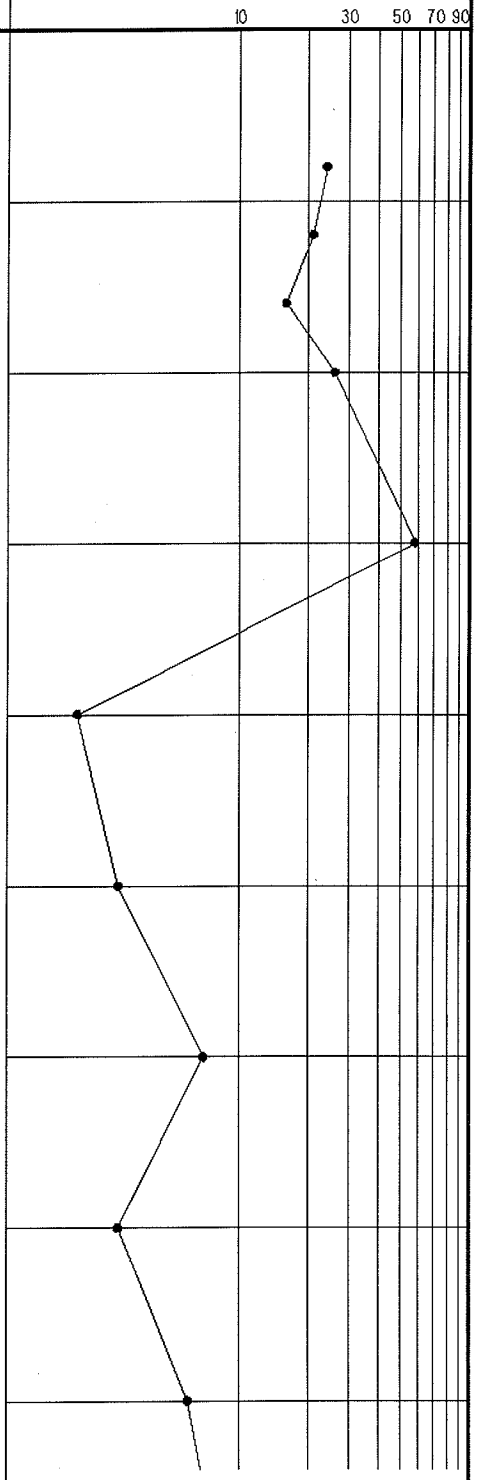
LOG OF BORING B-4

DRILLER: *J. Davis*
ELEVATION: *N/A*
DATE DRILLED: *2/23/09*
WATER LEVEL: *3'7" @ TOB*
DRILLING METHOD: *Mud Rotary*
BORING DEPTH: *82 Feet*

REMARKS: Casing NW 40 feet length. Hole collapsed due to shell. Bore hole grouted.

DEPTH (feet)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	'N' (blows/6 in.)
		concrete (13")	
		very firm light brown fine SAND w/shell (fill)	
5		very firm gray-brown fine SAND	24 (7,12,12,13)
		firm gray-brown fine SAND	21 (10,10,11,14)
		very firm light brown fine SAND w/shell	16 (7,8,8,15)
10			26 (12,13,13,19)
		very dense light brown fine SAND w/shell	
15			58 (12,27,31)
		very loose gray-brown silty fine SAND w/traces of shell	
20			2 (3,1,1)
		very loose gray-brown silty fine SAND w/traces of shell	
25			3 (3,1,2)
		loose gray-brown fine SAND w/shell	
30			7 (1,3,4)
		very loose light gray-brown silty fine SAND w/shell	
35			3 (2,1,2)
		loose light gray-brown silty fine SAND w/shell	
40			6 (4,3,3)

STANDARD PENETRATION TEST DATA (blows/ft)



TEST LAB, INC.

PROJECT:
SW Wastewater Treatment Plant
Bradenton, Florida

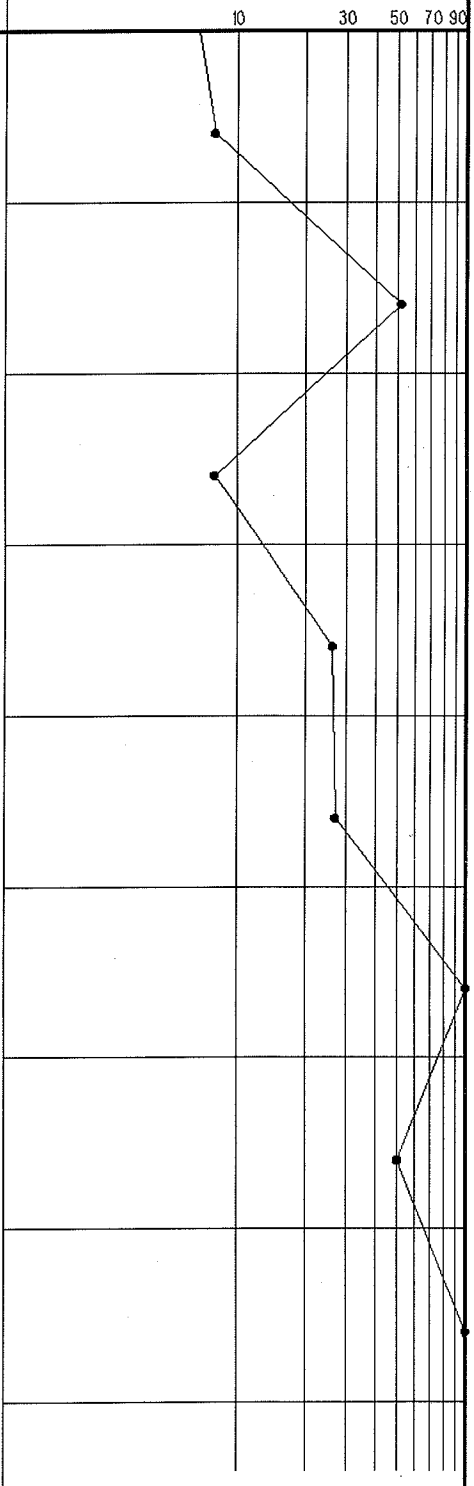
LOG OF BORING B-4

DRILLER: *J. Davis*
ELEVATION: *N/A*
DATE DRILLED: *2/23/09*
WATER LEVEL: *3'7" @ TOB*
DRILLING METHOD: *Mud Rotary*
BORING DEPTH: *82 Feet*

REMARKS: Casing NW 40 feet length. Hole collapsed due to shell. Bore hole grouted.

DEPTH (feet)	GRAPHIC LOG	GEOLOGIC DESCRIPTION	'N' (blows/6 in.)
		medium stiff gray-brown fine sandy CLAY w/cemented sand	8 (3,5,3)
47		very hard gray-brown fine sandy CLAY	52 (16,41,11)
52		medium stiff gray-brown fine sandy CLAY	8 (3,4,4)
57		very stiff gray-brown fine sandy CLAY	26 (12,13,13)
62		very stiff gray-brown fine sandy CLAY	27 (8,12,15)
67		very hard light gray-brown fine sandy calcareous clay (WEATHERED LIMESTONE)	50=4"
72		hard light gray-brown fine sandy calcareous clay (WEATHERED LIMESTONE)	50 (7,22,28)
77		very hard light gray-brown fine sandy calcareous clay (WEATHERED LIMESTONE)	50=5"
82		Boring terminated at 80'2"	

STANDARD PENETRATION TEST DATA (blows/ft)



TEST LAB, INC.

SOIL SYMBOLS


SAND


VOID/CAVITY


PEAT, MUCK, ORGANIC SOILS


CLAYEY SAND
SILTY SAND


WEATHERED LIMESTONE


MISCELLANEOUS FILL, TOPSOIL, ETC.


SANDY CLAY
SANDY SILT


LIMESTONE


SHELL


CLAY, SILT, SILTY CLAY, CLAYEY SILT


GRAVEL, COBBLES, BOULDERS

PARTICLE SIZE IDENTIFICATION

Boulders	- 8 inch diameter or more
Cobbles	- 3 to 8 inch diameter
Gravel	- 4.7mm to 3 inches
Sand	- Course 2.00 to 4.74mm (dia. of pencil lead)
	- Medium 0.42 to 2.00mm (dia. of broom straw)
	- Fine 0.074 to 0.42mm (dia. of human hair)
Silt	- 0.074 to 0.002mm (cannot see particles)
Clay	- Smaller than 0.002mm

CONSISTENCY

COHESIONLESS SOIL (sand)		
Very Loose	0 - 4	Blows/Ft.
Loose	5 - 10	Blows/Ft.
Firm	11 - 20	Blows/Ft.
Very Firm	21 - 30	Blows/Ft.
Dense	31 - 50	Blows/Ft.
Very Dense	51 - UP	Blows/Ft.

COHESIVE SOIL (clay, silt)		
Very Soft	0 - 2	Blows/Ft.
Soft	3 - 4	Blows/Ft.
Medium Stiff	5 - 8	Blows/Ft.
Stiff	9 - 15	Blows/Ft.
Very Stiff	16 - 30	Blows/Ft.
Hard	31 - 50	Blows/Ft.
Very Hard	51 - UP	Blows/Ft.

Strata Changes - In the column "Soil Descriptions" on the drill log the horizontal lines represent strata strata changes. A solid line (——) represents an actually observed change, a dashed line (- - -) represents an estimated change.

Ground Water - Observations were made at the times indicated. Porosity of soil strata, weather conditions, site topography, etc. may cause changes in the water levels indicated on the logs.

SOIL LEGEND

TEST LAB INC.
GEOTECHNICAL & MATERIALS
ENGINEERING, TESTING & INSPECTION

APPENDIX C

TEST LAB INC.
GEOTECHNICAL & MATERIALS
ENGINEERING, TESTING & INSPECTION
P.O. BOX 15732 • TAMPA, FLORIDA 33684 • 813/872-7821

SOIL ANALYSIS

PROJECT: SW Water Reclamation Facility
URS Job Number 12008492.00003
5th Clarifier – 10 MGD
Manatee County, Florida

PROJECT NO: GE-09-3474

CLIENT: URS

DATE: March 27, 2009

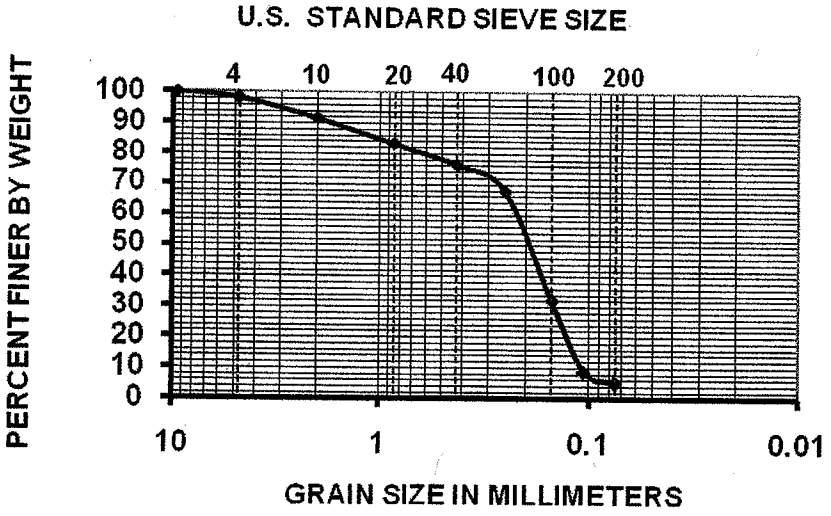
BORING NO.: SPT-1

DEPTH: 8-12'

SAMPLE NO.: 4

SAMPLE DESCRIPTION: Light gray-brown fine SAND w\shell

Sieve Number	Percent Passing
3/8"	100
No. 4	98
No. 10	92
No. 20	83
No. 40	76
No. 60	68
No. 100	32
No. 140	9
No. 200	5.14



DATE SAMPLED: 3/04/09

DATE TESTED: 3/06/09

REPORTS TO:

dtl\svs.1

TEST LAB INC.
GEOTECHNICAL & MATERIALS
ENGINEERING, TESTING & INSPECTION
P.O. BOX 15732 • TAMPA, FLORIDA 33684 • 813/872-7821

SOIL ANALYSIS

PROJECT: SW Water Reclamation Facility
URS Job Number 12008492.00003
5th Clarifier – 10 MGD
Manatee County, Florida

PROJECT NO: GE-09-3474

CLIENT: URS

DATE: March 27, 2009

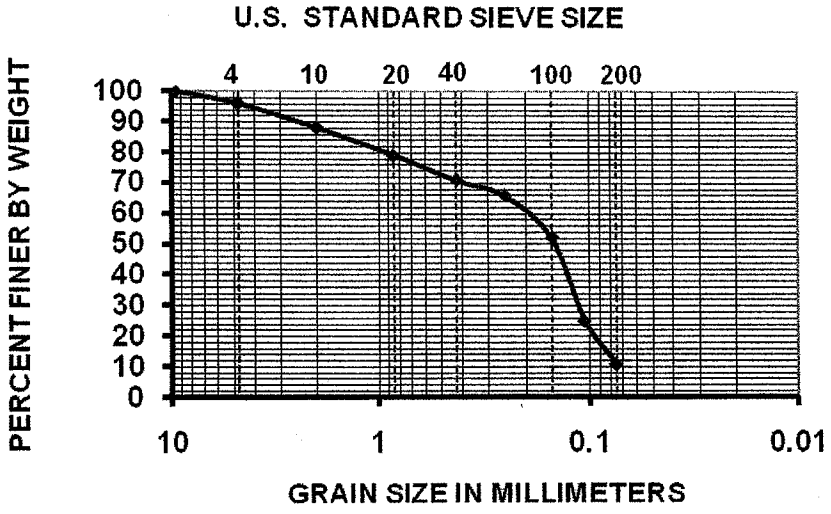
BORING NO.: SPT-1

DEPTH: 37-42'

SAMPLE NO.: 10

SAMPLE DESCRIPTION: Loose gray-brown silty fine SAND w\shell

Sieve Number	Percent Passing
3/8"	100
No. 4	96
No. 10	88
No. 20	79
No. 40	71
No. 60	66
No. 100	52
No. 140	25
No. 200	10.9



DATE SAMPLED: 3/04/09

DATE TESTED: 3/06/09

REPORTS TO:

dtl\svs.2

TEST LAB INC.
GEOTECHNICAL & MATERIALS
ENGINEERING, TESTING & INSPECTION
P.O. BOX 15732 • TAMPA, FLORIDA 33684 • 813/872-7821

SOIL ANALYSIS

PROJECT: SW Water Reclamation Facility
URS Job Number 12008492.00003
5th Clarifier – 10 MGD
Manatee County, Florida

PROJECT NO: GE-09-3474

CLIENT: URS

DATE: March 27, 2009

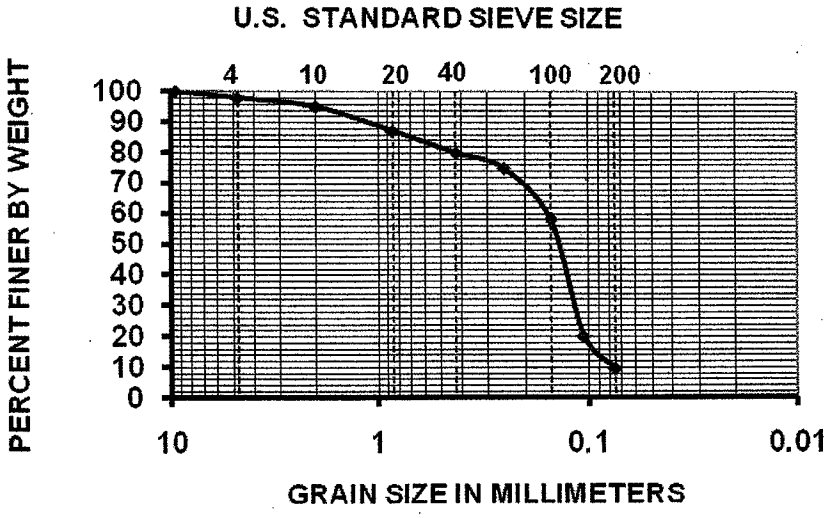
BORING NO.: SPT-2

DEPTH: 37-42'

SAMPLE NO.: 10

SAMPLE DESCRIPTION: Gray-brown silty fine SAND

Sieve Number	Percent Passing
3/8"	100
No. 4	98
No. 10	95
No. 20	87
No. 40	80
No. 60	75
No. 100	58
No. 140	20
No. 200	9.63



DATE SAMPLED: 3/04/09

DATE TESTED: 3/06/09

REPORTS TO:

dtl\svs.3

TEST LAB INC.
GEOTECHNICAL & MATERIALS
ENGINEERING, TESTING & INSPECTION
P.O. BOX 15732 • TAMPA, FLORIDA 33684 • 813/872-7821

SOIL ANALYSIS

PROJECT: SW Water Reclamation Facility
URS Job Number 12008492.00003
5th Clarifier – 10 MGD
Manatee County, Florida

PROJECT NO: GE-09-3474

CLIENT: URS

DATE: March 27, 2009

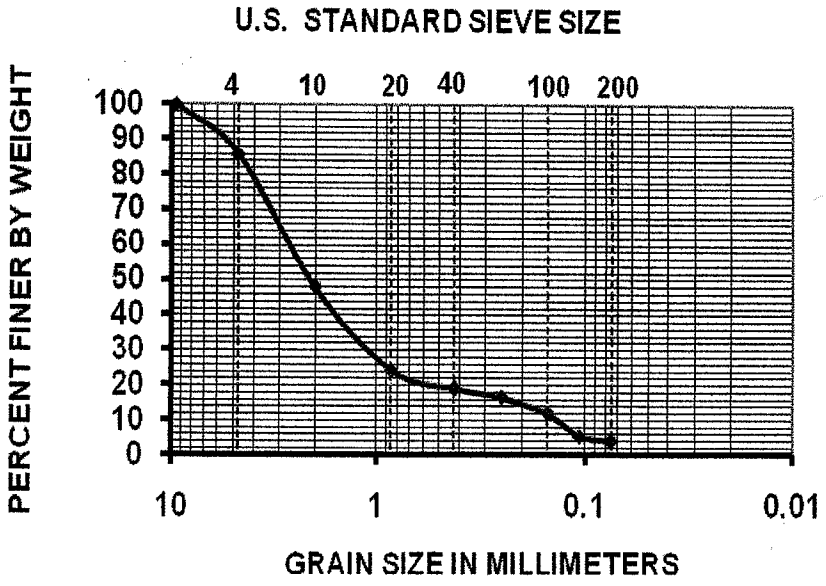
BORING NO.: SPT-2

DEPTH: 32-37'

SAMPLE NO.: 9

SAMPLE DESCRIPTION: Shell

Sieve Number	Percent Passing
3/8"	100
No. 4	86
No. 10	48
No. 20	24
No. 40	19
No. 60	17
No. 100	12
No. 140	5
No. 200	3.89



DATE SAMPLED: 3/04/09

DATE TESTED: 3/06/09

REPORTS TO:

dtl\svs.4

TEST LAB INC.
GEOTECHNICAL & MATERIALS
ENGINEERING, TESTING & INSPECTION
P.O. BOX 15732 • TAMPA, FLORIDA 33684 • 813/872-7821

SOIL ANALYSIS

PROJECT: SW Water Reclamation Facility
URS Job Number 12008492.00003
5th Clarifier – 10 MGD
Manatee County, Florida

PROJECT NO: GE-09-3474

CLIENT: URS

DATE: March 27, 2009

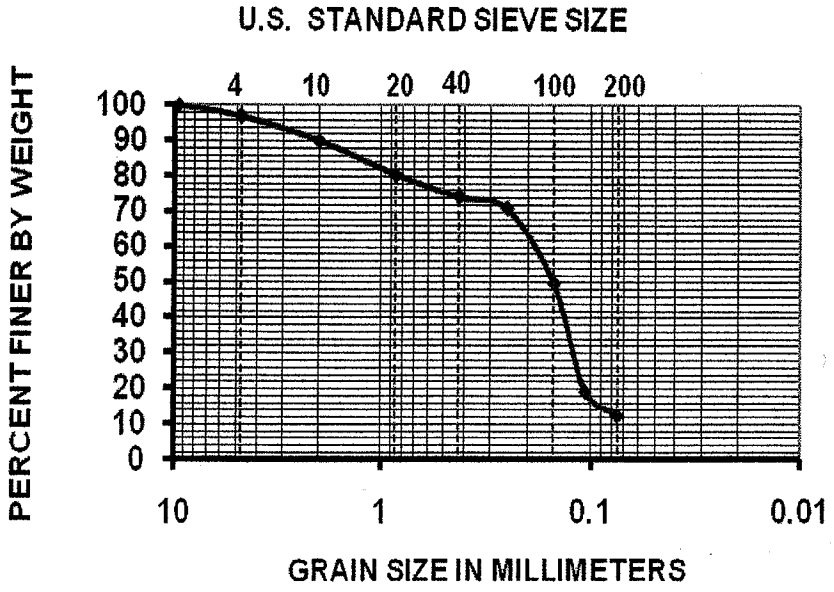
BORING NO.: SPT-3

DEPTH: 32-37'

SAMPLE NO.: 9

SAMPLE DESCRIPTION: Very loose light gray-brown fine SAND w\traces of shell

Sieve Number	Percent Passing
3/8"	100
No. 4	97
No. 10	90
No. 20	80
No. 40	74
No. 60	71
No. 100	50
No. 140	19
No. 200	12.45



DATE SAMPLED: 3/04/09

DATE TESTED: 3/06/09

REPORTS TO:

dtl\svs.5

TEST LAB INC.
GEOTECHNICAL & MATERIALS
ENGINEERING, TESTING & INSPECTION
P.O. BOX 15732 • TAMPA, FLORIDA 33684 • 813/872-7821

SOIL ANALYSIS

PROJECT: SW Water Reclamation Facility
URS Job Number 12008492.00003
5th Clarifier – 10 MGD
Manatee County, Florida

PROJECT NO: GE-09-3474

CLIENT: URS

DATE: March 27, 2009

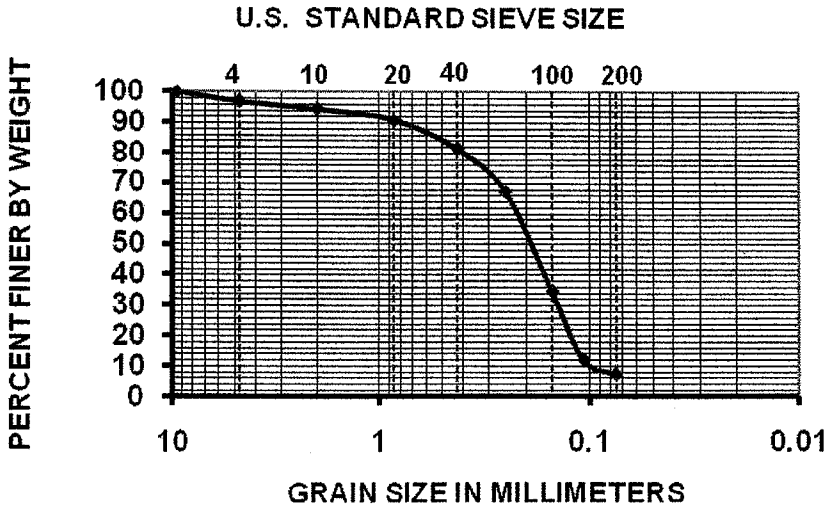
BORING NO.: SPT-4

DEPTH: 17-22'

SAMPLE NO.: 6

SAMPLE DESCRIPTION: Very loose gray-brown silty fine SAND

Sieve Number	Percent Passing
3/8"	100
No. 4	97
No. 10	94
No. 20	91
No. 40	81
No. 60	67
No. 100	35
No. 140	12
No. 200	7.4



DATE SAMPLED: 3/04/09

DATE TESTED: 3/06/09

REPORTS TO:

APPENDIX D

TEST LAB INC.
GEOTECHNICAL & MATERIALS
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SOIL ANALYSIS

PROJECT: SW Water Reclamation Facility
URS Job Number 12008492.00003
5th Clarifier – 10 MGD
Manatee County, Florida

PROJECT NO: GE-09-3474

CLIENT: URS

DATE: March 27, 2009

SAMPLE NO.: 15

BORING NO.: SPT-1

DEPTH FEET: 67-72'

SAMPLE DESCRIPTION: Light Gray-brown clayey fine SAND w\limestone

ATTERBERG LIMITS: **LL:** 38 **PL:** 28 **PI:** 10

DATE SAMPLED: 3/04/09

DATE TESTED: 3/09/09

REPORTS TO:
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SOIL ANALYSIS

PROJECT: SW Water Reclamation Facility
URS Job Number 12008492.00003
5th Clarifier – 10 MGD
Manatee County, Florida

PROJECT NO: GE-09-3474

CLIENT: URS

DATE: March 27, 2009

SAMPLE NO.: 11

BORING NO.: SPT-3

DEPTH FEET: 42-47'

SAMPLE DESCRIPTION: Gray-brown sandy clay

ATTERBERG LIMITS: LL: 68 PL: 25 PI: 43

DATE SAMPLED: 3/04/09

DATE TESTED: 3/09/09

REPORTS TO:
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SOIL ANALYSIS

PROJECT: SW Water Reclamation Facility
URS Job Number 12008492.00003
5th Clarifier – 10 MGD
Manatee County, Florida

PROJECT NO: GE-09-3474

CLIENT: URS

DATE: March 27, 2009

SAMPLE NO.: 12

BORING NO.: SPT-4

DEPTH FEET: 47-52'

SAMPLE DESCRIPTION: Gray-brown sandy clay

ATTERBERG LIMITS: **LL:** 38 **PL:** 25 **PI:** 13

DATE SAMPLED: 3/04/09

DATE TESTED: 3/09/09

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REPORTS TO:

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SOIL ANALYSIS

PROJECT: SW Water Reclamation Facility
URS Job Number 12008492.00003
5th Clarifier – 10 MGD
Manatee County, Florida

PROJECT NO: GE-09-3474

CLIENT: URS

DATE: March 27, 2009

SAMPLE NO.: 13

BORING NO.: SPT-2

DEPTH FEET; 52-57'

SAMPLE DESCRIPTION: Dark green-gray brown sandy clay

REMARKS:

ATTERBERG LIMITS: **LL:** 194 **PL:** 71 **PI:** 123

DATE SAMPLED: 3/04/09

DATE TESTED: 3/09/09

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REPORTS TO: