SECTION 7
STANDARD SPECIFICATIONS

This section provides standard specifications for storm drainage, potable water, wastewater and reuse water systems and landscape, irrigation systems and common area improvements. The section are numbered using CSI format and include:

- Section 02100 Clearing and Grubbing
- Section 02145 Special Provisions for Construction Activities in C-2 and C-3 Canals
- Section 02120 Earthwork
- Section 02224 Finish Grading of Landscape Area
- Section 02225 Excavation and Backfill for Utilities
- Section 02226 Excavation and Backfill for Structures
- Section 02270 Erosion and Sedimentation Control
- Section 02340 Portland Cement Concrete
- Section 02343 Reinforced Steel
- Section 02345 Site Concrete Work
- Section 02346 Precast Concrete
- Section 02400 Culverts and Storm Sewers
- Section 02440 Underdrains
- Section 02450 Rip-Rap
- Section 02451 Erosion Control Mattress
- Section 02510 Concrete Walks
- Section 02515 Brick Pavement
- Section 02526 Site Work Precast Concrete
- Section 02601 Drainage Structures
- Section 02610 Site Work Unit Masonry
- Section 02620 Site Work Cast Stone
- Section 02650 Site Work Ornamental Metalwork
- Section 02660 Water Distribution System
- Section 02663 Reclaimed Water Distribution System
- Section 02721 Oil Skimmers
- Section 02730 Sanitary Sewerage Collection System
- Section 02732 Sanitary Sewerage Force Main
- Section 02750 Submersible Sewage Pumping Station
- Section 02800 Miscellaneous Site Improvements
- Section 02810 Irrigation
- Section 02879 Landscape Maintenance
- Section 02900 Soil Preparation and Soil Mixes
- Section 02920 Finish Grading of Landscape Areas
- Section 02921 Transplanting of Trees
- Section 02930 Lawn and Grasses
- Section 02940 Trees, Shrubs and Groundcovers

- Section 04100 Mortary and Grout
- Section 04200 Unit Masonry
- Section 04420 Cast Stone
- Section 05700 Ornamental Metalwork
- Section 06100 Wood Fences

Technical specifications for roadways and bridges shall comply with the applicable sections of current Osceola County and Florida Department of Transportation (FDOT) standard construction specifications.

PART 1 - GENERAL

1.01 DESCRIPTION

A. This section includes removal and disposal of all timber, brush, stumps, roots, grass, weeds, sawdust, rubbish, structures, and existing pavement.

1.02 START OF WORK

A. Prior to initiating clearing and grubbing operations, field survey and stake the limits of construction.

B. Obtain the Owner's Representative's approval of the field survey.

C. Install all silt fence, hay bales and enviro fence along the limits of construction as indicated on the Drawings.

D. Obtain the Owner's Representative, Reedy Creek Improvement District (RCID) and South Florida Water Management District (SFWMD) approval of the installed erosion and sedimentation control measures.

E. Initiate clearing and grubbing operations.

PART 2 - PRODUCTS

2.01 DISPOSAL OF MATERIALS

A. Combustible materials may be disposed of by burning within the project limits of construction if prior approval is obtained from the appropriate governmental authorities Owner or the Owner's Representative. If such site and approval is not obtainable, then haul away and properly dispose of combustible materials off of Celebration property. All burning shall be completd with the use of an air curtain.

B. Haul away and properly dispose of all non-combustible materials off of Celebration Property.

C. The Contractor shall not allow any debris to accumulate on-site for more than 48 hours and shall remove such debris when requested by the Owner's Representative.

D. At the Contractor's option, stripping material may be disposed in non-structural areas within the limits of construction. Prior to construction, submit a detailed plan indentifying the proposed areas to receive stripping material for Owner review.

PART 3 - EXECUTION

3.01 CLEARING

A. In all areas of the project, unless otherwise noted, remove and dispose of trees, snags, stumps, shrubs, brush, limbs, and other vegetative growth. Remove all evidence of their presence from the surface including sticks and branches greater than 1 inch in diameter or thickness. Remove and dispose of trash piles, rubbish and stockpiled organic material. Protect trees, shrubs, and vegetative growth which are not designated for removal.

B. Clearing limits must be approved by the Owner prior to beginning clearing operations.

C. At the direction of the Owner's Representative, remove and dispose of any dangerous timber located at the edges of the electrical transmission and high pressure gas corridors. Trim all branches from existing trees back to the tree trunk which extend into the corridors.

3.02 GRUBBING

A. In all areas of the project, unless otherwise noted, remove all stumps, roots, brush and other debris greater than 1 inch in diameter to a depth of not less than two feet below the subgrade.

3.03 SELECTIVE CLEARING AND/OR GRUBBING

A. Special attention shall be given by the Contractor to saving, protecting, and preserving any existing trees, shrubs or other vegetation so designated by the Owner. Selective clearing and/or grubbing shall be performed in locations indicated on the plans and other areas specified by the Owner at no additional cost to the Owner. The Owner or the Owner's Representative will select and mark, or otherwise designate, trees, ornamentals or other vegetation to be preserved, before or after award of the contract or initiation of construction. Contractor shall install an approved enviro fence around designated vegetation for a minimum of 10 feet beyond the drip line of the trees, ornamentals, or other vegetation to be preserved. Clearing limits must be approved by the Owner prior to beginning clearing operations.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work covered under this section consists of excavating, removing, and satisfactorily disposing of all materials, of whatever nature, within the limits of construction. Included in this section is all excavation, embankment and finishing necessary for the construction, preparation and completion of all embankments, and fill areas in accordance with the required alignment, grade, and cross-sections shown on the Drawings or as directed by the Owner.

1.02 SUBMITTALS

A. Submit copies of a certification from an independent testing laboratory that borrow material used for all backfills, fills and structural backfills meets the specified criteria.

1.03 QUALITY ASSURANCE

A. The Contractor shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress.

1.04 JOB CONDITIONS

A. Available test borings made on the site and the surface exploration data are separately bound and provided as part of the Contract Documents and are for the Contractor's information ONLY.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Backfill and fill shall be excavated material or borrow that is free from clayballs larger than 2 inches in their largest dimension and contains no more than 10 percent by weight passing the No. 200 sieve, no more organic matter (peat, humus, leaves, and carbon compounds) than 1 percent by weight, and no cobbles larger than 2 inches in their largest dimension. The gradation of this and or well graded sand and gravel mixture shall be such as to achieve the specified compaction.

B. Structural backfill shall consist of clean, fine to medium sand, contain less than 0.5 percent by weight organic matter (peat, humus, leaves, and carbon compounds), and conform to the following gradation requirements:

Sieve Size (Square Openings)	Weight Percent Passing Square Mesh Sleeves
No. 4 (4.75 mm)	95 to 100
No. 10 (2.00 mm)	90 to 100
No. 40 (0.420 mm)	70 to 95
No. 60 (0.250 mm)	40 to 80
No. 100 (0.149 mm)	5 to 40
No. 200 (0.074 mm)	less than 5

2.02 WATER FOR COMPACTION

A. Water shall be free of acid, alkali, or organic materials and shall have a pH of 7.0 to 9.0. Provide all water needed for earthwork. Provide temporary piping, valves, and trucks to convey water from the source to the point of use. Provide any meters required if the water is taken from a public water system.

PART 3 - EXECUTION

3.01 EXCAVATION

A. The Contractor shall perform all excavation necessary to accomplish the construction indicated on the plans. Excavation shall be unclassified regardless of material encountered. All excavated material not required for fill or embankment shall be deposited on the project site as directed by the Owner or its representative. The Contractor shall do all shoring necessary to perform and protect the excavation and as necessary for the safety of the workers and any existing facilities. Wherever excavations are made below the grades indicated on the Plans, firm material shall be used to restore the area to the proper grade and shall be compacted in accordance with these Specifications.

3.02 UNSUITABLE MATERIAL

A. Where muck, rock, clay or other material within the limits of construction is, in the opinion of the Owner, unsuitable in its original position, the Contractor shall excavate such material and backfill the excavated area with suitable material, which shall be compacted and shaped to conform to the required section.

B. All unsuitable materials are to be removed and replaced with suitable backfill. Any removal above and beyond the limits indicated on the Contract Documents as required for construction of this project shall be considered as a part of the base contract. Stripings and unsuitable materials shall be disposed of onsite as designated by the Owner.

3.03 EMBANKMENT

A. This work shall consist of furnishing and placing the materials required for fill or embankment for the construction as shown on the Drawings. The material used for embankment shall consist of sand, gravel, or a mixture thereof, and/or other suitable material approved by the Owner.

B. Prior to placing any embankment, the surface to receive the embankment shall be cleared, grubbed and stripped. Fill or embankment shall be placed in successive uniform layers of not more than 8 inches, measured loose or as approved method in accordance with the requirements in this section.

1. Proof rolling operations shall be completed on all areas identified in the contract documents after clearing and grubbing with a self-propelled vibratory compactor. To adequately densify the subsoils at depth, the compactor should be capable of imparting a maximum dynamic drum force of at least 36,000 pounds. The limits of proof rolling should encompass the house pad plus a horizontal distance of five feet beyond the exterior edges of the proposed house pad.

2. Densification of the subsoils should be accomplished by making repeated overlapping coverages of the roller as it operates at its full vibrational frequency and at a travel speed of not more than two feet per second.

3. Proof rolling operations should be carried out under the surveillance of a geotechnical engineer so that observations of the subgrade can be made and in-place density tests taken to evaluate the compaction being achieved.

B. The Owner shall inspect all compacted areas prior to further construction operations to ensure that satisfactory compaction has been obtained. All embankment, including backfill and embankment adjacent to structures, shall be compacted to a density of not less than 98 percent of the maximum density as determined by ASTM D-1557 (AASHTO T-180).

3.10 TESTING

A. All testing as described below shall be performed by an independent laboratory. Coordinate and schedule all construction in accordance with the testing requirements.

B. Field density tests will be made in each vertical layer, and using the following approximate spacing:

1. Under berm structures, pavements, and slabs, one per 2,500 square feet with at least two per structure or area.

2. In trenches, one every 100 feet in continuous trenches under pavements or future pavements plus one at each intersection or one every 300 feet in continuous trenches not under pavements, plus one at each pavement or driveway crossing.

3. In all other areas, one 7,500 square feet.

C. If any field density tests are below the specified relative density, recompact or re-excavate, rebackfill and recompact the area until the specific density is obtained. A minimum of two field density tests per recompacted and/or re-excavated area will be performed to verify compliance with the specifications.

3.11 REPAIR OF DAMAGED PROPERTY

A. Curbs, walks, streets, poles, paving, survey monuments and other features which are to remain shall be fully protected by the Contractor. Any damaged items shall be removed and restored to their original condition at the Contractor's expense. Existing curbs and other facilities shall be altered as shown and the Contractor shall coordinate all such work with the City or County in which construction takes place.

3.12 ACCEPTANCE

A. After the specified density tests have been successfully completed, the Owner or his representative may cross section the excavation and/or fill area to verify that the excavation or fill area conforms to the lines and

3.04 BACKFILL

A. All backfill material shall be clean and free of lumber, trash, or other debris and shall be thoroughly compacted in layers not to exceed 8 inches and brought to an elevation above the finished grade sufficient to allow for settlement. Prior to placing backfill, the areas around structures upon which the backfill is to be placed shall be cleaned of all trash and debris of any nature. Sheeting and bracing if required shall be left in place. Any sheeting and bracing allowed to be left in place shall be cut off a minimum of 2.5 feet below finished grade and shall be noted on Contractor's "as-built" drawings.

3.05 EXCAVATED MATERIAL

A. During excavation, place the excavated material only within the project area. Do not obstruct any roadways, streets or above ground utility facilities. Conform to federal, state, and local codes governing the safeloading of trenches with excavated material. Separate suitable and unsuitable material.

3.06 DRAINAGE, EROSION AND SEDIMENTATION

A. Maintain all existing drainage patterns and control runoff from the construction area to prevent erosion, sedimentation, or flooding due to the construction.

3.07 SHEETING, SHORING AND BRACING OF TRENCHES

A. Install adequate sheeting and bracing to prevent damage to property and injury to persons. Comply with all applicable safety regulations and laws.

B. Remove sheeting when the trench has been backfilled to at least one-half its depth or when removal will not endanger proper pipe alignment or support.

C. When conditions or plans and specifications require that sheeting be left in place, cut off the top at an elevation 2.5 feet below finished grade, unless otherwise specified.

D. When the performance of the Work requires the use of shoring, sheet piling, bracing and other special construction related to excavation, the Contractor shall cause the design of said shoring, sheet piling and other special construction to be performed by a registered professional engineer licensed in the State of Florida. The Contractor shall submit, as a shop drawing, a certification by the registered engineer, stating that he has complied with this requirement.

3.08 FINISHING

A. This shall consist of the preparation, trimming, and shaping to the lines and grades shown on the Drawings, and all areas outside the paved areas in such a manner to receive grassing, and or planting without additional work.

B. Round tops of banks to circular curves to not less than a 6 foot radius. Neatly and smoothly trim rounded surfaces. Shape the surface of earthwork and trenches to conform to lines, grades, and cross sections that existing prior to beginning work or as shown on the Drawings, within 1/10 of a foot.

3.09 COMPACTION

A. Areas to be compacted shall be moistened and compacted by either rolling, tamping, or any other method approved by the Owner in order to obtain the desired density.

grades shown on the plans and to determine quantities of material. Correct deviations from line and grade in excess of the tolerances specified at no expense to the Owner.

END OF SECTION

PART 1 - GENERAL

1.01 SCOPE OF WORK

A. The Contractor shall provide all labor, materials, and equipment to perform the required work in the C-2 and C-3 Canals and wetlands as indicated in the Contract Documents. Work includes, but is not limited to, bridge substructure, temporary access culvert, existing access culvert enhancements, drainage collection systems, retaining walls, side slope stabilizations, and general canal improvements. The Contractor's staging area for work in the canal shall be kept neat and clean at all times and the Contractor shall adhere to practices specified in the Stormwater Pollution Prevention Plan (SWP3) for the project. All discharges resulting from dewatering, flow diversion, or other construction activities shall be in accordance with the Contract Documents and environmental permit conditions for the project.

B. Within thirty (30) days of Notice to Proceed, the Contractor shall submit to the Owner for review and approval a Canal Work Plan for each area of work. The plan shall include illustrations of construction sequence correlating to the Contractor's overall work schedule. As a minimum, the Canal Work Plan shall include provisions and details related to the proposed construction indicating the Contractor's proposed means and methods for partial temporary blockage of the canal, bypass conveyance, work area access, work area dewatering, turbidity control, erosion control, side slope stabilization, and site cleanup as required for each area of work.

C. The Canal Work Plan shall include provisions for monitoring of the canal bottom for scour during construction. After construction, the Contractor shall restore the canal bottom within areas disturbed by construction to same contours as that which existed prior to construction or to contours as shown in the Contract Documents.

D. Contractor submittals will be subject to review and approval by the Owner and the Reedy Creek Improvement District (RCID).

PART 2 - PRODUCTS

NOT USED

PART 3 - EXECUTION

3.01 FLOW CONTROL

A. The Contractor shall furnish and install temporary measures to control flows to allow for prosecution of the work. Temporary measures may consist of sheet piling, fill, culverts, additional storage volume, or other items deemed necessary by the Contractor to complete the proposed work.

B. Pile cap, column construction, and pile driving (if necessary) which requires preformed holes, shall be "in the dry." Channel bottom and side slope rubble and restoration activities are preferred in the dry. Contractor provisions for constructing in the dry shall be presented in the Contractor's Canal Work Plan.

C. Contractor submittals related to sheet piling or other means of work area isolation shall be prepared, signed, and sealed by a professional engineer employed by the Contractor and registered in the State of Florida, in accordance with the Contract Documents.

D. Any means and measures utilized for flow rate control or isolation of the work area, including the use of sheet piling, shall be removed by the Contractor upon satisfactory completion of the work and all disturbed areas restored to original or contract specifications. All temporary construction materials or construction waste, such as cutoff piles, shall be removed and disposed of by the Contractor.

3.02 CONVEYANCE REQUIREMENTS

A. The Contractor will be required to maintain conveyance capacity of the Canal during construction while work activities take place in the canal. Maintenance of conveyance capacity may be accomplished by one or more, or a combination, of the following means.

1. The Contractor shall furnish, install, and maintain a bypass system, which may include pumping equipment, capable of conveying a minimum for base flow and anticipated flow resulting from a 1" rainfall of 6-hour duration. The Contractor shall make provisions for on-site spare equipment and 8-hour availability of additional backup equipment in the event of failure of the equipment on-site.

2. The Contractor shall minimize constriction or obstruction of the canal to no more than 50% of the canal flow-way, or as approved by Owner. Maintenance of full conveyance capacity shall be accomplished by provisions for a bypass system which may include temporary pipes.

3. The Contractor's Canal Work Plan shall indicate means and methods for maintaining conveyance capacity in the canal and shall present details including flows, the potential for use of temporary off-line detention storage, anticipated pumping times as applicable, and provisions for controlling turbidity and erosion at discharge locations(s). Any hydraulic analysis and evaluation utilized in preparation of the Canal Work Plan shall be prepared, signed, and sealed by a professional engineer employed by the Contractor and registered in the State of Florida.

3.03 WORK AREA DEWATERING AND TURBIDITY CONTROL

A. The Contractor shall furnish and install erosion control devices at the canal work area in accordance with the Contract Documents prior to beginning work.

B. The Contractor shall control turbidity from dewatering operations through the use of alum and/or sedimentation basins, to supplement the turbidity control devices shown in the Contract Documents, as required to meet threshold conditions as outlined in 4.4 below.

C. The Contractor shall inspect and maintain erosion and turbidity control devices in and around the work area on a daily basis during construction. Documentation of daily inspection and maintenance activities shall be recorded and, upon request, submitted to the Owner.

D. The Contractor shall test upstream and downstream waters in accordance with the requirements of the Contract Documents and submit test results to the Owner. Immediate notification to the Owner shall be made if water quality does not meet acceptable levels. The Contractor shall take immediate corrective action and obtain satisfactory turbidity readings prior to continuation of work in the area.

3.04 STORM EVENTS GREATER THAN 6 HOUR DURATION STORM

A. In the event of conditions which do not allow for construction to proceed in the dry, the Contractor shall make provisions for disassembly of canal flow control devices. These provisions shall allow for restored flow conditions in the canal until such time as work can be resumed in accordance with the Contract Documents.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide finish grading of landscape areas as shown on the drawings, inferable therefrom and as specified herein.

1.02 RELATED WORK

A. Section 02810: Irrigation

B. Section 02930: Lawns and Grasses

C. Section 02940: Trees, Shrubs, and Groundcovers

D. Section 02900: Soil Preparation and Soil Mixes

1.03 QUALITY ASSURANCE

A. General:

1. This section specifies materials, equipment and work required to perform finish grading operations in landscape areas.

2. Completely coordinate work as required.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil: Section 02900: "Soil Preparation and Soil Mixes."

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify suitability of substrate to accept installation and assure proper subgrade drainage.

B. Installation constitutes acceptance of responsibility of performance.

3.02 PROTECTION AND RESTORATION

A. General:

1. Restore damage resulting from lack of protection or improper installation of protection. The contractor shall be responsible for damage to the waterproofing and protection system resulting from the soil installation.

   a. Restoration: Approved by the Owner's Representative.

3.03 GRADING

A. General:

1. Grade unpaved and paved areas as follows:

   a. To smooth and uniform surfaces
   b. To prevent surface water ponding

B. Unpaved Areas:

1. Finished Grades and Subgrades: Not to exceed half an inch above or below elevation indicated or as directed by the Owner's Representative.

C. Paved Areas:

1. Grade paved area subgrades to the lines, elevations indicated or specified.

   a. Finished Subgrades: Not to exceed one inch below elevation indicated or specified.

3.04 MAINTENANCE

A. Maintain all paved streets, sidewalks, etc., in clean, mud and dust-free condition during earthwork and subsequent construction operations.

1. Clean trucks and equipment, removing mud and debris, prior to entering the following:

   a. Public rights-of-way.

B. Maintain completed areas and project site as follows:

1. Keep free of trash and debris.

2. Regrade and recompact subgrades damaged or disturbed by the following:

   a. Adverse weather
   b. Soil erosion

c. Settlement
d. Subsequent construction operations

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Scope of Work: The work included under this Section consists of clearing, excavating, backfilling and grading required for the construction of the utilities as shown on the Drawings and as specified herein, including structures.

PART 2 - PRODUCTS

2.01 MATERIALS

A. General:

1. All fill material shall be subject to the approval of the Owner.

2. All fill material shall be free of organic material, trash, or other objectionable material. Excess unsuitable fill material shall be removed from the job site by the Contractor.

B. Common Fill Material: Common fill shall be sand and shall not contain stones, rock, concrete, asphalt or other rubble larger than two (2) inches in diameter. It shall have physical properties which allow it to be easily spread and compacted.

C. Structural Fill: Structural fill shall be sand with no more than 10 percent material passing a No. 200 sieve.

D. Class I Soils (Soils defined as Class I materials are not defined in ASTM D2487): Manufactured angular, granular material, 1/4 to 1/2 inches (6 to 12 mm) size, including materials having significance such as crushed stone or rock, broken coral, crushed slag, cinders, or crushed shells. Sieve analysis for crushed stone is given below separately.

Crushed Stone: Crushed stone shall consist of clean mineral aggregate free from clay, loam or organic matter, conforming with ASTM C33 stone size No. 8 and with particle size limits as follows:

U.S. Sieve Size	Percent Passing By Weight
1/2	100
3/8	85-100
No. 4	10-30
No. 8	0-10
No. 16	0-5

E. Class II Soils (In accordance with ASTM D2487):

1. GW: Well-graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

2. GP: Poorly graded gravels and gravel-sand mixtures, little or no fines. Fifty (50) percent or more retained on No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

3. SW: Well-graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

4. SP: Poorly graded sands and gravelly sands, little or no fines. More than fifty (50) percent passes No. 4 sieve. More than 95 percent retained on No. 200 sieve. Clean.

5. SW-SM: Well graded sand with silt. More than 50 percent passes No. 4 sieve. More than 88 percent retained on No. 200 sieve.

6. SP-SM: Poorly graded sand with silt. More than 50 percent passes No. 4 sieve. More than 88 percent retained on No. 200 sieve.

F. Coarse Sand: Sand shall consist of clean mineral aggregate with particle size limits as follows:

U.S. Sieve Size	Percent Passing By Weight
No. 4	95-100
No. 8	85-100
No. 16	65-97
No. 30	25-60
No. 50	5-35
No. 100	0-7

G. Other Material: All other material, not specifically described, but required for proper completion of the work shall be selected by the Contractor and approved by the Owner.

2.02 WATER FOR COMPACTION

A. Water shall be free of acid, alkalin, or organic materials and shall have a pH of 7.0 to 9.0. Provide all water needed for earthwork. Provide temporary piping, valves, and trucks to convey water from the source to the point of use. Provide any meters required if the water is taken from a public water system.

PART 3 - EXECUTION

3.01 EXCAVATION

A. General: Excavations for any utility, structures or trenches must be carefully executed in order to avoid interruption of the existing operations.

B. Excavating for Utility Structures or Trenches.

1. Excavation shall be made to such dimensions as will give suitable room for building or installing foundations of structures, for bracing and supporting, for pumping and draining, and for all other work required.

a. Excavation for precast or prefabricated structures shall be carried to an elevation 2 feet lower than the proposed outside bottom of the structure to provide space for the structural fill material. Prior to placing the structural fill, the excavation shall be sounded, if not dewatered, using a rigid pole to indicate to the satisfaction of the Owner that the excavation has been carried to the proper depth and is reasonably uniform over the area to be occupied by the structure.

b. Excavation for utility structures constructed or cast in place in dewatered excavations shall be carried down to the bottom of the structure where dewatering methods are such that a dry excavation bottom is exposed and the naturally occurring material at this elevation leveled and left ready to receive construction. Material disturbed below the founding elevation in dewatered excavations shall be replaced with crushed stone.

c. Footings: Cast-in-place concrete footing sides shall be formed immediately after excavation. Forming for footing sides is specified elsewhere.

2. The Contractor shall immediately document the location, elevation, size, material type and function of all new and existing subsurface installations, and utilities encountered during the course of construction.

3. Excavation equipment operators and other concerned parties shall be familiar with subsurface obstructions as shown on the Drawings and should anticipate the encounter of unknown obstructions during the course of the work.

4. Encounters with subsurface obstructions shall be hand excavated.

5. Excavation and dewatering shall be accomplished by methods which preserve the undisturbed state of subgrade soils. Subgrade soils which become soft, loose, "quick" or otherwise unsatisfactory for support of structures as a result of inadequate dewatering or other construction methods, shall be removed and replaced by crushed stone as required by the Owner at the Contractor's expense.

6. The bottom of excavations shall be rendered firm and dry before placing any structure. Excavated material not suitable for backfill shall be removed from the site and disposed of by the Contractor.

7. All pavements shall be cut prior to removal, with saws or approved power tools.

8. All locations and elevations as required herein must be permanently documented by the Contractor.

3.02 DRAINAGE

A. 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 excavations, and keep such excavations dry to as to obtain a satisfactory undisturbed subgrade foundation condition.

B. All water pumped or drained from the work shall be disposed of in a suitable manner without undue interference with other work, without damage to surrounding property, and in accordance with pertinent rules and regulations.

C. No construction, including pipe laying, shall be allowed in water. No water shall be allowed to contact masonry or concrete within 24 hours after being placed. The Contractor shall constantly guard against damage due to water and take full responsibility for all damage resulting from his failure to do so.

D. The Contractor will be required, at his expense, to excavate below grade and refill with approved fill material if the Owner determines that adequate drainage has not been provided.

3.03 UNDERCUT

A. If, because of Contractor's error or convenience, the bottom of any utility excavation is below that shown on the Drawings or specified, or unstable subgrade results from the Contractor`s excavation methods, he shall refill to normal grade with crushed stone (Class I material) at its own cost.

3.04 FILL AND COMPACTION

A. Compact and backfill excavations where specified according to the following schedule. Backfill schedule for pipes is listed in Table 02225-A. (Modified Proctor shall be ASTM D-1557 or AASHTO T-180):

STRUCTURES AND ROADWORK

Beneath Utility Structures	Structural Fill	8" lifts, compacted to 98% modified Proctor maximum density. Fill should not be placed over any in-place soils until those deposits have been compacted to 98% modified Proctor for a depth of two feet below the bottom of the excavation.
Around Utility Structures	Structural Fill	8" lifts, 98% of maximum density by modified Proctor Method.

B. Pipe shall be laid in open trenches unless otherwise indicated on the Drawings or elsewhere in the Contract Documents.

C. Excavations shall be backfilled to the original grade or as indicated on the Drawings. Deviation from this grade because of settling shall be corrected. Backfill operation shall be performed to comply with all rules and regulations and in such a manner that it does not create a nuisance or safety hazard.

D. If the Contractor requests approval to backfill material utilizing lifts and/or methods other than those specified herein, such request shall be in writing to the Owner. Approval will be considered only after the Contractor has performed test, at the Contractor's expense, to identify the material used and density achieved throughout the backfill area utilizing the method of backfill requested. The Owner's approval will be in writing.

3.05 UNSUITABLE MATERIAL

A. Where muck, rock, clay or other material within the limits of construction is, in the opinion of the Owner, unsuitable in its original position, the Contractor shall excavate such material and backfill the excavated area with suitable material, which shall be compacted and shaped to conform to the required section.

B. The Contract Documents indicate the general limits for the removal of unsuitable materials to be removed and replaced with suitable backfill. Any removal above and beyond the limits indicated required for construction of this project shall be considered as a part of the base contract. All unsuitable material shall be stockpiled onsite at a location determined by the Owner but within 1200 feet of the excavation.

3.06 SHEETING, SHORING AND BRACING OF TRENCHES

A. Install adequate sheeting and bracing to prevent damage to property and injury to persons. Comply with all applicable safety regulations and laws.

B. Remove sheeting when the trench has been backfilled to at least one-half its depth or when removal will not endanger proper pipe alignment or support.

C. When conditions or plans and specifications require that sheeting be left in place, cut off the top at an elevation 2.5 feet below finished grade, unless otherwise specified.

D. When the performance of the Work requires the use of shoring, sheet piling, bracing and other special construction related to excavation, the Contractor shall cause the design of said shoring, sheet piling and other special construction to be performed by a registered professional engineer licensed in the State of Florida. The Contractor shall submit, as a shop drawing, a certification by the registered engineer, stating that he has complied with this requirement.

3.07 TESTING

A. All testing as described below shall be performed by an independent laboratory. Coordinate and schedule all construction in accordance with the testing requirements.

B. Field density tests will be made in each vertical layer, and using the following approximate spacing:

1. Under berm structures, pavements, and slabs, one per 2,500 square feet with at least two per structure or area.

2. In trenches, one every 100 feet in continuous trenches under pavements or future pavements plus one at each intersection or one every 300 feet in continuous trenches not under pavements, plus one at each pavement or driveway crossing.

3. In all other areas, one 7,500 square feet.

C. If any field density tests are below the specified relative density, recompact or re-excavate, rebackfill and recompact the area until the specific density is obtained. A minimum of two field density tests per recompacted and/or re-excavated area will be performed to verify compliance with the specifications.

3.08 ACCEPTANCE

A. After the specified density tests have been successfully completed, the Owner or his representative may cross section the excavation and/or fill area to verify that the excavation or fill area conforms to the lines and grades shown on the plans and to determine quantities of material. Correct deviations from line and grade in excess of the tolerances specified at no expense to the Owner.

Table 02225-A

BACKFILL SCHEDULE FOR GRAVITY AND PRESSURE PIPING

Pipe Material	Pipe Size	Trench Condition	PIPE ENVELOPE					Others
			DEPTH	PRIMARY ZONE		SECONDARY ZONE		
			Material	Material	Depth(c)	Material	Depth	
Ductile Iron, Stainless Steel and Culvert Pipe	Less than 16"	Normal(a)	Compacted Common Fill	Coarse Sand	.5 O.D.	Coarse Sand	.5 O.D.+12"	
		Special(b)	Class I	Coarse Sand	.5 O.D. .5 O.D.	Coarse Sand	.5 O.D.+12"	
Prestressed Concrete Cylinder Pipe	Greater than or equal to 16"	Normal(a)	Class II	Common Fill	.25 O.D.	Common Fill	-	Class II Material should not have size less than 2". Organic content greater than 1.1% by weight.
		Special(b)	Class I	Common Fill	.25 O.D.	Common Fill	-	
Fiberglass, PVC and Other Plastic Pipe	Less than 6"	Normal(a)	Coarse Sand	Coarse Sand	.7 O.D.	Coarse Sand	.3 O.D.+6"	
		Special(b)	Class I	Coarse Sand	.7 O.D.	Coarse Sand	.3 O.D.+6"	
	Greater than or equal to 6"	Normal(a)	Class II	Class II	.7 O.D.	Class II	.3 O.D.+6"	
		Special(b)	Class I	Class II	.7 O.D.	Class II	.3 O.D.+6"	
R.C.P.	Less than 48"	Normal(a)	Class II	Class II	.5 O.D.	Common Fill	-	
		Special(b)	Class I	Class II	.5 O.D.	Common Fill	-	

Pipe Material	Pipe Size	Trench Condition	PIPE ENVELOPE					Others
			DEPTH	PRIMARY ZONE		SECONDARY ZONE		
			Material	Material	Depth(c)	Material	Depth	
Pipe laid in rock (min. trench requirements) except for fiberglass and PVC less than or equal to 6"		Rocks	Class I	Class II	.5 O.D.	Common Fill with max. stone size less than or equal to 2"	.5 O.D.+12"	
Gravity pipe (not specified above)		Normal	Coarse Sand	Coarse Sand	.5 O.D.	Common Fill	-	
Pressure pipe (not specified above)		Normal	Suitable Undisturbed Earth or Compacted Common Fill	Common Fill with max. stone size less than or equal to 2"	.5 O.D.	Common Fill with max. stone size less than or equal to 2"	.5 O.D.+12"	

(a) Dry soils.
(b) Saturated soils.
(c) Outside diameter of pipe = O.D.

Notes:

1. No special bedding shall be required in case of suitable undisturbed earth type trench bottom.
2. Bedding thickness shall be 6 inches unless specified otherwise.
3. The backfill shall be compacted to 98 percent modified proctor density near structures and under roads. In areas away from structures and not under roads, the backfill shall be compacted to 90 percent modified proctor density. Backfill shall be placed in 6-inch lifts for pipe envelope and in 12-inch lifts from secondary zone to grade. Common fill shall be used as final backfill material.
4. The Contractor shall remove unsuitable material below bedding level and replace with coarse sand or other acceptable stabilization method up to the bedding level.

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Excavating, backfilling and compacting for structures

B. Restore grades to required elevations

C. Stockpile excess material on-site

D. Pumping and dewatering

E. Sheeting of excavations

1.02 SUBMITTALS

A. Submit copies of a certification from an independent testing laboratory that borrow material used for all backfills, fills and structural backfills meets the specified criteria and contain less than 0.5 percent by weight asbestos.

1.03 QUALITY ASSURANCE

A. A testing laboratory provided on-site by the Owner will make such tests as are deemed advisable. The Contractor shall schedule his work so as to permit a reasonable time for testing before placing succeeding lifts and shall keep the laboratory informed of his progress. Costs for all testing requested by the Owner shall be paid for by the Owner.

1.04 JOB CONDITIONS

A. Test borings made on the site and the surface exploration data are separately bound and provided upon request with each set of Contract Documents and are for the Contractor's information ONLY.

1.05 TESTING AND INSPECTIONS

A. Method of Test: Density testing of the backfill shall be determined and completed in accordance with FDOT Section 125-8, except that tests shall be the Modified Proctor, ASTM D-1557 or AASHTO T-180.

B. Required Tests:

1. Backfill material: Determine suitability of backfill material not previously evaluated.

2. Maximum density tests: Determine optimum moisture content and maximum density of backfill materials placed and compacted.

3. Compaction Inspection: Determine degree of backfill compaction.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Backfill and fill shall be excavated material or borrow that is free from clayballs larger than 2 inches in their largest dimension and contains no more than 15 percent by weight passing the No. 200 sieve, no more organic matter (peat, humus, leaves, and carbon compounds) than 1 percent by weight, and no cobbles larger than 2 inches in their largest dimension. The gradation of this and or well graded sand and gravel mixture shall be such as to achieve the specified compaction.

B. Structural backfill shall consist of clean, fine to medium sand, contain less than 0.5 percent by weight asbestos or organic matter (peat, humus, leaves, and carbon compounds), and conform to the following gradation requirements:

Sieve Size (Square Openings)	Weight Percent Passing Square Mesh Sleeves
No. 4 (4.75 mm)	95 to 100
No. 10 (2.00 mm)	90 to 100
No. 40 (0.420 mm)	70 to 95
No. 60 (0.250 mm)	40 to 80
No. 100 (0.149 mm)	5 to 40
No. 200 (0.074 mm)	less than 5

C. All material shall contain less than 0.5 percent by weight asbestos.

2.02 WATER FOR COMPACTION

A. Water shall be free of acid, alkali, or organic materials and shall have a pH of 7.0 to 9.0. Provide all water needed for earthwork. Provide temporary piping, valves, and trucks to convey water from the source to the point of use. Provide any meters required if the water is taken from a public water system.

PART 3 - EXECUTION

3.01 PROTECTION

A. Protect public and adjacent properties, on- and off-site, in accordance with applicable laws and ordinances.

B. Protect from damage all existing on-site features, scheduled or indicated to remain, including flora, schedules to remain.

1. Do not allow earthmoving equipment within the branch spread perimeter (drip line) of existing trees.

C. Dust Control:

1. Throughout the entire construction period, effectively dust-palliate the working area, roadways, and involved portions of the site.

2. Palliation: Intermittent watering and sprinkling of such frequency as will satisfactorily allay the dust at all times. Chemical treatment of any type is not permitted.

D. Water Control:

1. Install and activate dewatering system sufficiently in advance of excavations so that construction areas are sufficiently dry for performance of excavation operations.

2. Operate systems on a 24-hour basis. Provide standby pumping facilities and personnel to maintain the continued effectiveness of the system.

3. Provide and operate dewatering system so that water will be lowered and maintained continuously at required levels for:

   a. Excavation stabiity
   b. Sheeting and bracing design
   c. Installation of waterproofing
   d. Backfilling
   e. Control of hydrostatic pressure
   f. Adequate placement and compaction of fill

4. If, in the Owner's opinion, the water levels are not being lowered or maintained in accordance with specification requirements and as determined by observation wells, Contractor shall install additional or alternate dewatering devices as necessary at no additional cost to Owner.

5. Locate temporary elements of the system so as to allow a continuous dewatering operation without interfering with construction of permanent work.

6. Where portions of the dewatering system are located in the area of permanent construction, Contractor shall submit to Owner for approval, details of the method he proposes to use to construct the permanent work in this facility.

7. Remove temporary facilities prior to completion of this work, unless otherwise directed by Owner.

8. Continue control of water for excavations until:

   a. Construction is sufficiently complete to provide adequate dead load to withstand the hydrostatic uplift of the normal ground water including maximum anticipated storm level.

   b. Concrete has reached sufficient strength to withstand earth and hydrostatic loads.

9. Do not discontinue dewatering operations without Owner's approval.

E. Cribbing and Shoring:

1. Provide temporary or permanent cribbing, sheeting, and shoring as necessary to safely retain earth banks and protect excavations from caving or other damage, all in accordance with all applicable codes and requirements.

2. Be responsible for design, installation, and maintenance of cribbing, sheeting, and shoring. Remove temporary cribbing and shoring after use.

3. All cribbing and shoring systems shall be designed by a State of Florida Registered Professional Engineer.

3.02 STRIPPING

A. Stockpile materials at locations designated by the Owner from excavations suitable for use in fill and backfill.

B. Remove materials, not approved for use as topsoil, fill or backfill, and excess excavating materials.

3.03 EXCAVATING

A. Excavate materials of every nature to dimensions and elevations indicated. Use equipment of suitable type for materials and conditions involved.

B. Extend excavation a sufficient distance from walls to allow for forming and shoring, application of waterproofing, installation of services and approvals. Do not excavate below indicated depths.

C. Correct unauthorized excavation made below depths indicated, as recommended by the Owner's soils and materials testing consultant, all at no additional cost to Owner.

3.04 FILL, BACKFILL, AND COMPACTION

A. Fill and Backfill: Place fill, backfill, and compact in accordance with FDOT Standard Specifications 125-8, except testing shall be the Modified Proctor (ASTM D-1557 or AASHTO T-180) and the following:

Subarticle 125-8.2.3 Following the last sentence of this subarticle add the following:

"Compaction within 3 feet of the back of abutments and wing walls shall be achieved using a power roller or plate less than 1000 pounds."

3.05 UNSUITABLE MATERIAL

A. Where muck, rock, clay or other material within the limits of construction is, in the opinion of the Owner, unsuitable in its original position, the Contractor shall excavate such material and backfill the excavated area with suitable material, which shall be compacted and shaped to conform to the required section.

B. The Contract Documents indicate the general limits for the removal of unsuitable materials to be removed and replaced with suitable backfill. Any removal above and beyond the limits indicated required for construction of this project shall be considered as a part of the base contract. Muck shall be stockpiled at locations designated by the Owner.

3.06 EXCAVATED MATERIAL

A. During excavation, place the excavated material only within the project area. Do not obstruct any roadways or streets. Conform to federal, state, and local codes governing the safeloading of trenches with excavated material. Separate suitable and unsuitable material.

3.07 DRAINAGE, EROSION AND SEDIMENTATION

A. Maintain all existing drainage patterns and control runoff from the construction area to prevent erosion, sedimentation, or flooding due to the construction.

3.08 TESTING

A. All testing as described below shall be performed by an independent laboratory retained by the Owner. Coordinate and schedule all construction in accordance with the testing requirements.

B. Field density tests will be made in each vertical layer, and using the following approximate spacing:

1. Under berm structures, pavements, and slabs, one per 2,500 square feet with at least two per structure or area.

2. In trenches, one every 100 feet in continuous trenches under pavements or future pavements plus one at each intersection or one every 300 feet in continuous trenches not under pavements, plus one at each pavement or driveway crossing.

3. In all other areas, one 7,500 square feet.

C. If any field density tests are below the specified relative density, recompact or re-excavate, rebackfill and recompact the area until the specific density is obtained. A minimum of two field density tests per recompacted and/or re-excavated area will be performed to verify compliance with the specifications.

3.09 ACCEPTANCE

A. After the specified density tests have been successfully completed, the Owner or his representative may cross section the excavation and/or fill area to verify that the excavation or fill area conforms to the lines and grades shown on the plans and to determine quantities of material. Correct deviations from line and grade in excess of the tolerances specified at no expense to the Owner.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work specified in this Section consists of measures required to control erosion on the project and in areas outside the right of way where work is accomplished in conjunction with the project, so as to prevent pollution of water, detrimental effects of public or private property adjacent to the project right of way and damage to work on the project. These measures will consist of construction and maintenance of temporary erosion control features or, where practical, the construction and maintenance of permanent erosion control features.

1.02 CONTROL OF CONTRACTOR'S OPERATIONS WHICH MAY RESULT IN WATER POLLUTION

A. Take sufficient precautions to prevent pollution of streams, canals, lakes, and other water impoundments, with fuels, oils, bitumens, calcium chloride, or other harmful materials. Conduct and schedule operations so as to avoid or otherwise minimize pollution or siltation of such streams, etc. and to avoid interference with movement of migratory fish. Do not dump the residue from dust collectors or washers into any water body.

B. Construction operations in rivers, streams, lakes, canals, and other impoundments shall be restricted to those areas where it is necessary to perform filling or excavation to accomplish the work shown in the Contract Documents and to those areas which must be entered to construct temporary or permanent structures. As soon as conditions permit, promptly clear canals, streams, and impoundments of all obstructions placed therein or caused by construction operations.

C. Except as necessary for construction, do not deposit excavated material in streams, canals, or impoundments, or in a position close enough thereto, to be washed away by high water or runoff.

D. Where pumps are used to remove highly turbid waters from enclosed construction areas such as cofferdams or forms, treat the water prior to discharge into State waters. Pump the water into grassed swales, appropriate vegetated areas, or sediment basins, or confine it by an appropriate enclosure such as siltation curtains when other methods are not considered appropriate. Do not contaminate state waters.

E. Do not disturb lands or waters outside the limits of construction, except as may be found necessary to complete the work.

1.03 START OF WORK

A. Prior to starting work, field survey and stake the limits of construction.

B. Obtain the Owner's Representative's approval of the field survey.

C. Install all silt fence, hay bales and enviro fence along the limits of construction as indicated on the Drawings.

D. Obtain the Owner's Representative, Reedy Creek Improvement District (RCID) and South Florida Water Management District (SFWMD) approval of the installed erosion and sedimentation control measures.

E. Initiate clearing and grubbing operations.

PART 2 - PRODUCTS

2.01 GENERAL

A. No testing of materials used in construction of temporary erosion control features will be required.

B. Materials used for the construction of the temporary erosion and sedimentation control measures not to be incorporated into the completed project may be new or used.

PART 3 - EXECUTION

3.01 GENERAL

A. Temporary erosion control features shall consist of, but not be limited to, temporary sodding, sandbagging, slope drains, sediment basins, artificial coverings, berms, baled hay or straw, floating silt barriers, staked silt barriers and staked silt fences. Design details for some of these items may be found in the Water Quality Section of the applicable edition of the FDOT Roadway and Traffic Design Standards.

B. Incorporate permanent erosion control features into the project at the earliest practical time. Correct conditions, using temporary measures, that develop during construction to control erosion prior to the time it is practical to construct permanent control features.

C. Construct temporary and permanent erosion and sediment control measures to prevent the pollution of adjacent water ways in conformance with the laws, rules and regulations of Federal, State and local agencies.

3.02 INSTALLATION

A. Temporary Sod: This work shall consist of furnishing and placing sod in accordance with Section 02934, Sodding.

B. Sandbagging: This work shall consist of furnishing and placing sandbags in configurations, so as to control erosion and siltation.

C. Slope Drains: This work shall consist of constructing slope drains, utilizing pipe, fiber mats, rubble, cement concrete, asphaltic concrete plastic sheeting, or other acceptable materials, in accordance with the details shown in FDOT's Roadway and Traffic Design Standards or as may be approved as suitable to adequately perform the intended function.

D. Sediment Basins: Sediment basins shall be constructed in accordance with the details shown in FDOT's Roadway and Traffic Design Standards or as suitable to adequately perform the intended function. Sediment basins shall be cleaned out as necessary.

E. Artificial Coverings: This work shall consist of furnishing and applying fiber mats, netting, plastic sheeting, or other approved covering to the earth surfaces.

F. Berms: This work shall consist of construction of temporary earth berms to divert the flow of water from an erodible surface.

G. Baled Hay or Straw:

1. This work shall consist of construction of baled hay or straw dams to protect against downstream accumulations of silt. The baled hay or straw dams shall be constructed in accordance with the details shown in FDOT's Roadway and Traffic Design Standards.

2. The dam shall be placed so as to effectively control silt dispersion under conditions present on this project. Alternate solutions and usage of materials may be used if approved.

H. Temporary Silt Fences and Staked Silt Barriers: This work shall consist of furnishing, installing, maintaining and removing staked turbidity barriers in accordance with the manufacturer's directions, these specifications and the details as shown in FDOT's Roadway and Traffic Design Standards.

I. Floating Silt Barriers: This work shall consist of installing, maintaining, and removal of floating silt barriers to contain turbidity that may occur as the result of dredging, filling, or other construction activities in waters of the State. The type barrier used, the deployment and maintenance of the barrier will be such as to minimize dispersion of turbid waters from the construction site. Alternate methods or materials may be used provided that compliance with applicable permit conditions and State water quality standards are maintained.

J. Enviro Fence: This work shall consist of furnishing, installing, maintaining and removing staked geo-grid fence in accordance with these specifications, the Drawings, and the manufacturer's recommendations.

3.03 REMOVAL OF TEMPORARY EROSION CONTROL FEATURES

A. In general, remove or incorporate into the soil any temporary erosion control features existing at the time of construction of the permanent erosion control features in such a manner that there will be no detrimental effect.

3.04 MAINTENANCE OF EROSION CONTROL FEATURES

A. General: Provide routine maintenance of permanent and temporary erosion control features until the project is completed and accepted.

3.05 PROTECTION DURING SUSPENSION OF CONTRACT TIME

A. In the event that it is necessary that the construction operations be suspended for any appreciable length of time, shape the top of the earthwork in such a manner as to permit runoff of rainwater and construct earth berms along the top edges of embankments to intercept runoff water. Provide temporary slope drains to carry runoff from cuts and embankments which are located in the vicinity of rivers, streams, canals, lakes, and impoundments. Should such preventive measures fail, immediately take such other action as necessary to effectively prevent erosion and siltation.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide portland cement concrete for structures as shown on the Drawings and specified herein.

1.02 SPECIFICATIONS

A. Provide all portland cement concrete in full compliance with the applicable provisions of FDOT Standard Specifications for Road and Bridge Construction, 1991 Edition Section 345.

B. Place, finish and cure concrete in full compliance with FDOT Specifications Section 400, Concrete Structures, as amended by any FDOT Supplemental Specifications and Special Provisions.

1.03 PAYMENT

A. Payment for the work will be made as set forth in the Bid Proposal.

PART 2 - PRODUCTS

2.01 GENERAL

A. Comply with referenced FDOT Specifications.

PART 3 - EXECUTION

3.01 GENERAL

A. Comply with referenced FDOT Specifications.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide reinforcing steel as shown on the Drawings and specified herein.

1.02 SPECIFICATIONS

A. Provide and place reinforcing steel in full compliance with the applicable provisions of FDOT Standard Specifications for Road and Bridge Construction, 1991 Edition, (FDOT Specifications), Section 415, Reinforcing Steel, as amended by Supplemental Specifications 415, Reinforcing Steel, dated 4-15-91, and 415, Reinforcing Steel Bar Supports, dated 6-12-91, and any subsequent FDOT revisions thereto.

1.03 PAYMENT

A. Payment for the work will be made, as set forth in the Bid Proposal.

PART 2 - PRODUCTS

2.01 GENERAL

A. Comply with referenced FDOT Specifications.

PART 3 - EXECUTION

3.01 GENERAL

A. Comply with referenced FDOT Specifications.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work under this section includes the construction of miscellaneous site structures including but not limited to drainage structures, catch basins, inlets, manholes, retaining walls, bridges and valve vaults.

1.02 QUALITY ASSURANCE

A. Reference specifications and standards:

1. Standard Specifications for Road and Bridge Construction, 1991 edition, as amended, issued by FDOT.

1.03 SUBMITTALS

A. Manufactured Items: Submit manufacturer's brochures and technical data for approval

B. Shop Drawings: Submit for shop fabricated items

1.04 TESTS AND INSPECTIONS

A. Portland Cement: Furnish cement mill test reports and manufacturer's certification that cement complies with specification requirements.

B. Required Tests:

1. Hardrock Aggregate: Test by approved testing laboratory in accordance with ASTM C 33.

2. Limerock Aggregate: Test by approved testing laboratory for conformance to local acceptable standards and specified requirements.

   a. Do not deliver aggregates (hardrock and limerock) to site, or to ready-mix plant until pit source has been approved, and plant, capacity, and ability to produce a uniform and continuous product has been verified.

   b. Take samples from aggregate stockpiles assigned to project.

3. Slump Tests: Make one slump test in accordance with ASTM C 143 for each set of test cylinders. Make additional tests as may be ordered by Owner.

   a. Make and keep an accurate record of all tests.

   b. Maximum Slumps: As specified in Article 2.02 of this section.

4. Test Cylinders: Take one sample of four cylinders from each day's placement of 100 cubic yards or fractional part thereof of each mix design. Take samples as concrete is deposited in forms. Mark cylinders with date, sample number, and point in structure from which sample was taken. Do not take more than one sample (four cylinders) from any point or batch of concrete.

   a. Make and store cylinders in accordance with ASTM C 31.

b. Curing: At end of 24 hours, take cylinders to laboratory, and store under moist curing conditions at approximately 70 degrees F until tested.

c. Testing: Test cylinders in accordance with ASTM C 39. Test cylinders at age of 7 days and 28 days.

(1) Seven-day strength: Not less than 60 percent of specified ultimate 28-day strength.

d. Mix Adjustment: Should test results indicate concrete strength below specified 7-day or 28-day minimum requirements, laboratory will adjust six proportions in future batches as necessary to achieve specified minimum requirements.

e. Concrete Failures: Should test results show that concrete strength requirements for any portion of work falls below 28-day minimum requirements, secure core or prism specimens of hardened concrete and test in accordance with ASTM C 42.

(1) Laboratory will secure and test specimens under Owner's direction.

C. Ready-mix Plant Inspections: Testing laboratory will provide and maintain continuous inspection at plant to check sieve analysis for quality and moisture content of aggregates, check mix with design mixes, check cement being used with test reports, check loading of mixer trucks, and certify quantities of materials loaded in each mixer truck.

1. Certification: Provide batch tickets signed by the dispatcher and the laboratory inspector at the ready-mix plant. Each batch ticket shall state batch quantities of cement, water, fine aggregates, coarse aggregates and admixture contained in each truck load.

    a. Deliver to Owner's representative on job site a properly signed ticket with each load of ready-mix concrete.

1.05 PROJECT CONDITIONS

A. Weather Limitations:

1. Do not place concrete when the atmospheric temperature is as low as 40 degrees F or expected to go below that temperature within 24 hours.

2. No concrete shall be placed when the temperature of the concrete exceeds 90 degrees F. The Contractor will be required to control the temperature of the concrete mix when it exceeds this limit. The proposed method of control shall be approved by the Owner.

3. Do not place concrete during any rain that will cause surface damage to the concrete.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete, cement, admixtures, natural dense aggregate, fine aggregates, coarse aggregates, grading and use of concrete: In accordance with Sections 345, 901, 902, 921 and 924 of FDOT Standard Specifications 1991 edition.

B. Curing Materials: In accordance with Section 925 of FDOT Standard Specifications, 1991 edition.

C. Joint Materials: In accordance with Sections 931 and 932 of FDOT Standard Specifications, 1991 edition.

D. Waterstops: Type and size indicated on Drawings.

1. If type not indicated on Drawings, provide extruded dumbbell type, spliced by thermal butt fusion.

E. Miscellaneous Materials: As required to complete the Work.

2.02 CONCRETE MIXES

A. Use only mixes designed by a Testing Laboratory approved by the Owner. Concrete shall develop ultimate compressive strength at 28 days equal to that noted on Drawings for class of concrete specified.

2.03 GRADING AND USES OF CONCRETE

A. Refer to Drawings. Conform to FDOT Section 345.

1. Conform to design mix prepared by Laboratory for proportions.

2. Mix concrete only in quantities for immediate use.

3. Do not retemper, or use partially set concrete.

2.04 CEMENT GROUT AND DRYPACK

A. Cement Grout: Mix one volume Portland cement, 2 ½ volumes fine aggregate, and enough water for required consistency. Depending on use, consistency may range from mortar consistency to a mixture that will flow under its own weight. Use for leveling, preparing setting pads or beds, for filling non-structural voids, and similar uses. Do not use for grouting under bearing plates or structural members in place.

B. Drypack: Mix one volume Portland cement, two volumes fine aggregate and enough water to hydrate cement and provide a mixture that can be molded with the hands into a stable ball (a stiff mix). Do not mix more than can be used in 30 minutes. Use for drypacking under bearing plates and structural members, for patching tie holes, honeycomb and large surface defects in concrete.

C. Non-shrink grout: Acceptable compounds and manufacturers.

1. Master Flo 713 by Master Builder Company.

2. Five Star Grout by U.S. Grout Corporation.

PART 3 - EXECUTION

3.01 INSPECTION

A. Assure that excavations and form work are completed, and that excess water is removed.

B. Check that reinforcement is secured in place.

C. Verify that expansion joint materials, anchors, and other embedded items are secured in position.

D. Owner or Owner's Authorized Representatives shall observe all formwork and reinforcement placement before placement of concrete.

3.02 SITE STRUCTURES

A. Construct catch basins, manhole bases, junction boxes, inlets, and other similar site structures to conform to requirements of FDOT Section 425, Inlets, Manholes, and Junction Boxes, 1991 edition.

B. Construct other concrete site structures in accordance with requirements of FDOT Section 400, Concrete Structures, 1991 edition.

C. Formwork shall conform to FDOT Section 400. Formwork for wingwalls, abutment walls, and retaining walls shall be designed by a Professional Engineer registered in the State of Florida.

3.03 PROTECTION OF COMPLETED WORK

A. During curing period, protect concrete from damaging mechanical disturbances, water flow, loading shock, and vibration.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work under this section includes furnishing and installing storm drainage pipe and appurtenances, excavation, backfilling, modifications to existing drainage structures, and other incidental work in connection with this construction.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions and Division 1 showing the materials to be used and manufacturer's certificates (for pipe, curing compound, gaskets, bituminous coating, fasteners) showing compliance with the specifications.

PART 2 - PRODUCTS

2.01 PIPE

A. Reinforced Concrete Pipe: FDOT Standard Specifications, 1991 edition, Section 941.

B. Corrugated Metal Pipe (CMP) shall be aluminized steel Type 2 spiral rib pipe with corrugation pattern of 3/4" x 3/4" x 7-1/2". The pipe shall conform to current ASTM A760 and A-A819 specifications. The gage for spiral rib pipe shall be in accordance with FDOT Roadway and Traffic Design Standards Index 205, dated January 1992.

C. Polyvinyl Chloride Pipe: FDOT Standard Specifications 1991 Edition, Section 948.

2.02 PIPE GASKETS

A. Pipe Gaskets: Pipe gaskets shall conform to the requirements of FDOT Standard Specifications 1991 Edition, Section 942.

2.03 JOINT MATERIALS

A. Joint materials shall be as specified in FDOT Specifications Section 430-7 through 430-11 for the particular type of pipe and conditions of usages as specified.

B. Jointing for corrugated metal pipe shall be as specified above, except that the following shall be required:

Joints shall be made with bands of the same base metal and corrugation as the pipe. Bands shall not be less than 12 inches wide for pipe up to and including 36-inch diameter, and not less than 24 inches for pipes larger than 36-inch diameter. Bands may be one- or two-piece lap type. Joints shall include an asphalt base sealer or neoprene gasket 12 inch width. The band shall be tightened in a manner such that all joints are watertight. Helical pipe shall have re-rolled annular ends.

C. All concrete pipe joints shall be wrapped with a three foot wide strip of FDOT approved filter fabric, with the ends taped a minimum of one foot.

2.04 PLASTIC FILTER FABRIC

A. Plastic filter fabric shall conform to Section 985 of the FDOT Standard Specifications, unless otherwise designated on the Drawings.

PART 3 - EXECUTION

3.01 PREPARATION

A. Pipe Trenches:

1. Pipe trenches shall be of necessary widths for the proper laying of the pipe and the banks shall be as nearly vertical as practicable. In paved areas the trench shall be vertical and sheets, if required; the clearance between the pipe and trench wall or back of sheeting shall not exceed 18 inches. The bottom of the trenches shall be excavated to a depth of the outside bottom of the pipe barrel. Any over excavation shall be replaced with suitable compacted material. Excavation for inlets and other appurtenances shall be sufficient to provide a clearance between their outer vertical surfaces and the face of the excavation or sheeting, if used, of not less than 12 inches.

2. Soft, spongy, or otherwise unstable material encountered below the established grade of the excavation which will not provide a firm foundation for subsequent work shall be removed and replaced as directed. Unless otherwise directed, all such unstable materials shall be removed for the full width of the excavation and replaced with approved fill material.

3. Where sheeting and bracing are necessary to prevent caving of the trench sidewalls, and to safeguard the workmen, the trench or excavation for other structures shall be dug to such width that the proper allowance is made for the space occupied by the sheeting and bracing to provide clearance as specified above.

3.02 INSTALLATION

A. Laying Concrete Pipe:

1. All pipe shall be carefully laid true to the line and grade shown on the Drawings. Any deviation from true alignment or grade which would result in a displacement from the normal position of the gasket of as much as 1/4 inch, or which would produce a gap exceeding 1/2 inch between sections of pipe for more than 1/3 of the circumference of the inside of the pipe, will not be acceptable and where such occurs, the pipe shall be relayed without additional compensation. No mortar, joint compound, or other filler which would tend to restrict the flexibility of the gasket joint shall be applied to the gap. Pipes having defects that have not caused their rejection are to be so laid that these defects will be in the upper half of the sewer.

2. Before installation of the pipe gasket, the gasket and the surface of the pipe joint, including the gasket recess shall be clean and free from grit, dirt, or other foreign matter at the time the joints are made. In order to facilitate closure of the joint, application of an approved vegetable soap lubricant immediately prior to closing of the joint will be permitted.

3. All pipes shall be laid with bells or grooves uphill. As the pipes are laid throughout the work, they must be thoroughly cleaned and protected from dirt and water. No length of pipe shall be laid until the two preceding lengths have been thoroughly embedded in place so as to prevent any movement or disturbance of the finished joint. No walking on or working over the pipes after they are laid, except as may be necessary in tamping earth and refilling, will be permitted until they are covered to a depth of 1 foot. Fill placed around the pipe shall be deposited on both sides simultaneously to approximately the same elevation and uniformly compacted. Whenever the pipe laying is discontinued, as at night, the unfinished end is to be securely protected from displacement due to caving of the banks or from other injury and a suitable stopper is to be insert therein.

B. Laying Corrugated Pipe:

1. All corrugated pipe shall be carefully laid, true to the line and grade shown on the Drawings. The pipe gasket and coupling band shall be centered over the joint with the coupling band bolts securely tightened without cutting the gasket.

2. Fill placed around the pipe shall be deposited on both sides simultaneously to approximately the same elevation and uniformly compacted. Whenever the pipe laying is discontinued, as at night, the unfinished end is to be securely protected from displacement due to caving of the banks or from other injury and a suitable stopper is to be inserted therein.

C. Backfilling for Pipe Culverts:

1. After the pipe has been installed, approved selected material from excavation at a moisture content which will facilitate compaction shall be placed along side of the pipe in layers not exceeding 6 inches loose measure in depth. Care shall be taken to insure thorough compaction of the fill of the haunches of the pipe. Each layer shall be thoroughly compacted by rolling or tamping with mechanical rammers. This method of fill and compacting shall be continued until the fill is 12 inches above the pipe, then the remainder of the backfill shall be placed in lifts not exceeding 9 inches. The operation of heavy equipment shall be conducted so that no damage to the pipe will result. Backfill material 12 inches and above the top of the pipe shall be compacted to a density as shown on the Drawings. Selected material for backfill shall not contain any stones or rock larger than 3 inches.

3.03 LAMPING

A. After the pipe has been installed and the compacted backfill placed up to top of subgrade or final grade, "lamp" in the presence of the Owner's Representative the installed drainage pipe between manholes, inlets or other structures in order to ascertain that they are clear and to correct alignment. The diameter of lamp image shall have no vertical reduction from that of the pipe inside vertical diameter and not more than 20 percent horizontal reduction.

B. Provide assistance to the Owner or his representative as necessary to lamp the pipes. If lamping indicates any faulty installation of the pipe, or dirt or debris in the pipe or structures, clean, repair or replace the pipe at no additional cost to the Owner.

3.04 FIELD TEST FOR INFILTRATION

A. It is the intent of the plans and specifications that the completed system (manholes and pipes) be watertight.

B. Test each section of pipe and manhole for infiltration subsequent to lamping. Provide all materials required for the tests. Compete the tests in the presence of the Owner's Representative.

C. Discontinue pumping of groundwater for at least five days. After the groundwater has stabilized, review each pipe section and manhole for noticeable indications of infiltration. Stop and repair all individual leaks that are observed. Remove and replace sections of pipe with significant infiltration, as directed by the Owner's Representative.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work specified under this section consist of the construction of underdrains in conformity to the lines, grades, notes and typical cross-sections shown in the plans and as directed by the Owner.

1.02 SPECIFICATIONS

A. Provide an underdrain system complying with the applicable provisions of FDOT Standard Specifications for Road and Bridge Construction, 1991 Edition, (FDOT Specifications), Section 440.

1.03 PAYMENT

A. Payment for the work will be made as set forth in the Bid Proposal.

PART 2 - PRODUCTS

2.01 GENERAL

A. Comply with referenced FDOT Specifications

PART 3 - EXECUTION

3.01 GENERAL

A. Comply with referenced FDOT Specifications

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. The work under this section consists of construction of riprap, composed of sand and cement, concrete block or rubble, as called for in the Plans. The riprap shall be placed against the embankment or other work to be protected, in conformity with the lines, grades, dimensions, and notes shown in the Plans. Riprap shall include geotextile filter fabric. No colored concrete shall be used.

1.02 SPECIFICATIONS

A. Provide riprap, geotextile filter fabric and other related material in accordance with the applicable provisions of FDOT Standard Specifications for Road and Bridge Construction, 1991 Edition, (FDOT Specifications), Section 530.

1.03 PAYMENT

A. Payment for the work will be made as set forth in the Bid Proposal

PART 2 - PRODUCTS

2.01 GENERAL

A. Comply with referenced FDOT Specifications

PART 3 - EXECUTION

3.01 GENERAL

A. Comply with referenced FDOT Specifications

END OF SECTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Furnish all labor, equipment, material, and transportation and perform all work necessary to complete excavation, backfilling and grading as required for the construction of the erosion control mattress as shown on the Drawings and as specified herein.

1.02 SUBMITTALS

A. Manufactured Items: Submit manufacturer's brochures and technical data of the material to be used and the method of installation in sufficient detail to demonstrate that the finished product will meet all the quality and properties stated herein.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Structural mortar shall consist of a mixture of portland cement, aggregate, and water so proportioned and mixed as to provide a pumpable slurry in which solids will remain in suspension without appreciable water gain. Pozzolan and grout fluidifiers conforming with these specifications may be used at the option of the Contractor.

Suggested Mix Proportion:

Portland Cement	800 lbs.
Sand	2,200 lbs.
Water	50 gal.

B. Portland cement shall conform to current ASTM Standards C-150.

C. Pozzolan, if used, shall be finely divided material composed essentially of compounds of amorphous silica, alumina and iron which possesses the property of combining with lime liberated during the process of hydration of portland cement, and shall conform to ASTM C-350.

D. Water shall be fresh, clean, and free from injurious amounts of sewage, oil, acids, alkali, salts, or organic materials.

E. Aggregate shall meet the requirements of current ASTM Standards C-33, except as to grading. Aggregate grading shall be reasonably consistent and shall be well graded from the maximum size which can be conveniently handled with pumping equipment available.

F. Fabric material shall be multiple panels of double layer fabric joined in a mattress configuration.

FABRIC DESCRIPTION

	Filter Point	Uniform Cross Section Configuration	Fiber
Warp-Top & Bottom, Ends/in.	22	22	850 den. Nylon 66
Fill - Top & Bottom	22	22	965 den. Cordura
Drop Stitches	--	--	1300 den. Nylon 66
Approx. Wt. oz./yd.	11.7	22.2	
Ship Wt. lbs./1,000 ft.	82	157	
Ship Vol. ft./1,000 ft.	5.2	12.1	

FABRIC TEST DATA

Tensile Strength - Warp & Fill	Min. 200#/in.	ASTM D-1682-75
Porosity	Min. 100 ft./Min.	ASTM D-737-75

1. Filter point mattresses shall be formed by joining together two layers of fabric by weaving the two layers together at uniform spacings, either 5 inches, 8 inches, or 10 inches. The style of the weaving at the filter point shall be no less permeable than that of a 40 x 40 count gasket weave of 1030 denier filament nylon.

Style	Woven Filter Point O.C.	Nominal Thickness	Weight #/S.F.
5" Filter Point	5"	2 1/4"	27 lbs
8" Filter Point	8	3 1/2"	42 lbs
10" Filter Point	10"	6"	72 lbs

2. Uniform cross section mattresses shall consist of multiple panels of double layer fabric joined together by interwoven ties of uniform length and spaced on 3-inch centers. The two fabric layers shall each be no lighter than 20 x 20 count per inch. The fabric shall be plain weave. Minimum denier shall be 840 filament and 965 bulked filament.

Style	Woven Filter Point O.C.	Nominal Thickness	Weight #/S.F.
2" Uniform N	2"	3" x 3"	24 lbs
3" Uniform N	3"	3" x 3"	36 lbs
4" Uniform N	4"	3" x 5"	48 lbs
6" Uniform N	5"	3" x 5"	72 lbs

PART 3 - EXECUTION

3.01 INSTALLATION

A. Compact and grade areas to receive erosion control mattress to the elevations shown on the Drawings.

B. Place fabric panels in position at their design location. Panels shall be joined edge-to-edge by field sewing the bottom layers of fabric together and the two top layers together.

C. Pump or injection portland cement slurry to form a stable mattress to the elevations shown on the Drawings.

D. Restore and regrade the area disturbed by construction to the original condition or to the proposed grades as applicable.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1, General Requirements, are a part of this section.

1.02 DESCRIPTION

A. This section specifies materials and work required to construct concrete walks and ramps.

1.03 STANDARDS

A. ANSI/ASTM

B. American Concrete Institute (ACI)

1.04 QUALITY INSURANCE

A. Contractor shall have a minimum of five years experience at installing architectural concrete and special poured-in-place concrete paving. Provide a list of references and completed projects which best represent your work.

1.05 SUBMITTALS

A. Products:

1. Submit certificate, signed by concrete producer and contractor, stating Portland cement concrete complies with this specification.

1.06 ON-SITE SAMPLES

A. Concrete sample panels:

1. Provide 8 foot by 8 foot sample panel for pavement specified. Provide a sample section of concrete which includes walks and one ramp.

1.07 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Schedule operations to avoid unnecessary rehandling.

B. Storage:

1. General:

a. Store in accordance with manufacturer's recommendations and as noted.

2. Portland Cement:

a. Store on platforms above ground and protect from adverse environmental conditions.

3. Aggregates:

   a. Store to prevent foreign material contamination.

4. Utility Joint Materials and Lubricants:

   a. Store in cool and dry location free of oil, grease, excessive heat and direct sunrays.

C. Handling:

1. General:

   a. Comply with manufacturer's recommendations and as noted.

2. Aggregates:

   a. Handle to prevent segregation.

1.08 PROJECT CONDITIONS

A. Limitations:

1. Underground Utilities:

   a. Do not proceed with concrete construction until underground construction is complete; including irrigation sleeving work.

2. Curbing:

   a. Do not proceed with concrete walk construction until adjacent or adjoining curb construction is complete.

PART 2 - PRODUCTS

2.01 FORMS

A. Straight or Tangent Walks:

1. Steel

2. Contractor's option: Wood

3. Slip-forming

B. Curved Walks:

1. Flexible spring steel

2. Contractors option: Laminated wood

3. Slip-forming

2.02 CONCRETE

A. Concrete Walks and Steps:

1. Portland cement

a. Class "A" Concrete: ANSI/ASTM C150

(1) Type: II A

b. Class "B" Concrete: ANSI/ASTM C150

(1) Type: II

c. High early strength concrete: ANSI/ASTM C150

(1) Type: III

2. Fine aggregate: ANSI/ASTM C33

3. Coarse aggregate: ANSI/ASTM C33

a. Size number: 67 (3/4 inch to No. 4)

4. Admixtures:

a. Air-entraining: ASTM C260

b Water Reducing: ASTM C494, Type A

c. Accelerator: Nonchloride, ASTM C494, Type C or E
d. Retarder: ASTM C494, Type B or D

5. Water: Clean and free of oil, acid and injurious amounts of vegetable matter, alkalies and salts.

a. River, stream and lake water: prohibited

6. Forms: ACI 347-68

B. Mixes:

1. Concrete Walks: Class "A" concrete

a. 28-day compressive strength: 2800 PSI

b. Air entrainment: Four to six percent

c. Mix contents:

(1) Portland Cement: Five bags (470 lbs.) per cubic yard

(2) Water: 5 1/4 gallons per bag of cement

d. Slump: Not to exceed five inches

2.03 CONCRETE REINFORCEMENT

2.04 JOINT MATERIALS

A. Expansion and isolation joints: AASHTO M33

1. Type: Bituminous preformed joint filler

2. Nominal Thickness: 1/2 inch

2.05 CURING MATERIAL

A. Mat Method:

1. Burlap Mats: AASHTO M182

a. Class: 1

B. Sheet Method:

1. Waterproof Paper: ASTM C171

a. Type: White

2. Contractor's Option: ASTM C171 polyethylene film
a. Type: White opaque

2.06 MISCELLANEOUS PRODUCTS

A. Form Release Compound:

1. Type: Nonstaining, approved by the Owner's Representative

B. Cement Mortar: AASHTO M85

1. Type: 1A

2. Color to match concrete walk

PART 3 - EXECUTION

3.01 PROTECTION AND RESTORATION

A. Concrete:

1. Protect completed concrete from damage.

2. Restore damaged concrete as directed by the Owner's Representative.

3.02 SUBGRADE PREPARATION

A. General:

1. Paved areas, Section 02200: Earthwork and as noted.

2. Verify utility casting elevations and reset or adjust to meet flush with finished concrete surface.

B. Concrete Walk:

1. Verify subgrade elevations and correct discrepancies before proceeding with the following:

   a. Concrete placement

2. Do not place the following on wet or muddy subgrade:

   a. Concrete base

3. Dampen subgrade if dry prior to placement of concrete.

3.03 FORMS

A. General:

1. Clean and coat forms with form release compound, prior to use.

2. Install forms to lines, grades and elevations indicated or as specified.

3. Brace forms to prevent movement during concrete placement.

4. Formwork shall be reviewed and approved by the Owner's Representative prior to placement of concrete.

5. Slip-forming of concrete walks is allowed.

3.04 EXPANSION AND ISOLATION JOINTS

A. General:

1. Install expansion joints as indicated or specified.

2. Place expansion joints perpendicular to concrete surface.

3. Place expansion joints with top edge 1/4-inch below concrete surface.

4. Caulk immediately to prevent water seepage to subgrade

3.05 CONTRACTION (CONTROL) JOINTS

A. General:

1. Provide contraction (control) joints at eight foot intervals or as indicated.

2. Form contraction joints, perpendicular to concrete surface, with removable 1/8 inch form spreader plates.

   a. Contractor's option: form contraction joints with 3/4 inch jointing tool.
   b. Where indicated or specified, saw contraction joints, to 1-1/2 inch depth, 12 hours after concrete placement.

3.06 CONCRETE PLACEMENT

A. General:

1. Place concrete in forms in one uniform layer.

2. Consolidate concrete by tamping, spading or vibrating to prevent honeycombing.

3. Place and consolidate concrete carefully to prevent joint material dislocation.

3.07 FINISHING

A. General:

1. Strike off top surfaces to top of forms and to smooth and uniform texture.

2. Remove joint support channel when concrete attains initial set.

3. Finish edges and joints with 1/8 inch radius edging tool.

4. Maintain forms in place 12 hours after concrete placement.

5. Correct defects (e.g. holes, honeycomb areas, broken edges, etc.) upon removal of forms, with cement mortar.

B. Finishing methodology may be modified in order to achieve desired appearance. Obtain approval for finishes from Owner's Representative prior to beginning concrete walks and ramps work.

C. Paving Finish Schedule:

1. Concrete walks: Light broom finish

2. Handicap ramps: As presented in the Drawings

3.08 CURING

A. Mat Method:

1. Moisten mats thoroughly with water placing on concrete.

2. Place mats on exposed concrete surfaces with six inch joint overlaps.

3. Maintain mats in continuously moist condition for seven calendar days.

4. Repair or replace damaged mats.

B. Contractor's Option: Sheeting Method

1. Moisten concrete surfaces with a fine spray of water before sheeting placement.

2. Place sheeting on exposed concrete surfaces with light-colored side up and 12-inch joint overlaps.

3. Anchor sheeting securely in place.

4. Maintaining sheeting in place for seven calendar days.

5. Repair or replace damaged sections of sheeting.

C. Membrane Curing Compound Method:

1. Apply membrane-forming curing compound to damp concrete surfaces as soon as possible (but no later than 2 hours) after final finishing operations are complete. Apply uniformly in a 2-coat continuous operation by power spray equipment of rollers in accordance with the manufacturer's recommendations. Recoat areas which are subjected to heavy rainfall within 3 hours after initial application. Maintain the continuity of the coating and repair damage to the coat during the entire cure period.

2. Do not use membrane curing compounds on surfaces which are to be covered with a coating material applied directly to the concrete or with a covering material bonded to the concrete, such as other concrete, floor hardener/sealer, waterproofing, dampproofing, flooring, painting, and other coatings and finish materials, unless otherwise approved by the Owner's Representative.

3.09 TESTING

A. Conduct the following:

1. Walk Horizontal Level Alignment Test:

a. Tolerance: Not to exceed 1/2-inch between any two contacts on 10 foot straightedge, except along horizontal curves.

b. Test locations: Random and determined by the Owner's Representative.

c. Test observation: By the Owner's Representative.

2. Walk Surface Smoothness Test:

a. Tolerance: Not to exceed 3/8 inch between any two surface contacts on 10 foot straightedge.

b. Test locations: Random and determined by the Owner's Representative.

c. Test observation: By the Owner's Representative.

B. Corrective Work:

1. Correct work not conforming to specified tolerances as directed by the Owner's Representative at no additional cost to the Owner.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

The work shall include, but not be limited to, the following:

A. Brick pavement on walkways, with concrete base and sand setting bed with sand-swept, hand-tight joints

B. Brick pavement on steps and ramps with mortar setting beds and joints

C. Site inspection and preparation

D. Base preparation for laying of pavers

E. Installation of brick masonry pavers indicated on the drawings

F. Cleanup, inspection, and review

G. Guarantee of all brick paving work

1.02 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1, General Requirements, are a part of this section.

1.03 REFERENCES

A. ASTM C67 - Method for Sampling and Testing Brick and Structural Clay Tile.

B. ASTM C902 - Pedestrian and Light Paving Brick.

C. ANSI A62.3 - Standard Sizes of Clay and Concrete Modular Masonry Units.

1.04 SUBMITTALS

A. Submit manufacturer's product data for each type of paving brick setting bed, mortar and adhesives required.

B. Submit a minimum of five full size samples of each type of paving brick. Include the full range of exposed finish, color and texture proposed for the work.

C. Submit samples of colored dry mix mortar selected for the work.

D. Test Reports:

1. Test reports for each type of building and facing brick are to be submitted to the Owner's Representative for approval.

2. Testing and reports are to be completed by an independent laboratory.

3. Test reports shall show:

a. Compressive strength

b. 24-hour cold water absorption
c. 5-hour boil absorption
d. Saturation coefficient
e. Initial rate of absorption (suction)

1.05 QUALITY ASSURANCE

A. Brick Tests:

1. Test in accordance with ASTM C 67 with the following additional requirements:

a. If the coefficient of variation of the compression samples tested exceeds 12%, obtain compressive strength by multiplying average compressive strength of specimens by:

$$\frac{1-1.5\ (\ v\ -\ 0.12)}{100}$$

where v is the coefficient of variation of sample tested.

b. Cost of test of units after delivery shall be borne by the purchaser, unless tests indicate that units do not conform to the requirements of the specifications, in which case cost shall be borne by the seller.

B. Furnish Sample Panel for each type of brick paving required:

1. Approximately 4 feet (1.2 m) long by 3 feet (1 m) wide, showing the proposed color range, texture, bond, mortar and workmanship. All brick shipped for the sample shall be included in the panel.

2. Layout panel in the presence of the Owner's Representative before installation of materials.

3. When required, provide a separate panel for each type of brick or mortar.

4. Do not start work until Owner's Representative has accepted sample panel.

5. Use panel as standard of comparison for all masonry work built of same material.

6. Do not destroy or move panel until work is completed and accepted by Owner.

C. The Contractor shall have prior experience in installation of brick masonry paving. Contractor shall supply Owner's Representative with documentation on past work experience.

D. Do not change source or brands of paving material during the course of the work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in manufacturer's unopened and undamaged containers with labels intact and legible.

B. Store brick off ground to prevent contamination by mud, dust, or materials likely to cause staining or other defects.

C. Cover materials when necessary to protect from elements.

1.07 PROJECT CONDITIONS

A. Establish and maintain required levels and grade elevations. Review installation procedures and coordinate work with other work affected by the brick paving work.

B. Hot Weather: Protect installed paving with windbreaks or artificial shade to prevent excessive moisture evaporation.

C. Protect partially completed paving against weather damage when work is not in progress.

D. Provide temporary barricades and warning lights as required for protection of project work and public safety.

E. Protect adjacent work from damage, soiling, and staining during paving operations.

F. Do not install brick paving until utility work, curbing, walls, or similar work is complete.

1.08 WARRANTY

A. The Contractor's warranty of the work shall include, but not be limited to, settling, heaving, shifting, spalling, chipping, cracking, and efflorescence. Terms of the guarantee will be as established in the conditions to the contract.

B. Repair and/or replace defective work within 14 days of notification at no expense to the Owner.

PART 2 - PRODUCTS

2.01 QUALITY

A. All materials used for construction shall be new, sound and free of defects that would interfere with the proper placing of the units or impair the strength or permanence of the construction.

2.02 HANDLING AND STORAGE

A. Protect all materials used for construction from damage, deterioration, or loss of any kind while in storage and during construction.

2.03 BRICK

A. General:

1. Solid (uncored) brick, meeting the requirements and tolerances of ASTM C902, Grade SX, Type 1.

2. Strength: Minimum compressive strength of 10,000 lbs. per square inch for any five bricks tested. Brick shall be capable of withstanding a minimum of 100 freeze-thaw cycles. Modulus of rupture (three-point loading) shall be a minimum of 1500 psi.

3. Absorption Rate: Average absorption rate shall be less than 4% in a 24-hour cold-water absorption test. Saturation co-efficient shall not exceed 0.78.

4. Paving brick when tested in accordance with ASTM C67 shall show no efflorescence. Submit manufacturer's certification of test results.

5. Refer to Drawing for schedule of brick types, including single and double widths, bullnose.

6. Do not exceed variations in color and texture of samples accepted by the Owner's Representative.

B. Brick - As manufactured by Hastings Pavement Company, Inc.; 30 Commercial Street; Freeport, NY; 11520; telephone (516) 379-3500 or approved equivalent:

1. Type: Brick Paver

2. Size: 4 inch x 8 inch

3. Thickness: 2-1/4 inch

4. Color: 2-208A

2.04 SETTING BED MATERIALS

A. Mortar Setting Bed for Ramps with Mortared Joints.

1. Latex - Portland Cement Mortar Setting Bed: ANSI A118.4.

   a. Mortar: ASTM C270, Type M portland cement lime mortar.
   b. Aggregate: ASTM C144, clean masonry sand.
   c. Latex Admixture: Acrylic resin or styrene butadiene rubber formations in factory pre-diluted or concentrated form, designated by manufacturer for use with mortar/paving applications.

      (1) Laticrete 3701 for setting bed and mortar joints, Laticrete 4237 or bond coat; Laticrete International; or approved equal.
      (2) Acrylbond TA-865; H.B. Fuller Co.; or approved equal.

d. Mix:

(1) One part Portland cement
(2) Three parts aggregate
(3) Mix dry until the mass is of uniform color. Once thoroughly mixed, the mass shall be moistened with latex admixture per manufacturer's requirements.

B. Fine aggregate: Clean, hard, sand with durable particles and free from adherent coatings, lumps of clay, alkali salts, and organic matter, uniformly graded from coarse to fine and all passing the No. 4 sieve and meeting the gradation requirements of ASTM C136.

C. Sand: ASTM C144, washed, clean, and graded.

1. Provide white sand for use with colored dry mix mortar.

D. Water: Clean, fresh, and potable.

E. Dry mix mortar colorant: Mineral-oxide pigments, lime and alkali-proof compatible with additives.

1. Manufacturer and type: Approved by the Owner's Representative.

2. Colors selected by the Owner's Representative to match pavers.

2.05 BASE MATERIALS

A. Concrete base as specified for concrete walks, Section 02510: Concrete Walks.

2.06 JOINT MATERIALS

A. Joint Materials for Brick:

1. Brick Pavement:

a. Expansion Joint:

(1) Cork joint filler: ASTM D 1751 premolded nonextruding cork for thickness indicated.
(2) Resilient and nonextruding.

b. Mortar Joint:

(1) Portland cement and aggregate: as specified for latex-portland cement setting bed.
(2) Mix: Manufacturer's standard prepackaged mixture of cement, aggregates and color-fast pigments formulated for mixing with latex admixture.

(a) Color: Selected by the Owner's Representative to match brick.

B. Expansion Joint Filler: ASTM D1751, cork preformed non-extruding resilient material, 1/2-inch thick.

C. Joint Sealant:

1. Nonstaining Polysulfide, Silicon, or Polyurethane Sealant: FS TT-S-00227, Type I, self-leveling; or Type II, nonsag; Class A; color to match adjacent concrete.

2. Primer: Nonstaining type, recommended by sealant manufacturer to suit application.

3. Joint Cleaner: Noncorrosive and nonstaining type, recommended by sealant manufacturer, compatible with joint forming materials.

4. Joint Backing: ASTM D1565; round, closed cell, polyethylene foam rod; oversized 30% to 50% larger than joint width.

5. Bond Breaker: Pressure sensitive tape recommended by sealant manufacturer to suit application.

2.07 CLEANING AGENTS

A. Do not use cleaning agent other than water on brick except with concurrence of Owner's Representative.

B. Acceptable cleaner for dark brick: As recommended by brick manufacturer.

C. Acceptable cleaner for light colored brick: As recommended by brick manufacturer.

PART 3 - EXECUTION

3.01 INSPECTION

A. Examine substrates and installation conditions. Report irregularities to Owner's Representative. Do not start brick paving work until unsatisfactory conditions are corrected.

B. Do not start brick paving work until utility work in the immediate area has been completed.

C. Beginning work of this Section implies acceptance of existing conditions.

3.02 COMPACTED SUBGRADE

A. Section 02200: Earthwork

3.03 INSTALLATION

A. Construct concrete base course as specified for concrete walks, Section 02510: Concrete Walks.

1. Forms: Section 02510: Concrete Walks

2. Expansion Joints:

a. Install expansion joints where indicated.
b. Place expansion joints perpendicular to concrete surface.

c. Place expansion joints with top edge flush with projected finish pavement surface.

3. Concrete Placement: Section 02510: Concrete Walks.

4. Finishing:

   a. Strike off top surfaces to top of forms and to smooth uniform texture.
   b. Maintain forms in place 12 hours after concrete placement.

5. Curing: Section 02510: Concrete Walks

B. Placing Latex-Portland Cement Mortar Setting Bed for Brick Pavers:

1. Clean concrete base free of all dirt, debris, etc.

2. Prepare and install setting bed in accordance with latex additive, manufacturer's recommendations to section, and grades indicated.

C. Installation of Brick Paver Over Latex-Portland Cement Mortar Setting Bed:

1. When the setting bed is prepared to receive pavers, carefully place the pavers in the pattern indicated, by hand, in straight courses, with hand tight joints and uniform top surface.

2. Do not use paving units with chips, cracks, voids, discolorations, or other visible defects.

3. Cut paving units with suitable saws or other required methods to provide clean, harp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full units without cutting wherever possible. Where cutting is required, use the largest size units possible. Avoid the use of small pieces or large joint spaces.

4. Set pavers in patterns and colors indicated with level surface and uniform 3/8-inch joints, in accordance with latex additive manufacturer's and brick manufacturer's recommendations.

D. Sand Setting Bed:

1. Place, spread, and screed sand setting bed evenly over concrete base to depth indicated on the Drawings.

E. Installation of Brick Paver over Sand Setting Bed:

1. Patterns: Install pavers in patterns indicated on the Drawings.

2. Cutting: Cutting shall be done with a masonry saw or industrial band saw.

3. Laying: Lay out pavers before setting to maintain uniformity in appearance of exposed work. Pavers shall be laid hand tight with a joint width of between 1/16 inch and 1/8 inch (maximum). Maintain straight and true lines, true to grade, and allow for positive drainage. After compaction, pavers shall be flush with all surrounding paving and curbs.

4. Compaction of Pavers: After placing all pavers, compact using a plate-type vibrating compactor. Run compactor a minimum of one pass in each direction, sweep sand into joints and vibrate with a plate-type vibrating compactor until the sand completly fills the joints. Joints are defined as filled when the sand joint is flush with the adjacent pavers.

5. Tolerances:

   a Vertical Offset 1/8 inch above adjacent drainage inlets, concrete curbs, or other joints.
   b. Surface Planeness: 1/4 inch in 10 feet.

F. Joint Treatment:

1. Hand Tight Joints: Sweep a dry, fine sand/cement mixture over pavers until joints are completely filled. Fog lightly with water. Stains that remain shall be cleaned.

2. Mortar Joints: Uniform 3/8 inch width joints, with flat profile no more than 1/8 inch below top of brick paver.

3.04 PROTECTION

A. Restrict traffic from paving surfaces during setting of units and for at least 24 hours after installation.

B. Protect brick paving from damage with plywood panels or other approved means until substantial completion.

3.05 CLEANING

A. Remove and replace paving units which are broken, chipped, stained, or otherwise damaged. Provide new matching units, install as specified and to eliminate evidence of replacement.

B. Clean paving not less than 6 days after completion of work using methods recommended by paver manufacturer. Do not use wire brushes, acid type cleaning agents or other cleaning compounds with caustic or harsh fillers.

C. Perform cleaning during installation of work and upon completion of work. Remove from site all excess materials, debris, and equipment. Repair damage resulting from paving operations.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions, and Division 1 - General Requirements, are a part of this Section.

1.02 DESCRIPTION

A. The extent of precast concrete work is shown on Drawings. Work includes design, manufacture and installation of precast concrete work indicated or specified.

B. This section establishes general criteria for materials, mixes, and evaluations of precast concrete as required for other related sections of these specifications.

1.03 STANDARDS

A. The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1. American Concrete Institute (ACI) Publications (latest edition):

ACI 301	Specifications for Structural Concrete for Buildings.
ACI 211.1	Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete.
ACI 211.2	Standard Practice for Selecting Proportions for Structural Lightweight Concrete.
ACI 304	Recommended Practice for Measuring, Mixing, Transporting and Placing Concrete.
ACI 311.4R	Guide for Concrete Inspection.
ACI-SP	ACI Detailing Manual.
ACI 318	Building Code Requirements for Reinforced Concrete.
ACI 347	Recommended Practice for Concrete Formwork.
ACI 512.2R	Precast Structural Concrete in Buildings.
ACI 512.1R	Suggested Design of Joints and Connection in Precast Structural Concrete.
ACI 533.4R	Design of Precast Wall Panels.
ACI 533.2R	Selection and Use of Materials for Precast Curtain Wall Panels.
ACI 533.3R	Fabrication, Handling and Erection of Precast Concrete Wall Panels.
ACI 533.1R	Quality Standards and Tests for Precast Concrete Wall Panels.

2. American Welding Society (AWS) Publications (latest edition):

D1.1 Structural Welding Code - Steel.

D1.4 Structural Welding Code - Reinforcing Steel.

3. American Society for Testing and Materials (ASTM) Publications (latest edition):

ASTM Standards in Building Codes.

Volume I A6-C114
Volume II C126-F656
(Pertinent individual standards in Volumes I and II are referenced in test by basic ASTM number designation.)

C88 Aggregate Soundness Test
C641 Aggregate Staining Test

4. Prestressed Concrete Institute (PCI) Publications (latest edition):

MNL 116 Manual for Quality Control for Plants and production Precast and Prestressed Concrete Products.
PCI Design Handbook, current edition.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications:

1. Firms which have at least 5 years successful experience in fabrication of precast concrete units similar to units required for this project, will be acceptable. Fabricator must have ample facilities and sufficientproduction capacity to produce required units without causing delay in work.

B. Installation Tolerances:

1. Install precast units without exceeding following tolerance limits:

a. Variations from Plumb: 1/4 inch any 20 foot run.

b. Variations from Level or Elevation: 1/4 inch in any 20 foot run; 1/2 inch in any 40 foot run; total plus or minus 1/2 inch maximum at any location.

c. Variation from Position in Plan: Plus or minus 1/2 inch maximum at any location.

d. Offsets in Alignment of Adjacent Members at any Joint: 1/16 inch any 10 foot run; 1/4 inch maximum.

C. Plant Quality Control Evaluations:

1. Precast units having dimensions greater or less than required will be rejected if appearance or function of the structure is adversely affected, or if larger dimensions interfere with other construction.

2. Repair, or remove and replace rejected units as required to meet construction conditions.
3. Strength of Units: The strength of precast concrete units will be considered potentially

deficient if the manufacturing processes fail to comply with any of the requirements which may affect the strength of the precast units, including the following:

a. Failure to meet compressive strength test requirements.

b. Concrete curing, and protection of precast units against extremes in temperature, not as specified.

c. Precast units damaged during handling and erection.

D. Defective Work:

1. Precast concrete units which do not conform to specified requirements, including strength, tolerances, and finishes, shall be replaced with precast concrete units that meet requirements of this Section. The Contractor shall also be responsible for the cost of corrections to any other work affected by or resulting from corrections to precast concrete work.

1.05 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings showing complete information for fabrication and installation of precast concrete units. Indicate member dimensions and cross-section; location, size and type of reinforcement and lifting devices necessary for handling and erection. Indicate profiles, joints and arrangement of units; detail of special designs or shapes; details of anchors, inserts, joints, connections to adjoining work or materials, reinforcing for each unit, and method of installation and anchoring.

2. Provide layout, dimensions, and identification of each precast unit corresponding to sequence and procedure of installation. Number each precast unit clearly on an unexposed surface to correspond with identity numbers on erection drawings. Indicate welded connections by AWS standard symbols. Detail accessories and construction at openings in precast units.

3. Provide location and details of anchorage devices that are to be embedded in other construction. Furnish templates if required for accurate placement.

C. Certification:

1. Submit certification that units conform with sizes and dimensions shown on shop drawings, within the specified fabrication tolerances specified.

D. Samples:

1. Submit 12 inch by 12 inch by two inches sample of each type of precast concrete to the Owner's Representative for his approval prior to installation.

2. Submit sample of each aggregate used to produce precast.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver precast concrete units to project site in such quantities and at such times to assure continuity of installation. Lift and support units at designated lift points.

B. Transport, store and handle precast units in a manner to avoid undue strains, hairline cracks, staining, or other damage. Deliver units from plant to project site in accordance with schedule and proper setting sequence. Store precast units free of the ground and protected from mud or rain splashes. Markings on units shall be visible during storage. Cover units, secure covers firmly, and protect the units from dust, dirt or other staining materials.

1.07 PROTECTION

A. During construction, protect exposed tops of units in place at end of each day's work and in bad weather. After erection, protect castings subject to damage adjacent to materials handling hoists and entrances.

PART 2 - PRODUCTS

2.01 PRODUCTS

A. Reinforcing Materials:

1. Reinforcing Bars: ASTM A615, Grade 60, unless otherwise indicated.

2. Reinforcing Bars to be Welded: Grade 60: ASTM A706. Grade 40: ASTM A615, weldable.

3. Galvanized Reinforcing Bars: ASTM A615 bars, hot-dip galvanized after fabrication and bending, complying with ASTM A153.

4. Steel Wire: ASTM A82, plain, cold-drawn, steel.

5. Welded Wire Fabric: ASTM A185, galvanized.

6. Welded Deformed Steel Wire Fabric: ASTM A497.

7. Supports for Reinforcement: Provide supports for reinforcement including bolsters, chairs, spacers and other devices for spacing, supporting and fastening reinforcing, complying with CRSI recommendations.

   a. For exposed-to-view concrete surfaces, where legs of supports are in contact with forms, provide supports with legs which are hot-dip galvanized, plastic protected or stainless steel protected.

B. Concrete Materials:

1. Portland Cement: ASTM C150, Type I or Type III.

2. Use only one brand and type of cement throughout the project, unless otherwise acceptable to Architect.

3. Aggregates: ASTM C33, and as herein specified. Provide aggregates from a single source for exposed concrete.

   a. Local aggregates not complying with ASTM C33, but which have shown by special test or actual service to produce concrete of specified strength and durability, may be used when acceptable to Owner's Representative.

b. Aggregate Color: Tan.

c. Submit sample of aggregates to be used for each cast stone type specified.

4. Lightweight Aggregate: ASTM C330.

5. Water: Potable or free from foreign materials in amounts harmful to concrete and embedded steel.

6. Air-Entraining Admixture: ASTM C260.

7. Water Reducing Admixtures: ASTM C494, Type A.

8. Calcium Chloride: Do not use calcium chloride in precast prestressed concrete.

C. Connection Materials:

1. Accessories: Provide clips, hangers, and other accessories required for installation of project units and for support of subsequent construction or finishes. Anchors, dowels, cramps, inserts, clip angles, anchor plates, shims, washers, setting loops, lifting hook inserts, and other fastening devices and accessories shall be steel, hot-dipped zinc coated in accordance with ASTM A123. Accessories with threaded portions shall be zinc or cadmium electroplated.

D. Grout Materials:

1. Cement Grout: Portland Cement, ASTM C150, Type I, and clean, natural sand, ASTM C404. Mix at ratio of 1.0 part cement to 2 1/4 to 3 parts sand, by volume, with minimum water required for placement and hydration.

2. Metalic Shrinkage-Resistant Grout: Pre-mixed and packaged ferrous aggregate type complying with CRD-C558, Type M.

3. Non-Metallic Shrinkage-Resistant Grout: Pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sands, Portland Cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with Corps of Engineers CRD-C588, Type A.

4. Submit samples of each type of grout used for Architects approval.

2.02 MIXES

A. Proportioning and Design of Mixes:

1. Prepare design mixes for each type of concrete required.

2. Design mixes may be prepared by an independent testing facility or by qualified precast manufacturing plant personnel, at precast manufacturer's option.

3. Proportion mixes by either laboratory trial batch or field experience methods, using materials to be employed on the project foreach type of concrete required, complying with ACI 211.1 or ACI 211.2.

a. Produce standard-weight concrete consisting of specified Portland Cement, aggregates, admixtures, and water to produce the following properties:

(1) Compressive strength; 5000 psi minimum at 28 days. Release strength for prestressed units: 3500 psi.

B. Admixtures:

1. Use air-entraining admixture in concrete, unless otherwise indicated.

2. Use water-reducing admixtures in strict compliance with manufacturer's directions. Admixtures to increase cement dispersion, or provide increased workability for low slump concrete, may be used subject to Owner's Representative's acceptance.

3. Use amounts as recommended by admixture manufacturer for climatic conditions prevailing at time of placing. Adjust quantities of admixtures as required to maintain quality control.

4. Use Color-Conditioned Concrete Admixtures as required to produce a warm buff color.

2.03 FABRICATION

A. General:

1. Fabricate precast concrete units complying with manufacturing and testing procedures, quality control recommendations, and dimensional tolerances of PCI MNL-116, and as specified for types of units required.

B. Built-In-Anchorages:

1. Accurately position built-in anchorage devices and secure to formwork. Locate anchorages where they do not affect position of main reinforcement or placing of concrete.

C. Identification

1. Provide permanent markings to identify pickup points and orientation in structure, complying with markings indicated on final shop drawings.

D. Finish:

1. Provide finishes for formed surfaces of precast concrete.

a. Architectural Grade A Finish: Air holes and pocket over 1/4 inch diameter filled with sand-cement paste, with form offsets or fins over1/8 inch ground smooth. Flat coat exposed surfaces with neat cement paste. After thin paste coat has dried, rub surfaces vigorously with burlap to remove loose particles.

b. Finish Texture: Light sandblast.

PART 3 - EXECUTION

3.01 INSPECTION

A. Erector must examine all parts of the supporting structure and the conditions under which the precast concrete work is to be erected, and notify the Contractor in writing of conditions detrimental to the proper and timely completion of work. Do not proceed with the installation until unsatisfactory conditions have been corrected

in a manner acceptable to the Erector.

3.02 INSTALLATION, GENERAL

A. General:

1. General contractor shall erect adequate barricades, warning lights or signs to safeguard traffic in the immediate area of hoisting and handling operations.

2. Set precast units level, plumb, square and true within the allowable tolerances. General contractor shall be responsible for providing lines, center and grades in sufficient detail to allow installation.

3. Provide temporary supports and bracing as required to maintain position, stability and alignment as units ar being permanently connected.

4. Non-cumulative tolerances for location of precast units shall be in accordance with installation tolerances specified.

5. Set non-laod bearing units dry without mortar, attaining specified joint dimension with lead, plastic or asbestos cement spacing shims.

B. Powder-Actuated Fasteners:

1. Do not use powder-actuated fasteners for surface attachment of accessory items in precast, prestressed unit unless otherwise accepted by precast manufacturer.

C. Grouting Connections and Joints:

1. After precast concrete units have been placed and secured, grout open spaces at connection and joints as follows:

   a. Cement grout consisting of 1 part Portland Cement, 2 1/4 to 3 parts sand, and only enough water to properly mix and for hydration.

   b. Shrinkage-resistant grout consisting of pre-mixed compound and water to provide a flowable mixture without segregation or bleeding.

   c. Provide forms or other acceptable method to retain grout in place until sufficiently hard to support itself. Pack spaces with stiff grout material, tamping until voids are completely filled. Place grout to finish smooth, plumb, and level with adjacent concrete surfaces. Keep grouted joints damp for not less than 24 hours after initial set. Promptly remove grout material from exposed surfaces before it hardens.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Construction of inlets, manholes, and modified inlets shall conform to the requirements of Section 425 of the FDOT Standard Specifications, 1991 edition, and the FDOT Roadway and Traffic Design Standards, except as amended hereinafter. Work under this section consists of furnishing all materials, supplies, and equipment in accordance with the requirements set forth and as shown on the Drawings.

1.02 SUBMITTALS

A. Submit shop drawings in accordance with the General Conditions and Division 1 for all drainage structures, inlets, manholes, headwalls, mitered end sections and other appurtenances.

PART 2 - PRODUCTS

2.01 MANHOLES

A. Manholes shall be constructed of concrete and shall have cast iron frames and covers. Invert channels shall be constructed smooth and semicircular in shape conforming to inside of adjacent sewer section. Changes in direction of flow shall be made in a smooth curve of as large a radius as the size of the manhole will permit. Steps or rungs shall not be constructed in manholes unless indicated on the Drawings.

B. Concrete: Concrete for manholes shall be made from Type I cement, 4,000 psi, conforming with Section 02345.

C. Frames and Covers: The manhole frames and covers shall be of gray cast iron conforming to ASTM A48, Class 30, with STORM SEWER cast into all covers so as to be plainly visible. The frames and covers shall be set so that the top of the cover will be flush with or higher than finished grade or as directed.

D. Precast Concrete Manholes: Precast concrete manholes shall be constructed in accordance with ASTM C478 and as shown on the Drawings of concrete attaining a minimum compression strength of 4,000 psi in 28 days using Type I cement. Details of design and construction shall be approved by the Owner prior to construction.

E. Joints are to be sealed with preformed flexible plastic joint sealer conforming to Federal Specifications SS-S-00211, "Ram-Nek", as manufactured by K. T. Snyder Co., Houston, Texas.

PART 3 - EXECUTION

3.01 EXCAVATION FOR APPURTENANCES

A. Excavation for manholes and similar structures shall be made to a size that will allow at least 12 inches in the clear between their outer surfaces and the embankment or sheeting or shoring which may be used to hold and protect the banks.

B. Keep excavation free of water during the construction process. Build facilities to the line and grade shown in the plans. Grade the excavation bottom to provide a smooth, firm and stable foundation underneath the facility. Remove large gravel or cobbles encountered in the excavation bottom from beneath the facility and replace with clean, compacted granular material to provide uniform support and a firm foundation.

3.02 MANHOLES AND INLETS

A. Construct in accordance with the detailed drawings, of the size and shape indicated, and at the location and grade shown on the plans, with flow channels having smooth and carefully shaped bottoms and built-up sides.

B. Hand-work the invert so as to provide channels conforming in size and shape to the lower portions of the inlets and outlets. Vary channels uniformly in size and shape from inlet to outlet. Smoothly and accurately shape the invert channel.

C. Set each section of precast manholes and inlets and make a watertight joint. Use sections of various heights in order to bring the top of the cover to the required elevation.

D. Join precast concrete manhole and inlet sections with Ram-Nek flexible plastic gaskets.

E. Set tops, frames and covers securely to elevations shown in the plans. Clean and scrape them prior to installation.

F. Watertightness of manholes and inlets shall be observed. Repair any visible leakage after dewatering is stopped.

3.03 BACKFILLING

A. Backfilling around manholes and inlets shall be accomplished in the same manner as the connected pipe and according to Section 02226.

3.04 RESTORATION OF DAMAGED SURFACES, STRUCTURES, AND PROPERTY

A. Where pavement, trees, shrubbery, fences or other property or surface structures have been damaged, removed or disturbed by the Contractor, whether deliberately or through failure to carry out the requirements of the Contract Documents, State laws, municipal ordinances or the specific direction of the Owner, or through failure to employ usual and reasonable safeguards, such property and surface structures shall be replaced or repaired at the expense of the Contractor to a condition equal to that before work began within a time frame approved by the Owner.

3.05 CLEAN-UP

A. The Contractor shall maintain the site of the work in a neat condition. The Contractor shall remove all excess materials, excess excavated materials and all debris resulting from his operations.

END OF SECTION

PART 1- GENERAL

1.01 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1, General Requirements, are a part of this section.

1.02 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery, stack unit masonry on wood pallet platforms: Cover with breathable tarpaulins and store in manner to provide from contact with soil. Exercise care in handling masonry units to avoid chipping, breakage.

1.03 COORDINATION

A. Cooperate with other trades in setting built-in items in masonry walls.

1.04 SUBMITTALS

A. Submit sample strap or panel containing four bricks. Include in each set the full range of exposed color and texture expected in the completed work. Owner's Representative's review will be for color and texture only.

1.05 SAMPLE PANEL

A. Prior to commencing masonry work, erect sample for each masonry type (finish) using materials, bond and joint tooling as directed by the Owner's Representative. Provide special features as directed for sealants and contiguous work. Build sample panel at the site, where directed, of full thickness and approximately 4 feet 0 inch x 3 feet 0 inch indicating the proposed range of color, texture and workmanship expected in the completed work. Obtain Owner's Representative's acceptance of visual qualities of the sample panels. Retain sample panels during construction as a standard for judging completed masonry work.

PART 2 - PRODUCTS

2.01 STUCCO

A. Stucco shall be Thorocoat as manufactured by Thorosystems with Thorobond bonding agent.

B. Color: As selected by the Owner's Representative.

1. Submit color samples of manufacturers standard color

2.02 CONCRETE MASONRY UNITS (CMU)

A. CMU: Provide CMU fabricated from lightweight concrete aggregate, complying with ASTM C331, free of combustible matter and organic impurities that would cause rusting, staining, pop-out to walls.

B. CMU Types:

1. Hollow load bearing units: ASTM C90, Grade N-1.

2. Provide sash type units at all control joints.

2.03 REINFORCING

A. Horizontal Joint Reinforcing:

1. Provide welded wire units prefabricated in straight lengths of not less than 10 feet, with matching corner ("L") and intersection ("T") units. Fabricate from cold-drawn steel wire complying with ASTM A82, with defromed or embossed continuous side rods and plain cross-rods, crimped for cavity wall construction (if any), with unit width of 1-1/2 inches to 2 inches less than thickness of wall.

2. For single wythe masonry walls provide ladder type fabricated with single pair of side rods and perpendicular cross-rods spaces not more than 16 inches O.C. or turss type fabricated with single pair of side roads and continuous diagonal cross-rods spaces not more than 16 inches O.C.

3. For multi wythe walls provide truss type fabricated with single pair of side rods and continuous diagonal cross-rods spaces not more than 16 inches O.C.

4. Wire: Fabricate with 9 gauge side and cross-rods, unless otherwise indicated.

5. Manufacturers offering products to comply with the requirements include the following:

a. AA Wire Products
b. Dur-O-Wal
c. Hohmann and Barnard

B. Anchoring Devices for Masonry:

1. Provide straps, bars, bolts and rods of the type and size shown, but fabricated from not less than 16 gage sheet metal or 3/8-inch diameter rod stock, unless otherwise shown, and as follows.

2. Flexible Anchors: Where masonry is shown or specified to be anchored to structural framework with flexible anchors, provide anchors which will permit horizontal and vertical movement of masonry but will provide lateral restraint, and as follows:

a. For anchorage to concrete framework, provide 2-piece anchors with sheet metal dovetail section and rectangular or vee-shaped 3/16-inch wire tie section sized to extend to within 1-inch of face of masonry.

C. Masonry Inserts in Concrete:

1. Unit type: Furnish cast iron or malleable iron inserts of the type and size shown, or fabricated from not less than 16 gauge steel, hot-dip galvanized after fabrication with 1.5 oz. zinc coating complying with ASTM A 153, Class B2.

2. For installation of concrete inserts, see Section 03300 of these specifications. Advise concrete installer of specific requirements regarding placement of inserts which are to be used by the masonry installer for anchoring of masonry work.

3. Dovetail Slots: Furnish 24 gauge galvanized steel Dovetail Slots with filler strips, where shown.

2.04 WEEPHOLES

A. Polyvinyl Chloride Pipe: ASTM D1785.

1. Nominal Size: Two inch.

2. Schedule Size: 40.

2.05 CONTROL JOINT

A. Provide premolded control joint strips of PVC or neoprene with a Shore A durometer hardness of 60 to 80 and designed fit standard sash block and maintain lateral stability in the masonry wall.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Do not erect masonry when air temperature is below or expected to go below 40 degrees F. except when permitted by Owner's Representative. When masonry work is authorized during temperatures below 40 degrees F., make provisions for heating, drying materials - protect completed work in accordance with BIA technical notes, Volume 1, No. 1. Do not build upon frozen work. Do not lay masonry units having water film or frost on its surface.

B. Build in required items as erection of masonry progresses.

C. Erect masonry within the following construction tolerances:

1. Variation from Plumb: For lines and surfaces of walls do not exceed 1/4-inch in 10 feet.

2. Variation from Level: Horizontal grooves and other conspicuous lines, do not exceed 1/4 in. in 20 feet.

3.02 MASONRY PROTECTIONS

A. Protect masonry materials during storage and construction from wetting by rain, snow or ground water and from soilage or intermixture with earth or other materials.

B. Do not use metal reinforcing or ties having loose rust or other coatings, including, ice, which will reduce or destroy bond.

C. In exposed work, do not use masonry units with chips, cracks voids, discolorations or other defects which might be visible or cause staining in the finished work.

3.03 PREPARATION

A. Wetting of Masonry Units:

1. Brick: Wet brick having ASTM C67 absorption rates greater than 0.025 oz. per square inch per minute.

   a. Determine absorption by placing 20 drops of water inside a circle the size of a quarter on typical units. If water is absorbed within 1-1/2 minutes, wet brick before laying.

   b. Use wetting methods which ensures that each masonry unit in nearly saturated but surface dry when laid. During freezing weather, comply with the recommendation of BIA.

2. Except for absorbent units specified to be wetted, lay masonry units dry. Do not wet concrete masonry units.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Thickness: Build walls to the full thickness indicated. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. Leave openings for other items to be installed before completion of masonry work.

C. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full-size units without cutting wherever possible.

3.05 BOND AND COURSING

A. CMU:

1. Erect CMU in running bond.

2. Vertical coursing for CMU shall be one course in 8-inch horizontal coursing shall be as required to produce joints 3/8 inches wide.

3.06 LAYING MASONRY WALLS (GENERAL)

A. Mortar types shall be as specified in Section 02600: Site Work Mortar and Grout.

B. Layout walls in advance for accurate spacing of surface bond patterns with uniform widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.

C. Lay-up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other work.

D. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

3.07 BRICK INSTALLATION

A. Shove brick into place (do not lay) in full mortar bed. Fill horizontal and vertical joints completely with mortar. Make vertical joint of same width as horizontal joints except for small variation to maintain bond. Butter ends with sufficient mortar to fill head joints and shove in place. Do not slush head joints.

B. Discard imperfect brick. Erect face brick in courses spaced accurately.

C. Erect exposed face brick with joints cut and lined. Tool joints in manner to squeeze mortar back into joints. Do no tooling until mortar has taken initial set.

3.08 CMU INSTALLATION

A. Erect CMU walls in location indicated. Bed each course solidly in specified mortar with vertical joints breaking halfway over course below. Butter vertical joints entire height of units. Bond each course at corners, intersections. Either bond into or anchor to adjacent construction with reinforcing.

B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course, and where adjacent to cells or cavities to be reinforced or filled with grout.

3.09 ADDITIONAL MASONRY REQUIREMENTS

A. Collar Joints:

1. At brick wall fill the vertical longitudinal joint between wythes so solidly with mortar by parging the in-place wythe and shoving units into the parging.

B. Stopping and Resuming Work:

1. Rack back 1/2-brick length in each course: Do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required)and remove loose masonry units and mortar prior to laying fresh masonry.

C. Built-in Work:

1. As the work progresses, build-in items indicated or specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.

D. Structural Bonding of Multi-wythe Masonry:

1. Use continuous reinforcing embedded in horizontal mortar joints for bond tie between wythes. Install at not more than 16 inches O.C. vertically.

2. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

3. Intersection and abutting walls: Provide same type of bonding specified for structural bonding between wythes and space as follows:

a. Provide masonry bond in alternate courses.
b. Provide continuity with horizontal joint reinforcing using prefabricated "T" units.

E. Reinforcing:

1. Horizontal Joint Reinforcing:

a. Provide continuous horizontal joint reinforcing as shown and specified. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on exterior side of walls and 1/2 inch at other locations. Lap reinforcement a minimum of 6 inches at ends of units. Do not bridge control and expansion joints with reinforcing except at wall openings.

b. Reinforce all walls with continuous horizontal joint reinforcing unless specifically noted or specified to be omitted.

c. Space continuous horizontal reinforcing as follows:

(1) For multi-wythe walls (solid or cavity) where continuous horizontal reinforcing also acts as structural bond or tie between wythes, space reinforcing as required by code but not more than 16 inches O.C. vertically.

(2) For single wythe walls, space reinforcing at 16 inches O.C. vertically, unless otherwise shown.

(3) Reinforce masonry openings greater than 1 foot 0 inches wide, with horizontal joint reinforcing placed in 2 horizontal joints approximately 8 inches apart, immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 2 feet 0 inches beyond jambs of the opening, bridging control joints where provided.

d. Lap reinforcing minimum 6 inches at splices.

F. Anchoring Masonry Work:

1. Provide anchoring devices of the type shown and as specified. If not shown or specified, provide standard type for facing and back-up involved.

2. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:

a. Provide an open space not less than 1/2 inch in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.

b. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise shown.

c. Space anchors as shown, but not more than 24 inches O.C. vertically and 36 inches O.C. horizontally.

G. Control and Expansion Joints:

1. Provide vertical expansion, control and isolation joints in masonry where shown. Build-in related

items as the masonry work progresses. Rake out mortar in preparation for application of calking and sealants.

H. Lintels:

1. Provide masonry lintels where shown in garden arches and wherever openings of more than 1 foot 0 inches are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Thoroughly cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.

2. Unless otherwise shown, provide one horizontal reinforcing bar-top and bottom for each 4 inches or less of wall thickness, of size-number not less than the number of feet of opening width.

3. For hollow masonry unit walls, use specially formed U-shaped lintel units with reinforcing bars, filled with Type M mortar or concrete grout.

4. Provide 8 inches minimum bearing each end.

5. Submit shop drawings for lintels.

I. Reinforced Masonry:

1. All voids in masonry units containing reinforcing bars shall be completely filled with grout.

2. Fine grout shall be used to fill voids up to 4 inches wide. Coarse grout shall be used in wider voids.

3. Grouting shall be placed in maximum lifts of 4 feet in height.

4. Forms, or shoring where required, shall remain in place until masonry can carry own weight and construction loads; beams minimum 10 days, slabs minimum 7 days.

5. Reinforcing bars shall be placed accurately and secured to prevent displacement, spaced at three feet on center. Splices shall be sufficient to develop full tension in bars.

6. Grout spaces less than 2 inches wide shall be grouted in lifts not exceeding 8 inches.

3.10 APPLIED FINISHES

A. Stucco:

1. Apply Thorocoat in accordance with manufacturers application instructions.

2. Apply Thoroshield in accordance with manufacturers application instructions.

3. Finished Texture: Coarse.

4. Prepare sample panel showing color, texture and peeling (eroded) of stucco from brick.

3.11 CLEANING

A. Progress work in as clean manner as possible - remove excess materials, mortar droppings daily. Remove mortar droppings on connecting or adjoining work before final set. Keep edge of scaffolding boards 2 inches minimum away from face of wall.

B. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, of if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

C. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar.

D. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of calking or sealant compounds.

E. Dry clean to remove large particles of mortar using wood paddles and scrappers. Use chisel or wire brush if required.

F. Presoak wall by saturating with water and flush off loose mortar and dirt.

G. Scrub down wall with stiffer fiber brush and a detergent as specified.

H. Rinse walls, using clean, pressurized water, to neutralize cleaning solution and remove loose material.

I. Acid cleaning of masonry will not be permitted.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This specification covers all labor, materials, and services incidental to and including the furnishing and setting of all Cast Stone as indicated on the Drawings and specified herein.

B. The Manufacturer shall be responsible for all labor, materials, equipment, and services necessary for and incidental to providing all Cast Stone covered by this specification.

C. The Setting Contractor shall unload, receipt for, store and set all Cast Stone covered by this specification and shall provide and install all anchors for same.

D. The Work, but is not limited to, the following:

1. Planter Urns

2. Fountain Surrounds

1.02 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions, and Division 1 General Requirements, are a part of this Section.

1.03 REFERENCES

A. Standard Specification for Cast Stone by Architectural Precast Association (APA).

B. Standard Specification for Cast Stone by Cast Stone Institute (CSI).

1.04 QUALITY ASSURANCE

A. Qualifications of Manufacturer:

1. The Manufacturer shall have a minimum of five years' continuous operation, having experience, adequate facilities, and capacity to furnish the quality , sizes, and quantity of Cast Stone required without delaying the progress of the work and whose products have been previously used and exposed to the weather with satisfactory results.

2. Any producer member of the Architectural Precast Association will be an acceptable Manufacturer.

B. Qualification of Erector: Firms which have a minimum of 3 years' successful experience in the erection of cast stone units, similar to units required for this project, will be acceptable.

C. Tests: The Owner's Representative may select at random from the job representative pieces of Cast Stone for testing. Tests shall be made at the Manufacturer's expense. Manufacturer shall replace tested units without charge:

1. Testing shall be performed in accordance with ASTM C 31, ASTM C 39, and ASTM C 642 except that 2-inch cube specimens shall be used, oven-dried in accordance with ASTM C 97.

2. Test results shall be determined by the average of three specimens per test.

3. The results of compression tests shall be divided by a factor of 0.8 when saw-cut or core-drilled specimens are used.

1.05 SUBMITTALS

A. Shop Drawings:

1. Scale and/or full size detail drawings will be furnished where necessary by the Owner's Representative, and they shall be accurately followed in the execution of this work.

2. The cast stone manufacturer shall prepare and submit for approval complete, properly marked setting drawings, showing details and sizes of stones; arrangement joints; bonding; details of anchors; inserts, joints, connections to adjoining walls or materials, reinforcing and method of installation and anchoring.

3. Unless otherwise specified, shop drawings shall provide for the following:

a. Provide suitable wash on all exterior sills, copings, projecting courses and pieces with exposed top surfaces.

b. All projecting pieces and soffit stones shall have drips under the outer edge.

c. The shop drawings shall show the setting mark of each stone and its location on the structure. The stone when delivered shall bear the same corresponding setting mark on an unexposed surface.

4. The manufacturer shall submit the shop drawings to the Contractor. The Contractor shall verify all dimensions and coordinate the drawings with field conditions. The Contractor shall submit the shop drawings to the Owner's Representative for approval.

5. The shop and setting drawings shall be approved by the Owner's Representative and the Contractor before the manufacturer shall be required to proceed with the work.

6. Design modifications may be made only as necessary to meet field conditions and to ensure proper fitting of the work, and only as acceptable to the Owner's Representative. Maintain general design concept shown without increasing or decreasing sizes of members or altering profiles and alignment shown.

B. Product Data: Submit manufacturer's specifications, data and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.

C. Samples:

1. Submit precast sample approximately 12 inch x 12 inch x 2 inch to illustrate quality, color, and texture of surface finish, and color of sealer where applicable, typical of the general range of color and finish to be furnished.

2. Prepare a full-size sample of a cast stone unit as selected by the Owner's Representative for the Owner's Representative installation work, and after Owner's Representative's review of finish samples. Acceptable full-size sample may be incorporated in job installation

3. The Owner's Representative review of samples will be for color, texture, and general condition only. Compliance with other requirements is the exclusive responsibility of the Contractor. Accepted samples will be used as the control example for standard of color and texture for Cast Stone.

1.06 DELIVERY, STORAGE, AND HANDLING

A. All cast stone shall be carefully loaded and packed for transportation exercising customary and reasonable precaution against damage while in transit.

B. All cast stone shall be received and unloaded at the project site by competent workmen with the necessary care and handling to avoid damage and soiling.

C. The cast stone material shall be stored clear of the ground on non-staining planking in such a manner as to be protected from damage while in storage. Should cast stone be stored for an extended period, cover with polyethylene or other non-staining waterproof material.

1.07 PROJECT CONDITIONS

A. Traffic:

1. Maintain pedestrian and vehicular traffic during stonework construction operations.

B. Limitations:

1. Underground Utilities:

a. Do not proceed with stonework construction until underground utility construction is complete.

2. Environmental:

a. Do not place Portland cement products during the following:

(1) Ambient air temperature is below 40°F or air temperature has been below 35°F for 12 or more consecutive hours.

(2) 15 November and 1 March without written authorization from the Foundation.

b. Cold weather construction:

(1) Precondition masonry materials to maintain 50°F when installed.

(2) Do not install stone masonry work when the temperature of the outside air is below 40°F and falling unless suitable means acceptable to the Foundation's Representative are provided to protect work from cold and frost and ensure that mortar will set without freezing. Comply with International Masonry Industry All-Weather Council cold weather construction and protection recommendations.

(3) No masonry work will be permitted when outside air temperature is below 25° F.

(4) Do not use frozen materials or materials mixed or coated with ice or frost.

1.08 GUARANTEE

A. The Contractor's guarantee of the Work shall include, but not be limited to, setting, heaving, shifting, spalling, chipping, cracking, and efflorescence. Terms of the guarantee will be established in Division 1 - General and Supplementary Conditions of the Contract.

B. Repair and/or replace defective work within 14 days of notification at no expense to Owner.

PART 2 - PRODUCTS

2.01 CAST STONE

A. Cast stone supplied by Carolina Cast Stone, Greensboro, NC (919-299-1717) or approved equal. Cast stone shall match approved samples specified.

1. Type: #2384

2. Finish: Smooth, as approved by Owner's Representative

B. Materials:

1. Cement - Portland Type I or Type III white and/or grey meeting ASTM C 150

2. Fine aggregate - carefully graded, washed and manufactured limestone sands meeting ASTM C 33 except that gradation may vary to achieve desired finish and texture.

3. Coarse aggregate - carefully graded and washed natural gravels, or crushed, graded stone such as granite, quartz, limestone or other durable stone meeting ASTM C 33 except that gradation may vary to achieve desired finish and texture.

4. Color - All colors added shall be inorganic (natural or synthetic) iron oxide pigments meeting ASTM C 979 excluding the use of a cement grade of carbon black pigment and shall be guaranteed by the pigment manufacturer to be limeproof. The amount of pigment shall not exceed 10% by weight of the cement used.

C. Properties of Mix Design:

1. The manufacturer shall be responsible to design a mix which achieves both the strength and the surface finish desired.

2. Compressive strength shall be not less than 5000 psi at 28 days when tested in accordance with the requirements of this specification.

3. The average water absorption of cast stone shall not exceed 6% by dry weight when tested in accordance with the requirements of this specification.

D. Reinforcement:

1. Cast stone shall be reinforced with new billet steel reinforcing bars meeting ASTM A 615, Grade 40 or Grade 60, when necessary for safe handling, setting, and structural stress, surfaces are to be exposed to the weather, the reinforcement shall be galvanized or epoxy coated when covered with less than 2 inches of material for bars larger than 5/8 inch and 1 1/2 inch for bars 5/8 inch or smaller. The material covering in all cases shall be at least twice the diameter of the bars.

2. Cast stone panels shall have a minimum thickness of 2 1/2 inches and be reinforced as may be required for handling and to allow for temperature changes and structural stress. There shall be a minimum steel reinforcement mounting to 1/4 percent of the sectional area of the panel and should the panel be greater than 12 inches in any sectional dimension, the temperature steel shall be placed in both directions.

3. Where applicable, cold-drawn steel wire reinforcement meeting ASTM A 82, welded wire fabric reinforcement meeting ASTM A 185 or ASTM A 497 or steel bar or rod mat reinforcement meeting ASTM A 184 may be used.

E. Finish:

1. The manufacturer shall submit to the Owner's Representative for selection and approval, samples of the cast stone specified which will be typical of color and finish to be furnished.

2. Exposed surface, unless otherwise specified, shall exhibit a typically fine grained texture similar to natural stone.

3. The samples shall be approved by the Owner's Representative before the manufacturer shall be required to proceed with the work.

F. Fabrication:

1. Fabricate all stone accurately to shape and dimensions, and full to square as indicated on the drawings. Cast stone units which are warped, cracked, broken, spalled, stained, or otherwise defective will not be acceptable.

2. Dress true all exposed faces. Beds and joints shall be at right angles to the face.

3. Execute carefully molded work from details. All exposed areas shall be true in alignment and slightly eased to prevent snipping.

4. Built-In Items: Provide reglets, slots, holes, and other accessories in units to receive cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.

5. Anchorages: Provide loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other miscellaneous steel shapes not provided by other trades, necessary for securing cast stone units to supporting and adjacent members.

6. Accommodate other trades in cutting and drilling of stone when the necessary information is furnished to the stone fabricator in time to be shown on his shop drawings and prior to shipment.

7. Provide lewis pine holes for stones that cannot be handled manually.

8. Drill required clamp holes upon receipt from the Contractor of the necessary sizes and locations. All stones under 3 1/2 inches thickness shall be provided with clamp holes, unless responsibility is assumed by the Contractor for the use of lewis pins.

9. Restrict all holes for handling device, sinkages for anchors, cramps, dowels, etc. as per industry standards and shop drawings.

G. Tolerances:

1. Height and width - Plus 1/16 inch minus 1/8 inch

2. Length:

a. Up to 2 feet 0 inches - plus 1/16 inch minus 1/8 inch

b. 2 feet 0 inches to 5 feet 0 inches - plus 1/8 inch minus 1/8 inch

c. 5 feet 0 inches to 10 feet 0 inches - plus 1/8 inch minus 3/16 inch

2.02 MORTAR AND GROUT

A. Section 04200: Unit Masonry

2.03 ANCHORS, DOWELS, ANGLES AND FASTENERS

A. Stainless Steel, Type 302 or 304, as recommended by the stone fabricators. Actual sizes, locations, and types shall be required by the project and drawn on the approved shop drawings. The Owner's Representative drawings do not show all necessary anchors, fastenings etc. Provide all necessary to complete stone work as shown on Drawing.

2.04 SEALANT

A. Sealant: Two-part elastomeric, FS TT-S-00227E, Type II, Class A, polyurethane epoxide, similar to Tremco "Dymeric" or Sika, "Sikaflex."

B. Color: To match cast stone color

C. Prime-Sealers and Cleaners: As recommended by manufacturer of sealant

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify suitability of substrate to accept installation.

B. Installation constitutes acceptance of responsibility for performance.

3.02 PREPARATION

A. General:

1. Deliver anchorage items which are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.

2. Do not install cast stone until design compressive strength is attained.

3. Have work performed under the supervision of a thoroughly competent foreman experienced in the type of materials and construction used.

4. Install work by competent stone settors skilled and experienced in the type of work required.

5. Perform all work in accordance with the approved shop drawings.

B. Stone Preparation: When necessary before setting, all stone shall be thoroughly cleaned on all exposed surfaces by washing with brush and soap powder, followed by a thorough drenching with clear water.

3.03 INSTALLATION

A. Setting:

1. Drench stone with clear water prior to setting in mortar.

2. Set stones as indicated in full beds of mortar with all joints slushed full and all holes completely filled.

3. Install cast stone members plumb, level, and in alignment. Provide temporary supports and bracing as required to maintain position, stability and alignment as members are being permanently connected. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses. All joints shall be 1/4 inch unless otherwise noted.

4. Place lead or plastic setting pads under heavy stones in same thickness as joint, and in sufficient quantity to avoid squeezing mortar out. Heavy stones shall not be set until materials below set in mortar have sufficiently hardened to avoid squeezing.

5. Accessories: Install clips, hangers, and other accessories required for erection of cast stone units to supporting members and back-up materials.

6. Anchor units in final position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring is completed.
   a. At bolted connections use lock washers or other acceptable means to prevent loosening of nuts.

   b. At welded connections apply rust-inhibitive coating on damaged areas, same as shop-applied material. Use galvanizing repair coating on galvanized surfaces.

B. Caulking:

1. Clean, dry, and rake out all joints and spaces to a depth of at least 3/4 inch from the face for pointing; remove all dust by swabbing with cleaner recommended by the caulking manufacturer.

2. Fill joints to within 3/8 inch of the surface with sealant backer, well forced in to provide a watertight seal; fill the exposed space with sealant.

3. Install sealant materials in strict accordance with the manufacturer's printed directions and provide a completely weathertight job.

4. Clean off excess sealant or smears with cleaning material recommended by the manufacturer of the sealant.

C. Pointing:

1. When ready for pointing, the joints shall be dampened and carefully pointed to a slight concave unless otherwise specified. No pointing shall be done in freezing weather nor in locations exposed to hot sun, unless properly protected. Pointing mortar shall be composed of one part non-staining cement (ASTM C 91), one part hydrate lime (ASTM C 207 - Type S) and four parts of clean, washed sand (ASTM C 144). Coloring pigments may be added as required. The Foundation's representative shall approve color of pointing mortar before proceeding with pointing.

D. Patching and Cleaning:

1. The repair of chipped or damaged cast stone shall be done only by mechanics skilled in this class of work, with materials furnished by the manufacturer and according to his direction.

2. Before pointing, the face of all cast stone shall be scrubbed with a fibre brush, using soap powder and water and shall then be thoroughly rinsed with clean running water. Any mortar on the face of the cast stone shall be removed. No acids or prepared cleaners shall be used without the approval of the cast stone manufacturer.

3.04 PROTECTION

A. Receipt, storage, and protection of stone work prior to, during and subsequent to installation shall be the responsibility of the Contractor.

B. Tops of walls during construction shall be carefully covered at night, and especially during any precipitation or other inclement weather.

C. Walls and pavers shall be adequately protected at all times from droppings.

D. Substantial wooden covering shall be placed whenever necessary to protect stone work. Non-staining building paper or membrane shall be used under the wood. Maintain all covering until removed to permit final clearing of stone work.

3.05 INSPECTION AND ACCEPTANCE

A. The Owner's Representative shall inspect the finished product within the scope of ACI Committee 311 Manual of Concrete Inspection.

B. Generally, acceptance of cast stone finish requires that color and texture shall be equal to the approved sample when viewed in good typical lighting at a distance of 10 feet.

C. Cast stone shall show no obvious repairs, or imperfections other than minimal color variations when viewed with the unaided eye at a 20-foot distance. Limitations as to the amount of patching which will be permitted is subject to acceptance by Owner's Representative.

3.06 CLEANUP

A. Perform cleaning during installation of the work and upon completion of the work. Cleaning includes, but is not limited to excess materials, soil, debris, and equipment. Repair damage resulting from installation operation.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1, General Requirements, are a part of this Section.

1.02 DESCRIPTION

A. This section specifies materials, equipment and work required to fabricate and install ornamental metalwork.

1.03 SUBMITTALS

A. Product data for each product used in ornamental metalwork, including finishing materials and methods.

B. Shop drawings showing fabrication and installation of ornamental metalwork including plans, elevations and details of components and attachments to other units of work. Indicate materials, profiles of each ornamental metalwork member and fitting, joinery, finishes, fasteners, anchorages and accessory items.

1. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as unit of work of other sections.

C. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual units or sections or units showing full range of colors and other finish characteristics available for each item specified.

D. Samples for verification purposes of each type of metal finish required, prepared of metal of same thickness and alloy indicated for final unit of work. Where finishes involves normal color and texture variations, include sample sets composed of two or more units shown in full range of variations expected.

1. Include 6-inch-long sample of linear shapes.

2. Include 6-inch-square sample of plates.

3. Include full-size samples of castings and forgings.

E. Installer certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

F. Qualification data for firms and persons specified "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Architects and Owners, plus other information specified.

G. Structural Performance of Handrails and Railing Systems: Provide handrails and railing systems capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved:

H. Top Rails of Guardrail Systems: Concentrated load of 300 lbf applied at any point and a uniform load of 100 lbf per linear feet with each load applied nonconcurrently with respect to direction and each other, vertically downward or horizontally.

I. Handrails Not Serving as Top Rails: Concentrated load of 200 lbf applied at any point and a uniform load of 50 lbf per linear feet with each load applied nonconcurrently with respect to direction and each other, vertically downward or horizontally.

J. Infill Area of Guardrail Systems: Horizontal concentrated load of 200 lbf applied to one square foot at any point in the system including panels, intermediate rails balusters, or other elements composing the infill area.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing ornamental metalwork similar to that indicated for this project, with sufficient production capacity to produce required units without causing delay in the work.

B. Installer Qualifications: Arrange for installation of ornamental metalwork specified in this section by same firm which fabricated them.

C. Organic Coating Applicator Qualifications: Firm experienced in successfully applying organic coatings of type indicated to aluminum extrusions; equipped as follows:

1. A multi-stage aluminum cleaning and pretreatment system capable of complying with test requirements of AAMA standard referenced for type of coating indicated.

2. Spray equipment required to apply a uniform coating.

3. Baking facilities to maintain quality control by verifying conformance of coating system and its application with requirements.

4. Testing facilities to maintain quality control by verifying conformance of coating system and its application with requirements.

5. A preventive maintenance program and good recordkeeping.

D. Qualify welding processes and welding operators in accordance with the following:

1. AWS D1.1 "Structural Welding Code - Steel."

2. AWS D1.2 "Structural Welding Code - Aluminum."

3. Certify that each welder employed in unit of Work of this section has satisfactorily passed AWS qualification tests for welding processes involved, and if pertinent, has undergone recertification.

4. Testing for recertification is Contractor's responsibility.

E. Engineer Qualifications: Professional engineer licenses to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated which has resulted in the successful installation of assemblies similar in material, design, and extent to that indicated for this Project.

1.05 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of ornamental metalwork. Do not delay job progress; allow for adjustments and fitting where taking of field measurements before fabrication might delay work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store metal components and materials in clean, dry location, away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation within covering.

B. Handling ornamental metalwork on site to a minimum; exercise care to avoid damaging metal finishes.

PART 2 - PRODUCTS

2.01 METALS

A. General: Provide ornamental metalwork composed of metals of the forms and types which comply with requirements of referenced standards and which are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, "oil canning," stains,discolorations or other imperfections on finished units are not acceptable.

B. Aluminum: Provide alloy and temper recommended by aluminum producer or finisher for type of use and finish indicated, and with not less than the strength and durability properties of the alloy and temper designated below for each aluminum form required.

1. Extruded Bar and Shapes: ASTM B 221, 6063-T6

2. Extruded Pipe and Tube: ASTM B 429, 6063-T6

3. Drawn Seamless Tube: ASTM B 483, 6063-T832

4. Plate and Sheet: ASTM B 209, 6061-T6

5. Die and Hand Forgings: ASTM B 247, 6061-T6

6. Castings: ASTM B 26,356.0-T6

C. Steel and Iron: Provide steel and iron in the form indicated complying with the following requirements:

1. Tubing: Cold-formed, ASTM A 500; or hot-rolled, ASTM A 5-01

2. Steel Plates, Shapes, and Bars: ASTM A 36

3. Gray Iron Castings: ASTM A 48, Class 30

4. Malleable Iron Castings: ASTM A 47, grade as recommended by fabricator for type of use indicated.

2.02 MISCELLANEOUS MATERIALS

A. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength and compatibility in the fabricated items.

B. Fasteners: Of same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals which are corrosive or otherwise incompatible with metals joined.

1. Provide concealed fasteners for interconnection of ornamental metalwork components and for their attachment to other work except where exposed fasteners are unavoidable or are the standard fastening method.

2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

C. Nonshrink Nonmetallic Grout: Pre-mixed, factory-packaged,nonstaining, noncorrosive, nongaseous grout complying with CE CRD C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

D. Anchors and Inserts: Provide anchors of type, size, and material required for type of loading and installation condition shown, as recommended by manufacturer, unless otherwise indicated. Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior locations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled- in-place anchors.

E. Primer Paint for Steel and Iron: Manufacturer's standard rust-inhibiting primer; compatible with finish coats of paint.

F. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic)

G. Zinc Chromate Primer: FS TT-P-645

2.03 FABRICATION, GENERAL

A. Form ornamental metalwork to required shapes and sizes, with true curves, lines and angles. Provide components in sizes and profiles indicated, but not less than required to comply with requirements indicated for structural performance.

B. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature, in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and night time sky heat loss.

1. Temperature Change (Range): 80 deg F, (55.5 deg C)

C. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners wherever possible.

D. Comply with AWS for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded joints of all welding flux, and dress on all exposed and contact surfaces.

E. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

F. Provide castings that are sound and free of warp or defects which impair strength and appearance.

G. Finish exposed surfaces to smooth, sharp, well-defined lines and arrises.

H. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

2.04 FABRICATION OF HANDRAILS, RAILINGS AND FENCES

A. Nonwelded onnections: Fabricate railing systems, handrails and fences for interconnection of members by means of concealed mechanical fasteners fittings unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

B. Welded Connections: Fabricate handrails, railing systems and fences of materials indicated below for interconnections of members by welding. Use welding method which is appropriate for metal and finish indicated and develops strength required to comply ith structural performance criteria. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

1. Provide welded connections for ferrous handrails, railing systems and fences.

C. Form changes in direction of railing members by bending members, insertion of prefabricated elbow fittings, radius bends, or by mitering.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, or otherwise deforming exposed surfaces of handrail and railing components.

E. For systems with nonwelded connections, provide weepholes or other means for evacuation of entrapped water in hollow sections of railing and fencing members.

F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of the railing and wall is 1/4 inch or less.

G. Close exposed ends of handrail, fence and railing members by use of manufacturer's standard prefabricated end fittings.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, fence and miscellaneous fittings, and anchors for interconnection of handrail, fence and railing members to other work, unless otherwise indicated.

1. Furnish inserts and other anchorage devices for connecting handrails, fences and railing systems to concrete or masonry work. Fabricate anchorage devices which are capable of withstanding loadings imposed by handrails, fence and railing systems. Coordinate anchorage devices with supporting structure.

2.05 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Protect mechanical finishes on exposed surfaces from damage by application of strippable temporary protective covering prior to shipment.

2.06 ALUMINUM FINISHES

A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Baked Enamel Finish: AA-C21C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting modified acrylic enamel primer/topcoat system complying with AAMA 603.8 except with minimum dry film thickness of 1.5 mils, medium gloss.

2. Color: As indicated.

C. High Performance Organic Coating: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.

1. Fluorocarbon 2-Coat Coating System: Manufacturer's standard 2-coat thermo-cured system, composed of specially formulated inhibitive primer and fluorocarbon color topcoat containing not less than 70 percent polyvinyldene resin by weight; complying with AAMA 605.2.

a. Color and Gloss: As indicated by reference to manufacturers standard color and sheen designations.

2.07 STEEL AND IRON FINISHES

A. Preparation for Paint Finish: Clean surfaces of dirt, grease, and loose rust or mill scale, including items fabricated from galvanized steel, if any, followed by a conversion coating of type suited to organic coating applied over it.

B. Factory - Primed Finish: Apply air-dried primer immediately following cleaning and pretreatment, to provide a minimum dry film thickness of 2.0 mils per applied coat, to surfaces which will be exposed after assembly and installation, and to concealed, nongalvanized surfaces.

2.08 DESIGN SCHEDULE: HANDRAILS, RAILINGS AND FENCES

A. Railings (Guardrail Systems):

1. As presented in the Drawings.

2.09 MISCELLANEOUS ORNAMENTAL METAL CASTINGS

A. Fountains:

1. Cast iron fountain manufactured by or approved equal.

a. Design name:
b. Finish:

1) Factory prime coat
2) Factory finish coats (2)
3) Finish color:

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages and setting drawings, diagrams, templates, instructions and directions for installation of items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the project site.

3.02 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where necessary for securing ornamental metal items to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

B. Perform cutting, drilling and fitting required for installation of ornamental metalwork. Set products accurately in location, alignment and elevation, plumb, level and true, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding and grinding are required for proper shop fitting and jointing of ornamental metal items, restore finishes to eliminate any evidence of such corrective work.

D. Do not cut or abrade finishes which cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing or provide new units as required.

E. Restore protective coverings which have been damaged during shipment or installation of the work. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at the same location.

1. Retain protective coverings intact and remove simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.

F. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal-arc welding, for appearance and quality of welds made, and for methods used in correcting welding work. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces.

G. Corrosion Protection: Coat concealed surfaces of aluminum, which will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint or zinc chromate primer.

3.03 HANDRAILS, RAILINGS AND FENCES

A. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.

B. Concrete-Anchored Posts in Sleeves: Insert posts in present sleeves cast into concrete and fill annular space between posts and sleeve solid with nonshrink, nonmetallilc grout, mixed and placed to comply with grout manufacturer's directions.

1. Cover anchorage joint with flange or escutcheon plate attached to post after filling of annular space.

2. Posts shall be installed plumb to 1/4 inch in 10 feet.

C. Anchor posts to metal surfaces with fittings designed for this purpose.

D. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic filler cement colored to match finish of handrails and railing systems.

E. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contract or use fittings designed for this purpose.

F. Expansion Joints: Provide expansion joints at locations indicated or, if not indicated, at intervals not to exceed 40 feet. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side, locate joint within 6 inches of post.

3.04 FOUNTAINS

A. Install fountains in accordance with manufacturer's recommendations and as indicated and as specified.

1. Fountains shall be installed plumb and level to 1/8 inch in 10 feet.

3.05 ADJUSTING

A. Protect finishes of ornamental metalwork from damage during construction period by use of temporary protective coverings approved by ornamental metalwork fabricator. Remove protective covering at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

END OF SECTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work under this Section includes providing a complete system of water distribution pressure piping system including continuous pipeline identification, valves, fittings and other appurtenances.

1.02 QUALITY ASSURANCE

A. Pipe Inspection: The Contractor shall obtain from the pipe manufacturers certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. All pipe and fittings shall be subjected to visual inspection at time of delivery by rail or truck, also just before they are lowered into the trench to be laid, and joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor. The entire product of any plant may be rejected when, in the opinion of the Owner, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

B. Prevention of Electrolysis: Where deemed necessary,electrolytic action through the contact of dissimilar metals, shall be prevented by either:

1. The separation of one material from the other by means of an insulating or dielectric coupling, or

2. The use of alternative materials, as directed by the Owner.

1.03 SUBMITTALS

A. Shop Drawings: In general, the following shop drawings shall be submitted to the Owner for approval prior to construction:

1. Mill test certificates or certified test reports on pipe
2. Details of restrained joints
3. Pipe linings and coatings
4. Fittings
5. Valves and valve boxes
6. Joint lubricant
7. Pipe laying schedule showing thrust restraint measures (restrained joints) for each pipe section, valve and fitting location
8. Temporary plug and anchorage system for hydrostatic pressure test
9. Tapping sleeves and valves
10. Air release valves

11. Marking tape and detector wire

12. Service connection assemblies

1.04 JOB CONDITIONS

A. Water in Excavation: Water shall not be allowed in the trenches while the pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the Owner. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working. In no case shall the pipelines being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately blocked during construction by the use of approved stoppers and not by improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the work any such material has entered the pipelines, it must be cleaned as directed by the Owner so that the entire system will be left clean and unobstructed.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ductile Iron Pipe And Fittings:

1. Ductile Iron Pipe: Ductile iron pipe shall conform to the requirements of AWWA C -150 and C-151, Pressure Class 350 for pipe sizes up to and including 12 inches in diameter. Pipe sizes greater than 12 inches shall be Pressure Class 250. Pipe interior shall have a bituminous seal coat over a cement mortar lining conforming to ANSI Standard A21.4. Exterior of pipe shall have a bituminous coating.

2. Fittings:

   a. All ductile iron fittings shall be mechanical joint or single gasket, push on type with a minimum pressure rating of 350 psi and shall conform to the requirements of ANSI Standard A21.10.

   b. Mechanical joint and/or single gasket, push on type fittings shall be cement lined, seal coated and outside coated as specified above for ductile iron pipe.

   c. Compact fittings shall conform to AWWA C153.

3. Joints: Mechanical joints consisting of bell, socket, gland, gasket, bolts and nuts shall conform to ANSI Standard A21.11. Bolts shall be high strength, annealed, cast iron, or high strength low alloy steel, T-head type having hexagonal nuts. Bolts and nuts shall be machined true and nuts shall be tapped at right angles to a smooth bearing surface. Single seal gasket push on type joints shall conform to the requirements of ANSI A21.11 and shall be "Tyton", "Fastite", "Super Bell Tite", "Altite", or approved equal.

4. Restrained Joints: Restrained joints may be of the types fabricated by the various manufacturers, upon approval by the Owner of details submitted by the Contractor. Restrained joints that require field welding will not be acceptable, and the thickness of the pipe barrel remaining at grooves cut for restraint shall not be less than that required for the design wall thickness. Joints using set screws will

not be acceptable. Restrained joints shall be furnishedfor 12 inches and larger pipe at changes in direction of the water main. Megalug by EBAA Iron Inc. are acceptable for mechanical joint pipe. "Field-Lok" by U.S. Pipe and "Fast-Grip" by American are acceptable for push on joint pipe.

5. Flanged Joints: ANSI B16.1, 125 pound standard. Full-faced-type rubber gaskets of an approved quality equal to "Rainbow" gaskets 1/16-inch thick, as manufactured by the U.S. Rubber Company. Bolts and nuts of Grade B conforming to the ASTM A307 for steel machine bolts and nuts and tap bolts.

6. Gaskets: Gaskets shall be of vulcanized crude rubber or polyvinyl chloride plastisol. Gaskets shall have plain tips unless otherwise specified.

B. Exposed Pipe

1. All exposed pipe shall be flanged.

2. For atmospherically exposed ductile iron and fabricated steel, the exterior protection shall be as follows:

a. Surface Preparation: Abrasive blast, or centrifugal wheel blast (Steel Structures Painting Council Specification SP 10).

b. Paint Material and Minimum Coats: Polyamide, anti-corrosive epoxy primer (1 coat, 2.5 mils minimum dry film thickness); polyurethane enamel (2 coats, 3 mils minimum dry film thickness). Exposed piping shall be "Keen Blue" color, Sherwin Williams SW179OLRV 21%, or approved equal.

C. Gate Valves: Resilient Seated Wedge Gate Valves for water service shall conform to, or exceed all applicable requirements of AWWA C509.

1. All resilient seated wedge gate valves shall have non-rising stems for counter clockwise operation and a 2-inch square operating nut.

2. All resilient seated wedge gate valves shall be bubble tight at 150 p.s.i.

3. Each valve shall have the manufacturer's name, pressure rating, the year of manufacture, and an arrow to indicate the direction of opening cast into the valve body.

4. The interior and exterior of the valve body and bonnet shall have a factory applied 2-part thermo setting epoxy resin lining equal to Tnemec 140 Pota-Pox. Interior minimum 8 mils (DFT) and exterior 12 mils (DFT).

5. Each valve shall be hydrostatically tested to a pressure equal to twice the specified working pressure prior to shipment from the factory. The manufacturer shall certify each valve.

6. Acceptable manufacturers:

   Clow, American, Mueller, M & H, Kennedy, Dezurik and U.S. Pipe. Substitutes will not be permitted.

D. Butterfly Valves:

1. General: All butterfly valves shall be of the tight-closing, rubber-seat type with rubber seats that are securely fastened to the valve body or disc. No metal-to-metal seating surfaces will be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction, and shall be satisfactory for applications involving frequent operation and for applications involving valve operation after long periods of inactivity and for buried installation. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Valves shall meet the full requirements of AWWA Standard C504 for Class 150B. The manufacturer shall have manufactured tight-closing, rubber-seat butterfly valves for a period of at least five years. All valves shall be Henry Pratt Company, American, Mueller or approved equal.

2. Valve Body: Valve bodies shall be constructed of cast iron ASTM A126 Class B or ductile iron. Ends shall be mechanical joint. Two trunnions for shaft bearings shall be integral with each valve body. When the disc has the rubber seat, the valve body shall have a 18-8 Type 304 stainless steel body seat.

3. Valve Discs: Valve discs shall be constructed either of alloy cast iron ASTM A 436 Type 1 (Ni-Resist), ductile iron ASTM A 536, or cast iron ASTM A 48 each with Type 316 stainless steel seating edge or the entire disc may be constructed of cast 316 stainless steel.

4. Valve Seats: Valve seats shall be of a synthetic or natural rubber compound and may be mounted on the disc or valve body.

5. Valve Bearings: Valves shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and self-lubricating.

6. Buried Operators: Buried service operators shall be permanently lubricated, sealed for submersion in water for pressures of 20 feet and equipped with a two-inch square AWWA operating nut which shall indicate the direction to open. The operator shall be constructed such that the valve will open when the nut is turned to the left (counter clockwise) to open.

7. Coatings: Interior of valve body and valve disc except for valve seat and stainless steel valve sear ring shall be coated with 8 mils (DFT) of Tnemic 140 Pota-Pox or approved equal. Exterior of valves with 12 mils (DFT) of Tnemic 140 Pota-Pox or approved equal.

E. Valve Boxes: Cast iron valve boxes shall be provided for all valves installed underground. The valve boxes shall be adjustable to fit the depth of earth cover over the valve and shall be designed so as to prevent the transmission of surface loads directly to the valve or piping. Valve boxes shall have an interior diameter of not less than 5 inches. The valve boxes shall be provided with covers marked WATER which shall be so constructed as to prevent tipping or rattling. Boxes shall be Clow Corporation No. F-2450, Mueller Company No. H-10357 or approved equal. Extension sections shall be cast iron only. The protective ring shall be constructed of Class B concrete.

F. Tapping Sleeves And Valves: Tapping sleeves and tapping valves used to make "wet" taps into existing mains shall be provided and installed at locations as shown on the Drawings. Tapping sleeves shall be split cast iron units and rated for 150 psi working pressure. Steel units shall be epoxy coated with stainless steel bolts. The

Contractor shall determine the outside diameter of the existing main before ordering the sleeve. Valves shall be of the nonrising stem type with O-ring seals and applicable to requirements as specified above for gate valves.

G. Corporation Stops and Service Clamps:

1. Corporation stops shall be Mueller Co. Type H-15000 for 1-inch service and Type H-10003 for 2-inch service or approved equal.

2. Corporation stops shall be Ford Meter Box Co. Type F-1000, Mueller Co. Type H-15009 or approved equal with inlet having AWWA tapered threads and outlet for polyethylene or copper tubing with stainless steel insert stiffener.

3. Service clamps for PVC mains shall be full circle bearing type, and for ductile iron mains service clamps shall be the double-strap tapped saddle type, Rockwell 313 or equal.

H. Service Terminal Fittings:

1. Single 1-inch terminal fitting shall be 1-inch ringstyle valve, drilled for wire sealing, angle inverted key meter valve cat. No. KV-23W by Ford Meter Box Co., Mueller No. H-14259, Hays No. 25012DF or approved equal.

2. Twin 1-inch shall be 1-inch "U" branch valve assembly, with standard 7 1/2-inch spacing between outlet centers, drilled for wire sealing, Ford Meter Box Co. No. UV63-42W, Hays No. 25040 DF or approved equal.

I. Castings: The manhole frame and cover shall conform to the ASTM Designation A48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength, or otherwise make them unfit for the service intended. The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown on the Drawings. The words "WATER VALVE" shall be cast in the manhole cover. The manhole frame and cover shall be traffic bearing.

J. Tie Rods: Steel for tie rods and tie bolts shall conform to the requirements of ASTM Designation A 242, and rods shall be galvanized in conformance with requirements of ASTM Designation A 123. Tie rods and tie bolts shall be Super Star Tierod Figure No. SS12 and Tiebolt Figure No. SST7 respectively as manufactured by Star National Products.

K. Additional Work: Additional items of construction, necessary for the complete installation of the systems, shall conform to specific details shown on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these specifications.

L. Air release valves shall be installed as shown on the plans. The valves shall be constructed with a cast iron body, cover and baffle, stainless steel float, bronze water diffuser, BUNA-N or viton seat and stainless steel trim and rated for a 200 psi test pressure.

1. Valves shall be provided with a vacuum check to prevent air from re-entering the line. All fittings shall be threaded.

2. Air release valves shall be Model 200 as manufactured by Apco Valve and Primer Corporation, Schaumburg, Illinois. Other acceptable manufacturers include Empire, Valmatic and Crispin.

M. Flanged coupling adapters shall be Clow Style 127 or equal.

N. Compression couplings shall be Dresser Style 153 or equal. Gaskets shall be suitable for the service conditions.

PART 3 - EXECUTION

3.01 PREPARATION

A. Bedding:

1. Pipe Cradle: Upon satisfactory installation of the pipe bedding material as specified in Section 02225, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.

2. Cleanliness: The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

3.02 INSTALLATION

A. Pipe:

1. Gradient: Lines shall be laid straight, and depth of cover shall be maintained uniform with respect to finish grade, whether grading is completed or proposed at time of pipe installation. When a grade or slope is shown on the Drawings, batter boards with string line paralleling design grade, or other previously approved means, shall be used by the Contractor to assure conformance to required grade.

2. Pipe Joint Deflection: Whenever it is desirable to deflect pipe, the amount of deflection shall not exceed the maximum limits as shown in AWWA Standard C600 for ductile iron pipe.

3. Rejects: Any pipe found defective shall be immediately removed and replaced with sound pipe at the Contractor's expense.

4. Joint Compounds: No sulphur base joint compound shall be used.

5. Guidelines: AWWA C600 for DIP.

B. Ductile Iron Pipe Joints:

1. Type: The joints of all pipelines shall be made absolutely tight. The particular joint used shall be approved by the Owner prior to installation. Where shown on the Drawings or where, in the opinion of the Owner, settlement or vibration is likely to occur, all pipe joints shall be bolted.
2. Mechanical Joints: All types of mechanical joint pipes shall be laid and jointed in full conformance with manufacturer's recommendations, which shall be submitted to the Engineer for review and approval before work is begun. Only especially skilled workmen shall be permitted to make up mechanical joints. Torque wrenches set as specified in AWWA Standard Clll, shall be used; or spanner type wrenches not longer than specified therein may be used without the permission of the Engineer.

3. Restrained Joints: Restrained joints shall be provided at changes in direction of all water mains in lieu of concrete thrust blocks.

   a. Restrained joints may be of the types fabricated by the various manufacturers, upon approval by the Engineer or details submitted by the Contractor. Restrained joints that require field welding will not be acceptable, and the thickness of the pipe barrel remaining at grooves cut for restraint shall not be less than that required for the design wall thickness. Joints using set screws will not be acceptable, unless specifically approved by the Engineer for the application.

   b. The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pressure pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. The formula and parameters given in the Dipra "Thrust Restraint Design for Ductile Iron Pipe" were used to determine the minimum requirements. The requirements are shown on the plans.

   c. Bolts and nuts for restrained joints shall be corten, low alloy, high strength steel.

C. Installing Valves And Boxes:

1. Valves: Valves shall be carefully inspected, opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Gate valves, unless shown otherwise, shall be set with their stems vertically above the center line of the pipe. Butterfly valves shall have the disc shaft installed horizontally. Any valve that does not operate correctly shall be removed and replaced.

2. Valve Boxes: Valve boxes shall be carefully centered over the operating nuts of the valves so as to permit a valve key to be fitted easily to the operating nut. In areas to be paved, valve boxes shall be set to conform to the level of the finished surface and held in position by a ring of concrete placed under the support flange as shown on the Drawings. The valve box shall not transmit surface loads to the pipe or valve. Care shall be taken to prevent earth and other material from entering the valve box. Any valve box which is out of alignment or whose top does not conform to the finished ground surface shall be dug out and reset. Before final acceptance of the work all valve boxes shall be adjusted to finish grade.

D. Backfilling:

1. After pipe has been laid, inspected, and found satisfactory, sufficient backfill shall be placed along the pipe barrel to hold the pipe securely in place during the conduction of the preliminary hydrostatic test. No backfill shall be placed over joints until the preliminary test is satisfactorily completed, leaving them exposed to view for the detection of visible leaks.

2. Upon satisfactory completion of the preliminary hydrostatic test, backfilling of the trench shall be completed.

3.03 PIPELINE IDENTIFICATION

A. Pipe Marking Tape:

1. Metallic, detectable underground utility tape (6 inches wide) shall be placed in the trench after initial backfill and compaction has been completed to the top of the pipe envelope. The tape thickness shall not be less than 4 mils. The tap shall be continuous for the entire length of the pipeline.

2. The utility tape shall be an inert plastic film formulated for extended use underground, and shall have a thickness of not less than 4 mils. The color shall extend the full width of the tape and be imprinted with the following information, "Caution Potable Water Main Below." The message shall be printed with silver lettering on a pantone safety precaution blue background. The tape shall be as manufactured by Shield-Tec (TM) or approved equal.

B. Pipe Color:

1. All ductile iron mains shall be marked with a continuous stripe located within the top 90 degrees of the pipe. The stripe shall be a minimum 2 inches in width and shall be the color blue. Backfill shall not be placed for 30 minutes following paint application.

3.04 SPACING

A. A minimum horizontal separation of 5 feet (center to center) or 3 feet (edge to edge), whichever is more stringent, shall be maintained between potable water mains and reclaimed water mains.

B. A minimum horizontal clearance of 10 feet (edge to edge) shall be maintained between potable water mains and sewage collection mains, recirculation force mains, sewage force mains and stormwater pipe facilities.

C. A minimum vertical separation of 18 inches between the invert of the upper pipe and the crown of the lower pipe shall be maintained between potable water mains and all other piping. At all crossings with less than 18 inches vertical separation, the potable water main shall be ductile iron pipe a minimum 10 feet each side of the crossing. Potable water lines shall be laid above sewage collection mains and reclaimed and raw water mains whenever crossing occurs.

3.05 FLUSHING

A. Foreign material left in the pipelines during installation often result in valve seat leakage during hydrostatic pressure testing. The Contractor shall make every effort to insure that lines are kept clean during installation.

B. Through flushing shall be required prior to hydrostatic pressure testing; flushing shall be accomplished by partially opening valves and fire hydrants several times under actual line pressures with pipeline velocities of not less than 3.0 feet per second in the largest line size to be flushed.

C. The pipelines shall be flushed full bore, and shall not be less than three (3) times the total volume of the section being tested.

D. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.

3.06 PRESSURE AND LEAKAGE TESTING

A. Hydrostatic pressure and leakage testing of reclaimed water mains shall be performed in accordance with Section 4 of AWWA C600-87. All testing shall be made using potable water. Air testing shall not be permitted.

1. The Contractor shall furnish all gauges, meters, pressure pumps, and all other equipment required to pressure test the main at no additional cost to the Owner.

2. Do not test until restraining devices are installed. Thoroughly clean and flush all pipe prior to testing to clear the lines of all foreign matter. While the pipe is being filled with water, exercise care to permit the escape of air from extremities of the test section, providing additional release cocks if required.

3. The piping shall be tested in sections as determined by the Contractor.

4. Perform hydrostatic testing at 150 pounds per square inch pressure, for a period of not less than two (2) hours).

5. The allowable limits for leakage during the hydrostatic test is determined by the formula:

$$\frac{L = SD(P)^{1/2}}{148{,}000}$$

in which,

L = Allowable leakage, in gallons per hour
S = Length of pipe being tested in feet
D = Nominal pipe diameter; in inches
P = Average test pressure during the test, in psi gauge.

6. The length of pipe shall be the actual length of pipe tested or 2,000 feet, whichever is less.

7. The Contractor shall provide accurate means for measuring the water required to maintain the test pressure. The quantity of water required to maintain the test pressure shall be the measure of the leakage.

8. Should the test fail, accomplish necessary repairs and repeat the test until within the established limits. Provide the necessary labor, water, pumps, gauges and all other items required to conduct the required water distribution system testing and perform necessary repairs.

9. If it is necessary to repair more than 10 percent of the joints, to pass the hydrostatic test, the Owner may require that the entire test section of pipe be excavated and re-laid or replaced at no additional cost.

3.07 DISINFECTION

A. Before any portion of water distribution system is considered to be substantially complete, it shall be disinfected in accordance with the requirements of AWWA Standard C651; and its disinfection shall be demonstrated by bacteriological test conducted in accordance with "Standard Methods for Examination of Water and Wastewater" for the coliaerogenes group, by an approved laboratory, acceptable to the Owner and the County Health Department having jurisdiction.

B. The disinfecting agent shall be free chlorine in aqueous solution, with sustained concentration for 24 hours or more of not less than 50 parts per million. Chlorine may be derived from chlorine gas, or 70 percent (high test) calcium hypochlorite (HTH or Perchloron, or equal). Administration may be by any of the several methods described in AWWA Standard C651 as proposed by the Contractor and approved by the Owner. Proposals as to method must be made prior to commencement of the disinfection process.

C. Following contact with chlorine solution, the system shall be thoroughly flushed out. Samples shall then be taken using sterile containers obtained from the County Health Department. Samples shall be taken by the Contractor and delivered by him to the County Health Department or approved laboratory for analysis. Sampling shall be completed on two consecutive days.

D. If samples do not demonstrate satisfactory results, the disinfection procedure shall be repeated until satisfactory samples are obtained.

3.08 SCHEDULE

A. Connection To Existing System:

1. No new water main may be placed in service until receipt of the Florida Department of Environment Protection letter of clearance.

2. All connections to existing mains shall be made after complete disinfection of the proposed system and shall be made under the direction of the owners of the existing system. Valves separating the mains being installed from existing mains shall be operated by or under the direction of said owner's representative. The cost of the work in making the connections shall be paid for by the Contractor.

3. In the event the proposed main is to be connected to a main which has one or more active services between the point of connection and the first existing line valve, a temporary plug or cap shall be installed on the new main until the pressure tests and disinfecting are completed. Upon satisfactory completion, the cap or plug shall be removed from both mains and the connection made with pipe which has been swabbed out with a solution of chlorine and water. The connection shall be made as swiftly as possible and any water in the ditch shall be kept below the level of the pipe. The pipeline shall then be placed in service by the owners' personnel.

4. In the event any existing users will be without water while a connection is being made, the Contractor shall notify the Owner when the water will be turned off and when he estimates service will be resumed. In some instances, these connections may have to be made at night. No user shall be without water service for more than two hours unless prior approval from the Owner has been received.

3.09 CONSTRUCTION QUALITY CONTROL

A. Notify the Owner, the Owner's representative and the City of Kissimmee at least 48 hours in advance of the following intervals of works:

1. Hydrostatic test

2. Taking samples for bacteriological testing

3. Placing in service

END OF SECTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. The work under this Section includes providing a complete system of reclaimed water distribution pressure piping system including continuous pipeline identification, valves, fittings and other appurtenances.

1.02 QUALITY ASSURANCE

A. Pipe Inspection: The Contractor shall obtain from the pipe manufacturers certificate of inspection to the effect that the pipe and fittings supplied for this Contract have been inspected at the plant and that they meet the requirements of these specifications. All pipe and fittings shall be subjected to visual inspection at time of delivery by rail or truck, also just before they are lowered into the trench to be laid, and joints or fittings that do not conform to these specifications will be rejected and must be removed immediately by the Contractor. The entire product of any plant may be rejected when, in the opinion of the Owner, the methods of manufacture fail to secure uniform results, or where the materials used are such as to produce inferior pipe or fittings.

B. Prevention of Electrolysis: Where deemed necessary,electrolytic action through the contact of dissimilar metals, shall be prevented by either:

1. The separation of one material from the other by means of an insulating or dielectric coupling, or

2. The use of alternative materials, as directed by the Owner.

1.03 SUBMITTALS

A. Shop Drawings: In general, the following shop drawings shall be submitted to the Owner for approval prior to construction:

1. Mill test certificates or certified test reports on pipe
2. Details of restrained joints
3. Pipe linings and coatings
4. Fittings
5. Valves and valve boxes
6. Joint lubricant
7. Pipe laying schedule showing thrust restraint measures (restrained joints) for each pipe section, valve and fitting location
8. Temporary plug and anchorage system for hydrostatic pressure test
9. Tapping sleeves and valves
10. Air release valves

11. Marking tape and detector wire

12. Service connection assemblies

1.04 JOB CONDITIONS

A. Water in Excavation: Water shall not be allowed in the trenches while the pipes are being laid and/or tested. The Contractor shall not open more trench than the available pumping facilities are able to dewater to the satisfaction of the Owner. The Contractor shall assume responsibility for disposing of all water so as not to injure or interfere with the normal drainage of the territory in which he is working. In no case shall the pipelines being installed be used as drains for such water, and the ends of the pipe shall be kept properly and adequately blocked during construction by the use of approved stoppers and not by improvised equipment. All necessary precautions shall be taken to prevent the entrance of mud, sand, or other obstructing matter into the pipelines. If on completion of the work any such material has entered the pipelines, it must be cleaned as directed by the Owner so that the entire system will be left clean and unobstructed. Also see Section 02140.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Ductile Iron Pipe And Fittings:

1. Ductile Iron Pipe: Ductile iron pipe shall conform to the requirements of AWWA C -150 and C-151, Pressure Class 350 for pipe sizes up to and including 12 inches in diameter. Pipe sizes greater than 12 inches shall be Pressure Class 250. Pipe interior shall have a bituminous seal coat over a cement mortar lining conforming to ANSI Standard A21.4. Exterior of pipe shall have a bituminous coating.

2. Fittings:

   a. All ductile iron fittings shall be mechanical joint or single gasket, push on type with a minimum pressure rating of 350 psi and shall conform to the requirements of ANSI Standard A21.10.

   b. Mechanical joint and/or single gasket, push on type fittings shall be cement lined, seal coated and outside coated as specified above for ductile iron pipe.

   c. Compact fittings shall conform to AWWA C153.

3. Joints: Mechanical joints consisting of bell, socket, gland, gasket, bolts and nuts shall conform to ANSI Standard A21.11. Bolts shall be high strength, annealed, cast iron, or high strength low alloy steel, T-head type having hexagonal nuts. Bolts and nuts shall be machined true and nuts shall be tapped at right angles to a smooth bearing surface. Single seal gasket push on type joints shall conform to the requirements of ANSI A21.11 and shall be "Tyton", "Fastite", "Super Bell Tite", "Altite", or approved equal.

4. Restrained Joints: Restrained joints may be of the types fabricated by the various manufacturers, upon approval by the Owner of details submitted by the Contractor. Restrained joints that require field welding will not be acceptable, and the thickness of the pipe barrel remaining at grooves cut for restraint shall not be less than that required for the design wall thickness. Joints using set screws will

not be acceptable. Restrained joints shall be furnishedfor 12 inches and larger pipe at changes in direction of the water main. Megalug by EBAA Iron Inc. are acceptable for mechanical joint pipe. "Field-Lok" by U.S. Pipe and "Fast-Grip" by American are acceptable for push on joint pipe.

5. Flanged Joints: ANSI B16.1, 125 pound standard. Full-faced-type rubber gaskets of an approved quality equal to "Rainbow" gaskets 1/16-inch thick, as manufactured by the U.S. Rubber Company. Bolts and nuts of Grade B conforming to the ASTM A307 for steel machine bolts and nuts and tap bolts.

6. Gaskets: Gaskets shall be of vulcanized crude rubber or polyvinyl chloride plastisol. Gaskets shall have plain tips unless otherwise specified.

B. Exposed Pipe

1. All exposed pipe shall be flanged.

2. For atmospherically exposed ductile iron and fabricated steel, the exterior protection shall be as follows:

a. Surface Preparation: Abrasive blast, or centrifugal wheel blast (Steel Structures Painting Council Specification SP 10).

b. Paint Material and Minimum Coats: Polyamide, anti-corrosive epoxy primer (1 coat, 2.5 mils minimum dry film thickness); polyurethane enamel (2 coats, 3 mils minimum dry film thickness). Exposed piping shall be purple in color.

C. Gate Valves: Resilient Seated Wedge Gate Valves shall conform to, or exceed all applicable requirements of AWWA C509.

1. All resilient seated wedge gate valves shall have non-rising stems for counter clockwise operation and a 2-inch square operating nut.

2. All resilient seated wedge gate valves shall be bubble tight at 150 p.s.i.

3. Each valve shall have the manufacturer's name, pressure rating, the year of manufacture, and an arrow to indicate the direction of opening cast into the valve body.

4. The interior and exterior of the valve body and bonnet shall have a factory applied 2-part thermo setting epoxy resin lining equal to Tnemec 140 Pota-Pox. Interior minimum 8 mils (DFT) and exterior 12 mils (DFT).

5. Each valve shall be hydrostatically tested to a pressure equal to twice the specified working pressure prior to shipment from the factory. The manufacturer shall certify each valve.

6. Acceptable manufacturers:

   Clow, American, Mueller, M & H, Kennedy, Dezurik and U.S. Pipe. Substitutes will not be permitted.

D. Butterfly Valves:

1. General: All butterfly valves shall be of the tight-closing, rubber-seat type with rubber seats that are securely fastened to the valve body or disc. No metal-to-metal seating surfaces will be permitted. Valves shall be bubble-tight at rated pressures with flow in either direction, and shall be satisfactory for applications involving frequent operation and for applications involving valve operation after long periods of inactivity and for buried installation. Valve discs shall rotate 90 degrees from the full open position to the tight shut position. Valves shall meet the full requirements of AWWA Standard C504 for Class 150B. The manufacturer shall have manufactured tight-closing, rubber-seat butterfly valves for a period of at least five years. All valves shall be Henry Pratt Company, American, Mueller or approved equal.

2. Valve Body: Valve bodies shall be constructed of cast iron ASTM A126 Class B or ductile iron. Ends shall be mechanical joint. Two trunnions for shaft bearings shall be integral with each valve body. When the disc has the rubber seat, the valve body shall have a 18-8 Type 304 stainless steel body seat.

3. Valve Discs: Valve discs shall be constructed either of alloy cast iron ASTM A 436 Type 1 (Ni-Resist), ductile iron ASTM A 536, or cast iron ASTM A 48 each with Type 316 stainless steel seating edge or the entire disc may be constructed of cast 316 stainless steel.

4. Valve Seats: Valve seats shall be of a synthetic or natural rubber compound and may be mounted on the disc or valve body.

5. Valve Bearings: Valves shall be fitted with sleeve-type bearings. Bearings shall be corrosion resistant and self-lubricating.

6. Buried Operators: Buried service operators shall be permanently lubricated, sealed for submersion in water for pressures of 20 feet and equipped with a two-inch square AWWA operating nut which shall indicate the direction to open. The operator shall be constructed such that the valve will open when the nut is turned to the left (counter clockwise) to open.

7. Coatings: Interior of valve body and valve disc except for valve seat and stainless steel valve sear ring shall be coated with 8 mils (DFT) of Tnemic 140 Pota-Pox or approved equal. Exterior of valves with 12 mils (DFT) of Tnemic 140 Pota-Pox or approved equal.

E. Valve Boxes: Cast iron valve boxes shall be provided for all valves installed underground. The valve boxes shall be adjustable to fit the depth of earth cover over the valve and shall be designed so as to prevent the transmission of surface loads directly to the valve or piping. Valve boxes shall have an interior diameter of not less than 5 inches. The valve boxes shall be provided with covers marked RECLAIMED WATER which shall be so constructed as to prevent tipping or rattling. Boxes shall be Clow Corporation No. F-2450, Mueller Company No. H-10357 or approved equal. Extension sections shall be cast iron only. The protective ring shall be constructed of Class B concrete.

F. Tapping Sleeves And Valves: Tapping sleeves and tapping valves used to make "wet" taps into existing mains shall be provided and installed at locations as shown on the Drawings. Tapping sleeves shall be split cast iron units and rated for 150 psi working pressure. Steel units shall be epoxy coated with stainless steel bolts. The Contractor shall determine the outside diameter of the existing main before ordering the sleeve. Valves shall

be of the nonrising stem type with O-ring seals and applicable to requirements as specified above for gate valves.

G. Corporation Stops and Service Clamps:

1. Corporation stops shall be Mueller Co. Type H-15000 for 1-inch service and Type H-10003 for 2-inch service or approved equal.

2. Corporation stops shall be Ford Meter Box Co. Type F-1000, Mueller Co. Type H-15009 or approved equal with inlet having AWWA tapered threads and outlet for polyethylene or copper tubing with stainless steel insert stiffener.

3. Service clamps for PVC mains shall be full circle bearing type, and for ductile iron mains service clamps shall be the double-strap tapped saddle type, Rockwell 313 or equal.

H. Service Terminal Fittings:

1. Single 1-inch terminal fitting shall be 1-inch ringstyle valve, drilled for wire sealing, angle inverted key meter valve cat. No. KV-23W by Ford Meter Box Co., Mueller No. H-14259, Hays No. 25012DF or approved equal.

2. Twin 1-inch shall be 1-inch "U" branch valve assembly, with standard 7 1/2-inch spacing between outlet centers, drilled for wire sealing, Ford Meter Box Co. No. UV63-42W, Hays No. 25040 DF or approved equal.

I. Castings: The manhole frame and cover shall conform to the ASTM Designation A48, Class 30. Castings shall be true to pattern in form and dimensions and free of pouring faults and other defects in positions which would impair their strength, or otherwise make them unfit for the service intended. The seating surfaces between frames and covers shall be machined to fit true. No plugging or filling will be allowed. Lifting or "pick" holes shall be provided, but shall not penetrate the cover. Casting patterns shall conform to those shown on the Drawings. The words "RECLAIMED WATER VALVE" shall be cast in the manhole cover. The manhole frame and cover shall be traffic bearing.

J. Tie Rods: Steel for tie rods and tie bolts shall conform to the requirements of ASTM Designation A 242, and rods shall be galvanized in conformance with requirements of ASTM Designation A 123. Tie rods and tie bolts shall be Super Star Tierod Figure No. SS12 and Tiebolt Figure No. SST7 respectively as manufactured by Star National Products.

K. Additional Work: Additional items of construction, necessary for the complete installation of the systems, shall conform to specific details shown on the Drawings and shall be constructed of first-class materials conforming to the applicable portions of these specifications.

L. Air release valves shall be installed as shown on the plans. The valves shall be constructed with a cast iron body, cover and baffle, stainless steel float, bronze water diffuser, BUNA-N or viton seat and stainless steel trim and rated for a 200 psi test pressure.

1. Valves shall be provided with a vacuum check to prevent air from re-entering the line. All fittings shall be threaded.

2. Air release valves shall be Model 200 as manufactured by Apco Valve and Primer Corporation, Schaumburg, Illinois. Other acceptable manufacturers include Empire, Valmatic and Crispin.

M. Flanged coupling adapters shall be Clow Style 127 or equal.

N. Compression couplings shall be Dresser Style 153 or equal. Gaskets shall be suitable for the service conditions.

PART 3 - EXECUTION

3.01 PREPARATION

A. Bedding:

1. Pipe Cradle: Upon satisfactory installation of the pipe bedding material as specified in Section 02225, a continuous trough for the pipe barrel and recesses for the pipe bells or couplings shall be excavated by hand digging. When the pipe is laid in the prepared trench, true to line and grade, the pipe barrel shall receive continuous, uniform support and no pressure will be exerted on the pipe joints from the trench bottom.

2. Cleanliness: The interior of the pipes shall be thoroughly cleaned of all foreign matter before being gently lowered into the trench and shall be kept clean during laying operations by means of plugs or other approved methods. During suspension of work for any reason at any time, a suitable stopper shall be placed in the end of the pipe last laid to prevent mud or other foreign material from entering the pipe.

3.02 INSTALLATION

A. Pipe:

1. Gradient: Lines shall be laid straight, and depth of cover shall be maintained uniform with respect to finish grade, whether grading is completed or proposed at time of pipe installation. When a grade or slope is shown on the Drawings, batter boards with string line paralleling design grade, or other previously approved means, shall be used by the Contractor to assure conformance to required grade.

2. Pipe Joint Deflection: Whenever it is desirable to deflect pipe, the amount of deflection shall not exceed the maximum limits as shown in AWWA Standard C600 for ductile iron pipe.

3. Rejects: Any pipe found defective shall be immediately removed and replaced with sound pipe at the Contractor's expense.

4. Joint Compounds: No sulphur base joint compound shall be used.

5. Guidelines: AWWA C600 for DIP.

B. Ductile Iron Pipe Joints:

1. Type: The joints of all pipelines shall be made absolutely tight. The particular joint used shall be approved by the Owner prior to installation. Where shown on the Drawings or where, in the opinion of the Owner, settlement or vibration is likely to occur, all pipe joints shall be bolted.
2. Mechanical Joints: All types of mechanical joint pipes shall be laid and jointed in full conformance with manufacturer's recommendations, which shall be submitted to the Engineer for review and approval before work is begun. Only especially skilled workmen shall be permitted to make up mechanical joints. Torque wrenches set as specified in AWWA Standard C111, shall be used; or spanner type wrenches not longer than specified therein may be used without the permission of the Engineer.

3. Restrained Joints: Restrained joints shall be provided at changes in direction of all water mains in lieu of concrete thrust blocks.

   a. Restrained joints may be of the types fabricated by the various manufacturers, upon approval by the Engineer or details submitted by the Contractor. Restrained joints that require field welding will not be acceptable, and the thickness of the pipe barrel remaining at grooves cut for restraint shall not be less than that required for the design wall thickness. Joints using set screws will not be acceptable, unless specifically approved by the Engineer for the application.

   b. The minimum number of restrained joints required for resisting forces at fittings and changes in direction of pressure pipe shall be determined from the length of restrained pipe on each side of fittings and changes in direction necessary to develop adequate resisting friction with the soil. The formula and parameters given in the Dipra "Thrust Restraint Design for Ductile Iron Pipe" were used to determine the minimum requirements. The requirements are shown on the plans.

   c. Bolts and nuts for restrained joints shall be corten, low alloy, high strength steel.

C. Installing Valves And Boxes:

1. Valves: Valves shall be carefully inspected, opened wide and then tightly closed and the various nuts and bolts shall be tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Gate valves, unless shown otherwise, shall be set with their stems vertically above the center line of the pipe. Butterfly valves shall have the disc shaft installed horizontally. Any valve that does not operate correctly shall be removed and replaced.

2. Valve Boxes: Valve boxes shall be carefully centered over the operating nuts of the valves so as to permit a valve key to be fitted easily to the operating nut. In areas to be paved, valve boxes shall be set to conform to the level of the finished surface and held in position by a ring of concrete placed under the support flange as shown on the Drawings. The valve box shall not transmit surface loads to the pipe or valve. Care shall be taken to prevent earth and other material from entering the valve box. Any valve box which is out of alignment or whose top does not conform to the finished ground surface shall be dug out and reset. Before final acceptance of the work all valve boxes shall be adjusted to finish grade.

D. Backfilling:

1. After pipe has been laid, inspected, and found satisfactory, sufficient backfill shall be placed along the pipe barrel to hold the pipe securely in place during the conduction of the preliminary hydrostatic test. No backfill shall be placed over joints until the preliminary test is satisfactorily completed, leaving them exposed to view for the detection of visible leaks.

2. Upon satisfactory completion of the preliminary hydrostatic test, backfilling of the trench shall be completed.

3.03 PIPELINE IDENTIFICATION

A. Pipe Marking Tape:

1. Metallic, detectable underground utility tape (6 inches wide) shall be placed in the trench after initial backfill and compaction has been completed to the top of the pipe envelope. The tape thickness shall not be less than 4 mils. The tap shall be continuous for the entire length of the pipeline.

2. The utility tape shall be an inert plastic film formulated for extended use underground, and shall have a thickness of not less than 4 mils. The color shall extend the full width of the tape and be imprinted with the following information, "Caution Reclaimed Water Main Below." The message shall be printed with yellow lettering on a pantone safety precaution purple background. The tape shall be as manufactured by Shield-Tec (TM) or approved equal.

B. Pipe Color:

1. All ductile iron mains shall be marked with a continuous stripe located within the top 90 degrees of the pipe. The stripe shall be a minimum 2 inches in width and shall be the color purple. Backfill shall not be placed for 30 minutes following paint application.

3.04 SPACING

A. A minimum horizontal separation of 5 feet (center to center) or 3 feet (edge to edge), whichever is more stringent, shall be maintained between potable water mains and reclaimed water mains.

B. A minimum horizontal separation of 10 feet (edge to edge) shall be maintained between reclaimed water mains and sewage collection mains.

C. A minimum vertical separation of 18 inches between the invert of the upper pipe and the crown of the lower pipe shall be maintained between potable water mains and all other piping. At all crossings with less than 18 inches vertical separation, the potable water main shall be ductile iron pipe a minimum 10 feet each side of the crossing. Reclaimed water lines shall be laid above sewage collection mains and below potable water mains whenever crossing occurs.

3.05 FLUSHING

A. Foreign material left in the pipelines during installation often result in valve seat leakage during hydrostatic pressure testing. The Contractor shall make every effort to insure that lines are kept clean during installation.

B. Through flushing shall be required prior to hydrostatic pressure testing; flushing shall be accomplished by partially opening valves and fire hydrants several times under actual line pressures with pipeline velocities of not less than 3.0 feet per second in the largest line size to be flushed.

C. The pipelines shall be flushed full bore, and shall not be less than three (3) times the total volume of the section being tested.

D. The Contractor shall dispose of the flushing water without causing a nuisance or property damage.

3.06 PRESSURE AND LEAKAGE TESTING

A. Hydrostatic pressure and leakage testing of reclaimed water mains shall be performed in accordance with Section 4 of AWWA C600-87. All testing shall be made using potable water. Air testing shall not be permitted.

1. The Contractor shall furnish all gauges, meters, pressure pumps, and all other equipment required to pressure test the main at no additional cost to the Owner.

2. Do not test until restraining devices are installed. Thoroughly clean and flush all pipe prior to testing to clear the lines of all foreign matter. While the pipe is being filled with water, exercise care to permit the escape of air from extremities of the test section, providing additional release cocks if required.

3. The piping shall be tested in sections as determined by the Contractor.

4. Perform hydrostatic testing at 150 pounds per square inch pressure, for a period of not less than two (2) hours).

5. The allowable limits for leakage during the hydrostatic test is determined by the formula:

$$\frac{L = SD(P)^{1/2}}{148{,}000}$$

in which,

L = Allowable leakage, in gallons per hour
S = Length of pipe being tested in feet
D = Nominal pipe diameter; in inches
P = Average test pressure during the test, in psi gauge.

6. The length of pipe shall be the actual length of pipe tested or 2,000 feet, whichever is less.

7. The Contractor shall provide accurate means for measuring the water required to maintain the test pressure. The quantity of water required to maintain the test pressure shall be the measure of the leakage.

8. Should the test fail, accomplish necessary repairs and repeat the test until within the established limits. Provide the necessary labor, water, pumps, gauges and all other items required to conduct the required water distribution system testing and perform necessary repairs.

9. If it is necessary to repair more than 10 percent of the joints, to pass the hydrostatic test, the Owner may require that the entire test section of pipe be excavated and re-laid or replaced at no additional cost.

3.07 DISINFECTION

A. Before any portion of the reclaimed water distribution system is considered to be substantially complete, it shall be disinfected in accordance with the requirements of AWWA Standard C651; and its disinfection shall be demonstrated by bacteriological test conducted in accordance with "Standard Methods for Examination of Water and Wastewater" for the coliaerogenes group, by an approved laboratory, acceptable to the Owner and the County Health Department having jurisdiction.

B. The disinfecting agent shall be free chlorine in aqueous solution, with sustained concentration for 12 hours or more of not less than 50 parts per million. Chlorine may be derived from chlorine gas, or 70 percent (high test) calcium hypochlorite (HTH or Perchloron, or equal). Administration may be by any of the several methods described in AWWA Standard C651 as proposed by the Contractor and approved by the Owner. Proposals as to method must be made prior to commencement of the disinfection process.

C. Following contact with chlorine solution, the system shall be thoroughly flushed out. Samples shall then be taken using sterile containers obtained from the County Health Department. Samples shall be taken by the Contractor and delivered by him to the County Health Department or approved laboratory for analysis.

D. If samples do not demonstrate satisfactory results, the disinfection procedure shall be repeated until two series of satisfactory samples are obtained, the period between such series of samples to be a minimum of 24 hours.

3.08 SCHEDULE

A. Connection To Existing System:

1. All connections to existing mains shall be made after complete disinfection of the proposed system and shall be made under the direction of the owners of the existing system. Valves separating the mains being installed from existing mains shall be operated by or under the direction of said owner's representative. The cost of the work in making the connections shall be paid for by the Contractor.

2. In the event the proposed main is to be connected to a main which has one or more active services between the point of connection and the first existing line valve, a temporary plug or cap shall be installed on the new main until the pressure tests and disinfecting are completed. Upon satisfactory completion, the cap or plug shall be removed from both mains and the connection made with pipe which has been swabbed out with a solution of chlorine and water. The connection shall be made as swiftly as possible and any water in the ditch shall be kept below the level of the pipe. The pipeline shall then be placed in service by the owners' personnel.

3. In the event any existing users will be without reclaimed water while a connection is being made, the Contractor shall notify the Owner when the water will be turned off and when he estimates service will be resumed. In some instances, these connections may have to be made at night. No user shall be without reclaimed water service for more than two hours unless prior approval from the Owner has been received.

3.09 CONSTRUCTION QUALITY CONTROL

A. Notify the Owner, the Owner's representative and the City of Kissimmee at least 48 hours in advance of the following intervals of works:

1. Hydrostatic test

2. Taking samples for bacteriological testing

3. Placing in service

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work included under this Section consists of furnishing and installing fiberglass oil skimmers. Skimmers shall be constructed to the lines and grades as shown on the Plans and conform to the material specifications as provided herein. The skimmers include all labor and materials including mounting fasteners, brackets, posts, Class I concrete for posts, and all other items necessary for the construction of the completed skimmer.

1.02 QUALITY ASSURANCE

A. Standards: Unless otherwise specified, all materials, workmanship and practices shall conform to the current editions of the following Standards:

1. Uniform Building Code

2. OSHA Standards

3. Section 965 of FDOT's "Standard Specifications for Road and Bridge Construction, 1991"

1.03 SUBMITTALS

A. Submit Shop Drawings, including material lists, fabrication and erection drawings for approval in accordance with the General Requirements. Fabrication shall not be approved until the submission has been approved.

PART 2 - PRODUCTS

2.01 OIL SKIMMERS

Oil skimmers and baffles shall be constructed of structural fiberglass reinforced plastic. The skimmers include the blades, mounting fasteners, brackets posts, and all items necessary for the construction and installation of the completed skimmer. The skimmer will be shipped assembled or knocked down (KD) with simple assembly instructions.

A. Material

Components of the fiber "Glaskimer" shall be fiberglass reinforced thermosetting resin, 40% normal glass content, meeting or exceeding the physical properties listed below. The reinforcements shall consist of a combination of unidirectional fiberglass roving, continuous strand mat, and polymeric surfacing veil. The resin shall be a corrosion resistant grade of isophthalic polyester with ultraviolet (UV) light inhibitors.

B. Thickness

Composite skimmer and weir plates shall normally be 3/16" and posts 1/4", unless otherwise specified.

C. Composite Skimmer Blades

Skimmer blades shall be fabricated from structural fiberglass flat plat and angles. All joints will be bonded and riveted following acceptable bonding procedures as specified by the manufacturer, Environmental Composites, Inc.

D. Support Brackets

Support brackets will be fabricated from the same grade of structural fiberglass as the skimmer blade.

E. Skimmer Posts and Weirs

Support posts on weir designs shall be structural fiberglass 3" x 1/4" square tubing. Fiberglass skimmer plate shall be attached to the posts by means of stainless steel thru bolts with washers, and with bonding strips and plastic rivets.

F. Physical Properties

The Fiber "Glaskimer" structural materials shall exhibit the following physical properties:

Property	Test Method	Unit	Longitudinal	Transverse
Tensile Strength	ASTM D638	PSI	30,000	7,000
Tensile Modulus	ASTM D638	PSIx10	3.0	.8
Flexural Strength	ASTM D790	PSI	30,000	10,000
Flexural Modulus	ASTM D790	PSIx10	1.6	.8
Izod Impact	ASTM D256	Ft-lb/in.	28	4
Compressive Strength	ASTM D695	PSI	30,000	15,000
Property	Test Method	Unit	Longitudinal	Transverse
Compressive Modulus	ASTM D695	PSI	2.5	1.0
Shear Strength	ASTM D732	PSI	5,500	5,500
Coefficient of:				
Thermal Expansion	ASTM D696	in/in/C	5.2x10-6	--
Water Absorption	ASTM D670	Max %	.6	--

2.02 FABRICATION

A. Fabrication shall be in accordance with the specified standards. Size of various members and number of parts indicated on the Drawings are minimum and shall be increased as necessary to meet requirements.

PART 3 - EXECUTION

3.01 PREPARATION

A. Pipe Trenches:

1. Excavate the pipe trenches to the widths necessary for the proper laying of the pipe and keeping the banks as nearly vertical as practicable. In paved areas, maintain the trench walls vertical and sheeted, if required, with the clearance between the pipe and trench wall or back of sheeting not exceeding 18 inches. Excavate the bottom of the trenches to a depth of the outside bottom of the

pipe barrel and replace any over excavation with suitable compacted material. For inlets and other appurtenances, make the excavation sufficient to provide a clearance between their outer vertical surfaces and the face of the excavation, or sheeting if used, of not less than 12-inches.

2. Remove for the full width of the excavation soft, spongy, or otherwise unstable material encountered below the established grade of the excavation which will not provide a firm foundation for subsequent work and replace with approved fill material.

3. Where sheeting and bracing are necessary to prevent caving of the trench sidewalls or sidewalls of excavation for other structures, and to safeguard the workmen, excavate the trench or excavation for other structures to such width that the proper allowance is made for the space occupied by the sheeting and bracing to provide clearance as specified above.

3.02 ERECTION

A. Erection of the skimmers shall be in accordance with the specified standards and as indicated on the Drawings.

END OF SECTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Section shall include, but not be limited to the construction and installation of a gravity sanitary sewerage collection system, including all labor, equipment, materials and all incidentals required to install manholes, gravity sewer mains, service laterals, and testing, including all appurtenances as shown on the plans and as specified herein.

B. The work shall include, but not be limited to polyvinyl chloride (PVC) pipe and fittings, ductile iron pipe, precast concrete manholes, sheeting, bracing, excavation, backfilling, dewatering where required, grading and drainage, slope protection, concrete work, Rip-Rap, compaction, grass restoration, pavement restoration where required, and all other work incidental to the project.

1.02 QUALITY ASSURANCE

A. Reference Standards:

1. W.P.C.F. Manual of Standard Practice No. 9

2. Handbook of Ductile Iron Pipe, 6th Edition (DIPRA)

3. Recommended Standards for Sewage Works, Chapter 20. (Ten State Standards)

4. Florida Department of Environmental Protection, F.A.C. 17-600

B. Inspection and Certification of Pipe and Fittings:

1. All pipe, fittings and appurtenances to be installed under this specification may be inspected and tested for compliance with these specifications at the manufacturers facility by an independent testing laboratory selected by the Contractor. The manufacturers cooperation shall be required in these inspections.

2. The Contractor shall obtain a certificate of inspection from the pipe manufacturer stating that the pipe and fittings supplied for this project has been inspected and tested at the point of origin, and that they meet or exceed the requirements set forth in these specifications.

3. The cost of the inspections and tests shall borne by the Contractor. Letters of certification shall be furnished to the Owner for all inspections and tests, prior to installation of the pipe.

1.03 HANDLING AND STORAGE OF PIPE, CONCRETE PRODUCTS AND APPURTENANCES

A. All pipe, pipe fittings, manhole sections, grade rings and cast iron rings and covers shall be loaded and unloaded by lifting with hoists or skidding in order to avoid shock or damage. Precast concrete manholes and manhole sections shall be handled with lift rings only. Under no circumstances shall pipe, fittings or concrete products be dropped, or moved in such a manner that would cause damage to the products.

1. Pipe, fittings and concrete products shall not be rolled or skidded into or against pipe or concrete products on the ground.

2. Slings, hooks, pipe tongs and other lifting devices shall be padded and used in such a manner as to prevent damage to pipe or other construction products.

3. Stored materials shall be kept safe from damage. The interior of all pipe, fittings, manholes etc. shall be kept free from dirt, oil, grease and foreign matter at all times.

B. The Contractor shall cover stored PVC pipe to prevent exposure to ultraviolet radiation.

C. Pipe gaskets shall be used in the work on a first-in, first-out basis.

1. Gaskets for mechanical joint and push-on joint ductile iron pipe shall be stored in a cool, dry location, out of direct sunlight.

2. Gaskets shall be stored in such a manner so as to prevent coming into contact with petroleum products.

D. Mechanical joint bolts and push-on joint locking segments shall be handled and stored in such a manner that will ensure proper use in respect to pipe types and sizes.

1.04 SUBMITTALS

A. Procedures:

1. Submit product data, shop drawings, samples, testing laboratory reports, etc. in a timely manner and in accordance with the general requirements of Section 01340.

B. Product Data:

1. Submit manufacturer's detailed product literature, which shall include, where applicable, mill test reports, equipment capacity data, manufacturer's literature that notes compliance with the reference standards including, but not limited to, product type, pressure rating, schedule, class, grade, and all other information pertinent to the installation.

2. The data to be submitted shall include, but not be limited to:

a. Polyvinyl Chloride (PVC) Pipe (ASTM 3034) or (ASTM F-949)

b. Ductile Iron Pipe ANSI/AWWA C-1512/A21-51-86

c. Precast Concrete Manhole Sections (ASTM C-478)

d. Concrete Mix (ASTM C-94, Type II Cement)

e. Concrete Coatings

f. Manhole Joint Sealant

g. Manhole Reinforcement

h. Resilient Manhole Connectors (ASTM C-928)

i. Manhole Frames and Covers

j. Manhole Adjustment Rings

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Polyvinyl Chloride (PVC) pipe and fittings for gravity sanitary sewer mains, laterals and stubs shall conform to ASTM 3034, SDR35 or ASTM F-949.

1. ASTM 3034:

a. PVC pipe shall be manufactured from approved, Type 1, Grade 1, PVC 12454-C conforming to ASTM D-1784 and shall meet all requirements of ASTM D-2122 and ASTM D-2412.

b. PVC pipe shall have integral wall thickened bells or extruded couplings with gasket seals. Solvent weld joints will not be permitted.

c. PVC pipe joints shall be rubber gasket push-on joints.

d. The pipe shall be colored green for inground identification as sewer pipe.

e. Joint seals in PVC pipe and fittings shall comply with ASTM D-3212 and ASTM F-477

f. PVC pipe supplied shall be UL/FM approved.

g. All PVC fittings for gravity sanitary sewer service shall conform to requirements of ASTM D-3034 with a minimum wall thickness of SDR 35 as defined in Section 7.4.1. Fittings in sizes through 8 inches shall be molded in one piece with elastomeric joints and minimum socket depths as specified in Sections 6.2 and 7.3.2.

h. PVC pipe shall be identified on the exterior of the pipe with the following information:

1) Nominal pipe size and o.d. base

2) Material code designation number (12454C)

3) Dimension ratio number (SDR 35)

4) Pipe Stiffness Designation (PS46)

5) ANSI/ASTM Designation (D-3034)

6) Pipe manufacturers name and production code.

2. ASTM F-949:

a. The thermoplastic material shall be a rigid PVC (polyvinyl chloride) plastic and shall meet or exceed the requirements of ASTM D-1784, for a minimum cell classification of 12454B or 12454C. The fittings shall be made of PVC plastic having a cell classification of 12454B, 12454C, or 13343C, as defined in ASTM D-1794.

b. The PVC sewer pipe shall be manufactured per ASTM F-949 with a minimum pipe stiffness (tested in accordance with ASTM D-2412) of 50 psi. There shall be no evidence of splitting, cracking or breaking when pipe is tested in accordance with ASTM D-2412 at 60 percent flattening.

c. Gasketed pipe joints shall show no leakage when tested in accordance with ASTM D-3212. Elastomeric seals (gaskets) shall meet the requirements of ASTM F-477.

d. Pipe dimensions and coupling and fitting socket dimensions, shall conform in accordance with ASTM D-2122. For information regarding dimensions of 4-inch through 18-inch PVC corrugated sewer pipe, refer to Table 1 in ASTM F-949.

e. Proper installation practices and procedures shall conform to ASTM D-2321.

B. Ductile Iron Pipe (DIP) and fittings for gravity sanitary sewer mains, laterals and stubs shall conform to AWWA C-150 and C-151, pressure Class 350.

1. Ductile Iron Pipe shall have a minimum tensile strength of 60,000 p.s.i. with a minimum yield strength of 42,000 p.s.i.

2. Ductile iron pipe joints shall be push-on joints complying with ANSI A21.11 (AWWA C111).

3. Ductile iron pipe shall receive an exterior bituminous coating as per ANSI A21.6, A21.8 (AWWA C106, 108).

4. Pipe Lining - Polyethylene:

a. Line the interior of pipe and fittings with polyethylene complying with ANSI/ASTM D 1248 compounded with sufficient carbon black to resist ultraviolet rays during aboveground storage of the piping and fittings. Lining to have an average thickness of 40 mils with a minimum thickness of 35 mils. The pipe interior shall be blast cleaned in accordance with SSPC SP-6 prior to lining. The polyethylene shall be heat bonded to the pipe interior.

b. In pipe utilizing push-on gaskets, the lining shall extend over the edge of the spigot end into the area sealed by the rubber gasket. The lining shall be continuous on the inside to the sealed gasket groove on the inside of the bell. The lining shall extend over the edge of the spigot end through the socket into the gauging ring area sealed by the gasket. The lining fittings shall cover the interior surfaces including the socket areas as defined above.

c. Pipe and lining shall be tested for holidays according to the National Association of Corrosion Engineers Standard Recommended Practice as outlined in RP0274. One holiday per pipe length may be repaired in the field. Pipe with holidays shall be rejected. Lining shall be American Cast Iron Pipe "Polybond", U.S. Pipe "Polylined", or equal.

2.02 PRECAST CONCRETE MANHOLE SECTIONS

A. Precast manhole base sections, barrel sections eccentric or concentric cone sections and grade rings shall be in accordance with ASTM C-478.

1. Concrete for the construction of manhole sections shall be Class A concrete with a compressive strength of 4,000 p.s.i. at 28 days and shall conform to ASTM C-94, Type II cement.

2. Manhole sections shall be cured by an approved method for a minimum of four (4) days prior to painting and shall not be shipped for a minimum of three (3) days after having been painted. Manhole sections shall not be shipped for a minimum of seven (7) days after removal from the forms.

3. The interior and mating surfaces shall have a protective coal tar epoxy coating having a minimum dry thickness of 16 Mils. The exterior surfaces shall have a protective coal tar epoxy coating with a minimum dry thickness of 9 Mils.

   The coatings shall be applied by the manufacturer in strict accordance with the paint manufacturers recommendations.

   Acceptable Coatings: Koppers 300M or approved equal.

4. The date of manufacture of the manhole sections and the name or trademark of the manufacturer shall be clearly marked or impressed on the exterior of each precast section when the form is removed, and on the interior after the section has been painted.

5. Precast manhole sections shall be cast with tongue and groove joints, sealed with "Ramnek" (TM) sealant as manufactured by the T.K. Snyder Company of Houston, Texas or approved equal. Joint sealant shall meet or exceed all requirements of Federal Specification SS-S-210A and AASHTO M-198. Rubber ring manhole joint seals shall not be permitted.

6. Precast manhole bases with invert channels cast or formed directly into standard precast concrete manhole bases shall be used except at junctions with existing sewer mains.

   The bench shall be formed smooth and brush finished and shall slope smoothly and evenly downward at the minimum slope of three quarters (3/4) inch per foot from the manhole wall to the flow channel. The size and shape of the flow channel shall conform to the lower eight tenths (0.8) diameter of the inlets and outlets.

   When flow line directional changes occur exceeding forty five (45) degrees an additional flow line drop of one tenth (0.1) foot across manholes shall be provided.

   The precast manhole base units shall be of the Moore Base design or Tru-Contour design.

7. Shallow or flat top manholes, where the depth of cover is less than four (4) feet, shall have vertical walls with a flat precast top slab. The precast top slab shall be capable of supporting the overburden plus a live load equivalent to AASHTO H-20 loading. The manhole shall be as shown in the applicable detail at the end of this section.

8. Brick manholes will not be permitted.

9. Precast manholes sections (4 ft diameter) shall have a wall thickness of not less than five (5) inches.

10. Manhole base sections shall not be less than eight (8) inches thick and shall be reinforced with number five (5) bars at nine (9) inches on centers, each way and shall have number four (4) bars around each pipe opening as shown in the applicable detail at the end of this section.

11. All precast concrete products shall be wet cast. Dry casting, or low slump concrete will not be acceptable.

12. All precast concrete manhole bases shall have proper lifting loops in the base slabs (minimum of three (3)).

13. Penetrating lifting holes will not be acceptable in any structure. Where non-penetrating lifting holes are approved, their use will not be permitted within eight (8) inches of any joint or pipe penetration.

14. Where pipes enter or exit manholes a neoprene rubber resilient connector shall be used to provide a watertight connection for the pipe penetration into the manhole. Watertight resilient manhole connectors shall conform to ASTM C-923.

    The resilient connector shall be Kor-N-Seal molded neoprene boot as manufactured by National Pollution Control Systems, Inc. of Nashua, New Hampshire or A-Lok resilient pipe connector as manufactured by A-Lok Products, Inc. of Tullytown, Pennsylvania, or approved equal.

    Resilient pipe connectors shall be supplied and installed by the manufacturer of the precast products.

15. Precast concrete grade rings for manhole adjustment shall conform to ASTM C-478. Grade rings shall be a minimum of two (2) inches thick, and a maximum of five (5) inches thick and shall be reinforced with six (6) gauge or thicker reinforcing wire. The use of brick for manhole adjustment shall not be approved.

16. All pipe penetrations into manhole walls shall be precast or corebored by mechanical means. The use of concrete chisels or hand tools shall not be allowed.

2.03 MANHOLE FRAME, COVER AND ADJUSTMENT RINGS

A. Gray iron castings for manhole frames, covers and adjustment rings shall conform to ASTM A-48 Class Thirty (30).

1. Lifting, or pick holes shall be non-penetrating.

2. Frames and covers shall be traffic bearing and shall be capable of supporting AASHTO H-20 loadings.

3. The minimum clear opening shall be 24 inches.

4. The manhole frame, cover and adjustment rings shall be USF 225 as manufactured by U.S. Foundry or equal.

PART 3 - EXECUTION

3.01 PIPELINE TRENCH CONSTRUCTION

A. Refer to Section 02225.

B. Trench excavation and shoring shall be in strict accordance with OSHA Standard 1926-606, Subpart P, Excavations Trenching and Shoring 29 CPR Chapter XVII (7-1-89 Edition) and OSHA Revised Rule 2226, Excavations, (Latest Revision).

C. Trench excavating and backfilling including sheeting, shoring, bracing, dewatering, foundation, bedding and compaction and the furnishing and disposal of material shall be performed in such a manner as to promote the safe and expedient execution of the work.

D. All properties that have been disturbed in the course of the work shall be restored to their original condition.

3.02 SHEETING, SHORING AND BRACING

A. The Contractor shall furnish install and maintain sheeting, bracing and shoring required to support the sides of the excavation, and to prevent any movement which may damage adjacent utilities, pavements or structures, damage or delay the work or endanger life and health. All voids outside the supports shall be immediately filled and compacted. All sheeting, bracing and shoring to be used shall be designed by a Florida registered professional Engineer, and shall be in accordance with OSHA Standard 1926-606, Subpart P, Excavation, Trenching and Shoring.

3.05 SETTING MANHOLES

A. The soil foundation beneath the manhole shall be stabilized and compacted to ninety five (95) percent of maximum density as determined by ASTM D-1557 and ASTM D-1556.

B. The precast manhole base section shall be carefully placed on the prepared foundation so as to be fully and uniformly supported in true alignment, making certain that all entering pipes can be inserted on the proper line and grade.

1. Precast manhole units shall be handled by lifting rings only.

2. The first precast section shall be placed and adjusted to true grade and alignment, all inlet pipes shall be properly installed so as to form an integral watertight unit. The sections shall be uniformly supported by the base structure, and shall not bear directly on any of the entering pipes.

3. Precast manholes shall be placed and aligned to provide vertical alignment with not greater than one eighth (1/8) inch maximum tolerance for six (6) feet of depth. The completed manhole shall be rigid, true to dimensions and alignment, and shall be watertight.

C. The manhole frame and cover shall be fully bedded in mortar, with precast concrete grade rings placed between the manhole cone and the manhole frame.

1. Precast concrete grade rings shall conform to the specification for precast concrete manhole sections as designated in ASTM C-478.

2. Precast concrete grade rings shall have a minimum depth of two (2) inches and a maximum depth of five (5) inches.

3. Precast concrete grade rings shall not be used for more than nineteen (19) inches of vertical adjustment.

4. The use of brick for manhole adjustment will not be permitted.

3.06 LAYING GRAVITY SEWER MAINS

A. Gravity sanitary sewer lines shall be laid in accordance with the details shown on the plans and specified herein, and shall be in compliance with all applicable portions of ASTM D-2321.

1. The trench bottom shall be graded to the proposed elevation of the pipe line and the bottom shaped to fit the lower quadrant of the pipe. Holes shall be excavated at each bell so that the pipe will be uniformly supported along the entire length of the barrel only. Pipe bedding shall be in compliance with Section 02225.

2. All sanitary sewer lines shall be laid using a laser for setting line and grade. The Contractor shall be responsible for all control for the project. The line and grade shall be constantly checked for conformance to the approved design on a joint by joint basis.

3. In the event a pipe segment deviates from the approved design, either in line or grade, the work shall immediately be stopped and the defect shall be remedied before proceeding with new work.

4. Pipe installation and jointing shall be in strict accordance with the pipe manufacturers specifications and instructions for the type of pipe used. Any pipe having a defective joint, bell or spigot shall be rejected, removed from the site and replaced with a sound unit.

5. Pipe laying in the finished trench shall commence at the lowest point and shall be laid upgrade from the point of connection with all bell ends forward.

6. All pipe shall be installed to the homing mark on the spigot. On field cut pipe, the Contractor shall provide a homing mark on the spigot end in strict accordance with the manufacturers recommendations.

7. All pipe laid shall be retained in position so as to maintain alignment and joint closure until sufficient haunching and backfill is in place to adequately hold the pipe in place.

8. Foreign materials shall be prevented from entering the pipe while pipe is being placed in the trench. No debris, tools, articles of clothing or other materials shall be placed in the pipe at any time.

9. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to the correct line and grade. The pipe shall be properly bedded and secured in place with haunching to the springline of the pipe. Bedding and haunching material shall be compacted by tamping to ninety five (95) percent of maximum density in accordance with ASTM D-1557.

10. At all times when pipe laying is not in progress for ten (10) minutes or more the open ends of the pipe shall be closed by a watertight plug or other approved means to ensure that absolute cleanliness is maintained inside the pipe at all times.

11. Laying conditions for sanitary sewerage collection systems shall be in accordance with ASTM A-746. Unless specified otherwise by the Owner, ordinary bedding conditions shall be used for sixteen (16) inch diameter pipe and smaller; First Class bedding conditions shall be used for eighteen (18) inch pipe and larger.

3.07 JOINTING SANITARY SEWER PIPES

A. Pipe installation and jointing shall be in strict accordance with the pipe manufacturers specifications and instructions for the type of pipe used.

B. The Contractor shall take all reasonable precautions to provide assurance that the interior of the pipe and the jointing seal shall be free from sand, dirt, trash or other foreign material before installation in the line. Any pipe or fitting that has been installed, containing dirt or other detrital material in it shall be removed, cleaned and relaid. Extreme care shall be taken to keep the bells of the pipe free from sand, dirt or rocks so that the joint may be properly assembled without over stressing the bells.

3.08 INSPECTION AND TESTING

A. Alignment and Deflection: The Contractor shall thoroughly flush and clean the sewer system prior to lamping. Lines shall be lamped between manholes and other structures for alignment, deflection and obstructions in the presence of the Owner. The results of the lamping may required further inspection by television camera as determined by the Owner. Should it be necessary to reinspect the lines by T.V. camera, the additional test shall be performed at the Contractor's expense.

B. Leakage Tests: Leakage tests by infiltration, as described shall be performed on all sewer lines in the system.

1. The maximum allowable infiltration shall be 100 gallons per day/per inch of pipe diameter/per mile of pipeline, except that an allowance of an additional 10 percent of gallonage will be accepted for each additional 2-feet of head over a basic 2-feet minimum internal pressure head.

2. The duration of the test shall not be less than 2 hours. Infiltration tests shall be conducted in the presence of the Owner.

3. The pipeline shall be tested for infiltration only after the backfill has been placed, and after the release of groundwater subsequent to the Contractor's dewatering operations, and at such time as the static water level has completely returned to the normal groundwater elevation.

4. The test for infiltration shall be performed as follows:

   a. The test for infiltration shall start at the farthest downstream test section and shall commence upstream, section by section until the entire sewer line has been tested.

   b. Place a water right plug in the upstream invert of the upstream manhole of the test section.

   c. Allow 30 minutes for the upstream flow to clear and the section under test.

   d. The flow (infiltration) shall be determined by using a direct reading v-notch weir, suitably sized for the size and the sewer main under test.

      Direct reading v-notch weirs as manufactured by N. B. Products Company, 35 Beulah Road, New Britain, Pennsylvania, or approved equal shall be used.

5. If upon inspection of the completed sewer or any part thereof, shows any manholes, pipes or joints which allow the infiltration of water in a noticeable stream or jet, the defective work or material shall be repaired or replaced as directed by the Owner at the Contractor's expense.

6. All leaks shall be repaired regardless of the amount of leakage.

7. All water used in testing and flushing the sewer system shall be at the expense of the Contractor.

8. Air testing shall not be allowed.

C. Cleaning the Lines:

1. At the conclusion of the work, the Contractor shall thoroughly clean all pipe by flushing with water or other means to remove all sand, dirt, stones, wood or other material which may have entered the system during the construction period.

   Debris cleaned from the lines shall be removed from the lowest outlet. Debris and water from flushing shall not be introduced into the existing sewage collection system.

   Following the final cleaning and flushing, if the obstruction still remains the Contractor shall remove the obstructions by whatever means are available at no additional cost to the Owner.

2. Following the final cleaning and flushing of the sewer lines the Engineer will perform the final inspection of the system for leaks. If defective pipes or joints are found, the Contractor shall make all necessary repairs and/or replacements at no additional cost to the Owner.

3. Upon completion of the work, the sewer system or selected sections therein shall be subject to a final test and inspection at the option of the Owner.

4. Additional test if required, shall be as specified herein and shall meet all requirements including but not limited to line, grade, cleanliness, infiltration, exfiltration and workmanship.

D. Final Testing Inspection and Acceptance:

1. Deflection testing will be performed on all thermoplastic, flexible pipe at the direction of the Owner. Pipe deflection shall not exceed 5 percent of the inside diameter of the pipe.

   Test equipment and test supervision shall be provided at the Contractors expense. Deflection testing shall be performed using a mandrel having a diameter equal to 95 percent of the inside diameter of the pipe. The test shall be performed without mechanical pulling devices.

2. Internal inspection of sewer mains shall be accomplished by the use of a self-contained television system.

3. Television inspection of sewers located within street right-of-ways, paved areas or areas subject to frequent vehicular traffic, when required by the Owner, shall be inspected with the television system on two occasions:

   a. The first inspection shall be performed immediately following the installation and compaction of the stabilized subgrade.

   b. The second inspection shall be performed following completion of compaction of the base course of the roadway.

4. Non paved areas, not subject to vehicular traffic, shall be inspected on one occasion.

END OF SECTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This section shall include, but not be limited to all labor, equipment, materials and all incidentals required for the construction, installation and testing of a sanitary sewer force main, including all appurtenances as shown on the plans and as specified herein.

B. The work shall include but not be limited to, ductile iron pipe, valves, air release and vacuum valves, tapping tees and sleeves, tapping saddles, valve boxes, valve vaults, all restrained joints as required for all types of piping. All sheeting, bracing, dewatering, excavation, backfilling, compaction, and all other work incidental to the project.

1.02 QUALITY ASSURANCE

A. Inspection and Certification of Pipe and Fittings:

1. All pipe fittings and appurtenances to be installed under this specification may be inspected and tested for compliance with these specifications at the manufacturer's facility by an independent testing laboratory selected by the Contractor. The manufacturers' cooperation shall be required in these inspections.

2. The Contractor shall obtain from the pipe manufacturer a certificate of inspection stating that the pipe and fittings supplied for this project have been inspected and tested at the point of origin, and that they meet or exceed the requirements set forth in these specifications.

3. The costs of the inspections and tests shall be borne by the Contractor. Letters of certification shall be furnished for all inspections and tests prior to the installation of the pipe and fittings.

1.03 HANDLING AND STORAGE OF PIPE FITTINGS AND APPURTENANCES

A. All pipe, fittings and appurtenances shall be loaded and unloaded by lifting with hoists or skidding in order to avoid shock or damage.

1. Pipe, fittings and appurtenances shall not be rolled or skidded into or against pipe, fittings or other construction products on the ground.

2. Slings, hooks, pipe tongs and other lifting devices shall be padded and used in such a manner as to prevent damage to pipe or construction products.

3. Stored materials shall be kept safe from damage. The interior of all pipe, fittings and appurtenances shall be kept free from dirt, oil, grease and foreign matter at all times.

B. Pipe gaskets shall be used in the work on a first-in, first-out basis.

1. Gaskets for mechanical joint and push-on joint ductile iron pipe and fittings shall be stored in a cool, dry location, out of direct sunlight.

2. Gaskets shall be stored in such a manner so as to prevent coming into contact with petroleum products.

C. Mechanical joint bolts and locking segments for push-on joints shall be handled and stored in such a manner that will insure proper use in respect to pipe types and sizes.

1.04 SUBMITTALS

A. Procedures:

1. Submit product data, shop drawings, samples, testing laboratory reports, etc. in a timely manner.

B. Product Data:

1. Submit manufacturer's detailed product literature, which shall include, where applicable, mill test reports, equipment capacity data, manufacturer's literature that notes compliance with the reference standards including, but not limited to, product type, pressure rating, schedule, class, grade, and all other information pertinent to the installation.

2. The data to be submitted shall include, but not be limited to:

a. Mill test certificates or certified test reports on pipe

b. Detailes of restrained joints

c. Pipe linings and coatings

d. Fittings

e. Valves and valve boxes

f. Joint lubricant

g. Pipe laying schedule showing thrust retraint measures (restrained joints) for each pipe section, valve and fitting location

h. Temporary plug and anchorage system for hydrostatic pressure test

i. Tapping sleeves and valves

j. Air release valves

k. Marking tape

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

A. Ductile iron pipe (DIP) and fittings for sanitary sewer force mains shall conform to ANSI/AWWA C151/A21.51-91.

1. Ductile iron pipe shall have a minimum tensile strength of 60,000 p.s.i. with a minimum yield strength of 42,000 p.s.i.

2. Pipe thickness shall be in accordance with Table 50.12, ANSI/AWWA C150/A21.50 and shall be Pressure Class 250 for all sizes.

3. Ductile iron pipe for sanitary force main service shall have a minimum 40 mil thick polyethylene lining in accordance with ASTM 1248 and a minimum 1.00 mill bituminous coating on the pipe exterior in accordance with ANSI 21.51.

   a. Polyethylene lining shall have sufficient carbon black added to resist ultraviolet rays during storage.

4. Ductile iron pipe shall be supplied in lengths not in excess of a nominal twenty (20) feet, and shall be single gasket push-on joints with locking segments conforming to ANSI/AWWA C150/A212.50 and ANSI/AWWA C111/A21.11-85.

5. Restrained Joints: Megalug by EBAA Iron are acceptable for mechanical joint pipe. "Field-Lok" by U.S. Pipe and "Fast-Grip" by American are acceptable for push on joint pipe.

6. Acceptable Manufacturers: U. S. Pipe, American Pipe, McWane

B. Compact Ductile Iron Fittings: Force Main pipe fitting shall be ductile iron conforming to ANSI/AWWA C153/A21.53-88.

1. Rubber gasket joints shall conform to ANSI/AWWA C111/A21.11.

C. Flanged Ductile Iron Pipe and Fittings with Threaded Flanges:

1. Flanged ductile iron pipe and fittings, where called for on the plans, shall conform to ANSI/AWWA C115/A21.15.

2. Flanges shall be furnished flat faced and drilled to 125 pound template in accordance with B16.1 full faced gaskets.

3. All exposed pipe shall be flanged dip.

4. For atmospherically exposed ductile iron, the exterior protection shall be as follows:

   a. Surface Preparation: Abrasive blast, or centrifugal wheel blast (Steel Structures Painting Council Specification SP 10).

   b. Paint Material and Minimum Coats: Polyamide, anti-corrosive epoxy primer (1 coat, 2.5 mils minimum dry film thickness); polyurethane enamel (2 coats, 3 mils minimum dry film thickness). Color shall be green.

D. Air release and vacuum valves for sanitary force main service shall be installed as shown on the plans. The valves shall be constructed with a cast iron body, cover and baffle, stainless steel float, bronze water diffuser, BUNA-N or viton seat and stainless steel trim.

1. Valves shall be provided with a vacuum check to prevent air from re-entering the line. All fittings shall be threaded.

2. Air release and vacuum valves shall be Series 400 SAVV as manufactured by Apco Valve and Primer Corporation, Schaumburg, Illinois or approved equal.

E. Plug values shall be full flow resilient faced, non-lubricating and shall be of eccentric design.

Plug value shall be drop-tight rated up to pressures of 175 psig.

Value body shall be cast iron ASTM A126 Class B. Flanged ends shall conform to ANSI B16.1 Class 125.

F. Flanged coupling adapters shall be Clow Style 127 or equal.

G. Compression couplings shall be Dresser Style 153 or equal. Gaskets shall be suitable for the service conditions.

2.02 PRECAST CONCRETE PRODUCTS

A. Precast concrete valve vaults and air relief manholes shall be in accordance with ASTM C478.

1. Concrete for the construction of manhole sections and valve vaults shall be Class A concrete with a compressive strength of 4000 p.s.i. at 28-days and shall conform to ASTM C94, Type II cement.

2. Precast sections shall be cured by an approved method for a minimum of four (4) days prior to painting and shall not be shipped for a minimum of three (3) days after having been painted. Precast sections shall not be shipped for a minimum of seven (7) days after removal from the forms.

3. The interior and mating surfaces of all precast concrete products shall have a protective coal tar epoxy coating having a minimum dry thickness of 16 mils. The exterior surfaces shall have a protective coal tar epoxy coating with a minimum dry thickness of 9 mils. The coatings shall be applied by the manufacturer in strict accordance with the paint manufacturers recommendations.

   Acceptable Coating: Koppers 300M or approved equal.

4. The date of manufacture of the precast sections and the name or trademark of the manufacturer shall be clearly marked or impressed on the exterior of each precast section when the form is removed, and on the interior after the section has been painted.

5. Precast sections shall be cast with tongue and groove joints, sealed with "Ramnek" (TM) sealant as manufactured by the T.K. Snyder Company of Houston, Texas or approved equal. Joint sealant shall meet or exceed all requirements of Fed. Spec. SS-S-210A and AASHTO M198.

6. Rubber ring joint seals for precast sections shall not be permitted.

7. Shallow valve and meter vaults, where the depth of cover is less than four (4) feet, shall be capable of supporting the overburden plus a live load equivalent to AASHTO H-20 loading.

8. Valve and meter vault base sections shall not be less than eight (8) inches thick and shall be reinforced with number five (5) bars at nine (9) inches on centers, each way and shall have number four (4) bars around each pipe opening as shown in the plans.

9. Meter vaults shall be equipped with sump pumps, (installed in cast-in depressions in the vault floor) where groundwater table elevations are seasonably above the floor elevations of the vault.

10. All precast concrete products shall be wet cast. Dry casting, or low slump concrete will not be acceptable.

11. All precast concrete products shall have proper lifting loops in the base slabs, (minimum of three (3)). Penetrating lifting holes will not be acceptable in any structure. Where non-penetrating lifting holes are approved, their use will not be permitted within eight (8) inches of any joint or pipe penetration.

12. Precast concrete grade rings for manhole adjustment shall conform to ASTM C478. Grade rings shall be a minimum of two (2) inches thick and a maximum of five (5) inches thick and shall be reinforced with six (6) gauge or thicker reinforcing wire.

PART 3 - EXECUTION

3.01 PIPELINE TRENCH CONSTRUCTION

A. Refer to section 02225.

B. Trench excavation and shoring shall be in strict accordance with OSHA Standard 1926-606, Subpart P, Excavations, Trenching and Shoring, 29 CFR Chapter XVII (7-1-89 edition), and OSHA Revised Rule 2226, Excavations. (Latest Revision)

C. Trench excavating and backfilling, including sheeting, shoring, bracing, dewatering, foundation, bedding and compaction, and the furnishing and disposal of material shall be performed in such a manner as to promote the safe and expedient execution of the work.

3.02 SHEETING, SHORING AND BRACING

A. The Contractor shall furnish, install and maintain all sheeting, shoring and bracing required to support the sides of the excavation, and to prevent any movement which may damage adjacent utilities, pavements or structures, damage or delay the work or endanger life and health. All voids outside the supports shall be immediately filled and compacted. All sheeting, shoring and bracing to be used shall be designed by a Florida registered professional Engineer and shall be in accordance with OSHA Standard 1926-606, Subpart P, Excavations, Trenching and Shoring.

3.03 SETTING VALVE VAULTS AND MANHOLES

A. All valve vaults and air relief manholes shall be in accordance with the drawings.

1. Valve vaults and air relief manholes shall be precast concrete units and shall be in accordance with ASTM C478.

2. Valve vaults and manholes shall be precast with integral base slab and wall sections. Poured in place base slabs shall not be approved. Valve vaults and manholes shall conform to Subsection 2.02 of this specification and the applicable standard detail at the end of this section.

B. The soil foundation beneath the precast unit shall be stabilized and compacted to ninety-five (95) percent of the maximum density as determined by ASTM D1557 and ASTM D1556.

1. The precast valve vaults shall be carefully placed on the prepared foundation so as to be fully and uniformly supported in true alignment, making certain that the pipe can pass through the designed line and grade.

2. Precast valve vaults shall be handled by lifting rings only.

3. Precast valve vaults and manholes shall be placed and aligned to provide vertical alignment with not more than one eighth (1/8) inch maximum tolerance for five (5) feet of depth. The completed unit shall be rigid, true to dimensions and alignment.

3.04 LAYING SANITARY FORCE MAINS

A. Sanitary force mains shall be laid in accordance with the details shown on the plans, and as specified herein.

1. The trench bottom shall be graded to the proposed elevation of the pipeline and the bottom shaped to fit the lower quadrant of the pipe. Holes shall be excavated at each bell so the pipe will be uniformly supported along the entire length of the barrel only. Pipe bedding shall be as specified herein.

2. Pipe installation and jointing shall be in strict accordance with the pipe manufacturers specifications and instructions for the type of pipe used.

3. Any pipe having a defective joint, bell or spigot shall be rejected, removed from the work site and replaced with a sound unit.

4. All pipe shall be installed to the homing mark on the spigot. On field cut pipe, the Contractor shall provide a homing mark on the spigot end in strict accordance with the manufacturer's recommendations.

5. All pipe shall be retained in position so as to maintain alignment and joint closure until sufficient haunching and backfill has been placed to adequately hold the pipe in place.

6. Foreign materials shall be prevented from entering the pipe while pipe is being placed in the trench. No debris, tools, articles of clothing or other materials shall be placed in the pipe at any time.

7. At all times when pipe laying is not in progress for ten (10) minutes or more, the open ends of the pipe shall be closed by a watertight plug or other approved means to insure that absolute cleanliness is maintained inside the pipe at all times.

3.05 JOINTING SANITARY FORCE MAINS

A. Pipe installation and jointing shall be in strict accordance with the pipe manufacturer's specifications and instructions for the type of pipe used. Joints shall be in strict accordance with AWWA C600-87.

B. The Contractor shall take all reasonable precautions to provide assurance that the interior of the pipe and the jointing seal shall be free from sand, dirt, trash or other foreign material before installation in the line. Any pipe or fitting that has been installed containing dirt or other detrital material shall be removed, cleaned and relaid. Extreme care shall be taken to keep the bells of the pipe free from sand, dirt or rocks so that the joint may be properly assembled without over stressing the bells.

C. All pipe shall be installed to the homing mark on the spigot. When field cutting of pipe is required, cutting shall be done by machine, leaving a smooth cut at right angles to the axis of the pipe, cut ends of pipe to be used with push-on bell shall be beveled to conform to the manufacturers spigot end. Care shall be taken to prevent damage to linings.

D. Deflection at pipe joints shall not exceed one half of the maximum pipe deflection recommended by the pipe manufacturer. If at any time joint deflections exceed the manufacturer's maximum recommended pipe deflections, an appropriate fitting shall be used.

3.06 PIPE JOINT RESTRAINTS

A. Mechanically Restrained Joints: Mechanical pipe restraining mechanisms for push-on or mechanical joints shall be used. Restraining glands, tie rods, clamps or other components of dissimilar metals shall be protected against corrosion by the application of a suitable coating at the direction of the Owner.

Acceptable Mechanical Restraints: Megalug or approved equal.

B. Mechanical restraints or thrust blocking shall be sized for the working pressure plus surge allowance, or a test pressure of 150 p.s.i., whichever is greater. Adequate factors of safety shall be employed.

3.07 PIPELINE IDENTIFICATION

A. Underground Pipe Marking Tape:

1. Metallic, detectable underground utility tape (6 inches wide) shall be placed in the trench after initial backfill and compaction has been completed to the top of the pipe envelope. The tap thickness shall not be less than 4 mils. The tape shall be continuous for the entire length of the pipeline.

2. The utility tape shall be an inert plastic film formulated for extended use underground, and shall have a thickness of not less than 4 mils. The color shall extend the full width of the tape and be imprinted with the following information, "Caution Sanitary Forcemain Below." The message shall be printed with silver lettering on a pantone safety precaution brown background. The tape shall be as manufactured by Shield-Tec (TM) or approved equal.

B. Pipe Color:

1. All ductile iron mains shall be marked with a continuous stripe located within the top 90 degrees of the pipe. The stripe shall be a minimum 2 inches in width and shall be the color green. Backfill shall not be placed for 30 minutes following paint application.

3.08 FLUSHING

A. Foreign material left in the pipelines during installation often result in valve seat leakage during hydrostatic pressure testing. The Contractor shall make every effort to insure that lines are kept clean during installation.

B. Thorough flushing shall be required prior to hydrostatic pressure testing. The pipelines shall be flushed full bore, and shall not be less than three (3) times the total volume of the section being tested.

3.09 PRESSURE AND LEAKAGE TESTING

A. Hydrostatic pressure and leakage testing of sanitary force mains shall be performed in accordance with Section 4 of AWWA C600-87. All testing shall be made using water. Air testing shall not be permitted.

1. The Contractor shall furnish all gauges, meters, pressure pumps, and all other equipment required to pressure test the main at no additional cost to the Owner.

2. Do not test until restraining devices are installed. Thoroughly clean and flush all pipe prior to testing to clear the lines of all foreign matter. While the pipe is being filled with water, exercise care to permit the escape of air from extremities of the test section, providing additional release cocks if required.

3. The piping shall be tested in sections as determined by the Contractor.

4. Perform hydrostatic testing at 150 pounds per square inch pressure, for a period of not less than two (2) hours.

5. The allowable limits for leakage during the hydrostatic test is determined by the formula:

$$\frac{L = SD\,(P)1/2}{148{,}000}$$

in which,

L = Allowable leakage, in gallons per hour
S = Length of pipe being tested in feet
D = Nominal pipe diameter; in inches
P = Average test pressure during the test, in psi gauge.

6. The length of pipe shall be the actual length of pipe tested or 2,000 feet, whichever is less.

7. The Contractor shall provide accurate means for measuring the water required to maintain the test pressure. The quantity of water required to maintain the test pressure shall be the measure of the leakage.

3.10 SPACING

A. A minimum horizontal separation of 10 feet (edge to edge) shall be maintained between sewage collection mains and potable water mains.

B. A minimum vertical separation of 18 inches between the invert of the upper pipe and the crown of the lower pipe shall be maintained between sewage collection mains and all other piping. At all crossings with less than 18 inches vertical separation, the potable water main shall be ductile iron pipe a minimum 10 feet each side of the crossing. Sewage collection mains shall be laid below potable water and reclaimed water mains whenever crossing occurs.

END OF SECTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. This work specified in this section shall include, but not be limited to, furnish all labor, equipment, materials and all incidental required for construction, installation, and testing of submersible wastewater pumps including all appurtenances as shown on the Drawings and as specified herein.

1.02 QUALITY ASSURANCE

A. Unit Responsibility: The pumps, motors, frame and cover, discharge elbows, guide rail system and controls shall be supplied by the pump supplier to insure unit responsibility.

B. Guaranteed Parts Stock Program: The pump supplier shall have a guaranteed parts stock program in the State of Florida. These parts shall include at least one set of spare parts as detailed below for the pump station(s) included in this Contract.

1. Upper Mechanical Seal
2. Lower Mechanical Seal
3. Wear Rings
4. Motor Cable
5. Cable Entry Washer/Grommet
6. Inspection Plug Washers
7. Impeller Bolt
8. Impeller Key
9. Upper Bearing
10. Lower Bearing
11. Complete Set of "O" Rings

1.03 SUBMITTALS

A. Shop Drawings: Pump curves shall be submitted with the shop drawings and shall indicate test performance of pumping units similar of units furnished. The Contractor shall submit, with the shop drawings, layout drawings showing exact installation, piping and foundation details for the pumping units being submitted. Complete wiring diagrams and panel face layout drawings shall also be submitted prior to fabrication of control panel.

B. Operating and Maintenance Instructions: The Contractor shall submit operation and maintenance manuals. The operation and maintenance manuals shall be prepared specifically for the model and type of pump furnished and shall not refer to other models and types of similar equipment. The operation and maintenance manuals shall include but not be limited to the following:

1. Equipment function

2. Description

3. Normal and limiting operating characteristics

4. Installation instructions (assembly, alignment and adjustment procedures).

5. Operating instructions (normal startup and shutdown procedures, normal operating conditions and emergency situations).

6. Lubrication and maintenance instructions.

7. Troubleshooting guide

8. Parts lists with catalog numbers and predicted life of parts subject to wear.

9. Drawings - cross sectional view, assembly and wiring diagrams.

10. Performance curves.

11. Coating System.

1.04 PUMP WARRANTY

A. Warranty: The pump manufacturer shall warrant the pumps being supplied for the project against defects in workmanship and materials for a period of five (5) years under normal use, operation and service. In addition, the manufacturer shall replace certain parts which shall become defective through normal use and wear on a progressive schedule of cost for a period of five (5) years; parts included are the mechanical seal, impeller, pump housing, wear ring and ball bearings. The Warranty shall be in published form and apply to all similar units.

B. Service: The pump manufacturer shall also provide factory-authorized service and parts stock within the State of Florida. The factory-authorized service center's location and the telephone number shall be indicated in the shop drawing submittal and the operation and maintenance manuals.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Piping: Pipe and fittings shall be as shown on the Drawings or as specified herein.

2.02 EQUIPMENT

A. Pumps:

1. The Contractor shall furnish and install motor driven totally submersible wastewater pumps to meet the following requirements:

Location:

Pumps required	_____
Pump discharge elbow size (inches)	_____
Capacity, each (gpm)	_____ gpm
TDH, (feet)	_____ ft.
Model	FLYGT_____
Impeller No.	_____
Maximum Motor hp required	_____horsepower
Speed	_____rpm

2. The pumping unit design operating conditions shall be within 25 percent ± of the flow at the point of best operating efficiency, unless otherwise approved.

3. All pumps shall be capable of passing a 3-inch sphere without clogging.

4. Pump Manufacturer: Pumping equipment shall be submersible non-clog wastewater pumps as manufactured by Flygt, or a similar and equal manufacturer.

5. Materials: The stator casing, oil casing and impeller shall be of ASTM A-48 Class 30 grey iron construction. All grey iron components shall have smooth surfaces and be devoid of blow holes. All parts coming in contact with sewage protected by a coat of rubber-asphalt paint. All exposed nuts, bolts, washers and other fastening devices coming in contact with sewage shall be 304 stainless steel. All mating surface requiring watertight sealing shall be machined and fitted with nitrile rubber O-rings.

6. Cable Connections: Cable shall enter the pump through a heavy-duty entry assembly with a compression fitting with or without and epoxy secondary sealing system. The system used must insure an absolutely watertight submersible seal. Cable shall terminate in a junction chamber. Junction chamber shall be sealed from motor by a stator lead sealing gland or terminal board which shall eliminate water or solids from entering the pump top.

7. Cooling: Each pumping unit shall be provided with a cooling system allowing unsubmerged continuous operation at any power output to and including rated power in ambient air of 40 degrees C.

8. Seals: Each pump shall be provided with a tandem double mechanical rotating shaft seal system. The seals, both upper and lower, shall be of lapped silicon carbide design and operated in an oil bath. Seal faces shall be self-aligning, positively driven. Each seal shall be held by separate spring systems. The seals shall require neither maintenance nor adjustment and shall be easily replaceable. Conventional double mechanical seals with a single or double spring between the rotating faces, requiring constant differential pressure to effect sealing shall not be considered equal to the tandem seal specified.

9. Shaft: The pump/motor shaft shall be AISA Type 420 stainless steel and shall rotate on two grease lubricated bearings. Upper bearing shall be single row and lower bearing shall be a double row angular contact bearing to compensate for axial thrust and radial forces.

10. Impeller: The pump impeller shall be Class 30 grey iron, statically and dynamically balanced. The impeller shall be capable of passing solids, fibrous material and heavy sludge. Impellers shall have heavy-duty Type 304 stainless steel wear rings.

B. Motor:

1. The pump motor shall be induction type with a squirrel cage rotor, shell type, NEMA B design housed in a watertight chamber. The stator shall be copper wound designed to Class F insulation, 115° rise above 40°C minimum. Thermal and moisture sensors shall be provided to sense excessive motor temperatures or seal leakage. The pump motor shall be suitable for operation on a 480 volts, 3-phase, 60 hertz power supply with a 1.15 or greater service factor.

2. The pump motor shall be air cooled and guaranteed to run continuously in a totally, partially or non-submerged condition without damage to the pump motor. Pump motor shall be of sufficient horse-power as to be non-overloading, over the entire length of pump curve. Pump motors shall be rated for the horsepower and RPM indicated on drawings.

C. Pump Motor Cable: Pump motor cable shall be sized according to NEC and ICEA and shall be installed with a double-jacketed protection system suitable for submersible pump application and the rating shall be indicated by a code or legend permanently embossed on the cable. Provide adequate length of submersible cable for the intended installation without splices. Outer jacket of cable shall be oil resistant chloroprene rubber.

D. Pump Accessories:

1. Guide Rails: Guide rail system shall be Schedule 40, Type 316 stainless steel suitably sized for pumps furnished. The guide rail system shall require two parallel guide rails. Lower guide holders shall be integral to the pump discharge connection. Upper guide brackets shall be Type 316 stainless steel mounted with Type 316 stainless steel anchor bolts.

2. Lift Cables: Lift cables shall be of Type 316 stainless steel. Cables shall have adequate strength to lift the pump out of the wetwell with a safety factor of 3. Lift cables shall be shackled to a yoke attached to stator housing for removal and reinstallation of the unit. Provide 3 feet of excess cable above top of wetwell over to facilitate removal of pumping units. Cable holders shall be suitably sized to accommodate lift cables provided without deformation.

3. Discharge: The pump discharge fitting shall be a quick disconnect type compatible with the guide rail system and allowing the pump to be lifted from the wetwell for service and lowered in place for pumping without unbolting any flange, lowering the liquid level, or requiring personnel to enter the wetwell. The pump discharge shall seal to the discharge elbow by a metal to metal contact.

4. Wetwell Frame and Cover: Wetwell frames and covers shall be aluminum with stainless steel hinge and accessories. All bolts and anchors shall be stainless steel.

5. Value Vault Frame and Cover: Valve vault covers shall be aluminum with stainless steel bolts and anchors.

E. Control Panel:

1. General: The pumping station shall be provided with a pump control panel containing all the electrical and mechanical equipment necessary to provide for the operation of two electric submersible wastewater pumps. Control panel shall be designed for operating on 480 volts, 3-phase electrical service.

2. Control Panel Operation:

a. The Control panel shall operate two electrical submersible pumps at the power characteristics as shown on the Drawings.

b. The control function shall provide for the operation of the lead pump under normal conditions. If the incoming flow exceeds the pumping capacity of the lead pump, the second pump shall automatically start to handle this increased flow. The operating pump (s) shall then run until the liquid level in the station reaches the "Pump OFF" level as sensed by the "Pump OFF" level indicator. As the flow decreases, pumps shall be cut off at elevations as shown on the Drawings. In the event of a malfunction or a flow that exceeds the capacity of both pumps, a high level alarm and light shall be activated to indicate an alarm condition.

3. Enclosure:

a. The enclosure shall be NEMA 4X stainless steel with full welded seams and corners. The enclosure door shall have a full length hinge with stainless steel hinge pin and shall have provisions for padlocking. All exterior hardware shall be stainless steel.

b. The enclosure shall contain an interior aluminum "dead front" panel door. This interior door shall have a full length hinge and a hand operated latch assembly which latches to a full length door stop. The dead front shall have cut-outs for the operating handles of all circuit breakers. Flush mounted to, or through mounted on, the dead front door shall be wetwell level pilot lights, pump running lights, hand-off-automatic switches, elapsed time meters, reset buttons, 115 volt duplex convenience outlet and other specified items.

c. The control compartment shall have a removable back panel to which all control components shall be securely fastened by means of bolts or threaded screws. Self tapping screws are not acceptable. The back panel shall be secured to the enclosure with collar studs.

4. Lightning Protection: Each panel shall be provided with a three phase lightning transient protector with tell-tale warning light connected to each undergrounded phase at the point of incoming normal service.

5. Circuit Breakers:

a. A main service circuit breaker shall be provided.

b. A thermal magnetic circuit breaker shall be provided for each pump motor circuit.

c. All circuit breakers shall be heavy duty molded case type with a symmetrical RMS interrupting rating of at least 14,000 amperes at 480 volts, equal to Square D FAL breakers. Each breaker shall be adequately sized to meet the pump motor operating conditions.

6. Motor Starters: An open frame, across the line, full voltage non-reversing, NEMA rated, magnetic motor starter shall be provided for each pump motor. Motor starter contacts and overload relays shall be easily replaceable without removing the motor starter from its mounted position. Overload relays, with individual protection for each leg, shall be block type utilizing melting alloy spindles and shall have visual trip indication with trip-free operation. Starter oil voltage shall be 120 volts. Definite purpose contactors, horsepower rated motor starters and fractional NEMA sizes are not acceptable. Motor starters shall be interlocked with an automatic alternator.

7. Power Monitor: The three-phase panel shall be provided with a line voltage rated, adjustable type, phase monitor for sensing low voltage, high voltage, phase loss and phase reversal in all three phases. The monitor shall be connected to sense the incoming power line. It shall de-energize the control circuits for the pumps upon sensing any of the above listed faults and shall automatically re-energize the control circuits upon restoration of normal power.

8. Provide factory sized control transformers 480V-120V and 480V-12/24V. As required for controls, alarms, liquid level control and service receptacle (allow 300VA for service convenience receptacle). All transformers shall have primary and secondary protection and be grounded per N.E.C.

9. Liquid Level:

a. Control and Indicating Components

(1) A solid state automatic electric plug-in alternator relay shall be provided to equalize wear on the pumps. It shall alternate pump starts on each pump cycle and provide for both pumps to operate on demand. A built in switch shall allow manual selection of either pump as the lead pump, or automatic alternating operation.

(2) A three position hand-off-automatic switch, mounted on the inner door, shall be provided for each pump. Switches shall be heavy duty, watertight, industrial type with contacts rated for 10 amps continuous at 120 volts AC.

(3) A green pump run indicating light for each pump, and an amber liquid level indicating light for each pumping level shall be provided and mounted on the face of the inner door. Lights shall be heavy duty, watertight, industrial type rated 120 volts for pump run lights and 24 volts for level lights.

(4) A 110-volt to 24-volt transformer, with fused secondary, shall be provided for the level control system which shall operate on 24 volts DC.

10. Liquid Level Floats:

a. Liquid level float switches shall be Flygt Corporation Model EHN-10 or equal. Each float switch shall be provided with sufficient electric cable to reach the control panel without splicing.

b. Four float switches shall be provided for in the pump station.

11. A six digit non-resettable elapsed time meter registering hours and tenths of hours, 0 to 99999.9, shall be provided for each pump and shall be flush mounted to the inner panel door.

12. Control relays shall be enclosed general purpose industrial relays, with enclosed indicator lights. They shall be the plug-in type with bases, and contacts rated 10 amps at 120 volts AC.

13. Alarms: A flashing red 100 watt alarm warning light in a weather proof fixture shall be provided and mounted on top of the enclosure. An audible weatherproof alarm horn with a watertight alarm silencing button shall be provided and mounted on the exterior of the enclosure. The silencing button shall de-activate the audible but maintain the visual alarm until the fault is corrected.

14. Provisions for contact signals shall be included in the control panel equipment and control circuit wiring for future interface with a telephone dialer. Additional dry contacts shall be provided on alarm control relays and wired out to a telephone dialer interface terminal strip.

15. Wiring:

a. Terminal strips shall be provided for connection of all external circuits including the liquid level probe and pump motor thermal sensors.

b. All control wiring shall be color coded. Conductors shall be stranded copper, minimum size No. 18 AWG, Type TFFN, rated 600 volts, 105 degrees C.

c. Power wiring shall be color coded per the NEC. Conductors shall be stranded copper, minimum size No. 12 AWG, Type THHN, rated 600 volts, 90 degrees C.

d. A full schematic wiring diagram and a pump data sheet shall be permanently affixed to the interior of the enclosure door. The diagram and data sheet shall be made of extruded vinyl homopolymer laminate or equal, and all information thereon shall be fully water resistant.

16. Temperature sensors: One temperature sensing relay with associated red indicator light for each pump shall be mounted in the dead front panel. These sensors shall detect excessive heat within the pump motor. If this condition is noted, then the indication light shall light and the pump shall be disconnected from the control circuits until manually reset.

2.03 COATING SYSTEMS

A. Class 1 Exposures - Metal (Submerged): Class 1 exposures consist of metal surfaces that are submerged or exposed to gases and are within wetwells, valve vaults, and manholes.

1. Surfaces to be Coated:

a) Pumps, equipment and appurtenances, as applicable

b) Pipes, valves and fittings inside wet well or manholes

c) Miscellaneous carbon steel plates, shapes, etc.

d) Aluminum access covers and frames (interior surfaces)

2. Class 1 Coating System:

a) Surface Preparation: Ferrous metal - sandblast clean to white metal (SSPC-SP5). Non-Ferrous Metal - degrease by solvent cleaning in compliance with SSPC-SP1.

b)	Prime Coat:	Ferrous Metal - Rust InhibitivePrimer (2 mils DFT) (Kop-Coat: Pug Primer) Non-Ferrous Metal - wash primer (0.2 mils DFT) (Kop-Coat 40 Passivator)
c)	First Intermediate Coat:	Coal Tar Epoxy (10 mils DFT) (Kop-Coat: Bitumastic No. 300M, Color: Black)
d)	Second Intermediate Coat:	Coal Tar Epoxy (10 mils DFT) (Kop-Coat: Bitumastic No. 300M, Color: Red)
e)	Finish Coat:	Coat Tar Epoxy (10 mils DFT) (Kop-Coat: Bitumastic No. 300M, Color: Black)

NOTE: MAXIMUM ELAPSED TIME BETWEEN COATS, AS STATED BY THE COATING MANUFACTURER, SHALL NOT BE EXCEEDED.

B. Coating of concrete wet well - As indicated on the construction plans.

PART 3 - EXECUTION

3.01 INSTALLATION

A. All materials and equipment shall be installed as shown on the Drawings and as recommended by the manufacturer.

B. Additional items of construction, such as valve boxes, flanged adapters, thrust blocks and other items necessary for the complete installation of the system shall conform to specific details on the Drawings and shall be constructed of first-class materials conforming to the applicable sections of these Specifications.

3.02 INSPECTION AND TESTING

A. Factory Tests: The pump manufacturer shall perform the following tests on each pump prior to shipment. Tests shall be at rated speeds, capacities, heads, efficiencies, brake horsepower and such other conditions of head and capacity to establish performance curves.

1. Megger the pump motor and cable for insulation breaks or moisture intrusion.

2. Prior to submergence, run pump dry and check for correct rotation.

3. Pump shall be run continuously for 30 minutes in a submerged condition, with a minimum submergence of six (6) feet.

4. Pump shall be removed from test tank, meggered immediately for moisture; oil plugs removed for checking lower seal; inspection plug removed for checking upper seal and possible water intrusion of stator housing.

B. Field Acceptance Testing:

1. Pre-final Inspection: Prior to final inspection, the Contractor shall conduct a preliminary pump performance test and pre-final site inspection in the presence of the Owner. Any deficiencies noted at this time shall be corrected prior to scheduling of the final inspection.

2. Final Inspection: The Contractor shall be responsible for conducting the following field acceptance tests and start-up procedures in the presence of the Owner. The Contractor shall notify the Owner and the pump manufacturer's representative 48 hours prior to start-up. The Contractor shall furnish all labor piping, equipment, water and materials required to perform the acceptance testing.

a. Pump Performance: Prior to acceptance as part of the final inspection, the Contractor shall conduct a pump performance test. Pumps shall operate according to the operating conditions herein before specified without excessive vibration or overheating. Testing shall be performed using clean water. The Contractor shall utilize on-site water to perform the required testing. Pumping rates shall be determined by pumping a calculated volume of water in a specified time interval. Head and flow conditions shall be measured and recorded. Water levels during testing shall fall within the pump control levels shown on the Drawings. Amperage draws shall be monitored to determine effectiveness and efficiency of equipment. The test shall be repeated until satisfactory results are obtained. The test results shall be recorded on the Pump Test Report sheet included herein.

b. If the Contractor is unable to demonstrate that the pumping unit performs satisfactory, the unit shall be rejected. The Contractor shall then remove and replace the defective unit at his own expense.

(1) Pumps: Pumps shall deliver rated gpm at rated TDH.

(2) Motors: Running amperage shall be noted and recorded on each leg of power cord while pump is operating under full load.

(3) All self test trip relays shall demonstrate ability to simulate a fault condition. Level control system shall simulate various liquid levels and signal appropriate relays in pump logic controller to perform appropriate call functions as displayed by LED status indicators. All test results shall be recorded on pump test report and submitted to the Owner.

(4) Pumps, when tested, shall operate within 5 percent of the approved, certified head capacity curve.

(5) Following performance testing, pumps shall be meggered for pu pump-moisture intrusion.

3.03 PUMP CURVES

A. Submit (6) copies of the performance curve for each pump, 8 1/2-inch by 11-inch in size, laminated in plastic. The pump curve shall indicate the pump number, type of service, manufacturer, model number, serial number, location in the plant and other data specified to the pump as required above for submittals.

END OF SECTION

PUMP TEST REPORT

PROJECT Celebration **DATE** _____

LOCATION Osceola County, Florida

PUMP DATA

Manufacturer _____ Model _____

_____ Serial No. _____

Motor HP _____ RPM _____

Wetwell Diameter _____ Gals/V. Ft. _____

Pump Design Point _____ GPM @ _____ Feet T.D.H.

TEST DATA

Pump No.:	_____	_____
Start Time:	_____	_____
Stop Time:	_____	_____
Elapsed Time (min):	_____	_____
Water El. Start (HWL) (feet)	_____	_____
Water El. Stop (MWL) (feet)	_____	_____
Net Drawdown (ft.)	_____	_____
Gallons	_____	_____
Gallons/Minute	_____	_____
Pressure Gauge Reading (feet)	_____	_____
Ammeter Reading (amps)		

General Contractor _____

Owner _____

Manufacturer's Representative _____

Engineering Design Firm and Representative _____

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1, General Requirements, are a part of this section.

1.02 DESCRIPTION

A. This section specifies materials and work required to install site furnishings including, but not limited to: benches, trash receptacles, drinking fountains, bicycle racks, flagpoles, bollards and planters.

1.03 SUBMITTALS

A. Submit manufacturers descriptive literature and installation instructions for the following:

1. Benches
2. Trash receptacle and liner
3. Drinking fountain
4. Bicycle rack
5. Flagpole
6. Bollard
7. Planters

1.04 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery:

1. Schedule operations to avoid unnecessary rehandling.

2. Deliver products to the project site on pallets constructed with non-staining and nondiscoloring materials. Stack materials off the ground and protect from damage and soiling.

3. Mortar Materials:

   a. Deliver cement, lime, and admixtures materials in manufacturer's unopened and undamaged containers with labels intact and legible. Store materials off the ground, under cover, and protect from weather damage and deterioration.

   b. Stockpile and handle aggregates to prevent mixing with foreign materials.

B. Storage:

1. General:

a. Store in accordance with manufacturer's recommendations.

C. Handling:

1. General:

a. Comply with manufacturer's recommendations.

1.05 PROJECT CONDITIONS

A. Do not begin miscellaneous site improvements work before completion of submittal requirements and approvals.

B. Limitations: Section 02510: Concrete Walks and as noted

1. Section 02510: Concrete Walks and as noted

2. Protect partially-completed stone masonry work against weather damage and moisture, when work is not in progress. Cover tops of walks with strong, waterproof, non-staining membrane. Extend membrane 2 feet 0 inches beyond dimensions of paving.

3. Cold Weather Construction:

(a) Precondition masonry materials to maintain 50°F when installed.

(b) Do not install stone masonry work when the temperature of the outside air is below 40° F and falling unless suitable means acceptable to the Owner are provided to protect work from cold and frost and ensure that mortar will set without freezing. Comply with International Masonry Industry All-Weather Council cold weather construction and protection recommendations.

(c) No masonry work will be permitted when outside air temperature is below 25°F.

(d) Do not use frozen materials or materials mixed or coated with ice or frost.

PART 2 - PRODUCTS

2.01 BENCH (TYPE "A")

A. Bench manufactured by Gardenside Limited, 999 Andersen Drive, San Rafael, California, 94901, telephone (415) 455-4500; or approved equivalent.

1. Type/Model: #2606 "Parkside"

2. Length: 6 feet 0 inches

3. Color: Natural Teak

4. Anchor: Per manufacturer's recommendations

2.02 BENCH (TYPE "B")

A. Bench manufactured by Gardenside Limited, 999 Andersen Drive, San Rafael, California, 94901, telephone (415) 455-4500; or approved equivalent.

1. Type/Model: #2608 "Parkside"

2. Length: 8 feet 0 inches

3. Color: Natural Teak

4. Anchor: Per manufacturer's recommendations

2.03 BENCH (TYPE "C")

A. Bench manufactured by Lister by Geebro, 1900 The Exchange, Suite 655, Atlanta, Georgia, 30339, telephone (404) 952-4489; or approved equivalent.

1. Type/Model: #5036 "Amberly"

2. Length: 5 feet 0 inches

3. Color: Natural Teak

4. Anchor: Per manufacturer's recommendations

2.04 BENCH (TYPE "D")

A. Bench manufactured by Victor Stanley, Inc., Brick House Road, Dunkirk, Maryland, 20745, telephone (800) 368-2573; or approved equivalent.

1. Type/Model: #RB-28 "Ribbon Series"

2. Length: 6 feet 0 inches

3. Color: Painted to match Celebration "Dark English Green".

4. Anchor: Per manufacturer's recommendations.

2.05 BENCH (TYPE "E")

A. Bench manufactured by Gardenside Limited, 999 Andersen Drive, San Rafael, California, 94901, telephone (415) 455-4500; or approved equivalent.

1. Type/Model: #2308 "Provence"

2. Length: 5 feet 0 inches

3. Color: Natural Teak

4. Anchor: Per manufacturer's recommendations

2.06 BENCH (TYPE "F")

A. Bench manufactured by Gardenside Limited, 999 Andersen Drive, San Rafael, California, 94901, telephone (415) 455-4500; or approved equivalent.

1. Type/Model: #2608 "Parkside"

2. Length: 8 feet 0 inches

3. Color: Natural Teak

4. Anchor: Per manufacturer's recommendations

2.06 BENCH (TYPE "F")

A. Bench manufactured by Lister by Geebro, 1900 The Exchange, Suite 655, Atlanta, Georgia, 30339, telephone (404) 952-4489; or approved equivalent.

1. Type/Model: #5067 "Evesham"

2. Length: 5 feet 0 inches

3. Color: Natural Teak

4. Anchor: Per manufacturer's recommendations

2.07 BENCH (TYPE "G")

A. Bench manufactured by Barlow Tyrie, 2251 Wisconsin Avenue N.W., Washington, D.C., 20007, telephone (202) 342-6294; or approved equivalent.

1. Type/Model: "The Glenham Tree Seat"

2. Diameter: 86-1/2 inches

3. Color: Natural Teak

4. Anchor: Per manufacturer's recommendations

2.08 TRASH RECEPTACLE (TYPE "A")

A. Trash Receptacle manufactured by Victor Stanley, Inc., Brick House Road, Dunkirk, Maryland, 20745, telephone (800) 368-2573; or approved equivalent.

1. Trash Receptacle Model: S-35, 24 gallon.

2. Trash Receptacle Color: Painted to match Celebration "Dark English Green".

3. Liner: Plastic liner to fit trash receptacle specified. Color: Black.

4. Anchor Bolt: ASTM A307, low-carbon steel bolts, nuts and carbon steel washers. Units shall be galvanized per ASTM A153.

2.09 TRASH RECEPTACLE (TYPE "B")

A. Trash Receptacle manufactured by Trystan Site Furnishings, 146 Morrell Street, Brantford, Ontario, N3T4J8, telephone (519) 756-0762; or approved equivalent.

1. Trash Receptacle Model: TUV-1, 24 gallon.

2. Trash Receptacle Color: Painted to match Celebration "Dark English Green".

3. Liner: Plastic liner to fit trash receptacle specified. Color: Dark Green.

4. Anchor Bolt: ASTM A307, low-carbon steel bolts, nuts and carbon steel washers. Units shall be galvanized per ASTM A153.

2.10 BIKE RACK

A. Bike Rack manufactured by Bike Security Racks Company, R.R.#1, Box 476B, Rumney, New Hampshire, 03266, telephone 1-800-545-2757; or approved equivalent.

1. Type/Model: Bike Standard "BS-4.8" or "BS-8.8"

2. Color: To match Celebration "Dark English Green"

3. Anchor: Per manufacturer's recommendations

2.11 DRINKING FOUNTAIN

A. Drinking fountain manufactured by Murdock Water Service Equipment, 2488 River Road, Cincinnati, Ohio, 45204, telephone (513) 471-7700; or approved equivalent.

1. Type/Model: "MC 76-1"

2. Color: To match Celebration "Dark English Green"

3. Anchor: Per manufacturer's recommendations

2.12 FLAGPOLE

A. Flagpole manufactured by Baartol Company, Inc., P.O. Box 670, Kenton, Ohio, 43326, telephone (800) 537-4143; or approved equivalent.

1. Type/Model: 30 feet, internal halyard w/ornamental base style "BB"

2. Color: Brushed aluminum

3. Anchor: Per manufacturer's recommendations

2.13 BOLLARDS

A. Bollards manufactured by Antique Street Lamps, Inc., 8412 South Congress, P.O. Box 43289, Austin, Texas, 78745, telephone (512) 282-9780; or approved equivalent.

1. Type/Model: Cast aluminum, model NYB-CA

2. Color: Painted to match Celebration "Dark English Green"

3. Anchor: Per manufacturer's recommendations

2.14 PLANTERS

A. Planter urn manufactured by Dura Art Stone, Inc., 100 Lee's Mill Road, Forest Park, Georgia, 30050, telephone (404) 763-9000; or approved equivalent.

1. Type/Model: Design "Z", Mediterranian

2. Size: 24 inch x 22 inch and 36 inch x 22 inch

3. Color: Limestone

4. Finish: Light Sandblast / Acid Etch

B. Planter urn manufactured by Dura Art Stone, Inc., 100 Lee's Mill Road, Forest Park, Georgia, 30050, telephone (404) 763-9000; or approved equivalent.

1. Type/Model: Design "Y", Mediterranian

2. Size: 24 inch x 22 inch and 36 inch x 22 inch

3. Color: Limestone

4. Finish: Light Sandblast / Acid Etch

C. Planter urn manufactured by Dura Art Stone, Inc., 100 Lee's Mill Road, Forest Park, Georgia, 30050, telephone (404) 763-9000; or approved equivalent.

1. Type/Model: Design "NS", Aquarian

2. Size: 24 inch diameter and 36 inch diameter

3. Color: Limestone

4. Finish: Light Sandblast / Acid Etch

D. Planter urn manufactured by Dura Art Stone, Inc., 100 Lee's Mill Road, Forest Park, Georgia, 30050, telephone (404) 763-9000; or approved equivalent.

1. Type/Model: Design "N", Mediterranian

2. Size: 24 inch diameter and 36 inch diameter

3. Color: Limestone

4. Finish: Light Sandblast / Acid Etch

E. Planter urn manufactured by Dura Art Stone, Inc., 100 Lee's Mill Road, Forest Park, Georgia, 30050, telephone (404) 763-9000; or approved equivalent.

1. Type/Model: Design "X", Mediterranian

2. Size: 24 inch diameter and 36 inch diameter

3. Color: Limestone

4. Finish: Light Sandblast / Acid Etch

PART 3 - EXECUTION

3.01 PROTECTION AND RESTORATION

A. Protect completed miscellaneous site improvements from damage.

B. Restore damaged improvements as directed by Owner's Representative.

1. Restoration: Approved by Owner's Representative.

3.02 BENCH

A. Assemble and install benches in accordance with manufacturers installation instructions.

1. Bench locations: Where indicated

3.03 TRASH RECEPTACLE

A. Install trash receptacle in accordance with manufacturer's installation instructions and as noted.

1. Trash receptacle locations: As presented in the Drawings.

B. Excavation, Concrete Foundations, and Anchors: Section 0220: Earthwork and Section 03300: Cast-In-Place Concrete and as noted.

1. Use galvanized steel shims per manufacturers recommendations to adjust vertical alignment of trash receptacles plumb to 1/4 inch per 10 feet.

3.04 BIKE RACKS

A. Assemble and install bike racks in accordance with manufacturers installation instructions and as presented in the Drawings.

1. Bike rack locations: As presented in the Drawings.

3.05 DRINKING FOUNTAIN

A. Assemble and install drinking fountains in accordance with manufacturers installation instructions and as presented in the Drawings.

1. Drinking fountain locations: As presented in the Drawings.

3.06 PLANTER URN

A. Assemble and install planter urns in accordance with manufacturers installation instructions and as presented in the Drawings.

1. Planter Urn locations: As presented in the Drawings.

END OF SECTION

PART 1 - GENERAL

1.01 WORK INCLUDED

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

B. The completed and proper construction of the landscape irrigation system including, but not limited to:

1. All piping, including mains, laterals, fittings, connections, tees, risers, clamps, and swing joints.

2. All control, gate, glove, pressure reducing, quick coupling and other valves; including valve boxes, markers, connections, operators and other accessories.

3. Complete automatic control system as shown on plans: including controllers, control wiring low voltage connections and from power source as shown on plans.

4. All rotating and stationary spray sprinkler heads; including proper nozzles as called for herein and shown on the plans and all other appurtenances and accessories for proper operations.

5. Connections of piping to the supply sources as shown on the plans.

6. All excavation, site work, relocation or replacement of utilities, backfill and restoration of all disturbed areas.

7. The contractor shall be responsible for providing a complete and operable system for the irrigation of all areas to be landscaped on the project site. The plans and these specifications are intended to include all items obviously necessary and requisite for the proper irrigation of the project. This in no way relieves the contractor of his responsibility to furnish any additional labor, materials and equipment required for a proper system.

8. The contractor shall be responsible for adjusting head location, type and size, and any other system components to comply with the requirements of landscaping as indicated in the contract documents. Such adjustments shall be made at no cost to the Owner except for, when authorized in writing, such adjustments which will be compensated at an agreed upon price.

9. The contractor shall supply, deliver, store, and protect all equipment and materials including pipe and fittings, sprinkler heads, valves, controllers, wire, irrigation pump and all other component parts necessary for the installation of a fully automatic irrigation system as indicated in the plans and specifications. Adequate security of materials on site shall be provided by the contractor at all times at his expense.

10. Preparation of "as-built" plans.

C. Coordination: Coordinate the work in this Section with all other underground utilities and with the trades responsible for their installation. Refer to respective Drawings pertaining to the other work.

1.02 QUALITY ASSURANCE

A. All irrigation work shall be installed by qualified personnel or a qualified irrigation subcontracting company that has experience in irrigation systems of similar size, scope, mainline, system pressure, etc. as is indicated for this project. The contractor shall submit for the Owner's review and approval, resumes of all irrigation superintendents and foreman designated to perform the irrigation work, and a list of five (5) projects with references with which he or she was involved; those projects must be of similar size and scope as this project. If the contractor elects to use a subcontractor for this portion of the work, the subcontractor shall have been in operation for a minimum of five (5) years, and licensed to work in the state of Florida. To demonstrate ability and experience necessary for this project, the contractor shall submit to the Owner the following:

List of three (3) projects completed in the last two (2) years of similar complexity to this project. Description of projects shall include:

1. Name of Project
2. Location
3. Owner's name, address, and business phone number
4. Scope of work and contract amount

The Owner reserves the right to accept or reject the proposed subcontractor or its designated personnel in whole or in part base on the information provided.

B. All applicable ANSI, ASTM, FED.SPEC. Reuse water Standards and Specifications, and all applicable building codes and other public agencies having jurisdiction upon the work shall apply including City of Kissimmee, Osceola County, State of Florida.

C. The contractor shall be responsible for constructing the system in complete accordance with all local codes, ordinances and laws. Any modifications made to conform with said codes, laws and ordinances shall be completed at the contractor's expense with no additional compensation allowed.

D. Protection of existing Plants and Site Conditions: The contractor shall take necessary precautions to protect site conditions to remain. Should damages be incurred, the contractor shall repair the damage to its original condition at his own expense. Any disruption, destruction, or disturbance of any existing plant, tree, shrub or turf, or any structure shall be completely restored to the satisfaction of the Owner and his representatives, solely at the contractor's expense.

E. Ordinances and Code Regulations: Inspections required by local ordinances during the course of construction shall be arranged by the contractor with notification to the owners representative. On completion of the work, satisfactory evidence shall be furnished to the Owner to show that all work has been installed in accordance with the ordinance and code requirements.

F. Approval: Whenever the terms "approve", "approval", or "approved" are used in the specifications, they shall mean the approval of the Owner or Owner's Representative in writing.

G. The Owner reserves the right to substitute, add or delete any material or work as the work progresses. Adjustment to the contract price shall be negotiated if deemed necessary by the Owner or the Owner's Representative and shall be credited or deducted to the contract sum according to the unit prices provided in his proposal.

H. The contractor shall provide full coverage in all irrigated areas and shall be responsible for additional heads and components as required, installed at his own cost.

I. Contractor shall make necessary adjustments in the layout as may be required to connect to existing stubouts, should such stubs not be located exactly as shown, and as may be required to work around existing work at no increase in cost to the Owner.

J. On-Site Observation: At any time during the installation of the irrigation system by the contractor, the Owner or Landscape Architect may visit the site to observe work underway. Upon request, the contractor shall be required to uncover specified work as directed by the Owner or Landscape Architect without compensation. Should the material, workmanship, or method of installation not meet the standards specified herein, the contractor shall replace the work at his own expense.

K. Workmanship: All work shall be installed in a neat, orderly, and responsible manner with recognized standards of workmanship. The Owner or Owner's Representative reserve the right to reject material or work which does not conform to the contract documents. Rejected work shall be removed or corrected at the earliest possible time at the contractor's expense.

L. Final Acceptance: Final Acceptance of the work may be obtained from the Owner's representative upon the satisfactory completion of all work. Acceptance by the Owner's representative in no way removes the contractor of his responsibility to make further repairs, corrections and adjustments to eliminate any deficiencies which may later be discovered.

M. Final Acceptance: Final acceptance of the work may be obtained from the Owner upon the satisfactory completion of all work including punchlist work. Acceptance by the Owner's representative and/or Owner in no way removes the contractor of his responsibility to make further repairs, corrections and adjustments to eliminate any deficiencies which may later be discovered.

1.03 SUBMITTALS

A. Qualifications: The contractor shall submit complete qualification statements as specified herein for review and approval at the time proposals are submitted.

B. Work Schedule: Within 14 days after award of the contract, the contractor shall submit to the Owner a work schedule.

C. Within 14 days after the award of the contract, the contractor shall provide cut sheets of all products specified or required for use necessary to provide the entire system outlined in the specifications. The cut sheets shall list manufacturer's name, catalog name, and catalog number as well as size, type and illustration of the product to be supplied. The information shall be supplied to the Owner and Owner's Representative for approvals. Only when the Owner approves contractor's supplied information shall the contractor begin construction and installation of submitted items.

D. All submittals shall be coordinated into one submittal and compiled into a "note-book" format with a removable binder. Name of project, date, and each product required shall be clearly highlighted on each separate product information cut sheet and labeled for each product's intended use. Five separate copies of the full submittal are required and shall include but not be limited to the following:

1. Each pipe type and size (main, lateral, other)
2. Each wire type (electrical, communication, with color coding)
3. Each controller and required components and accessories
4. Each sprinkler type

5. Each valve type/size (electric, coupler, gate, etc.)
6. Each valve box type
7. PVC cement and primer
8. Backflow preventer
9. List of personnel with qualifications
10. Schedule of work
11. As-Builts (upon completion)
12. Maintenance Manual (upon completion)

E. "As-Built" Irrigation Drawings

1. Prepare an "As-Built" drawing on reproducible bases which shall show horizontal and vertical deviations from the bid documents made during construction affecting but not limited to the mainline pipe, controller locations, remote control valves, quick coupler valves, and gate valves. The drawings shall also indicate and show approved substitutions of size, material, and manufacturer's name and catalog number. All mainline piping shall be dimensioned and drawn to scale. All valve types shall have two (2) measurements from fixed objects for each valve. All zone valves shall be labeled with their correct size and accurate G.P.M. to establish correct flow zone data to be inserted into the irrigation computer control program.

2. Store "As-Built" drawings apart from documents used for construction.

3. Maintain drawings in a clean, dry, legible condition and in good order. Do not use record documents for construction purposes.

4. Make documents available at all times for inspection by the Landscape Architect or Owner's Representative.

5. Label each document "As-Built" in neat, large printed letters or by rubber stamp.

6. Record information concurrently with construction progress. Do not conceal any work until required information is recorded.

7. Drawings: Legibly mark to record actual construction and installation, including:

   a. Horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements
   b. Field changes of dimension and detail
   c. Changes made by Field Order or by Change Order
   d. Details not on original Contract Drawings

8. Specifications and Addenda: Legibly mark each Section to record changes made by field order or by change order.

9. The Landscape Architect shall supply the contractor with one complete set of sepia mylar prints to be used for the record document submittal. Contractor shall transfer all record documents information outlined above to these reproducible prints.

10. Prior to contract closeout, the contractor shall deliver the complete set of sepia mylar prints fully updated and containing the information outlined above to the Landscape Architect for the Owner. Additionally, the contractor shall furnish three (3) blueline copies of "as-built" drawings. These drawings shall be delivered to the Landscape Architect prior to his review for substantial completion

of the work.

11. As-Built drawings shall be kept updated weekly and shall be reviewed by the Owner or Owner's Representative during the course of the work. If during the course of the work the record documents are found to be substantially incorrect or substantially behind the progress of the work, the Owner shall have the right to hold progress payments until said documents are brought to an acceptable level of completeness.

12. Accompany submittal of Record Documents 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 drawing
    e. Signature of contractor or his authorized representative

13. Operations and Maintenance Manuals: The contractor shall prepare and deliver to the Landscape Architect/Owner's Representative within ten (10) calendar days prior to final acceptance minimum of three (3) hard cover binders with three rings containing the following information:

    a. Index sheet stating the contractor's address and business telephone number, list of equipment with name(s) and address(es) of local manufacturer's representative(s).

    b. Catalog and parts sheet on every material and equipment installed under this contract.

    c. Complete operating and maintenance instruction on all major equipment.

    d. Provide the Owner's maintenance personnel with written and "hands-on" instruction for major equipment and show evidence in writing to the Owner at the conclusion of the project that this service has been rendered.

F. Checklist:

1. Complete the following checklist at the end of each segment of the project, using the format shown and on the forms provided:

    a. Plumbing permits - if none required, so state
    b. Material approvals
    c. Pressure line tests - by whom approved and date
    d. Materials furnished-recipient and date
    e. Manufacturer's warranties, if required - recipient and date
    f. Written guarantee - recipient and date
    g. Lowering of heads in lawn areas - if not complete, so state and include anticipated completion date

2. The signed and dated checklist(s) shall be forwarded to the Owner's Representative before final acceptance of the project.

1.04 EXPLANATION OF DRAWINGS

A. Due to the scale of the drawings, it is not possible to indicate all offsets, fittings, and sleeves which may be required. The contractor shall carefully investigate the structural and finished conditions affecting all of the work and plan his work accordingly, furnishing such offsets, fittings and sleeves as may be required to meet such conditions.

B. The drawings are generally diagrammatic and indicative of the work to be installed. The work shall be installed in such a manner as to avoid conflicts between irrigation systems, underground utilities, sidewalks, plantings, hardscape and architectural features. Deviations shall be brought to the Owner's Representative's attention.

C. All work called for on the drawings by notes or details shall be furnished and installed whether or not specifically mentioned in the specifications.

D. The contractor shall not willfully install the irrigation system as shown on the drawings when it is obvious in the field that obstructions, grade differences, or discrepancies in area dimensions exist that might not have been know in engineering. Such obstructions or differences should be brought to the attention of the Owner's Representative. In the event that notification is not performed, the contractor shall assume full responsibility for costs related to any revision necessary.

E. Explanation of Drawings: Conflicts between the plans, notes, details, or specifications shall be immediately brought to the attention of the Owner's Representative. These discrepancies or conflicts shall be interpreted by the Owner's Representative, and his decision shall be final in all cases. Should the contractor fail to notify the Owner's Representative of the conflict(s) and by so, take advantage of the said discrepancy, the contractor shall be held responsible for making any and all changes as directed by the Owner's Representative with no compensation for extra labor, material, or equipment.

F. The contractor shall, prior to trenching, verify the location of all underground utilities. He shall take proper precaution not to damage or disturb said improvements.

G. If, in the opinion of the Owner's representative, the labor furnished by the contractor is incompetent, unskilled, or unreliable, his equipment inadequate, improper or unsafe, or if the contractor shall fail to continuously and diligently execute the construction, the Owner's Representative shall, in writing, instruct the contractor to remove all such causes of noncompliance and contractor shall promptly comply.

H. The contractor shall be responsible for full and complete coverage of all irrigation areas. The Owner's Representative shall be notified of any necessary adjustments at no additional cost to the Owner. Any proposed revisions to the irrigation system must be submitted and answered in written form, along with any change in contract price.

I. The contractor shall coordinate and assist with the Owner/Operator and manufacturer in the operational requirements of the system.

1.05 PROJECT CONDITIONS

A. The Owner reserves the right to make temporary repairs as necessary to keep the sprinkler irrigation system equipment in operating condition. This in no way alters the requirements of Contract Documents.

1. Inspection of the Site: The contractor shall acquaint himself with all on-site conditions. Should utilities not shown on the drawings be found during excavations, the contractor shall promptly notify the Owner's representative for instructions as to further action. Failure to do so will make the

contractor liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities not shown on the Drawings.

2. Protection of the Property: The contractor shall be responsible for the preservation and protection of all site conditions to remain from damage due to this work. In the event damage does occur, all damage shall be completely repaired of its original condition at no additional cost to the Owner.

3. Trenching: All trenching or other work under the leaf canopy of any and all trees shall be done by hand or by other methods so that no branches are damaged in any way. Trenching around existing plant material shall be done by hand so as to minimize root disturbance.

   Buildings, walks, walls, and other property shall be protected from damage. Open ditches exposed shall be flagged and barricaded by the contractor by approved means. The contractor shall restore disturbed areas to their original condition.

4. Protection and Repair of Underground Utilities: The contractor shall be responsible for requesting the proper utility company to sake the exact location of any underground lines including, but not limited to, electric, gas, telephone service, cable TV, roadway lighting, potable water, reclaimed water, sanitary sewer and storm sewer.

   The contractor shall take whatever precautions are necessary to protect these underground lines from damage. In the event damage does occur, all damage shall be completely repaired to its original condition, at no additional cost to the Owner.

5. Private Utilities: The contractor shall contact any private utilities (i.e., electrical service to outside lighting) before proceeding with any excavation. If the contractor damages staked or located utilities, they shall be repaired at the contractor's expense.

B. Coordinate Work with that of other trades, all underground improvements, the location and planting of specimen trees and all other planting. Verify location of all planting requiring excavations 24 in. dia. and larger with Owner prior to installation of main lines.

C. Provide temporary irrigation at all times to maintain plant materials.

1.06 WARRANTY

A. Warrant the entire irrigation and water system to give satisfactory service for a period of one (1) year from the date of final acceptance by the Owner and the Owner's Representative.

B. Should any problems develop within the warranty period due to inferior or faulty materials or workmanship, they shall be corrected at no expense to the Owner.

C. Any and all damages resulting from faulty materials or workmanship shall be repaired by the Contractor to the satisfaction of the Owner's Representative and the Owner, at no additional cost.

D. Written warranty shall be supplied upon completion of each segment of the project, showing date of completion and period of warranty.

PART 2 - PRODUCTS

2.01 GENERAL

A. All materials throughout the system shall be new and in perfect condition. No deviations from the specifications shall be allowed except as noted.

2.02 PIPING

A. The irrigation system pipe shall be as stated herein and shall be furnished, installed and tested in accordance with these specifications. Unless otherwise stated on the plans, all pipe fittings shall be capable of withstanding a sustained pressure of at least 150 P.S.I.

B. Polyvinyl Chloride (PVC) Pipe, Class 200 Fluid-Tite gasket joint, as manufactured by Certain-Teed, Johns Mansville, World of Plastics, or approved equal, will be used on all constantly pressurized mainline 2-1/2 inches and larger upstream of individual zone valves. Pipe shall be Standard Dimension Ratio (SDR) 21 conforming to ASTM D2241 and ASTM D1784. All mainline pipe 2 inches and smaller shall be PVC Class 200 or PVC Schedule 40 solvent weld. **ALL CONSTANTLY PRESSURIZED MAINLINE PIPING SHALL BE PURPLE IN COLOR AND LABELED RECLAIMED WATER.**

1. Lubrication for gasket joint pipe shall be water soluble, non-toxic, be non-objectionable in taste and odor imparted to the fluid, be non-supporting of bacterial growth, and shall have no deteriorating effect on the PVC or rubber gaskets. It shall be supplied by Certain-Teed Products, Can-Tex, or approved equal.

C. Polyvinyl Chloride (PVC) Pipe, Class 160 solvent weld shall be used on all system lines downstream of remote control valves. Pipe shall conform to ASTM D2467 and ASTM D2464. **PIPING SHALL BE PURPLE IN COLOR AND LABELED RECLAIMED WATER.**

D. All nipples, pipe connections, bushings, swing joints, etc. required shall be Polyvinyl Chloride (PVC) Pipe, Schedule 80.

E. All pipe extensions for varied height shrub risers and PVC pipe sleeves shall be Polyvinyl Chloride (PVC) Pipe, Schedule 40.

2.03 PIPE FITTINGS

A. All pipe fittings on mainline (gasketed pipe) shall be as follows:

1. All pipe fittings shall be Class 250, ASTM-A-536 ductile iron, cast iron, deep joint socket fittings. Fittings shall be suitable for pressures up to 350 PSI as manufactured by Harco Union Foundry, or equal. All fittings for gasketed pipe shall be thrust blocked per details, and of the size recommended by the manufacturer of the fitting. No solvent weld fittings on the mainline 2-1/2 inches and larger shall be accepted.

2. All fittings shall bear the manufacturer's name or trademark, material designation, size, applicable IPS schedule and NSF seal of approval.

B. All pipe fittings on mainline 2 inches and smaller shall be Schedule 40 PVC conforming to ASTM D2466.

C. For Polyvinyl Chloride (PVC) Pipe Class 160 solvent weld, all fittings shall be Schedule 40 PVC conforming to ASTM D2466.

1. Connection between mainline pipe fittings and automatic or manual control valves shall be made using Schedule 80 threaded fittings and nipples with teflon tape or teflon pipe dope; Type I, Grade I, ASTM D 2464, and ASTM F 437 for pressure pipe.

2. All fittings shall bear the manufacturer's name or trademark, material designation, size, and applicable I.P.S. schedule.

2.04 PVC PIPE CEMENT AND PRIMER

A. Provide solvent cement and primer for PVC solvent weld pipe and fittings as recommended by the manufacturer. Pipe joints for solvent weld pipe to be belled end. Pipe joints for gasketed pipe to be intrical ring type. Insert gaskets will not be accepted.

B. Solvent weld cement shall be colored with primer a contrasting color and be easily recognizable against PVC pipe.

2.05 THREADED CONNECTIONS

A. Threaded PVC connections shall be made up using teflon tape or teflon pipe dope.

B. Connection between mainline pipe fittings and automatic or manual control valves shall be made using Schedule 80 threaded fittings and nipples

2.06 GATE VALVES

A. Manual gate valves 2 in. and smaller: Provide the following, unless otherwise noted on Drawings:

1. 150 lb. saturated steam rated
2. Brass body - ASTM B 62
3. Screwed joints
4. Non-rising stem
5. Screwed bonnet
6. Solid disc
7. Equipped with handwheel

B. Gate valves 2-1.2 in. and larger: Provide the following, unless otherwise noted on Drawings:

1. AWWA-C-509
2. 200 lb. O.W.G.
3. Cast Iron body - ASTM A 126 Class B
4. Deep socket joints
5. Rising stem
6. Bolted bonnet
7. Double disc
8. Equipped with operating handle

2.07 THRUST BLOCKS

A. Main line piping shall have thrust blocks sized and placed in accordance with the pipe manufacturer's recommendations and as detailed on the Drawings. Thrust blocks shall be standard concrete mix in accordance with ASTM C-150, ASTM C-33, and ASTM C-94 with a compressive strength (28 days) of 3000 PSI. Thrust blocks shall be installed at all tees, elbows, 45's crosses, reducers, plugs, caps and valves. Contractor shall be responsible to ensure stability of all thrust blocks.

2.08 PIPE AND WIRE SLEEVES

A. Sleeves to be installed:

1. The contractor shall install irrigation system pipe and wire sleeves conforming to the following:

   a. All pipe sleeves shall be a minimum of two (2) pipe sizes larger than the pipe it is to hold.

   b. All pipe sleeves shall extend a minimum of 24 inches beyond the edges of pavement.

   c. All pipe sleeves to be installed under existing road surfaces shall be PVC Schedule 40 pipe installed using the "cut and patch" method or jack and bore steel pipe per DOT specifications.

   d. All irrigation system wires shall be sleeved separately from main or lateral lines.

   e. All pipe sleeves shall be installed at the minimum depth specified for mainlines, lateral lines and electrical wire.

   f. Contractor shall coordinate all pipe sleeve locations and depths prior to initiating installation of the irrigation system.

   g. Contractor shall be responsible to adjust the system layout as necessary to properly align with all pipe sleeves at no additional cost to the Owner.

   h. Record all sleeve locations on As-Built drawings at the time of installation.

B. Existing sleeves:

1. The contractor shall verify location of all existing sleeves and notify Owner's Representative of any discrepancies.

2.09 ABOVE GROUND PIPING

A. All above the ground piping shall be steel and painted purple in color to signify reclaimed water.

2.10 MASTER CONTROL VALVES

A. Valve shall be a pilot-operated diaphragm-actuated globe valve. The main valve shall have a single removable seat and a resilient disc. The disc shall have a rectangular cross section and be contained on 3-1/2 sides. Repairs shall be possible without removing the valve body from the line. It shall close tight when pressure is applied to the cover chamber and open when the pressure is relieved from the cover chamber. The pilot control shall be a solenoid valve controlling a three-way auxiliary valve. The valve shall be similar in all respects to the Model #93-01 AB pressure reducing solenoid control valve as manufactured by CLA-VAL Co.

B. Valve boxes shall be Carson 1730D purple. Extensions as needed.

2.11 REMOTE CONTROL VALVES

A. The remote control valve shall be a normally closed 24 VAC 60 cycle solenoid actuated globe pattern diaphragm type. Valve pressure rating shall be not less than 200 PSI. The valve body and bonnet shall be constructed of heavy duty glass filled nylon; diaphragm shall be of nylon reinforced nitrile rubber. The scrubber shall consist of a stainless steel cylinder screen and a nylon scrapper.

B. The valve shall have a pressure regulating module capable of regulating outlet pressure between 15 and 100 PSI (+-5 PSI). Module shall have an adjusting screw for setting pressure and a schrader valve connection for monitoring pressure.

C. The valve shall be actuated by a low power 5.5 V.A. 24 VAC solenoid. The solenoid plunger shall have a "Grit Filter" to insure a positive valve operation.

D. The valve shall have a flow control stem and wheel handle for regulating or shutting off the flow of water and both a manual internal bleed and manual external bleed for manual operation of the valve without electrically energizing the solenoid coil.

E. The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.

F. Identify all control valves using Christy I.D. tags (or approved equal) numbered to match drawings.

2.12 IRRIGATION CONTROL WIRE

A. This contract shall include all control wiring between controllers and automatic remote control valves and shall be UF (direct burial), 14 AWG size, U.L. listed, or sized larger as needed.

1. All common wire between controllers and automatic remote control valves shall be UF (direct burial), 14 AWG size, U.L. listed, or sized larger as needed.

B. Install wiring in the same trench and along the main line whenever possible.

1. Where wire will not be run in the same trench as the mainline install all wire in schedule 40 PVC conduit a minimum of 24 inches below finished grade.

C. When more than one wire is placed in a trench, tape the wiring together at intervals of 12 feet.

D. Make wire splices using Pen-Tite connectors. Make an expansion loop of 12 inches at each wire connection and at each directional turn.

E. Size wire according to manufacturer's recommendations. Do not use less than No. 14 AWG size U.L. listed.

F. Use a continuous wire between controller and remote control valves. Do not use wire splices without prior approval. Install each approved splice in a remote control valve box or in a 12-inch round plastic box, marked "electrical wires".

G. Color of all ground wires shall be white.

H. Color code all control wires per the following chart:

a. Black
b. Orange
c. Brown
d. Blue
e. Green
f. Tan
g. Purple
h. Blue with white stripe
i. Pink
j. Gray
k. Yellow
l. Red

Repeat color code sequence for zones 13 - 24.

1. If no other wires are to run along with the mainline in any location a 14 AWG UF tracer wire shall be run with the mainline.

2.13 QUICK COUPLER VALVES

A. Quick coupler valves shall be 3/4-inch Rain Bird #33DNP with purple covers. Valves to be mounted on triple swing joints manufactured by Spears as shown in the detail drawings. Contractor shall supply one (1) Rainbird #33K series quick coupler key on one (1) hose swivel ELS to the Owner for each ten (10) quick coupler valves installed. Quick couplers shall be located as specified in the drawings. All quick coupler valves shall be installed inside a locking purple valve box as detailed on the drawings.

2.14 VALVE BOXES

A. For gate valves, use a Fastech 3101, or approved equal cast iron valve box with a cast iron lid. Lid shall be imprinted with "Reclaimed Water."

B. For remote control valves and quick coupler valves, use a Carson 1419 16-1 valve box with a 1419-4B purple boltdown lid imprinted with "Reclaimed Water".

C. For control wiring splices, use a Carson 9-10 10-inch round valve box with a 910-2B locking cover.

2.15 SPRINKLER HEADS

A. Rotary sprinkler heads: Lawn rotor heads shall be of the size and type noted on Drawings with purple covers.

B. Small shrubbery sprinkler heads, adjustable: All shrub heads shall be by the manufacturer noted on the Drawings and installed in accordance with their respective construction details.

C. Hi-pop risers:

1. Locate where indicated on Drawings
2. Install heads in accord with detail on Drawings

D. Small lawn sprinkler heads: Size and type noted on Drawings with purple covers.

E. All sprinkler heads to be installed on Schedule 80 Swing Joints with Marlex Fittings, Spears.

2.16 MASTER CONTROL SYSTEM COMPUTER (N.I.C.)

A. The computer shall be an IBM (or approved equivalent) 486-25DX or faster Personal Computer having at least one floppy disk drive (3-1/2 inch), a 320 MB hard drive or larger and a minimum 8MB internal RAM memory. An approved equivalent computer will be allowed only if it guarantees to be 100% IBM compatible. The computer shall include a 101 key keyboard, Microsoft or approved equivalent) 2 button bus mouse, 14 inch or larger VGA color monitor and graphics card, and Epson (or approved equivalent) 24 pin dot-matrix printer and a Hayes (or approved equivalent) 2400 Baud or faster external or internal phone modem. A minimum of two serial ports are required, one for the Direct Connect to the CCU and one for the phone modem. Owner to provide telephone service to the computer location.

B. Software:

1. The computer shall come with Microsoft DOS V6.0 or greater, and Microsoft Windows V3.1 or greater. The MAXICOM package shall include CIMS-ET software, guide to operations and the CCU-M.

C. Surge Protection:

a. Furnish and install and ISO-REG model 075-12-12-12-2-U-U 120VAC, 60 HS, 7650VA with package style B-75 (or approved equivalent) voltage stabilizer unit for the computer, printer and CCU-1-R to assure constant input voltage to the computer.

2.17 CCU (CLUSTER CONTROL UNIT)(N.I.C.)

A. The CCU (Cluster Control Unit) encoder Unit shall be microprocessor based with micro electronics solid state circuitry devices for interpreting the signal from the central control via telephone service and actuating the field satellites. The CCU-Encoder shall be a single unit containing a modem, IBM Computer interface, site control function, and the encoder module. The CCU-Encoder shall connect directly to the Telephone Company lines via a standard connector Model RJ11C, in full compliance with Part 68, FCC docket 19528. Each CCU-Encoder shall have a single 2 wire output through the terminal strip with in-line resettable circuit breaker and shall operate up to 28 satellites, switching decoders, sensor decoders, or pulse decoders, or any combination of satellites or decoders. An indicating light shall be provided for each encoder channel or station and shall provide a lighted display giving a status report of all satellites or decoders in operation.

B. The CCU-encoder units shall have a durable heavy duty, metal cabinet with baked epoxy coated enamel finish complete with a sponge rubber gasket door having a key operated lock and suitable for wall mounting using Model WB (Univ) Wall Mount Bracket Assembly. The unit shall require 117 Volt A.C. power supply.

C. The 2-Wire path shall be used to transmit the coded signal from the encoder out toe field satellites and to also carry the "Feed-Back" signal from the field satellite units back to the encoder.

D. The model, location, and number of CCU Encoders shall be as shown on the drawings or as instructed and shall be as manufactured and furnished by Rain Bird Sprinkler Manufacturing Corp., Glendora, California.

2.18 SATELLITE CONTROLLERS

A. The satellite controller(s) shall be Rain Bird Model PAR microprocessor-based, solid-state satellite controllers. The satellite controllers shall be either 16 or 24 station models, as specified on the Drawings.

B. The PAR units shall have a heavy-duty, stainless steel pedestal. All models shall be provided with a sponge rubber gasket door having a key operated lock. The pedestals shall be mounted to a concrete pad as per detail in Drawings.

C. The PAR satellite units shall require 120-VA, 60HZ or 220-240 VA, 50HZ input power. Each shall have a stepdown transformer (120 VA or 220/240 VA to 26.5 VA) rated at 2.0 AMP output capacity for operating a maximum os six (6) standard Rain Bird solenoids at one time. Unit shall be complete with a reset circuit breaker, rated at 2.5 AMP holding current and 4.37 AMP breaking current. All satellites shall be grounded to a 10-ohm or less earth ground. The unit shall use relays and MOV's to electrically isolate the circuitry from field noise, while providing a physical gap to protect against surge damage. The unit shall have a detachable harness connector that allows for quick removal of the front panel and reduces the need to disconnect and reconnect the field wires. The satellite units shall use socketed chips on the printed circuit boards which will enable future field upgrades or repair work.

D. The unit's control panel shall have a large 32-character alphanumeric liquid crystal display (LCD) to show operation information and diagnostic data as well as indicator lights to display active schedules and central control status. The satellite's control panel shall have 15 large, raised buttons with clear, descriptive icons and (English) labeling.

E. The satellite units shall have three (3) automatic schedules and a multi-manual program. Each schedule shall have up to twelve (12) start times per day and overlapped starts shall automatically stack. Water budgeting shall be from 0 to 200% in 10% increments to allow changes to all station watering times without separately reprogramming each station. The sixteen (16) or twenty-four (24) individual stations shall allow for the setting of operation times from 1-minute minimum time to a 120-minute maximum time, in one(1) minute increments.

F. The "CONTROL MODE" button shall provide for three (3) satellite control modes: 1) "OFF" for "Rain Shutdown", 2) "LOCAL" to remove central control and operate only as a "stand-alone" controller, and 3) "MAXI" to allow for the response of the PAR satellite unit to the MAXI® computer programming.

G. The PAR satellites shall be capable of multi-station operation as programmed on the satellite itself or as programmed at MAXICOM. It shall be capable of simultaneously operating up to four (4) stations maximum (6 solenoids maximum).

H. Under all normal MAXI® operations, all station timing (for the 16/24 individual stations) of a PAR satellite unit shall be done by the MAXI® CENTRAL and not according to the times programmed for each of its stations. The programming on the satellite unit itself shall be only functional in case of emergency, should the communication link between the satellite and the MAXI® CENTRAL be lost.

For local field control and operation, the PAR satellite unit shall be capable of being manually operated on any one of the sixteen (16) or twenty-four (24) stations for single-station operation, any portion of a cycle, or a complete cycle manually started, as desired.

I. When the "CONTROL MODE" is in the "LOCAL" position, the PAR satellite unit will ignore all MAXI® communications and programming and respond only to its own programming operating as a "stand-alone" controller.

J. If so specified, the 2-wire path shall be used to communicate from the MAXI® CENTRAL to the PAR satellites. This 2-wire path shall also be used to communicate a feedback signal, used by the MAXI® CENTRAL to verify and log in memory all satellite and decoder activity. This 2-wire path communication link shall be of the type wire hereinafter specified, and installed and tested as specified and/or directed.

K. The model, location, and number of PAR satellites shall be shown on the drawings or as instructed, and shall be manufactured and furnished by Rain Bird Sprinkler Mfg. Corp., Glendora, California.

L. Install additional terminal strip option per drawing.

2.19 TELEPHONE COMMUNICATION WIRE

A. Contractor shall be responsible for all equipment, labor, conduit, telephone communication wire, connections, etc., for the direct connection with existing telephone lines as provided by others and all of the irrigation system's satellite controllers, and sensor as specified herein or as shown on the drawings. All work shall be fully coordinated with Vista United Telecommunications and the Owner's representative, and conform in strict accordance with all applicable codes.

B. The telephone communication wire shall be brand Rex Direct Burial telephone cable. 19-6 Icky Pic.

C. All telephone communication wire shall be installed with no underground splices unless absolutely necessary and unavoidable as deemed by the Owner's Representative. Any and all underground splices that are required to be made shall be made in a valve box. All wire splices shall be made to telephone specifications using the "Scotch Lok" phone wire connector for 19 gauge telephone wire. All wire shall be installed in PVC Schedule 40 gray conduit a minimum of 18 inches below finished grade when not run with the mainline.

D. Provide complete, continuous, and non-interrupted telephone wire connection terminating at telephone point of connection after coordinating with Owner's Representative on one end and extending to and terminating at each satellite controller and sensor as shown on the Drawings.

2.20 SURGE PROTECTION/GROUNDING

A. Surge Suppression Receptacle

1. At each Satellite Controller a Surge Suppression Receptacle for 120 volt power wiring shall be installed. The receptacle shall be a Pass and Seymour Model #6262-ISP Hospital Grade Transient Voltage Surge Suppressor Receptacle (or approved equal).

B. Grounding

1. Each satellite or grouping of satellites shall be grounded by means of a #10 or larger bare copper grounding wire connected to a 3-rod grid copper grounding network (three (3) 5/8-inch diameter copper clad grounding rods 8' long arranged in a triangle at least 8 feet apart and tied together underground with a #10 or larger bare copper wire). The grounding network shall measure 10 OHMS or less when measured with a Vibra-Ground instrument.

2.21 FLOW SENSOR

A. Irrigation mainline flow sensor decoders shall be installed in accordance with drawings. See drawings for locations. Contractor shall be responsible for installation, hook-ups, materials, components, connections, etc., of the flow sensors and pulse decoders for the complete automatic operation of the system.

B. The flow sensors shall be manufactured by Data Industrial Company, Model #IR-220SS and Model #IR-228SS. The decoder shall be a Rain Bird Model No. F6P300. Install as recommended by the manufacturer and as detailed including hookup to the Data Industrial 600-10 Output Pulse Transmitter with Rex Brand 19-3 Icky Pic. Provide lighting protection as detailed on Drawings.

2.22 MISCELLANEOUS MATERIALS (Spare parts)

A. As hereinafter specified and as required to complete work.

1. 25 spray heads of each type
2. 25 rotor heads of each type
3. 25 of each spray nozzle type
4. 25 - 1/2 inch swing joints
5. 25 - 3/4 inch swing joints
6. 2 - 5 foot square head gate valve keys

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Before work is commenced, hold a conference with the Owner and the Owner's Representative to discuss general details of the work.

B. Verify dimensions and grades at job site before work is commenced.

C. During the progress of the work, a competent superintendent and any assistants necessary shall be on site, all satisfactory to the Owner's Representative. This superintendent shall not be changed, except with the consent of the Owner's Representative, unless he proves unsatisfactory and ceases to be employed. The superintendent shall represent the Contractor in his absence and all directions given to the superintendent shall be as binding as if given to the Contractor.

D. Contractor must obtain and pay for all plumbing permits and all inspections required by outside authorities.

E. All work indicated or notes on the Drawings shall be provided whether or not specifically mentioned in the Specifications.

F. If there are ambiguities between the Drawings and Specifications, and specific interpretation or clarification is not issued prior to bidding, the interpretation or clarification, the Owner's Representative, and the Contractor shall comply with the decisions. In the event the installation contradicts the directions given, the installation shall be corrected by the Contractor at no additional cost to the Owner.

G. Layout of sprinkler lines shown on Drawings is diagrammatic only. Location of sprinkler equipment is contingent upon and subject to integration with all other underground utilities. Contractor shall employ all data contained in the contract Documents and shall verify this information at the construction site to confirm the manner by which it relates to the installation.

H. Coordinate the installation of all sprinkler materials, including pipe, with the landscape Drawings to avoid conflict with the trees, shrubs, or other planting.

I. Do not proceed with the installation of the sprinkler system when it is apparent that obstructions or grade differences exist or if conflicts in construction details, legend, or specific notes are discovered. All such obstructions, conflicts, or discrepancies shall be brought to the attention of the Owner's Representative.

J. Replace, or repair to the satisfaction of the Owner, all existing paving disturbed during the course of this work. New paving shall be the same type, strength, texture, finish, and be equal in every way to the material removed.

K. The Owner reserves the right to make temporary repairs as necessary to keep equipment in operating condition without voiding the Contractor's guarantee or relieving the Contractor of his responsibilities during the guarantee period.

L. Piping and related materials shall be delivered and stored on the jobsite with suitable protection against damages and shall be covered with tarps or plastic sheeting until installation.

3.02 EXCAVATING AND BACKFILLING

A. Trenching - General:

1. Dig sides of trenches straight. Provide continuous support for pipe on bottom of trenches. Lay pipe to uniform grade. Trenching excavation shall follow layout indicated on Drawings.

2. Provide minimum cover of 24 inches from the top of pipe. Where lines occur under paved area, the coverage shall be from bottom of concrete or asphalt paving.

3. Provide minimum cover of 24 inches over all control wire.

4. Unless otherwise noted on Drawings, provide minimum cover of 12 inches over non-pressure lines.

5. Maintain 6-inch horizontal minimum clearance between sprinkler lines and between all lines of other trades.

   a. Do not install sprinkler lines directly above another line of any kind.

6. Maintain 1-inch vertical minimum between lines which cross at angles of 45 degrees to 90 degrees.

7. Exercise care when excavating, trenching and working near existing utilities.

8. Overexcavation of trenches to avoid conflicts with other utilities shall be at the Contractor's expense.

B. Backfilling:

1. All pressure supply lines (mainline) shall have 12 inches of fill placed over the pipe then a continuous length of yellow color underground marking tape. The tape shall be imprinted with "CAUTION RECLAIMED IRRIGATION WATER MAIN BURIED BELOW" in purple letters. Followed by the remainder of the backfill.

2. Initial backfill on all lines shall be of a fine gramular material with not foreign matter larger than 1/2 inch.

3. Compact backfill in trenches to dry density equal to the adjacent undisturbed soil, and conform to adjacent grades without dips, sunken areas, humps, or other irregularities.

4. Where feasible, the Owner's representative may authorize the use of flooding in lieu of tamping.

5. Do not, under any circumstances, use equipment or vehicle wheels for compacting soil.

6. Restore grades and repair damages where settling occurs.

7. Compact each layer of fill with approved equipment to achieve a maximum density per AASHTO T 180 - latest edition. Under landscaped area, compaction shall not exceed 85% of maximum density.

8. Compaction shall be obtained by the use of mechanical tampers or approved hand tampers. When hand tampers are used, the materials shall be deposited in layers not more than four (4) inches thick. The hand tampers shall be suitable for this purpose and shall have a face area of not more than 100 square inches. Special precautions shall be taken to prevent damage to the irrigation system piping and adjacent utilities.

C. Routing of Piping:

1. Routing of pressure and non-pressure piping lines are indicated diagrammatically on Drawings.

2. Coordinate specimen trees and shrubs with routing of lines.

   a. Planting locations shall take precedence over sprinkler and piping locations.
   b. Report to Owner any major deviation from routing indicated.

3. Conform to Drawings layout without offsetting the various assemblies from the pressure supply line.

4. Lay out sprinkler heads and make any minor adjustments required due to differences between site and Drawings. Any such deviations in layout shall be within the intent of the original Drawings, and without additional cost to the Owner.

5. Lay out all systems using an approved staking method, and maintain the staking of approved layout.

3.03 INSTALLATION

A. Water supply: Connections to the water sources shall be at the approximate locations indicated on the Drawings. Make minor changes caused by actual site conditions without additional cost to the Owner.

B. Assemblies:

1. Routing or pressure supply lines as indicated on Drawings is diagrammatic only. Install lines and required assemblies in accordance with details on Drawings and in accordance with Section 17-604.20 and all of the applicable provisions of DEP and the City of Kissimmee Chapter 29..

2. Do not install multiple assemblies on plastic lines. Provide each assembly with its own outlet. When used, the pressure relief valve shall be the last assembly.

3. Install all assemblies in accord with the respective detail Drawings and Specifications.

4. Plastic pipe and threaded fittings shall be assembled using Teflon tape, applied to the male threads only.

C. Plastic Pipe:

1. Install plastic pipe in accord with manufacturer's recommendations.

2. Install sprinkler head on plastic pipe as indicated on Drawings.

3. Prepare all welded joints with manufacturer's cleaner prior to applying solvent.

a. Allow welded joints as least 15 minutes setup/curing time before moving or handling.

b. Partially center load pipe in trenches to prevent arching and shifting when water pressure is on.

c. Do not permit water in pipe until a period of at least four hours has elapsed for solvent weld setting and curing, unless recommended otherwise by solvent manufacturer.

4. Curing:

a. When the temperature is above 80°F, allow soluble weld joints at least 24 hours curing time before water is introduced under pressure.

5. Flushing the system:

   a. After all sprinkler pipe lines and risers are in place and connected, and prior to installation of sprinkler heads, open the control valves and flush out the system with a full head of water.

   b. Sprinkler heads shall be installed only after flushing of the system has been accomplished to the complete satisfaction of the Owner's Representative.

6. Installing piping under existing pavement:

   a. Piping under existing pavement may be installed by jacking & boring.

   b. Secure permission from Owner before cutting or breaking any existing pavement. All repairs and replacements shall be approved by Owner and shall be accomplished at no additional cost to the Owner.

D. Satellite Controllers:

1. Install all automatic satellite controllers as shown in the plans and details. Electric control valves shall be connected to the proper station number in the controller as noted on the plans. Electric source shall be as indicated in the contract documents. Contractor shall be responsible for all connections, grounding, hook-ups, labor, etc. for complete automatic operation according to all applicable codes.

   a. The location of all satellite controllers shall be approved by the Owner's representative prior to installation.

2. All satellite controllers shall be equipped with surge arrestors and grounded as specified elsewhere in this section. Grounding of 10 OHMS or less is required. If grounding rods will not give the 10 OHMS or less, 150 feet of bare #6 wire will be installed 8 inches to 12 inches deep into an irrigated area. This wire will be connected to the ground rod by a single piece brass clamp.

E. Remote Control Valves:

1. Install at sufficient depth to provide not more than 6 inches, nor less than 4 inch cover from the top of the valve to finish grade.

2. Install valves in a plumb position with 24 inches minimum maintenance clearance from other equipment, 3 feet minimum from edges of sidewalks, buildings, and walls, and no closer than 7 feet from the back of curb or edge of pavement along roadways.

3. Contractor shall adjust the valve to provide the proper flow rate or operating pressure for each sprinkler zone.

F. Wire:

1. Install control wires at least 24 inches below finish grade and lay to the side of the mainline. Provide a minimum of 24 inches of looped wire slack at valves and changes in direction and snake wires in trench to allow for contraction of wires. Tape wires in bundles at 10 foot intervals. The wire shall be laid in the trench prior to the installation of the pipe. The wire must be beneath and 6 inches to the side of the mainline pipe.

2. All underground wire splices shall be made in electric remote control valve boxes or splice boxes with

Snap-Tite Connectors as manufactured by Rain Bird or approved equal.

3. Run wire for remote control valves with main line and show on "As-built" project record Drawings if deviations occur.

4. Connections to all electrical control devices shall be made with Snap-Tite Connectors as manufactured by Rain Bird or 3M.

G. Gate Valves:

1. Install where indicated and with sufficient clearance from other materials for proper maintenance.

2. Check and tighten valve bonnet packing before backfill.

H. Sprinkler Heads:

1. Install in a plumb position at intervals not to exceed the maximum spacings indicated.

2. Install all rotor heads adjacent to a roadway (no curb) 36 inches from the edge of the road and 6 inches from the edge of all curbs and sidewalks.

a. Thrust blocks:

b. All mainline pipe shall have thrust blocks installed at tees, bends, or at the end of pipe lines as detailed on the drawings. Care shall be taken to install the concrete on the fittings and away from the joints of pipe. Control, power, and valve wires must be kept free of concrete and placed outside and away from the thrust block. Thrust blocks shall be poured against undisturbed ground as detailed on the drawings. No pre "bagged" or pre-cast thrust blocks will be allowed.

3.04 ELECTRICAL (120 VAC)

A. Install electric to all controllers per applicable electrical codes and specifications.

B. A licensed electrical contractor employed by the irrigation contractor shall pay all fees and obtain permits for all work associated with the electrical installation of all controllers and other MAXICOM related equipment.

C. Electrical power (120 VAC) point of connection shall be provided by others to within 10 feet (10') of the satellite controller locations. Contractor shall connect at this point to provide power to controllers.

3.05 TESTING

A. The contractor shall notify the Owner's Representative seventy-two (72) hours in advance of testing.

B. Prior to the backfilling of mainline fittings, contractor shall fill the mainline piping with water, in the presence of the Owner's Representative, taking care to purge all the air from the pipe. A small, high pressure pump shall be connected to the mainline and set so as to maintain 125 psi in the mainline system for two (2) hours without interruption. When this has been accomplished and while the pressure in the system is still 125 psi, leakage testing shall be performed in accordance with AWWA Standard C-600 (ie., .08 of a gallon (x) diameter of pipe (x) per 1,000 feet of pipe (=) allowable amount of water added.

Pressure readings shall be noted and make-up water usage shall be recorded. Should the rate of make-up water

usage indicate significant leakage, the source of such leakage shall be found and corrected and the system re-tested until the Owner's Representative is satisfied that the system is reasonably sound. Lateral line testing shall be conducted during the operating testing of the system by checking visually the ground surface until no leaks in this portion of the system are evident. Leaks shall be repaired or paid for by the contractor at any time during the warranty period.

C. Adjustment and coverage of system: The contractor shall balance and adjust the various components of the system so that the overall operation of the system is most efficient. This includes a synchronization of the controllers, adjustments to the pressure regulators, pressure relief valves, sprinkler heads, and individual station adjustments on the controllers.

D. All items of construction and operation of the irrigation system are subject to the inspection and testing of the Owner's Representative. Any item may be rejected because of non-compliance with the plans and specifications, non-suitability, poor materials, inadequate workmanship or improper assembly or other causes which would prevent the system from functioning properly, or which in the Owner's Representative's opinion would be detrimental to the longevity of the system, or which would necessitate excessive labor or maintenance.

E. The contractor shall fully comply with the schedule of testing and inspection, as well as other tests or inspections that may be ordered by the Owner's Representative. All labor, materials, and equipment for said tests and inspections shall be furnished at the sole expense of the contractor. Work stoppages for testing, inspection, and replacement or repair of any inadequate item shall not add to the allocated time of completion.

F. All repairs, replacements, adjustments, and reconstruction required to pass said inspections and tests shall be at the contractors expense.

G. Contractor shall be responsible for the full and proper maintenance of the irrigation including but not limited to adjustments, repairs, integration with the master control system, etc. Contractor's responsibility for maintenance (exclusive of replacements or repairs within the guarantee/warranty period) shall terminate on the date of Final Completion for the entire project or designated portion thereof as declared by the Owner's Representative according to the conditions of the contract, provided the contractor has provided the Owner's Representative with irrigation 'as-built' drawings and three (3) copies of the Operation and Maintenance Manual as specified under paragraph 1.03 of this section.

H. Tests of satellite controllers and for grounding network shall measure 10 OHMS or less when measured with vibra-sound equipment. All testing to be at contractor's expense.

I. Final inspection shall be made when the complete system is in place, operable, and all repairs, additions, adjustments, and other work is complete. At such time, the contractor shall adequately demonstrate the proper operation of the system, shall show the system's complete conformance with the plans and specifications, and demonstrate that the irrigation system gives proper and adequate coverage of all landscaped areas.

J. Final acceptance by the Owner's Representative in no way removes the contractor of his responsibilities to make further repairs, corrections and adjustments to eliminate any deficiencies which may be later discovered. Moreover, the contractor shall fully honor the warranty period outlined herein.

3.06 GUARANTEES

A. The Contractor shall furnish warranties in WRITING certifying that the quality and workmanship of all materials and installation furnished is in accordance with these specifications and in accordance with the original manufacturer's warranties. Contractor shall warrant the installation workmanship for a period of One (1) Year from final acceptance; repairs or replacement of material or equipment during the warranty period shall be performed promptly by the Contractor at no cost to the Owner.

1. The guarantee shall also cover repair of damage to any part of the premises resulting from leaks or other defects in material, equipment and workmanship, to the satisfaction of the owner. The contractor shall not be responsible for work damaged by others. Repairs, if required, shall be done promptly. The guarantee shall state the name of the Owner, provide full guarantee terms, effective and termination date, name and license number of contractor providing guarantee, address, and a telephone number. It shall be signed by chief executive of the contractor and notarized. Manufacturer's warranties shall not relive the contractor of his liability under the guarantee. Such warranties shall only supplement the guarantee.

2. If, within ten (10) days after mailing of written notice by the Owner to the contractor requesting repairs or replacement resulting from a breach of warranty, the contractor shall neglect to make or undertake with due diligence to make the same, the Owner may make such repairs at the contractor's expense, provided; however, that in the case of emergency where, in the judgment of the Owner, delay would cause serious loss or damage, repairs or replacement may be made without notice being sent to the contractor, and contractor, shall pay the cost thereof.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

A. Provide landscape maintenance as shown on the Drawings, inferable therefrom and as specified herein.

1.02 QUALITY ASSURANCE

A. General:

1. Furnish all labor, materials, tools, equipment and services necessary for and reasonably incidental to complete the planting work as shown on the Drawings or specified, including but not limited to the following:

   a. Landscape maintenance
   b. Preparation of landscape maintenance manual
   c. Irrigation maintenance

2. Completely coordinate with work of all other trades.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for sound, secure and complete installation.

B. Work Force: Should be experienced in landscape maintenance and preferably should have an education in ornamental horticulture.

C. Materials: All materials used shall either conform to bid specifications or shall otherwise be acceptable to the Owner's Representative. The Owner's representative shall be given a monthly record of all herbicides, insecticides, and disease control chemicals used.

PART 2 - PLANT ESTABLISHMENT PERIOD

2.01 FUNCTIONS TO BE PERFORMED

A. The plant establishment period shall consist of a twelve month maintenance period and twelve monthly work programs. The time required for the plantestablishment shall be considered as indicated in the total time limit specified for the contract. The maintenance work program shall include the specified work locations for the month in which this work is to be done.

2.02 PLANT ESTABLISHMENT PERIOD

A. The plant establishment period shall begin on the date that a "Certificate of Final Completion" issued by the Owner's Representative indicates that all plants are in place and have been installed according to Plans and Specifications. When installation is accepted, the duration of the plant establishment period shall be for twelve months. Maintenance shall include but not limited to those operations listed herein.

2.03 MONTHLY WORK PROGRAM

A. The monthly work program shall consist of planting, watering, fertilization, weeding, spraying/dusting, debris removal, plant replacement and pruning. This monthly program shall be prepared by the Contractor in consultation with the Owner's Representative. The monthly work program shall set forth for each week of the month the items shown on the Landscape Maintenance Work Program. This maintenance pro-

gram shall be prepared by the Contractor no later than the 15th day of the month preceding the monthly program. The program will be approved by the Owner's Representative prior to the commencement of work. Six copies of the monthly work program will be submitted to the Owner's Representative.

2.04 LANDSCAPE MAINTENANCE MANUAL

A. After the plant establishment period, the Contractor shall provide the Owner's representative with an organized document of written, pictorial, and graphic instructions based on a record of maintenance during the monthly work program. This data shall form the basis of the Landscape Maintenance Manual.

B. Maintenance instructions shall be applicable to the Project Site's environmental conditions, materials, labor, management and shall follow logical irrigation and horticultural ground keeping practices. This data shall be assembled in vinyl covered pages, a three-ring, loose-leaf binder. The manual shall be presented to be used by local technical and laboring personnel. Final presentation form of the maintenance manual shall be reviewed and subject to the approval of the Owner's Representative.

PART 3 - EXECUTION

3.01 WATERING

A. The Contractor shall maintain an adequate supply of water to insure root zone moisture. Watering by hose or any applicator shall not displace mulch, erode soil, or dislocated plants. Any items disrupted shall be required by the Contractor immediately. Water shall be applied as required to meet the watering schedule as indicated.

3.02 FERTILIZER

A. The Contractor shall take one soil sample per each planting area as directed by the Owner's Representative. The soil samples shall be tested for agricultural nutrients and fertility by an approved agricultural soil testing laboratory as directed by the Owner's Representative. The testing laboratory shall provide the recommended rates of fertilizer application for the planting area being fertilized. Based on soil tests performed periodically as directed by the Owner's Representative, the Contractor shall adjust the fertilizer analysis and rate of application to meet these requirements which may differ from the original analysis. Fertilizer application shall be performed by the Contractor and will be monitored and certified by the Owner's Representative at the time of injection.

3.03 REPLACEMENT

A. Dead plants shall be immediately removed from the Project site and the area re-planted at the Contractor's expense. Plants not in a healthy condition as inspected by the Owner's Representative will be noted to the Contractor. As soon as seasonal planting conditions are appropriate, the Contractor shall re-plant any areas containing unhealthy and dead plants. Replacement plant(s) and installations shall be at the Contractor's expense.

3.04 MOWING

A. Turf areas shall be maintained at a uniform height of approximately 2". Mowing shall commence prior to the turf obtaining a maximum height of 4". Mowing shall be performed with power lawn mower. Clippings shall be removed to prevent thatch build-up as directed by the Owner's Representative.

3.05 PRUNING

A. Pruning shall be performed at the time of installation. Additional pruning shall be performed every two months or as directed by the Owner's Representative.

3.06 PLANT TIES

A. The main stem of the shrubs or vine-like plants planted near walls shall be secured to the wall with plastic tie material to allow new growth to be guided as directed by the Owner's Representative.

3.07 WEED AND DEBRIS REMOVAL

A. Weeding/debris removal from the mulched planted urns and planting beds areas shall be performed so as to maintain a clean, orderly planting installation site, as directed by the Owner's Representative.

3.08 SPRAYING, DUSTING, AND FERTILIZING

A. Spraying and dusting with approved insecticides and fungicides to control pests and to insure healthy plant growth and survival and fertilizing shall be performed as directed by the Owner's Representative.

3.09 EROSION CONTROL

A. The Contractor shall correct soil erosion which occurs during the installation and the maintenance establishment period in the planting areas. Work shall consist of replacing minor volumes of aggregate mulch or displaced soil, re-grading and repairing plant water base wells as directed by the Owner's Representative.

3.10 RE-SEEDING

A. Three months following the date of sowing seed, the Owner's Representative will inspect the planted areas to determine if the area has completely germinated and has a uniformly developed turf area. If planted areas contain germinated seeds which are not the specified seed sown and/or these areas have not germinated, the Contractor shall re-seed the designated areas at his expense and as directed by the

Owner's Representative. If the germinated areas have not produced a uniformly appearing lawn area, then the Contractor shall re-seed the designated areas at his expense.

3.11 PERENNIAL MAINTENANCE

A. Fertilizer - Unless otherwise stated, the word "fertilizer" means an application of Osmocote slow time release fertilizer or similar. Generally applied at a ratio of 10 lbs. per square feet (see manufacturer's recommendations for application instructions).

B. After the initial planting, fish emulsion should be used over the entire bed to help the plants establish themselves. Subsequent applications of fish emulsion can be used for a quick response for small areas or to stimulate an individual plant species. Fish emulsion should be applied 2 to 3 tablespoons per 1 gallon of water (Osmocote and fish emulsion are available at most garden centers).

C. Watering - The amount of water required varies greatly from microclimate to microclimate, but as a general rule it is recommended that beds be watered thoroughly 1 to 2 times per week throughout the year. During periods of drought and intense heat, the frequency should be increased as needed. During periods of extensive precipitation, watering should be decreased accordingly.

D. Contractor shall monitor the irrigation and adjust the mechanism or hand-water to achieve the specified watering program.

E. Mulching - It is recommended that all beds be mulched with 2" pine needle mulch in late winter (February or March), with a top dressing of 1" in late summer (September). The mulch depth shall be 2 to 2 1/2" and supplemented as stated above to maintain this depth.

F. Weeding - As a general rule, all planting beds should be weeded every other week (minimum) throughout the growing season. This is especially crucial during the first several growing seasons until plants establish themselves.

G. Pruning - As a general rule, perennials require either no pruning or annual pruning of plants to the ground in late winter (February or March). Pruning varies from plant to plantand should be executed with care.

H. It is essential that all maintenance procedures be executed by trained personnel with expertise in care of perennials.

3.12 GENERAL CLEAN-UP

A. Restoration and Clean-up: Excess and waste material shall be removed daily. When planting in an area has been completed, the area shall be cleaned of all debris, spoil piles, and containers. Where existing grass areas have been damaged or scarred during planting operations, the Contractor shall restore disturbed areas to their original condition at his expense. At least one paved pedestrian access route to each building shall be kept clean at all times. Other paving shall be cleaned when work in adjacent areas is complete.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide finish grading of landscape areas as shown on the drawings, inferable therefrom and as specified herein.

1.02 QUALITY ASSURANCE

A. General:

1. This section specifies materials, equipment and work required to perform finish grading operations in landscape areas.

2. Completely coordinate work as required.

3. Although such work is not specifically indicated, furnish and install all supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Topsoil:

1. Section 02900: Soil Preparation and Soil Mixes

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify suitability of substrate to accept installation and assure proper subgrade drainage.

B. Installation constitutes acceptance of responsibility of performance.

3.02 PROTECTION AND RESTORATION

A. General:

1. Restore and/or repair damage to existing improvements and completed work resulting from lack of protection or improper installation of protection. The contractor shall be responsible for damage resulting from the soil installation.

3.03 GRADING

A. General:

1. Grade unpaved and paved areas as follows:

   a. To smooth and uniform surfaces
   b. To prevent surface water ponding

B. Unpaved Areas:

1. Finished grades and subgrades: Not to exceed half an inch above or below elevation indicated or specified or as directed by the Owner's Representative.

C. Paved Areas:

1. Grade paved area subgrades to the lines, elevations indicated or specified.

   a. Finished subgrades: Not to exceed one inch above or below elevation indicated or specified.

3.04 MAINTENANCE

A. Maintain all paved sidewalks, etc. in clean, mud and dust-free, condition during earthwork and subsequent construction operations.

1. Clean trucks and equipment, removing mud and debris, prior to entering the following:

   a. Public rights-of-way
   b. Celebration roadways

B. Maintain completed areas and project site as follows:

1. Keep free of trash and debris

2. Re-grade and recompact subgrades damaged or disturbed by the following:

   a. Adverse weather
   b. Soil erosion
   c. Settlement
   d. Subsequent construction operations

END OF SECTION

PART 1 - GENERAL

1.01 SCOPE

A. Furnish all labor, materials, supplies, equipment, and tools necessary to perform all operations in connection with and reasonably incidental to completion of the transplanting of trees as presented on the Drawings and as specified herein.

B. The work of this Section includes, but is not limited to, the following:

1. The transplanting and relocation of existing on-site trees by means of a tree spade machine.

2. The transplanting and relocation of existing on-site trees by means of hand digging, root boxing and transportation.

C. Transplanting of trees shall include root pruning prior to removal, excavation for removal, boxing or other approved method, lifting, transporting, and re-planting of trees in locations identified on the Drawings.

D. Re-planting of selected specimen trees on the project site shall include protections, preparation of tree planting pits with approved soil mixtures, staking and guying, and providing other activities necessary to insure continued and healthy plant life.

E. The Contractor shall provide maintenance for one year of re-planted specimen trees which shall include pruning, watering, fertilization and tree protection.

F. All work specified in this Section shall be performed by, or under the direct supervision of a qualified arborist with demonstrated experience of 5 years (minimum) in the field of large tree (15 inches to 20 inches caliper or larger) transplantation. The Contractor shall identify a minimum of three similar projects with successful transplant for which the Contractor has been responsible and shall provide references for those projects.

G. The Contractor shall coordinate the tree moving schedules of each specimen tree with the season for moving appropriate to the species.

H. The Contractor will be given 30 days notice prior to start of tree transplanting.

1.02 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions, and Division 1, General Requirements, are a part of this section.

1.03 SUBMITTALS

A. General: Conform with submittal requirements and procedures specified in Section 01300: Submittals.

B. Name, address, and qualifications of Arborist proposed for this work.

C. Schedules and Programs: Prior to beginning tree transplantation, the Contractor shall prepare and submit a detailed work plan of action for the transplantation of the trees indicated on the Drawings for approval by the Owner's Representative. The plan shall include the following:

1. Transplanting, holding and re-planting schedules of all prospective transplant tree specimens.

2. Detailed outline of procedures and equipment involved.

3. Detailed maintenance plan.

4. Holding area location plan which shall include the location of proposed site area for free storage, proposed protective fencing, and maintenance facilities available.

D. Product Data: Prior to the beginning of tree transplanting, submit manufacturer's product literature and technical data with all pertinent information (i.e., name of product, manufacturer's name, and compliance with the specifications) for material of this Section.

E. Certificates: Submit certified test reports including analysis tests for physical characteristics of the following materials to be furnished and used for transplanting and on-site re-planting.

1. Topsoil, on-site
2. Sand
3. Commercial Fertilizers
4. Mulch

1.04 PROJECT CONDITIONS

A. Environmental Conditions:

1. Trees shall be transplanted in the fall or spring.

2. Conduct transplanting under favorable weather conditions during the appropriate season.

B. Limitations:

1. Verify the locations of all underground utilities with the appropriate utility companies prior to digging.

2. Do not transplant when conditions exist which may adversely affect the health of the transplanted tree.

C. Coordination with other trades: Certain transplanted trees identified in the Drawings require placement prior to commencement of other work. The Contractor shall coordinate tree transplantation so as not to interfere with or delay other contruction activities.

D. Protect existing utilities, paving and other facilities from damage caused by tree transplanting operation.

E. Provide hose and watering equipment as required.

1.05 MAINTENANCE

A. Contractor shall begin maintenance immediately after each plant is transplanted and shall continue maintenance until two (2) year after replanting at project site. Maintenance shall consist of pruning, refertilization, watering, weeding, mulching, tightening and repairing of guys and stakes, resetting plants to proper grades or upright position, restoration of the planting saucer, and spraying.

B. Pruning shall be done periodically, and as necessary, to remove dead or damaged branches.

C. Watering of plant materials shall be done as part of this work, and it shall remain within the scope of this work to water as necessary to keep the plant materials in their best conditions. Coordinate schedules and procedures with the Owner. Water all plants at least once each week during the growing season or at a greater frequency if directed by the Architect. Water shall be coordinated with irrigation system to insure that pines are not over watered.

D. Repair or replace stakes and tighten guys as necessary. Remove stakes and guys at end of maintenance period, unless otherwise directed by the Owner.

E. Spraying shall be done as necessary to control insects, fungus, and other diseases.

PART 2 - PRODUCTS

2.01 TOPSOIL

A. Definition: topsoil shall be considered to mean the original surface soil typical of the area capable of supporting native plant growth. All topsoil shall be imported from offsite sources or meet specifications below.

B. Quality: Friable, reasonably free of subsoil, clay lumps, stones over 2 inches in any dimension and debris. Topsoil shall be free of excessive weeds, roots and root mats.

C. Mechanical Composition:

1. Organic Matter: Minimum three percent, maximum 15 percent
2. Clay: Minimum 10 percent, maximum 15 percent
3. Silt: Minimum 15 percent, maximum 25 percent
4. Sand: Minimum 40 percent, maximum 60 percent
5. Soluable Salts: Maximum 500 ppm
6. pH range: 5.8-7.0

D. Imported Topsoil:

1. Furnish imported topsoil as required from sources approved by the Owner's Representative. Provide imported topsoil and provide amendments necessary to bring it to standards specified above.

2.02 SAND

A. Grading:

Percent Passing	Sieve Designation
	-1004.76 mm (#4)
	95-1002.00 mm (#10)
	90-1001.00 mm (#18)
	65-100500 micron (#35)
	0-50250 micron (#60)
	0-20105 micron (#140)
	0-1053 micron (#270)

B. Chemical Properties:

1. The saturation extract conductivity shall not exceed 3.0 millimhos/cm 2.25°C.

2. Boron: the concentration in the saturation extract shall not exceed 1.0 ppm.

3. Sodium: the sodium absorption ration (SAR) as calculated from analysis of the saturation extract shall not exceed 6.0.

2.03 CHEMICAL ADDITIVES

A. Pre-plant Fertilizer: 50% of the nitrogen to be derived from natural organic sources of urea-form. Available phosphoric acid shall be from superphosphate, bone or tankage. Potash shall be derived from murate of potash containing 60% potash. Fertilizer shall consist of the following percent by weight and shall be mixed by a commercial fertilizer supplier.

1. Pre-plant fertilizer:

10% Nitorgen
6% Phosphorus
4% Potash

a. Application rate shall be in accordance with manufacturers recommendation and as noted.

(1) Trees: 1-2 lbs. per inch of trunk diameter.

B. Root Simulator: "Polymure," product of Veri-Chem, Inc., Bay City, Texas (409) 245-7278, or "Maxicrop," a product of Maxirop, USA, Inc. (708) 253-0756, or equivalent product, subject to approval.

C. Wetting Agent: "APSA 80," produced by Amway, or equivalent product, subject to approval.

D. Fertilizer: Specifications for "XL Injecto Feed", Davey "Arborgreen" or equivalent powder blue nitroform derivative.

E. Pesticide: "Lindane" or "Dursban" or suitable product.

F. Herbicide: "Round-up," or suitable product as approved.

2.04 ANTI-DESICCANT

A. Emulsion type, film-forming agent similar to Dowax by Dow Chemical Co., or Wilt-Prof by Nursery Specialty Products, Inc., designed to permit transpirations but retard excessive loss of moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.

2.05 MULCH

A. Premium grade shredded hardwood bark 3/4 inch to 1 1/2 inches in diameter, free of sticks, dirt, dust and other debris, as approved. Submit one cubic foot sample.

2.06 TREE SUPPORT SYSTEMS

A. Stake Method:

1. Hardwood Stakes: 2 inch x 2 inch x (as indicated) painted black.

2. Wires: Provide wire ties of 2-strand, twisted, pliable galvanized iron wire not lighter than 12 gauge.

3. Hose: Two-ply, black reinforced garden hose not less than 1/2 inch diameter.

B. Stake and Guy Method:

1. Stakes: Hardwood, 2 inch x 2 inch x 1 foot 6 inches.

2. Guys: Provide wire ties and guys of 2-strand, twisted, pliable galvanized iron wire not lighter than 12 gauge.

3. Guying Hose: Two-ply, black reinforced garden hose not less than 1/2 inch diameter.

2.07 TREE WRAP

A. Standard waterproofed tree wrapping paper, 2 1/2 inches wide made of 2 layers of crape kraft paper weighing not less than 30 lbs. per ream, cemented together with asphalt.

2.08 WATER

A. Clean potable fresh water, free from harmful materials. Water shall be furnished by the Contractor. The Contractor shall transport the water as required.

2.09 PESTICIDES

A. Approved to use for type and rate of application prior by the Owner's Representative. Pesticide use shall conform to all laws, codes and requirements of local and state agencies having jurisdiction.

2.10 DRAINAGE FILL AND FILTER FABRIC CLOTH

A. Drainage Fill for Tree Pits: Clean, dry, crushed stone.

B. Fabric Filter Cloth: For planting pits provide a non-woven fabric, needle punched and heat fused of 100% polypropylene staple fiber, freely permeable to moisture transmittal, and approved by the Owner's Representative for each condition of application.

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify that supporting construction provided under other sections is irregularities.

B. Beginning work of this section implies acceptance of existing conditions.

3.02 PRUNING

A. Prior to digging, or within 48 hours after transplanting, all transplanted trees shall be pruned as follows:

1. Prune all transplanted trees to preserve their natural character. Prune in a manner appropriate to the particular requirements of each tree at the time of transplanting and to the satisfaction of the Owner's Representative.

2. Crossing branches and branches which are dead, dying, diseased, weak, or objectionable shall be removed first.

3. Approximately 60% of all smaller interior branches shall be left intact.

4. All cuts shall be back to the lateral branch and removed of the branch collar.

5. The majority of the mass to be removed shall be from the outer canopy of the tree.

B. Pruners shall be kept sharp and adjusted to ensure proper cuts. The use of "anvil" type pruners or loppers is not allowed.

C. Promptly trace and treat all accidental damage to the plant which does not require removal of the branch or the replacement of the tree. Treat in accordance with recognized acceptable horticultural practices and as directed by the Owner's Representative.

3.03 HAND-DUG TREE TRANSPLANTING

A. All trees larger than 24 inches DBH (diameter at breast height) shall be moved by ball and burlap or boxing method approved by Owner's Representative. The size of the ball shall be determined by the following guidelines:

1. Planting details have been developed based on using a five (5) foot diameter plaster cast root ball. Should it be determined that a larger root ball is required, the Contractor shall notify the Owner's Representative.

2. The depth of the soil ball is variable, but shall be of sufficient depth to include the majority of the fibrous roots and to give required mechanical support to the ball.

B. Apply anti-desiccant to trunks, branches, and twigs prior to digging trees.

C. Trees shall be moved by an experienced operator utilizing the appropriate equipment for the task.

D. Do not move trees if the ball is dry, cracked, or broken.

E. Removing Tree From Hole:

1. The tree trunk shall be well padded to prevent trunk damage.

2. Avoid strain on the trunk of the tree.

3. Tree shall be picked up by cables attached to the side of the box or under the base of the root ball if the tree box is not used.

3.04 MACHINE-DUG TREE TRANSPLANTING

A. All trees 24 inches DBH (diameter at breast height) size and smaller shall be transplanted using a 156-inch tree spade machine.

B. Trees shall be centered in the machine when dug. Caution shall be exercised at all times to avoid damage to the branches and trunks of the tree.

C. Protruding branches shall be tied as necessary to avoid damage while digging and transporting.

D. Roots protruding from the digging module shall be cleanly cut flush with the root ball prior to planting.

E. Plant trees 2 inches to 3 inches higher than existing grade.

3.05 PREPARATION OF PLANTING PITS

A. Layout: Stake out new locations for trees to be replanted where shown on Drawings. Necessary adjustments of locations shall be approved by the Owner's Representative. Do not excavate any planting pits until stake locations have been inspected and approved by the Owner's Representative. Adjust stake locations as directed by the Owner's Representative.

B. Circular tree pits with vertical sides shall be excavated. Sand setting mound shall slope away from the tree ball.

C. Excavate and install drainage sump.

D. Do not put plants in pits until the pits and beds have been approved by the Owner's Representative.

E. Remove all excavated subsoil and dispose of excess excavated material.

3.06 PLANTING

A. Unless otherwise specified, all plants shall be planted in pits, centered, and set on sand to such depth that the finish grade level at the plant after settlement will be the same as that which the plant was grown.

B. Trees shall be planted upright and, if necessary, faced to give the best appearance or relationship to adjacent plants and structures.

C. No burlap shall be pulled out from under balls. Platforms, wire, and surplus binding from top and sides shall be removed. All broken or frayed roots shall be cut off cleanly.

D. Planting soil shall be placed and compacted carefully to avoid injury to roots and to fill all voids. Tamp backfill firm to prevent settlement.

E. Trees shall be sanded after placement as follows:

1. Wash sand into crevices with the intent to eliminate air pockets between the soil and the root ball.

2. Complete sanding operations within 24 hours of planting.

3.07 CHEMICAL TREATMENT

A. Root Simulation:

1. Trees shall be root-stimulated with a mixture of seaweed derivative, Adjuvant and Nitroform fertilizer. Mix per manufacturer's recommendations.

2. Mixture shall be injected into the soil with approximately 150 p.s.i. at locations shown on the Drawings.

3. Inject (10) gallons of mixture at each tree moved with a 90 inch (or larger) tree spade. Inject seven (7) gallons per tree moved with a 60 inch to 78 inch tree spade, and five (5) gallons per tree moved with a 44 inch or larger tree spade.

B. Fertilization: Rates of fertilizer application shall be carefully monitored to prevent over-fertilization of the trees.

C. Spraying and Pest Management: Inspect all plant materials at least once a month during maintenance period to locate any disease or insect pest infestation.

1. Upon the discovery of any disease or insect pest infestation, identify, or have identified, the nature or species of the infestation and submit the proposed method of control to the Owner's Representative for approval prior to application of control measures.

2. Pines shall be sprayed for pine borer prevention in July.

3.08 WATERING

A. Water shall be applied slowly so as to penetrate the entire root system at a rate which will prevent saturation of the soil.

3.09 TREE PROTECTION

A. Wrapping: The trunks of all hardwood trees shall be wrapped after planting from the ground line to the height of the branches. The paper wrap shall overlap. Wrapping shall be neat and snug and be held in place with laced twine.

B. Guying: Trees shall be supported immediately after planting and wrapping. All trees shall be guyed as presented in the Drawings.

1. Wires shall be encased in hose to prevent direct contact with the bark of the tree and shall be placed around the trunk in a single loop.

2. Wire shall be tightened and kept taut by using turnbuckles.

3. Trees shall stand plump after staking and guying.

4. Guying shall be done with three (3) guys spaced equally about each tree. Each guy shall consist of white plastic coated twisted steel 8mm aircord with 3/8 inch x 6 inch turnbuckles and appropriate sized galvanized cable clamps.

5. Guys shall be maintained taut throughout the Maintenance and Guarantee Period.

3.10 MULCHING

A. Apply 4 inches to 6 inches of mulch within the water ring of each tree and cover the water ring with one inch of mulch. Complete mulching within 48 hours of planting.

3.11 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Plug all holes left by tree spade and remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from transplanting operations.

B. Perform cleaning during installation of the work and upon completion of the work. Cleaning includes but is not limited to removal from site of all excess materials, soil, debris, and equipment. Repair damage resulting from installation operations.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Provisions of the Contract, including General Requirements apply to the work specified in this Section.

B. Furnish all labor, materials and equipment to complete the work of this Section.

1.02 DESCRIPTION

A. The work of this Section includes, but is not limited to, the following:

1. Section 02940: Trees, Shrubs and Groundcovers

1.03 REQUIREMENTS OF REGULATORY AGENCIES

A. Perform work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State, and local authorities in furnishing, transporting, and installing materials.

B. Certificates of inspection required by law for transportation shall accompany invoice for each shipment of seeds or plants. File copies of certificates with Owner after acceptance of material. Inspection by Federal or State Governments at place of growth does not preclude rejection of material at project site.

1.04 QUALITY ASSURANCE

A. Standards:

1. Florida Turf Producers Association, all sod shall be Florida Standard Grade
2. Federal Specifications (FS) 0-F-241c(1), Fertilizers, Mixed Commercial
3. Florida Seed Law

B. Testing Agency: Independent Testing Laboratory

1.05 APPROVAL

A. Wherever the terms "approve," "approval" or "approved" are used herein, they mean approval by the Owner's Representative in writing.

1.06 SUBMITTALS

A. Products:

1. Submit certificates, signed by Producer and Contractor, stating the following comply with this specification:

a. Sod
b. Seed

2. Certificates to include the following:

a. Sod: Mixture percentage and classification

b. Seed: Mixture percentage and germination rate

3. Submit product container labels.

4. Sod:

a. All St. Augustine 'Floratam' shall be Florida Standard Grade so as defined by the 'Florida Turf Producers Association' which is true to botanical variety and 98% free of weeds and foreign grasses (e.g., Bermuda, Bahia, Rye, etc.).

b. All 'Argentine' Bahia Sod shall be Florida Standard Grade sod as defined by the "Florida Turf Producers Association" which is true to botanical variety and 98% free of weeds and foreign grasses (e.g., Bermuda, Rye, etc.).

c. Florida Standard Grade may have no visible broadleaf weeds when viewed from a standing position and the turf shall be visibly consistent with no obvious patches of foreign grasses. In no case may the total amount of foreign grasses or weeds exceed 2% of the total canopy. The sod shall be neatly mowed and be matured enough that when grasped at one end, it can be picked up and handled without damage.

d. Grass species and variety with date and location of field from which sod is cut.

e. One certificate per truckload is required.

f. Compliance with state and federal quarantine restrictions if applicable.

5. Seed:

a. All 'Argentine' Bahia seed shall meet or exceed standards set by Florida's Seed Law which is true to botanical variety and 95% free of weeds, crop seed, inert matter and foreign grasses (e.g., Bermuda, Rye, etc.).

b. Compliance with state and federal quarantine restrictions if applicable.

6. Upon acceptance, submit written maintenance instructions recommending procedures for maintenance of lawns.

1.07 PRODUCT DELIVERY AND STORAGE

A. Sod Storage:

1. Store products in accordance with producer's recommendations and as noted.
2. Sod: stack roots to roots and grass to grass, protected from exposure to wind and sun.
3. Protect sod against dehydration, contamination, and heating during transportation and delivery.
4. Do not deliver more sod than can be installed within 24 hours.

5. Keep stored sod moist and under shade, or covered with moistened burlap.
6. Do not pile sod more than 2 feet deep.
7. Do not tear, stretch, or drop sod.

B. Seed Storage:

1. Store seed in accordance with producer's recommendations and as noted.

2. Protect from exposure to wind and sun.
3. Protect against contamination, and heating during transportation and delivery.
4. Do not store seed in direct contact with ground or floors. Seed shall be stored on pallets in well ventilated, cool, dry area..

1.08 PROJECT CONDITIONS

A. Limitations:

1. Site and utility construction:

a. Do not proceed with lawn preparation until site and utility construction in the immediate area of the work is complete.

B. Protect existing utilities, paving, and other facilities from damage caused by lawn installation operations.

C. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as required.

D. Provide hose and lawn watering equipment as required.

1.09 INSPECTIONS

A. Make written request for initial inspection after planting operations have been completed.

B. Submit written requests for inspections to the Owner's Representative at least 10 days prior to anticipated inspection date.

1.10 WARRANTY PERIOD

A. Contractor shall warrant that all lawns and grasses planted under this contract will be healthy and in flourishing condition of active growth twelve months from date of substantial completion.

B. Replacement sod under this guarantee shall be guaranteed for twelve (12) months from the date of installation.

C. Contractor shall not be held responsible for failures due to neglect by Owner, vandalism, etc., during Warranty Period. Report such conditions to Owner in writing.

PART 2 - PRODUCTS

2.01 SOD

A. Class of sod and composition.

1. Type:

   a. Stenotaphrum secundatum 'Floratam', St. Augustine 'Floratam' sod, sand grown.
   b. Paspalum notatum 'Argentine', 'Argentine' Bahia sod, sand grown.

2. Grade:

   a. American Sod Producers Association (ASPA) Grade: Nursery Grown or Approved. Field grown sod is not acceptable.
   b. Florida Turf Producers Association: Florida Standard Grade.

3. All sod shall conform to the following requirements:

   a. Furnish in pads that are not stretched, broken, or torn.
   b. Uniformly mowed height when harvested: Two inches in height.
   c. Inspected and found free of diseases, nematodes, pests, and pest larvae, by entomologist of State Department of Agriculture.
   d. Uniform in color, leaf texture, and density.

4. Sod containing Quackgrass, Johnsongrass, Poison Ivy, Nutsedge, Nimblewill, Canada Thistle, Bermudagrass (accept when Bermudagrass is specified), Dollarweed, Centilla, Crabgrass, or Bromegrass weeds will not be acceptable.

2.01 GRASS SEED MIX

A. Mix shall be comprised as follows:

1. Argentine Bahia: 95 percent minimum pure seed content, with 80 percent minimum germination.

2.02 WILDFLOWER/GRASS SEED MIX

A. Mix shall be comprised of a 50:50 ratio as follows:

1. Wildflower Mix #609 - Southeast Mixture, as manufactured by Applewood Seed Co., 5380 Vivian Street, Arvada, Colorado; telephone (303) 431-6283; or approved equivalent.

2. Argentine Bahia Seed: 95 percent minimum pure seed content, with 80 percent minimum germination.

2.03 FERTILIZER

A. Section 02900: Soil Preparation and Soil Mixes

2.04 WATER

A. Shall be non-potable and furnished by Contractor as specified in the Contract Documents. Contractor to transport and apply as required.

PART 3 - EXECUTION

3.01 PROTECTION AND RESTORATION

A. Restore lawns, damaged by construction operations as directed by the Owner's Representative.

1. Restoration approved by the Owner's Representative.

3.02 SEEDING AND SODDING

A. Soil Preparation: Section 02900: Soil Preparation and Soil Mixes

1. Verify that soil to depth of 12 inches in compacted areas have been tilled to produce a loose, friable soil conducive to exceptional sod and seed growth.

2. Water dry soil 24 hours before seeding or sodding.

B. Sod Installation:

1. Begin sodding at bottom of slopes.
2. Install with first row in straight line (e.g., walk edge, curb, wall, etc.).
3. Install, subsequent rows parallel to first row, with tight joints.
4. Stagger lateral joints one-half pad length.
5. Do not stretch or overlap joints. Any gap exceeding 1 inch shall be subject to be top dressing or having sod installation redone.
6. Moisten sod immediately after installation.
7. Compact sod upon completion of installation with light rollers and thoroughly water.
8. After application, the Contractor shall not operate any equipment over the covered area.

C: Seed Application: One of the two following methods shall be used for seeding after final soil preparation has been completed. Although seeding may be done throughout the year, the prime seeding season is March 1 through June 1. No seeding shall be done when the temperature is 32 degrees Fahrenheit or lower.

1. Dry Application:

a. Apply grass mixture immediately after final soil preparation with either a broadcast spreader or a Brillion seeder. Apply in 2 different directions for best coverage at the following application rates:

(1) Argentine Bahia Seed Mix: Apply mixture at the rate of 30 lbs. of seed mix per acre.

(2) Wildflower/Grass Seed Mix:. Apply mixture at the rate of 20 lbs. of seed mix per acre.

b. Two Methods of Dry Application:

(1) Brillion Seeder - applies seed just below soil surface and compacts at the same time. No mulching or stabilizing is necessary.

(2) Broadcast Spreader:

(a) Apply seed mix

(b) Compact the seed bed by means of a culti-packer or other similar equipment.

(c) Apply mulching material to retain moisture and minimize erosion. Rate for straw: 1/2 - 1-inch thick layer or 60-80 bales/acre (3-5 straws thick). Rate for cellulose fiber: 650 lbs./half acre.

(d) Stabilize the mulch by either a crimper, asphalt emulsion, chemical tacking, cellulose fiber, twine or netting and stapling, as appropriate. Precautionary measures shall be taken to prevent marking or defacing structures, pavements, utilities or planting.

2. Hydroseeding:

a. Water, seed and fertilizer shall be sprayed on the previously prepared seedbed in the form of an aqueous mixture at the rate of 1500 gal./acre. (Seed type and rate is the same as in Dry Application above). Fertilizer shall be applied during hydroseeding if it was not incorporated into soil during soil preparation - Section 02920.

All mixtures shall be constantly agitated from the time they are mixed until they are finally applied to the seedbed. CAUTION: If fertilizer is mixed into slurry, no more than 30 minutes should lapse before it is applied to prevent fertilizer burning the seed. Care shall be exercised to insure a uniform coverage and to guard against misses and overlaps. Straw shall be applied by hand or with straw blower and stabilized. The same rates and procedures shall be followed as detailed for Dry Application above.

3.03 MAINTENANCE

A. Sodded Areas:

1. Maintain, protect and care for sodded areas until a healthy, well rooted, even-colored viable lawn is established free of weeds and bare areas. Maintenance period shall not be less than 60 days.

a. Water as required to maintain adequate moisture in top four inches of topsoil and when directed by the Owner's Representative.

2. Mowing:

a. Maintain St. Augustine and Argentine Bahia grass between 2-1/2 inches and 3-1/2 inches in height. When grass reaches 4-5 inches in height, mow to 2-1/2 to 3 inches in height.

b. Do not cut off more than 30% of grass leaf in single mowing.

c. Remove all grass clippings throughout.

3. Re-sod spots larger than 1 square foot not having uniform stand of grass.

4. Weed Eradication: Between second and third mowing, apply herbicide specifically recommended for grass type uniformly at manufacturer's recommended rate.

5. Fertilizer: Apply fertilizer uniformly at manufacturer's recommended rate two days after sodding and at three-month intervals thereafter. Water in to avoid "burning" or damaging grass.

6. Warranty period begins when specific areas are accepted by the Owner's Representative as being substantially complete.

B. Seeded Areas:

1. Maintain, protect and care for seeded areas until a healthy, well rooted, even-colored viable lawn is established free of weeds and bare areas. Maintenance period shall not be less than 60 days after seed germination.

   a. Water as required to maintain adequate moisture in top four inches of topsoil and when directed by the Owner's Representative.

2. Mowing:

   a. Maintain Argentine Bahia grass between 2-1/2 inches and 3-1/2 inches in height. When grass reaches 4-5 inches in height, mow to 2-1/2 to 3 inches in height.

   b. Do not cut off more than 30% of grass leaf in single mowing.

   c. Remove all grass clippings throughout.

3. Re-seed spots larger than 1 square foot not having uniform stand of grass.

4. Weed Eradication: Between second and third mowing, apply herbicide specifically recommended for grass type uniformly at manufacturer's recommended rate.

5. Fertilizer: Apply fertilizer uniformly at manufacturer's recommended rate five weeks after seed has germinated and at three-month intervals thereafter. Water in to avoid "burning" or damaging grass.

6. Warranty period begins when specific areas are accepted by the Owner's Representative as being substantially complete.

3.04 INSPECTIONS

A. Inspection of the entire project or designated portion thereof, shall be made upon written request of Contractor. At that time, if all work is satisfactory and complete according to the conditions of the Contract, the Owner's Representative shall declare the work substantially complete.

B. Contractor's written request for review of the work of any designated portion thereof shall be received by Owner's Representative at least five (5) days before anticipated date of inspection.

C. Final completion of the work for the entire project or designated portions thereof shall constitute the beginning of guarantee period.

D. Contractor's responsibility for maintenance (exclusive of replacement with guarantee period) shall terminate on the date of the entire project or designated portion thereof is declared to be complete.

END OF SECTION

PART 1- GENERAL

1.01 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions, and Division 1, General Requirements, are a part of this section.

1.02 QUALITY ASSURANCE

A. Perform work in accordance with all applicable laws, codes, and regulations required by authorities having jurisdiction over such work and provide for all inspections and permits required by Federal, State, and local authorities in furnishing, transporting and installing materials.

B. Furnish plant materials certified by State Department of Agriculture to be free from harmful insects or apparent disease. Verify that all plant material is free of harmful insects and disease.

C. All plant material shall meet or exceed the minimum grade of Florida No. 1 in accordance with "Grades and Standards for Nursery Plants" published by the State of Florida Department of Agriculture.

D. Plant material shall be shade or sun grown, and/or acclimatized depending on planting location.

E. Certificates of inspection required by law for transportation shall accompany invoice for each shipment of plants. File copies of certificates with owner's Representative after acceptance of material. Inspection by Federal or State Governments at place of growth does not preclude rejection of plants at project site.

1.03 SELECTION, TAGGING AND ORDERING OF PLANT MATERIAL

A. Plants shall be subject to tagging, inspection and approval by Owner's Representative at place of growth and upon delivery for conformity to specifications. Such approval shall not impair the right of inspection and rejection during progress of the work. Submit written requestfor inspection of plant material at place of growth to Owner's Representative. Written request shall state the place of growth and quantity of plants to be inspected. Owner's Representative reserves right to refuse inspection at this time if, in his judgment, a sufficient quantity of plants is not available for inspection.

B. Substitutions of plant materials will not be permitted unless authorized in writing by Owner's Representative. If proof is submitted that any plant specified is not obtainable, a proposal will be considered for use of the nearest equivalent size or variety with corresponding adjustment of Contract price. These provisions shall not relieve Contractor of the responsibility of obtaining specified materials in advance if special growing conditions or other arrangements must be made in order to supply specified materials.

C. Under no circumstances shall the Contractor ship any tree stock to the jobsite prior to tagging, inspection and approval by the Owner's Representative.

D. Contractor shall provide a list of procured plant material and nursery locations for those materials within 30 calendar days after Notice to Proceed.

E. Contractor shall be responsible for all transportation related expenses for rejected or unapproved plant material.

1.04 INTENT OF DRAWINGS AND SPECIFICATIONS

A. It is the intent of the drawings and specifications to provide planting with plants in vigorous growth, ready for Owner's use. Any items not specifically shown in the drawings or called for in the specifications, but normally required to conform with such intent, are to be considered as part of the work.

1.05 APPROVAL

A. Wherever the terms "approve", "approval" or "approved" are used herein, they mean approval by Owner's Representative in writing.

1.06 SUBMITTALS

A. Furnish 6 copies of manufacturer's literature or laboratory analytical data for the following items:

1. "Pine needle mulch".

B. Certificate of inspection of plant materials by State Authorities.

C. Maintenance Instruction: Prior to the end of the maintenance period, furnish three copies of written maintenance instructions to the Owner's Representative for maintenance and care of installed plants throughout their full growing season.

D. Grower's Certification: Requirements for root pruning and holding plant stock at the nursery.

E. All submittals required in this section of work shall be forwarded in a single package to the Owner's Representative as outlined in the Contract Documents.

F. Plant list is for convenience only. Contractor is to prepare his own quantity list from the plan. All groundcover beds and littoral areas shall be filled at the specified spacing.

1.07 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Mark plants for identification. Securely attach legible labels to at least 25 percent of each species and variety of separate plants (except perennials) in any one shipment before delivery to the site.

B. Preparation for Delivery:

1. Prune head and/or roots of all trees only under direction of the Owner's Representative, and as required to assure safe loading, shipment and handling without damaging the natural form and health of the plant.

2. Container-grown Plants:

   a. Prepare for shipment in manner that will not damage roots, branches, shape, and future development after replanting. Container shall be sufficiently rigid to hold the root ball shape protecting the root mass during shipping.

C. Delivery:

1. Deliver soil conditioners (pesticides, herbicides, fumigants, and fertilizers) to site in original unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark, and conformance to state law. Store in designated areas only.

2. Deliver planting soil mixes and mulch in bulk with manufacturer's guaranteed mix, name, and conformance to State law. Store in designated areas only.

3. Protect during transport/delivery with shade cloth or other acceptable means to prevent wind burn.

4. Protect all plant material during delivery to prevent damage or desiccation to root ball or desiccation of crown and leaves.

5. Mist root balls, and tree crowns during delivery and handling to ensure against drying.

6. Notify Owner's Representative of delivery schedule five working days in advance so plant material may be inspected upon arrival at job site.

7. Remove unacceptable plant material immediately from job site.

D. Storage:

1. Container-grown plant stock: Deliver direct from nursery.

2. Protect roots of all plant material from drying or other possible injury. Keep plant root ball and crown moist at all times.

3. Store plants in shade and protect from weather. Heel in trees in a vertical position as required. Irrigate all stored plants as required.

4. Maintain and protect plant material not to be planted within four hours.

E. Handling:

1. Do not drop plants.

2. Do not pick up container plants by stems or trunks.

3. Do not use chains or cables on any trees. Handle using nylon straps, 2 inch minimum width.

F. Deliver manufactured materials to the project site in their original unopened containers or wrappings, clearly labeled with the manufacturer's name.

G. Do not expose fertilizer and mulch to weather until used and do not store in direct contact with the ground.

H. Protection and Loading Restrictions:

1. Keep all areas of work clean, neat and orderly at all times. Keep all paved areas protected and clean during planting and maintenance operations. Clean up and remove all deleterious materials and debris from the entire work area prior to beginning of landscape maintenance period to the satisfaction of Owner's Representative.

2. Do not overload entrance paving, sidewalks and curbs. Use planking, plywood, or other material approved by Owner as required for protection of paving and curbs.

1.08 ACCEPTANCE

A. Initial inspections to determine substantial completion of planted areas will be made by the Owner's Representative upon Contractor's request. Provide notification at least 10 working days before requested inspection date.

B. Incomplete or incorrect work identified during the initial inspection shall be corrected by Contractor and approved by the Owner's Representative prior to substantial completion and commencement of Warranty Period.

1.09 WARRANTY PERIOD AND REPLACEMENTS

A. Contractor shall warrant that all trees, shrubs and vines planted under this Contract will be healthy and in flourishing condition of active growth one year from date of final completion.

B. Replace, without cost to Owner, and as soon as weather conditions permit, all dead plants and all plants not in a vigorous, thriving condition, as determined by Owner during and at the end of Warranty Period. Plant shall be free of dead or dying branches and branch tips, and shall bear foliage of a normal density, size and color. Replacement shall closely match adjacent specimens of the same species and shall be subject to all requirements of this specification.

C. Final inspection shall be made at end of Warranty Period.

PART 2 - PRODUCTS

2.01 PLANT MATERIALS

A. Plants shall be nursery grown or collected as specified in accordance with good horticultural practices under climatic conditions similar to those of project. All plants shall be exceptionally heavy, symmetrical, tightly knit, so trained or favored in development and appearance as to be superior in form, number of branches, compactness and symmetry.

B. Plants shall be sound, healthy and vigorous, well branched and densely foliaged when in leaf. They shall be free of disease, insect pests, eggs, or larvae, and shall have healthy, well developed root systems. They shall be free from physical damage or adverse conditions that would prevent thriving growth.

C. Plants shall be true to species and variety and shall conform to measurements specified except that plants larger than specified may be used if approved by Owner's Representative. Use of such plants shall not increase Contract price. If larger plants are approved, the ball of earth shall be increased in proportion to the size of the plant. Plants shall be measured when branches are in their normal position. Height and spread dimensions specified refer to main body of plant and not branch tip to tip. Caliper measurement shall be taken at a point on the trunk 6 inches above natural ground line for trees up to 4 inches in caliper and at a point 12 inches above the natural ground line for trees over 4 inches in caliper. If a range of size is given, no plant shall be less than the minimum size and not less than 40% of the plants shall be as large as the maximum

size specified. The measurements specified are the minimum size acceptable and are the measurements after pruning, where pruning is required. Plants that meet the measurements specified, but do not possess a normal balance between height and spread shall be rejected.

D. Container stock shall have grown in the containers in which delivered for at least six months, but not over two years. Samples must prove no rootbound conditions exist. No container plants that have cracked or broken balls of earth when taken from container shall be planted except upon special approval by Owner.

E. Trees which have damaged or crooked leaders, or multiple leaders, unless specified, will be rejected. Trees with abrasions of the bark, sunscalds, disfiguring knots, or fresh cuts of limbs over 3/4 inch which have not completely calloused, will be rejected.

F. Minimum grade of Florida No. 1 in accordance with "Grades and Standards for Nursery Plants" published by the State of Florida Department of Agriculture. All plants not listed in "Grades and Standards for Nursery Plants", published by the Division of Plant Industry, shall conform to a minimum grade of Florida No. 1 as to:

1. Health and vitality
2. Condition of foliage
3. Root system
4. Freedom from pests or mechanical damage
5. Heavily branched and densely foliated according to the accepted normal shape
6. Freedom of low and/or tight "V" shaped crotches

G. Nursery Grown: ANSI Z60.1.

1. Grown under climatic conditions similar to those in locality of project.

2. Container grown stock:

   a. Growing in container for minimum 6 months prior to delivery, with sufficient root system for container size.
   b. Not root-bound or with root systems hardened off.

3. Use only ground cover plants well-established in removable containers, integral containers, or formed homogenous soil sections.

H. Approved Nurseries:

1. Skinner's Wholesale Nursery: 6800 South Point Parkway, Suite 400, Jacksonville, Florida, 32216; telephone 800-741-2020

2. Cherry Lake Farms: 7836 Cherry Lake Road, Groveland, Florida, 34736; telephone 904-429-2171.

3. Marian Gardens: 619 State Road 50, Groveland, Florida, 34736; telephone 904-429-4151.

4. D&D Tree Farm & Nursery, Inc.: 12165 Payne Road, Sebring, Florida, 33872.

2.02 MULCH

A. Premium grade pine needle bark, free of sticks, dirt, dust and other debris, as approved. Submit one cubic foot sample.

1. Minimum organic matter by weight on an oven dry basis: 85%.

2.03 TREE SUPPORT SYSTEMS

A. Stake Method:

1. Stakes: Wolmanized lodge poles.

2. Wires: Provide wire ties of 2-strand (or more as required), twisted, pliable galvanized iron wire not lighter than 12 gauge.

3. Hose: Two-ply black reinforced garden hose not less than 1/2 inch diameter.

2.04 PRE-EMERGENCE WEED CONTROL

A. In areas of Woody Ornamental Plants: Treflan, as manufactured by Elanco Products Company, Division of Eli-Lilly Company, Indianapolis, Indiana.

2.05 POST-EMERGENCE WEED CONTROL

A. Post-emergence herbicide, "Roundup", manufactured by Monsanto Corporation.

2.06 ANTI-DESICCANT

A. Emulsion type, film-forming agent similar to Dowax by Dow Chemical Co., or Wilt-Prof by Nursery Specialty Products, Inc., designed to permit transpirations but retard excessive loss or moisture from plants. Deliver in manufacturer's fully identified containers and mix in accordance with manufacturer's instructions.

2.07 CHEMICAL ADDITIVES

A. Section 02900: Soil Preparation and Soil Mixes

PART 3 - EXECUTION

3.01 SITE INSPECTION

A. Inspect project site before beginning landscape development operations and notify Owner's Representative, in writing, of any conditions which might prevent satisfactory completion. Do not begin work in any location affected by such conditions until those conditions have been corrected.

B. Alert Owner's Representative of potential poor drainage of tree and shrub pits. Recommend a program for amelioration of condition and submit to Owner's Representative.

3.02 PLANT PROTECTION

A. Protect all plants from drying action of sun and wind during and after being dug, while being transplanted and while awaiting planting. Cover or heel in container plants which cannot be planted immediately upon delivery.

B. Contractor is responsible for irrigation of stored and installed plant material. If final irrigation system is not complete, contractor is responsible for other means of temporary irrigation.

3.03 SOIL PREPARATION

A. Section 02900: Soil Preparation and Soil Mixes

B. Stake location of trees and shrubs and outline of bed area. Place ornamental grasses, groundcovers and perennials in position on bed areas before containers have been removed. Obtain Owner's Representative approval. Owner's Representative reserves right to interchange or shift plant locations prior to planting.

C. Verify all grades, location of underground utilities and elevations thereof. Report any discrepancies to Owner's Representative before proceeding with work.

3.04 PLANTING

A. Preparation:

1. Planting Pits:

a. Excavate circular plant pits with vertical sides, to dimensions indicated or specified.

b. Scarify bottom of pit to a depth of four inches.

c. Remove unsuitable and/or excess material from the site.

2. Perennial Planting Beds:

a. Excavate planting beds a minimum of 8 inches deep or as indicated.

b. Scarify bottom of bed to a depth of 4 inches.

c. Remove unsuitable and/or excess material from site.

d. Place specified soil mix on prepared subgrade to depth specified or indicated.

e. Soil additives for the perennial bed shall be spread over the bed two inches deep and thoroughly mixed by one of the following methods.

(1) Rototilling
(2) Picking

3. Shrubs and Groundcovers:

a. Depth:

(1) 2- and 3-gallon plant material shall receive a minimum of 2 inches of planting soil mixture beneath the rootball.

(2) Plant materials sized 1 gallon or less, and/or materials planted 24 inches o.c. or less shall receive a full 6 inches of amended planting soil mix tilled to a minimum depth of 6 inches. Note: All annuals beds shall receive a full 6 inches of amended planting soil mix tilled to a minimum depth of 6 inches. Excess excavated soil may be evenly spread on site at the direction of the Owner's Representative.

b. Width or Diameter:

(1) All 2- or 3-gallon material shall be placed within a minimum 14 inches planting hole, and backfilled with the specified planting soil mix.

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

4. Trees:

a. Install trees in accordance with planting pit specifications.
b. Mulch to the following depth.

(1) Two inch minimum, three inch maximum.

B. Installation:

1. General:

a. Place plant material in planting pit to proper grade and alignment, indicated.

b. Set plants upright, plumb and faced to give the best appearance or relationship to each other or adjacent structure.

c. Set plant plumb and hold rigidly in position until soil has been tamped firmly around planting ball.

d. Place sufficient planting soil under plant to bring top of planting ball to grades indicated in the Contract Documents.

e. Backfill pit or trench with planting soil in 9 inch layers and water each layer thoroughly to settle soil and work soil completely around roots and planting ball.

f. After soil settles, fill pit with planting soil, water, and leave pit surfaces even with finish grade.

g. Topsoil berm:

(1) Construct a topsoil berm 6 inches above finish grade forming a watering basin with a level bottom around each palm or tree.

(2) Size: 2 feet greater than diameter of planting ball.

(3) Construct a topsoil berm 6 inches above inished grade for all planting beds on slopes per planting details.

(4) Leave saucer for 3 months or as directed by Owner's Representative. At the end of 3 months regrade area and re-mulch 12 inches out from trunk (or planting bed) for all plantings. Remove excess from basin and clean area. Replace any damaged plant material or sod at no cost to Owner.

B. Container-Grown Plants:

1. Can/container removal:

a. Carefully remove plants without injury or damage to planting ball.

b. After removing plant. Superficially cut edge roots with knife on three sides. Note: Rootbound plants shall not be accepted.

2. Dig planting holes to size as shown.

3. Hand place plants which are in containers less than one gallon in size.

4. Hand backfill and hand tamp leaving slight depression around bases of plants.

5. Do not cover top of root ball.

6. Azaleas shall be planted with root ball 2 inches above finished grade. Mound planting soil to top of root ball.

7. Water for settlement and replace required planting soil.

3.05 CHEMICAL ADDITIVES

A. Apply gramular preplant fertilizer at time of planting and repeat 3 months from first application.

B. Apply granular preplant fertilizer at following rates, to planting bed and saucer areas around each tree, palm and shrub:

1. Trees:

a. Caliper 4 inches and larger: 5 lbs. per inch of caliper
b. Caliper under 4 inches: 3 lbs. per inch of caliper

2. Shrubs: 2 lbs. per 100 square feet of area.

3. Groundcover Plants: 2 lbs. per 100 square feet of area.

C. Broadcast under foliage canopy and incorporate into soil.

D. Water immediately until root structure of plant is wet. Assure protection from fertilizer burn.

3.06 WEED CONTROL

A. Apply post-emergent herbicide per manufacturer's rate and method of application to all landscape bed areas as necessary.

B. Apply pre-emergent herbicide before mulching and again as necessary throughout required maintenance period to prevent weed seed germination.

C. The Landscape Contractor shall verify that the herbicide and application technique will not damage plant material prior to application, and shall replace, and/or repair damage to any plant inured by herbicide application at no cost to the Owner.

3.07 MULCH AND WATERING

A. After planting has been completed and approved by the Owner's Representative, mulch pits, trenches and planting beds with specified mulching material immediately after planting. Thoroughly water mulched areas. After watering, rake mulch to provide a uniform finished surface.

3.08 ANTI-DESICCANT

A. Apply anti-desiccant using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage.

B. Spray deciduous trees or shrubs which are moved in full-leaf with anti-desiccant at nursery before and two weeks after planting.

3.09 PRUNING

A. Prune branches of deciduous stock, at the time of installation to balance the loss of roots and preserve the natural character appropriate to the particular plant requirements. In general, remove 1/4 to 1/3 of the leaf bearing buds, proportion shall in all cases be acceptable to the Owner's Representative. Remove or cut back broken, damaged, and unsymmetrical growth of new wood.

B. Prune evergreens only to remove broken or damaged branches.

3.10 TREE SUPPORT SYSTEMS

A. General:

1. Tree support systems shall be completed within 48 hours of planting.

B. Stake Method:

1. Space specified stakes evenly on the outside of tree ball and drive firmly into the ground.

2. Care shall be taken not to penetrate root ball with stake.

3. Place hose and wire at the height required to provide optimum support.

4. Remove excess wire.

3.11 MAINTENANCE

A. General:

1. Begin maintenance immediately after each item is planted and continue untilm final completion of each designated portion of the project as defined in the General Terms and Conditions of the Contract. The Owner's responsibility for landscape maintenance shall commence on the date each designated portion of the project is determined to have achieved final completion.

2. Maintain a healthy growing condition by pruning, watering, cultivating, weeding, mowing, mulching, tightening, and repairing of guys, resetting plants to proper grades or upright position, restoration of plant saucer, and furnishing and applying such sprays as necessary to keep planting free of insects and diseases.

3. The root system of plants shall be watered at such intervals as will keep the surrounding soil in best condition for promotion of root growth and plant life.

4. Keep planting saucers and beds free of weeds, grass and other undesired vegetation growth.

5. Protect planting areas and plants against trespassing and damage of any kind for the duration of the maintenance period.

6. Inspect plants at least once a week and perform maintenance promptly. Replace impaired or dead plants promptly. Do not wait until near the end of the guarantee period to make replacements of plants which have become unacceptable.

7. Remove soil ridges from around watering basins prior to end of maintenance period, as directed by the Owner's Representative.

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

3.12 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from planting operations.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1, General Requirements, are a part of this section.

1.02 RELATED WORK IN OTHER SECTIONS

A. Section 04200: Unit Masonry

1.03 SUBMITTALS

A. Submit a sample mortar strip for each type of colored masonry mortar.

B. Final Mortar color approval will be contingent on approval as a part of the sample panel required in Section 04200: Unit Masonry.

C. Submit mix designs of mortar and grout types.

1.04 HANDLING AND STORAGE

A. Deliver all materials in useable condition.

B. Store off the ground in a dry location and covered with tarpaulins or polyethylene sheets to prevent wetting by capillary action or rain.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement: ASTM C150-77 Type I, non staining without air entrainment and of natural color to produce the required mortar color.

1. Use Type III when temperatures drop below 40° F or when high early strength is desired.

B. Mortar coloring agent: Solomon grind service admixture in custom color (series "A") selected by the Architect.

1. Submit color chart.

C. Hydrated lime: ASTM C207-76, Type S.

D. Aggregate: ASTM C144-70 natural or manufactured sand of natural color as required to obtain mortar color indicated.

1. For joints less than 1/4 inch use aggregate graded with 100 percent passing a No. 16 seive.

2. For all other joints grading shall comply with the following limits:

Sieve Size	Percent Passing
No. 4 (4.76 MM)	100
No. 8 (2.38 MM)	95 to 100
No. 16 (1.19 MM)	60 to 100
No. 30 (595 UM)	35 to 70
No. 50 (297 UM)	15 to 35
No. 100 (149 UM)	2 to 15
No. 200 (74 UM)	0 to 2

E. Water: Clean, fresh, potable and free of deleterious amounts of acids, alkalis, salts or organic materials.

F. The use of anti-freeze admixtures is prohibited.

2.02 MORTAR USES AND COLOR

A. Mortar - ASTM C270.

1. All exposed masonry above grade: Type N

2. All other walls below grade and in contact with earth: Type M

3. Grout and Mortar for Reinforced Masonry: ASTM C476

B. Color: Selected by Architect

2.03 MORTAR TYPES AND PROPORTIONS

A. Type M: Not more than 1/4 part lime per part of Portland cement.

1. Integral type water proofer proportion: Per manufacturer mixing instructions.

B. Type N: Not more than 1 part lime per part of Portland cement.

C. For all mortar types, aggregate (when measured in a damp loose condition) shall be not less than 2 1/4 or more than 3 times the sum of the volumes of the cement and lime used.

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Mix cementitious materials and aggregate in a mechanical batch mixer for a minimum of 7 minutes with the maximum amounts of water to produce a workable consistency.

B. Mortars that have stiffened because of evaporation of water may be tempered by adding water as frequently as needed to restore the required consistency. Mortars shall be used and placed in final position within 2 hours after mixing. Retempering of mortar by remixing with new batches will not be permitted.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions and Division 1, General Requirements, are a part of this section.

1.02 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Delivery, stack unit masonry on wood pallet platforms: Cover with breathable tarpaulins and store in manner to provide from contact with soil. Exercise care in handling masonry units to avoid chipping, breakage.

1.03 COORDINATION

A. Cooperate with other trades in setting built-in items in masonry walls.

1.04 SUBMITTALS

A. Submit sample strap or panel containing four bricks. Include in each set the full range of exposed color and texture expected in the completed work. Architect's review will be for color and texture only.

1.05 SAMPLE PANEL

A. Prior to commencing masonry work, erect sample for each masonry type (finish) using materials, bond and joint tooling as directed by the Architect. Provide special features as directed for sealants and contiguous work. Build sample panel at the site, where directed, of full thickness and approximately 4 feet-0 inch x 3 feet-0 inch indicating the proposed range of color, texture and workmanship expected in the completed work. Obtain Architect's acceptance of visual qualities of the sample panels. Retain sample panels during construction as a standard for judging completed masonry work.

PART 2 - PRODUCTS

2.01 FACE BRICK

A. Face Brick: ASTM C216.

1. Color: Red to terra-cotta.

2.02 CONCRETE MASONRY UNITS (CMU)

A. CMU: Provide CMU fabricated from lightweight concrete aggregate, complying with ASTM C331, free of combustible matter and organic impurities that would cause rusting, staining, pop-out to walls.

B. CMU Types:

1. Hollow load bearing units: ASTM C90, Grade N-1.

2. Provide sash type units at all control joints.

2.03 REINFORCING

A. Horizontal Joint Reinforcing:

1. Provide welded wire units prefabricated in straight lengths of not less than 10 feet, with matching corner ("L") and intersection ("T") units. Fabricate from cold-drawn steel wire complying with ASTM A82, with defromed or embossed continuous side rods and plain cross-rods, crimped for cavity wall construction (if any), with unit width of 1-1/2 inches to 2 inches less than thickness of wall.

2. For single wythe masonry walls provide ladder type fabricated with single pair of side rods and perpendicular cross-rods spaces not more than 16 inches O.C. or turss type fabricated with single pair of side roads and continuous diagonal cross-rods spaces not more than 16 inches O.C.

3. For multi wythe walls provide truss type fabricated with single pair of side rods and continuous diagonal cross-rods spaces not more than 16 inches O.C.

4. Wire: Fabricate with 9 gauge side and cross-rods, unless otherwise indicated.

5. Manufacturers offering products to comply with the requirements include the following:

a. AA Wire Products
b. Dur-O-Wal
c. Hohmann and Barnard

B. Anchoring Devices for Masonry:

1. Provide straps, bars, bolts and rods of the type and size shown, but fabricated from not less than 16 gage sheet metal or 3/8-inch diameter rod stock, unless otherwise shown, and as follows.

2. Flexible Anchors: Where masonry is shown or specified to be anchored to structural framework with flexible anchors, provide anchors which will permit horizontal and vertical movement of masonry but will provide lateral restraint, and as follows:

a. For anchorage to concrete framework, provide 2-piece anchors with sheet metal dovetail section and rectangular or vee-shaped 3/16-inch wire tie section sized to extend to within 1 inch of face of masonry.

C. Masonry Inserts in Concrete:

1. Unit type: Furnish cast iron or malleable iron inserts of the type and size shown, or fabricated from not less than 16 gauge steel, hot-dip galvanized after fabrication with 1.5 oz. zinc coating complying with ASTM A 153, Class B2.

2. For installation of concrete inserts, see Section 03300 of these specifications. Advise concrete installer of specific requirements regarding placement of inserts which are to be used by the masonry installer for anchoring of masonry work.

3. Dovetail Slots: Furnish 24 gauge galvanized steel Dovetail Slots with filler strips, where shown.

2.04 WEEPHOLES

A. Polyvinyl Chloride Pipe: ASTM D1785

1. Nominal Size: Two inch

2. Schedule Size: 40

2.05 CONTROL JOINT

A. Provide premolded control joint strips of PVC or neoprene with a Shore A durometer hardness of 60 to 80 and designed fit standard sash block and maintain lateral stability in the masonry wall.

2.06 BRICK CLEANER

A. Sure Klean No. 600 detergent manufactured by Process Solvent Company.

B. Muratic acid based cleaner are prohibited.

2.07 STUCCO

A. Stucco shall be Thorocoat as manufactured by Thorosystems with Thorobond bonding agent.

B. Color: As selected by the Architect

1. Submit color samples of manufacturers standard color

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. Do not erect masonry when air temperature is below or expected to go below 40°F except when permitted by architect. When masonry work is authorized during temperatures below 40°F, make provisions for heating, drying materials - protect completed work in accordance with BIA technical notes, Volume 1, No. 1. Do not build upon frozen work. Do not lay masonry units having water film or frost on its surface.

B. Build in required items as erection of masonry progresses.

C. Erect masonry within the following construction tolerances:

1. Variation from Plumb: For lines and surfaces of walls do not exceed 1/4 inch in 10 feet.

2. Variation from Level: Horizontal grooves and other conspicuous lines, do not exceed 1/4 inch in 20 feet.

3.02 MASONRY PROTECTIONS

A. Protect masonry materials during storage and construction from wetting by rain, snow or ground water and from soilage or intermixture with earth or other materials.

B. Do not use metal reinforcing or ties having loose rust or other coatings, including, ice, which will reduce or destroy bond.

C. In exposed work, do not use masonry units with chips, cracks voids, discolorations or other defects which might be visible or cause staining in the finished work.

3.03 PREPARATION

A. Wetting of Masonry Units:

1. Brick: Wet brick having ASTM C67 absorption rates greater than 0.025 oz. per square inch per minute.

   a. Determine absorption by placing 20 drops of water inside a circle the size of a quarter on typical units. If water is absorbed within 1-1/2 minutes, wet brick before laying.

   b. Use wetting methods which ensures that each masonry unit in nearly saturated but surface dry when laid. During freezing weather, comply with the recommendation of BIA.

2. Except for absorbent units specified to be wetted, lay masonry units dry. Do not wet concrete masonry units.

3.04 GENERAL INSTALLATION REQUIREMENTS

A. Thickness: Build walls to the full thickness indicated. Build single-wythe walls to the actual thickness of the masonry units, using units of nominal thickness shown or specified.

B. Leave openings for other items to be installed before completion of masonry work.

C. Cut masonry units using motor-driven saws to provide clean, sharp, unchipped edges. Cut units as required to provide pattern shown and to fit adjoining work neatly. Use full-size units without cutting wherever possible.

3.05 BOND AND COURSING

A. Face Brick:

1. Erect face brick in patterns indicated.

2. Vertical coursing for brick shall be 3 coursed in 12 inches. Horizontal coursing shall be as required to produce vertical joints equal in size to horizontal joints.

B. CMU:

1. Erect CMU in running bond.

2. Vertical coursing for CMU shall be one course in 8 inches. Horizontal coursing shall be as required to produce joints 3/8 inch wide.

3.06 LAYING MASONRY WALLS (GENERAL)

A. Layout walls in advance for accurate spacing of surface bond patterns with uniform widths and to properly locate openings, movement-type joints, returns and offsets. Avoid the use of less-than-half-size units at corners, jambs and wherever possible at other locations.

B. Lay-up walls plumb and true to comply with specified tolerances, with courses level, accurately spaced and coordinated with other work.

C. Remove masonry units disturbed after laying; clean and reset in fresh mortar. Do not pound corners at jambs to fit stretcher units which have been set in position. If adjustments are required, remove units, clean off mortar and reset in fresh mortar.

3.07 BRICK INSTALLATION

A. Shove brick into place (do not lay) in full mortar bed. Fill horizontal and vertical joints completely with mortar. Make vertical joint of same width as horizontal joints except for small variation to maintain bond. Butter ends with sufficient mortar to fill head joints and shove in place. Do not slush head joints.

B. Discard imperfect brick. Erect face brick in courses spaced accurately.

C. Erect exposed face brick with joints cut and lined. Tool joints in manner to squeeze mortar back into joints. Do no tooling until mortar has taken initial set.

3.08 CMU INSTALLATION

A. Erect CMU walls in location indicated. Bed each course solidly in specified mortar with vertical joints breaking halfway over course below. Butter vertical joints entire height of units. Bond each course at corners, intersections. Either bond into or anchor to adjacent construction with reinforcing.

B. Lay hollow concrete masonry units with full mortar coverage on horizontal and vertical face shells. Bed webs in mortar in starting course, and where adjacent to cells or cavities to be reinforced or filled with grout.

3.09 ADDITIONAL MASONRY REQUIREMENTS

A. Collar Joints:

1. At brick wall fill the vertical longitudinal joint between wythes so solidly with mortar by parging the in-place wythe and shoving units into the parging.

B. Stopping and Resuming Work:

1. Rack back 1/2-brick length in each course: Do not tooth. Clean exposed surfaces of set masonry, wet units lightly (if required)and remove loose masonry units and mortar prior to laying fresh masonry.

C. Built-in Work:

1. As the work progresses, build-in items indicated or specified under this and other sections of these specifications. Fill in solidly with masonry around built-in items.

D. Structural Bonding of Multi-wythe Masonry:

1. Use continuous reinforcing embedded in horizontal mortar joints for bond tie between wythes. Install at not more than 16 inches O.C. vertically.

2. Corners: Provide interlocking masonry unit bond in each course at corners, unless otherwise shown.

3. Intersection and abutting walls: Provide same type of bonding specified for structural bonding between wythes and space as follows:

a. Provide masonry bond in alternate courses.

b. Provide continuity with horizontal joint reinforcing using prefabricated "T" units.

E. Reinforcing:

1. Horizontal Joint Reinforcing:

a. Provide continuous horizontal joint reinforcing as shown and specified. Fully embed longitudinal side rods in mortar for their entire length with a minimum cover of 5/8 inch on exterior sideof walls and 1/2 inch at other locations. Lap reinforcement a minimum of 6 inches at ends of units. Do not bridge control and expansion joints with reinforcing except at wall openings.

b. Reinforce all walls with continuous horizontal joint reinforcing unless specifically noted or specified to be omitted.

c. Space continuous horizontal reinforcing as follows:

(1) For multi-wythe walls (solid or cavity) where continuous horizontal reinforcing also acts as structural bond or tie between wythes, space reinforcing as required by code but not more than 16 inches O.C. vertically.

(2) For single wythe walls, space reinforcing at 16 inches O.C. vertically, unless otherwise shown.

(3) Reinforce masonry openings greater than 1'-0" wide, with horizontal joint reinforcing placed in 2 horizontal joints approximately 8 inches apart, immediately above the lintel and immediately below the sill. Extend reinforcing a minimum of 2'-0" beyond jambs of the opening, bridging control joints where provided.

d. Lap reinforcing minimum 6 inches at splices.

F. Anchoring Masonry Work:

1. Provide anchoring devices of the type shown and as specified. If not shown or specified, provide standard type for facing and back-up involved.

2. Anchor masonry to structural members where masonry abuts or faces such members to comply with the following:

a. Provide an open space not less than 1/2 inch in width between masonry and structural member, unless otherwise shown. Keep open space free of mortar or other rigid materials.

b. Anchor masonry to structural members with metal ties embedded in masonry joints and attached to structure. Provide anchors with flexible tie sections, unless otherwise shown.

c. Space anchors as shown, but not more than 24 inches O.C. vertically and 36 inches O.C. horizontally.

G. Control and Expansion Joints:

1. Provide vertical expansion, control and isolation joints in masonry where shown. Build-in related items as the masonry work progresses. Rake out mortar in preparation for application of calking and sealants.

H. Lintels:

1. Provide masonry lintels where shown in garden arches and wherever openings of more than 1'-0" are shown without structural steel or other supporting lintels. Provide precast or formed-in-place masonry lintels. Thoroughly cure precast lintels before handling and installation. Temporarily support formed-in-place lintels.

2. Unless otherwise shown, provide one horizontal reinforcing bar-top and bottom for each 4 inches or less of wall thickness, of size-number not less than the number of feet of opening width.

3. For hollow masonry unit walls, use specially formed U-shaped lintel units with reinforcing bars, filled with Type M mortar or concrete grout.

4. Provide 8 inches minimum bearing each end.

5. Submit shop drawings for lintels.

I. Reinforced Masonry:

1. All voids in masonry units containing reinforcing bars shall be completely filled with grout.

2. Fine grout shall be used to fill voids up to 4 inches wide. Coarse grout shall be used in wider voids.

3. Grouting shall be placed in maximum lifts of 4 feet in height.

4. Forms, or shoring where required, shall remain in place until masonry can carry own weight and construction loads; beams minimum 10 days, slabs minimum 7 days.

5. Reinforcing bars shall be placed accurately and secured to prevent displacement, spaced at three feet on center. Splices shall be sufficient to develop full tension in bars.

6. Grout spaces less than 2 inches wide shall be grouted in lifts not exceeding 8 inches.

3.10 APPLIED FINISHES

A. Stucco:

1. Apply Thorocoat in accordance with manufacturers application instructions.

2. Apply Thoroshield in accordance with manufacturers application instructions.

3. Finished Texture: Coarse.

4. Prepare sample panel showing color, texture and peeling (eroded) of stucco from brick.

3.11 CLEANING

A. Progress work in as clean manner as possible - remove excess materials, mortar droppings daily. Remove mortar droppings on connecting or adjoining work before final set. Keep edge of scaffolding boards 2 inch minimum away from face of wall.

B. Remove and replace masonry units which are loose, chipped, broken, stained or otherwise damaged, of if units do not match adjoining units as intended. Provide new units to match adjoining units and install in fresh mortar or grout, pointed to eliminate evidence of replacement.

C. Pointing: During the tooling of joints, enlarge any voids or holes, except weep holes, and completely fill with mortar.

D. Point-up all joints at corners, openings and adjacent work to provide a neat, uniform appearance, properly prepared for application of calking or sealant compounds.

E. Dry clean to remove large particles of mortar using wood paddles and scrappers. Use chisel or wire brush if required.

F. Presoak wall by saturating with water and flush off loose mortar and dirt.

G. Scrub down wall with stiffer fiber brush and a detergent as specified.

H. Rinse walls, using clean, pressurized water, to neutralize cleaningsolution and remove loose material.

I. Acid cleaning of masonry will not be permitted.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. This specification covers all labor, materials, and services incidental to and including the furnishing and setting of all cast stone as indicated on the Drawings and specified herein.

B. The manufacturer shall be responsible for all labor, materials, equipment, and services necessary for and incidental to providing all cast stone covered by this specification.

C. The setting Contractor shall unload, receipt for, store and set all cast stone covered by this specification and shall provide and install all anchors for same.

1.02 RELATED DOCUMENTS

A. The General Conditions, Supplementary Conditions, and Division 1 General Requirements, are a part of this Section.

1.03 REFERENCES

A. Standard Specification for cast stone by Architectural Precast Association (APA).

B. Standard Specification for cast stone by Cast Stone Institute (CSI).

1.04 QUALITY ASSURANCE

A. Qualifications of Manufacturer:

1. The manufacturer shall have a minimum of five years' continuous operation, having experience, adequate facilities, and capacity to furnish the quality, sizes, and quantity of cast stone required without delaying the progress of the work and whose products have been previously used and exposed to the weather with satisfactory results.

2. Any producer member of the Architectural Precast Association will be an acceptable manufacturer.

B. Qualification of Erector: Firms which have a minimum of 3 years' successful experience in the erection of cast stone units, similar to units required for this project, will be acceptable.

C. Tests: The Owner's Representative may select at random from the job representative pieces of cast stone for testing. Tests shall be made at the manufacturer's expense. Manufacturer shall replace tested units without charge:

1. Testing shall be performed in accordance with ASTM C 31, ASTM C 39, and ASTM C 642 except that 2-inch cube specimens shall be used, oven-dried in accordance with ASTM C 97.

2. Test results shall be determined by the average of three specimens per test.

3. The results of compression tests shall be divided by a factor of 0.8 when saw-cut or core-drilled specimens are used.

1.05 SUBMITTALS

A. Shop Drawings:

1. Scale and/or full size detail drawings will be furnished where necessary by the Owner's Representative, and they shall be accurately followed in the execution of this work.

2. The cast stone manufacturer shall prepare and submit for approval complete, properly marked setting drawings, showing details and sizes of stones; arrangement joints; bonding; details of anchors; inserts, joints, connections to adjoining walls or materials, reinforcing and method of installation and anchoring.

3. Unless otherwise specified, shop drawings shall provide for the following:

   a. Provide suitable wash on all exterior sills, copings, projecting courses and pieces with exposed top surfaces.

   b. All projecting pieces and soffit stones shall have drips under the outer edge.

   c. The shop drawings shall show the setting mark of each stone and its location on the structure. The stone when delivered shall bear the same corresponding setting mark on an unexposed surface.

4. The manufacturer shall submit the shop drawings to the Contractor. The Contractor shall verify all dimensions and coordinate the drawings with field conditions. The Contractor shall submit the shop drawings to the Owner's Representative for approval.

5. The shop and setting drawings shall be approved by the Owner's Representative and the Contractor before the manufacturer shall be required to proceed with the work.

6. Design modifications may be made only as necessary to meet field conditions and to ensure proper fitting of the work, and only as acceptable to the Owner's Representative. Maintain general design concept shown without increasing or decreasing sizes of members or altering profiles and alignment shown.

B. Product Data: Submit manufacturer's specifications, data and instructions for manufactured materials and products. Include manufacturer's certifications and laboratory test reports as required.

C. Samples:

1. Submit precast sample approximately 12 inch x 12 inch x 2 inch to illustrate quality, color, and texture of surface finish, and color of sealer where applicable, typical of the general range of color and finish to be furnished.

2. Prepare a full-size sample of a cast stone unit as selected by the Owner's Representative for the Owner's Representative installation work, and after Architect's review of finish samples. Acceptable full-size sample may be incorporated in job installation

3. The Owner's Representative review of samples will be for color, texture, and general condition only. Compliance with other requirements is the exclusive responsibility of the Contractor. Accepted samples will be used as the control example for standard of color and texture for cast stone.

1.06 DELIVERY, STORAGE, AND HANDLING

A. All cast stone shall be carefully loaded and packed for transportation exercising customary and reasonable precaution against damage while in transit.

B. All cast stone shall be received and unloaded at the project site by competent workmen with the necessary care and handling to avoid damage and soiling.

C. The cast stone material shall be stored clear of the ground on non-staining planking in such a manner as to be protected from damage while in storage. Should cast stone be stored for an extended period, cover with polyethylene or other non-staining waterproof material.

1.07 PROJECT CONDITIONS

A. Traffic:

1. Maintain pedestrian and vehicular traffic during stonework construction operations.

B. Limitations:

1. Underground Utilities:

a. Do not proceed with stonework construction until underground utility construction is complete.

2. Environmental:

a. Do not place portland cement products during the following:

(1) Ambient air temperature is below 40°F or air temperature has been below 35°F for 12 or more consecutive hours.

(2) 15 November and 1 March without written authorization from the Foundation.

b. Cold weather construction:

(1) Precondition masonry materials to maintain 50°F when installed.

(2) Do not install stone masonry work when the temperature of the outside air is below 40°F and falling unless suitable means acceptable to the Foundation's Representative are provided to protect work from cold and frost and ensure that mortar will set without freezing. Comply with International Masonry Industry All-Weather Council cold weather construction and protection recommendations.

(3) No masonry work will be permitted when outside air temperature is below 25° F.
(4) Do not use frozen materials or materials mixed or coated with ice or frost.

1.08 GUARANTEE

A. The Contractor's guarantee of the Work shall include, but not be limited to, setting, heaving, shifting, spalling, chipping, cracking, and efflorescence. Terms of the guarantee will be established in Division 1 - General and Supplementary Conditions of the Contract.

B. Repair and/or replace defective work within 14 days of notification at no expense to Owner.

PART 2 - PRODUCTS

2.01 CAST STONE

A. Cast stone supplied by Carolina Cast Stone, Greensboro, NC (919-299-1717) or approved equal. Cast stone shall match approved samples specified.

1. Type: #2384

2. Finish: Smooth, as approved by Owner's Representative

B. Materials:

1. Cement - Portland Type I or Type III white and/or grey meeting ASTM C 150.

2. Fine aggregate - carefully graded, washed and manufactured limestone sands meeting ASTM C 33 except that gradation may vary to achieve desired finish and texture.

3. Coarse aggregate - carefully graded and washed natural gravels, or crushed, graded stone such as granite, quartz, limestone or other durable stone meeting ASTM C 33 except that gradation may vary to achieve desired finish and texture.

4. Color - All colors added shall be inorganic (natural or synthetic) iron oxide pigments meeting ASTM C 979 excluding the use of a cement grade of carbon black pigment and shall be guaranteed by the pigment manufacturer to be limeproof. The amount of pigment shall not exceed 10% by weight of the cement used.

C. Properties of Mix Design:

1. The manufacturer shall be responsible to design a mix which achieves both the strength and the surface finish desired.

2. Compressive strength shall be not less than 5000 psi at 28 days when tested in accordance with the requirements of this specification.

3. The average water absorption of cast stone shall not exceed 6% by dry weight when tested in accordance with the requirements of this specification.

D. Reinforcement:

1. Cast stone shall be reinforced with new billet steel reinforcing bars meeting ASTM A 615, grade 40 or grade 60, when necessary for safe handling, setting, and structural stress, surfaces are to be exposed to the weather, the reinforcement shall be galvanized or epoxy coated when covered with less than 2 inches of material for bars larger than 5/8 inch and 1 1/2 inches for bars 5/8 inch or smaller. The material covering in all cases shall be at least twice the diameter of the bars.

2. Cast stone panels shall have a minimum thickness of 2 1/2 inches and be reinforced as may be required for handling and to allow for temperature changes and structural stress. There shall be a minimum steel reinforcement mounting to 1/4 percent of the sectional area of the panel and should the panel be greater than12 inches in any sectional dimension, the temperature steel shall be placed in both directions.

3. Where applicable, cold-drawn steel wire reinforcement meeting ASTM A 82, Welded Wire Fabric Reinforcement meeting ASTM A 185 or ASTM A 497 or steel bar or rod mat reinforcement meeting ASTM A 184 may be used.

E. Finish:

1. The Manufacturer shall submit to the Owner's Representative for selection and approval, samples of the cast stone specified which will be typical of color and finish to be furnished.

2. Exposed surface, unless otherwise specified, shall exhibit a typically fine grained texture similar to natural stone.

3. The samples shall be approved by the Owner's Representative before the manufacturer shall be required to proceed with the work.

F. Fabrication:

1. Fabricate all stone accurately to shape and dimensions, and full to square as indicated on the drawings. cast stone units which are warped, cracked, broken, spalled, stained, or otherwise defective will not be acceptable.

2. Dress true all exposed faces. Beds and joints shall be at right angles to the face.

3. Execute carefully molded work from details. All exposed areas shall be true in alignment and slightly eased to prevent snipping.

4. Built-In Items: Provide reglets, slots, holes, and other accessories in units to receive cramps, dowels, reglets, waterstops, flashings, and other similar work as indicated.

5. Anchorages: Provide loose steel plates, clip angles, seat angles, anchors, dowels, cramps, hangers, and other miscellaneous steel shapes not provided by other trades, necessary for securing cast stone units to supporting and adjacent members.

6. Accommodate other trades in cutting and drilling of stone when the necessary information is furnished to the stone fabricator in time to be shown on his shop drawings and prior to shipment.

7. Provide lewis pine holes for stones that cannot be handled manually.

8. Drill required clamp holes upon receipt from the Contractor of the necessary sizes and locations. All stones under 3 1/2 inches thickness shall be provided with clamp holes, unless responsibility is assumed by the Contractor for the use of lewis pins.

9. Restrict all holes for handling device, sinkages for anchors, cramps, dowels, etc. as per industry standards and shop drawings.

G. Tolerances:

1. Height and width - Plus 1/16 inch minus 1/8 inch

2. Length:

a. Up to 2' 0" - plus 1/16 inch minus 1/8 inch

b. 2' 0" to 5'0" - plus 1/8 inch minus 1/8 inch

c. 5' 0" to 10' 0" - plus 1/8 inch minus 3/16 inch

2.02 MORTAR AND GROUT

A. Section 04200: Unit Masonry

2.03 ANCHORS, DOWELS, ANGLES AND FASTENERS

A. Stainless Steel, Type 302 or 304, as recommended by the stone fabricators. Actual sizes, locations, and types shall be required by the project and drawn on the approved shop drawings. The Owner's Representative drawings do not show all necessary anchors, fastenings etc. Provide all necessary to complete stone work as shown on drawing.

2.04 SEALANT

A. Sealant: Two-part elastomeric, FS TT-S-00227E, Type II, Class A, polyurethane epoxide, similar to Tremco "Dymeric" or Sika, "Sikaflex"

B. Color: To match cast stone color

C. Prime-Sealers and Cleaners: As recommended by manufacturer of sealant

PART 3 - EXECUTION

3.01 INSPECTION

A. Verify suitability of substrate to accept installation.

B. Installation constitutes acceptance of responsibility for performance.

3.02 PREPARATION

A. General:

1. Deliver anchorage items which are to be embedded in other construction before start of such work. Provide setting diagrams, templates, instructions and directions as required for installation.

2. Do not install cast stone until design compressive strength is attained.

3. Have work performed under the supervision of a thoroughly competent foreman experienced in the type of materials and construction used.

4. Install work by competent stone settors skilled and experienced in the type of work required.

5. Perform all work in accordance with the approved shop drawings.

B. Stone Preparation: When necessary before setting, all stone shall be thoroughly cleaned on all exposed surfaces by washing with brush and soap powder, followed by a thorough drenching with clear water.

3.03 INSTALLATION

A. Setting:

1. Drench stone with clear water prior to setting in mortar.

2. Set stones as indicated in full beds of mortar with all joints slushed full and all holes completely filled.

3. Install cast stone members plumb, level, and in alignment. Provide temporary supports and bracing as required to maintain position, stability and alignment as members are being permanently connected. Maintain horizontal and vertical joint alignment and uniform joint width as erection progresses. All joints shall be 1/4 inch unless otherwise noted.

4. Place lead or plastic setting pads under heavy stones in same thickness as joint, and in sufficient quantity to avoid squeezing mortar out. Heavy stones shall not be set until materials below set in mortar have sufficiently hardened to avoid squeezing.

5. Accessories: Install clips, hangers, and other accessories required for erection of cast stone units to supporting members and back-up materials.

6. Anchor units in final position by bolting, welding, grouting, or as otherwise indicated. Remove temporary shims, wedges, and spacers as soon as possible after anchoring is completed.

   a. At bolted connections use lock washers or other acceptable means to prevent loosening of nuts.

   b. At welded connections apply rust-inhibitive coating on damaged areas, same as shop-applied material. Use galvanizing repair coating on galvanized surfaces.

B. Caulking:

1. Clean, dry, and rake out all joints and spaces to a depth of at least 3/4 inch from the face for pointing; remove all dust by swabbing with cleaner recommended by the caulking manufacturer.

2. Fill joints to within 3/8 inch of the surface with sealant backer, well forced in to provide a watertight seal; fill the exposed space with sealant.

3. Install sealant materials in strict accordance with the manufacturer's printed directions and provide a completely weathertight job.

4. Clean off excess sealant or smears with cleaning material recommended by the manufacturer of the sealant.

C. Pointing:

1. When ready for pointing, the joints shall be dampened and carefully pointed to a slight concave unless otherwise specified. No pointing shall be done in freezing weather nor in locations exposed to hot sun, unless properly protected. Pointing mortar shall be composed of one part non-staining cement (ASTM C 91), one part hydrate lime (ASTM C 207 - Type S) and four parts of clean, washed sand (ASTM C 144). Coloring pigments may be added as required. The Foundation's representative shall approve color of pointing mortar before proceeding with pointing.

D. Patching and Cleaning:

1. The repair of chipped or damaged cast stone shall be done only by mechanics skilled in this class of work, with materials furnished by the manufacturer and according to his direction.

2. Before pointing, the face of all cast stone shall be scrubbed with a fibre brush, using soap powder and water and shall then be thoroughly rinsed with clean running water. Any mortar on the face of the cast stone shall be removed. No acids or prepared cleaners shall be used without the approval of the cast stone manufacturer.

3.04 PROTECTION

A. Receipt, storage, and protection of stone work prior to, during and subsequent to installation shall be the responsibility of the Contractor.

B. Tops of walls during construction shall be carefully covered at night, and especially during any precipitation or other inclement weather.

C. Walls and pavers shall be adequately protected at all times from droppings.

D. Substantial wooden covering shall be placed whenever necessary to protect stone work. Non-staining building paper or membrane shall be used under the wood. Maintain all covering until removed to permit final clearing of stone work.

3.05 INSPECTION AND ACCEPTANCE

A. The Owner's Representative shall inspect the finished product within the scope of ACI Committee 311 Manual of Concrete Inspection.

B. Generally, acceptance of cast stone finish requires that color and texture shall be equal to the approved sample when viewed in good typical lighting at a distance of 10 feet.

C. cast stone shall show no obvious repairs, or imperfections other than minimal color variations when viewed with the unaided eye at a 20-foot distance. Limitations as to the amount of patching which will be permitted is subject to acceptance by Owner's Representative.

3.06 CLEANUP

A. Perform cleaning during installation of the work and upon completion of the work. Cleaning includes, but is not limited to excess materials, soil, debris, and equipment. Repair damage resulting from installation operation.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

The General Conditions, Supplementary Conditions and Division 1, General Requirements, are a part of this Section.

1.02 DESCRIPTION

A. This section specifies materials, equipment and work required to fabricate and install ornamental metalwork.

1.03 SUBMITTALS

A. Product data for each product used in ornamental metalwork, including finishing materials and methods.

B. Shop drawings showing fabrication and installation of ornamental metalwork including plans, elevations and details of components and attachments to other units of Work. Indicate materials, profiles of each ornamental metalwork member and fitting, joinery, finishes, fasteners, anchorages and accessory items.

1. Include setting drawings, templates, and directions for installation of anchor bolts and other anchorages to be installed as unit of work of other sections.

C. Samples for initial selection purposes in form of manufacturer's color charts consisting of actual units or sections or units showing full range of colors and other finish characteristics available for each item specified.

D. Samples for verification purposes of each type of metal finish required, prepared of metal of same thickness and alloy indicated for final unit of Work. Where finishes involves normal color and texture variations, include sample sets composed of two or more units showin full range of variations expected.

1. Include 6 inch long sample of linear shapes

2. Include 6 inch square sample of plates

3. Include full-size samples of castings and forgings

E. Installer certificates signed by Contractor certifying that welders comply with requirements specified under "Quality Assurance" article.

F. Qualification data for firms and persons specified "Quality Assurance" article to demonstrate their capabilities and experience. Include list of completed projects with project name, addresses, names of Architects and Owners, plus other information specified.

G. Structural Performance of Handrails and Railing Systems: Provide handrails and railing systems capable of withstanding the following structural loads without exceeding the allowable design working stress of materials involved:

H. Top Rails of Guardrail Systems: Concentrated load of 300 lbf applied at any point and a uniform load of 100 lbf per linear ft. with each load applied nonconcurrently with respect to direction and each other, vertically downward or horizontally.

I. Handrails Not Serving as Top Rails: Concentrated load of 200 lbf applied at any point and a uniform load of 50 lbf per linear foot with each load applied nonconcurrently with respect to direction and each other, vertically downward or horizontally.

J. Infill Area of Guardrail Systems: Horizontal concentrated load of 200 lbf applied to one square foot at any point in the system including panels, intermediate rails balusters, or other elements composing the infill area.

1.04 QUALITY ASSURANCE

A. Fabricator Qualifications: Firm experienced in successfully producing ornamental metalwork similar to that indicated for this Project, with sufficient production capacity to produce required units without causing delay in the Work.

B. Installer Qualifications: Arrange for installation of ornamental metalwork specified in this section by same firm which fabricated them.

C. Organic Coating Applicator Qualifications: Firm experienced in successfully applying organic coatings of type indicated to aluminum extrusions; equipped as follows:

1. A multi-stage aluminum cleaning and pretreatment system capable of complying with test requirements of AAMA standard referenced for type of coating indicated.

2. Spray equipment required to apply a uniform coating.

3. Baking facilities to maintain quality control by verifying conformance of coating system and its application with requirements.

4. Testing facilities to maintain quality control by verifying conformance of coating system and its application with requirements.

5. A preventive maintenance program and good recordkeeping.

D. Qualify welding processes and welding operators in accordance with the following:

1. AWS D1.1 "Structural Welding Code - Steel"

2. AWS D1.2 "Structural Welding Code - Aluminum"

3. Certify that each welder employed in unit of Work of this section has satisfactorily passed AWS qualification tests for welding processes involved, and if pertinent, has undergone recertification.

4. Testing for recertification is Contractor's responsibility.

E. Engineer Qualifications: Professional engineer licenses to practice in jurisdiction where project is located and experienced in providing engineering services of the kind indicated which has resulted in the successful installation of assemblies similar in material, design, and extent to that indicated for this Project.

1.05 PROJECT CONDITIONS

A. Field Measurements: Take field measurements prior to preparation of shop drawings and fabrication, where possible, to ensure proper fitting of ornamental metalwork. Do not delay job progress; allow for adjustments and fitting where taking of field measurements before fabrication might delay Work.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store metal components and materials in clean, dry location, away from uncured concrete and masonry. Cover with waterproof paper, tarpaulin or polyethylene sheeting in a manner that permits air circulation within covering.

B. Handling ornamental metalwork on site to a minimum; exercise care to avoid damaging metal finishes.

PART 2 - PRODUCTS

2.01 METALS

A. General: Provide ornamental metalwork composed of metals of the forms and types which comply with requirements of referenced standards and which are free from surface blemishes where exposed to view in the finished unit. Exposed-to-view surfaces exhibiting pitting, seam marks, roller marks, "oil canning," stains,discolorations or other imperfections on finished units are not acceptable.

B. Aluminum: Provide alloy and temper recommended by aluminum producer or finisher for type of use and finish indicated, and with not less than the strength and durability properties of the alloy and temper designated below for each aluminum form required.

1. Extruded Bar and Shapes: ASTM B 221, 6063-T6

2. Extruded Pipe and Tube: ASTM B 429, 6063-T6

3. Drawn Seamless Tube: ASTM B 483, 6063-T832

4. Plate and Sheet: ASTM B 209, 6061-T6

5. Die and Hand Forgings: ASTM B 247, 6061-T6

6. Castings: ASTM B 26,356.0-T6

C. Steel and Iron: Provide steel and iron in the form indicated complying with the following requirements:

1. Tubing: Cold-formed, ASTM A 500; or hot-rolled, ASTM A 5-01

2. Steel Plates, Shapes, and Bars: ASTM A 36

3. Gray Iron Castings: ASTM A 48, Class 30

4. Malleable Iron Castings: ASTM A 47, grade as recommended by fabricator for type of use indicated.

2.02 MISCELLANEOUS MATERIALS

A. Welding Electrodes and Filler Metal: Type and alloy of filler metal and electrodes as recommended by producer of metal to be welded, complying with applicable AWS specifications, and as required for color match, strength and compatibility in the fabricated items.

B. Fasteners: Of same basic metal and alloy as fastened metal, unless otherwise indicated. Do not use metals which are corrosive or otherwise incompatible with metals joined.

1. Provide concealed fasteners for interconnection of ornamental metalwork components and for their attachment to other work except where exposed fasteners are unavoidable or are the standard fastening method.

2. Provide Phillips flat-head machine screws for exposed fasteners, unless otherwise indicated.

C. Nonshrink Nonmetallic Grout: Pre-mixed, factory-packaged,nonstaining, noncorrosive, nongaseous grout complying with CE CRD C621. Provide grout specifically recommended by manufacturer for interior and exterior applications of type specified in this section.

D. Anchors and Inserts: Provide anchors of type, size, and material required for type of loading and installation condition shown, as recommended by manufacturer, unless otherwise indicated. Use nonferrous metal or hot-dipped galvanized anchors and inserts for exterior locations and elsewhere as required for corrosion resistance. Use toothed steel or expansion bolt devices for drilled- in-place anchors.

E. Primer Paint for Steel and Iron: Manufacturer's standard rust-inhibiting primer; compatible with finish coats of paint.

F. Bituminous Paint: SSPC-Paint 12 (cold-applied asphalt mastic)

G. Zinc Chromate Primer: FS TT-P-645

2.03 FABRICATION, GENERAL

A. Form ornamental metalwork to required shapes and sizes, with true curves, lines and angles. Provide components in sizes and profiles indicated, but not less than required to comply with requirements indicated for structural performance.

B. Allow for thermal movement resulting from the following maximum change (range) in ambient temperature, in the design, fabrication, and installation of installed metal assemblies to prevent buckling, opening up of joints and overstressing of welds and fasteners. Base design calculations on actual surface temperatures of metals due to both solar heat gain and night time sky heat loss.

1. Temperature Change (Range): 80 deg F, (55.5 deg C)

C. Provide necessary rebates, lugs and brackets for assembly of units. Use concealed fasteners wherever possible.

D. Comply with AWS for recommended practices in shop welding. Provide welds behind finished surfaces without distortion or discoloration of exposed side. Clean exposed welded joints of all welding flux, and dress on all exposed and contact surfaces.

E. Mill joints to a tight, hairline fit. Cope or miter corner joints. Form joints exposed to weather to exclude water penetration.

F. Provide castings that are sound and free of warp or defects which impair strength and appearance.

G. Finish exposed surfaces to smooth, sharp, well-defined lines and arrises.

H. Preassemble items in shop to greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation.

2.04 FABRICATION OF HANDRAILS, RAILINGS AND FENCES

A. Nonwelded onnections: Fabricate railing systems, handrails and fences for interconnection of members by means of concealed mechanical fasteners fittings unless otherwise indicated. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

B. Welded Connections: Fabricate handrails, railing systems and fences of materials indicated below for interconnections of members by welding. Use welding method which is appropriate for metal and finish indicated and develops strength required to comply with structural performance criteria. Finish exposed welds and surfaces smooth, flush, and blended to match adjoining surfaces.

1. Provide welded connections for ferrous handrails, railing systems and fences.

C. Form changes in direction of railing members by bending members, insertion of prefabricated elbow fittings, radius bends, or by mitering.

D. Form simple and compound curves by bending members in jigs to produce uniform curvature for each repetitive configuration required; maintain profile of member throughout entire bend without buckling, twisting, or otherwise deforming exposed surfaces of handrail and railing components.

E. For systems with nonwelded connections, provide weepholes or other means for evacuation of entrapped water in hollow sections of railing and fencing members.

F. Provide wall returns at ends of wall-mounted handrails, unless otherwise indicated. Close ends of returns unless clearance between end of the railing and wall is 1/4 inch or less.

G. Close exposed ends of handrail, fence and railing members by use of manufacturer's standard prefabricated end fittings.

H. Brackets, Flanges, Fittings, and Anchors: Provide wall brackets, flanges, fence and miscellaneous fittings, and anchors for interconnection of handrail, fence and railing members to other work, unless otherwise indicated.

1. Furnish inserts and other anchorage devices for connecting handrails, fences and railing systems to concrete or masonry work. Fabricate anchorage devices which are capable of withstanding loadings imposed by handrails, fence and railing systems. Coordinate anchorage devices with supporting structure.

2.05 FINISHES, GENERAL

A. Comply with NAAMM "Metal Finishes Manual" for recommendations relative to application and designations of finishes.

B. Protect mechanical finishes on exposed surfaces from damage by application of strippable temporary protective covering prior to shipment.

2.06 ALUMINUM FINISHES

A. Finish designations prefixed by "AA" conform to the system established by the Aluminum Association for designating aluminum finishes.

B. Baked Enamel Finish: AA-C21C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified

below). Apply baked enamel in compliance with paint manufacturer's specifications for cleaning, conversion coating, and painting.

1. Organic Coating: Thermosetting modified acrylic enamel primer/topcoat system complying with AAMA 603.8 except with minimum dry film thickness of 1.5 mils, medium gloss.

2. Color: As indicated

C. High Performance Organic Coating: AA-C12C42R1x (Chemical Finish: cleaned with inhibited chemicals; Chemical Finish: chemical conversion coating, acid chromate-fluoride-phosphate pretreatment; Organic Coating: as specified below). Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturer's instructions.

1. Fluorocarbon 2-Coat Coating System: Manufacturer's standard 2-coat thermo-cured system, composed of specially formulated inhibitive primer and fluorocarbon color topcoat containing not less than 70 percent polyvinyldene resin by weight; complying with AAMA 605.2.

a. Color and Gloss: As indicated by reference to manufacturers standard color and sheen designations.

2.07 STEEL AND IRON FINISHES

A. Preparation for Paint Finish: Clean surfaces of dirt, grease, and loose rust or mill scale, including items fabricated from galvanized steel, if any, followed by a conversion coating of type suited to organic coating applied over it.

B. Factory - Primed Finish: Apply air-dried primer immediately following cleaning and pretreatment, to provide a minimum dry film thickness of 2.0 mils per applied coat, to surfaces which will be exposed after assembly and installation, and to concealed, nongalvanized surfaces.

2.08 DESIGN SCHEDULE: HANDRAILS, RAILINGS AND FENCES

A. Railings (Guardrail Systems): As presented in the Drawings

2.09 MISCELLANEOUS ORNAMENTAL METAL CASTINGS

A. Fountains:

1. Cast Iron fountains manufactured by or approved equal.

a. Design name: .

b. Finish:

1) Factory prime coat
2) Factory finish coats (2)
3) Finish color:

PART 3 - EXECUTION

3.01 PREPARATION

A. Coordinate and furnish anchorages and setting drawings, diagrams, templates, instructions and directions for installation of items having integral anchors which are to be embedded in concrete or masonry construction. Coordinate delivery of such items to the project site.

3.02 INSTALLATION, GENERAL

A. Provide anchorage devices and fasteners where necessary for securing ornamental metal items to in-place construction; including, threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws and other connectors as required.

B. Perform cutting, drilling and fitting required for installation of ornamental metalwork. Set products accurately in location, alignment and elevation, plumb, level and true, measured from established lines and levels. Provide temporary bracing or anchors in formwork for items which are to be built into concrete, masonry or similar construction.

C. Fit exposed connections accurately together to form tight, hairline joints or, where indicated, with uniform reveals and spaces for sealants and joint fillers. Where cutting, welding and grinding are required for proper shop fitting and jointing of ornamental metal items, restore finishes to eliminate any evidence of such corrective work.

D. Do not cut or abrade finishes which cannot be completely restored in the field. Return items with such finishes to the shop for required alterations, followed by complete refinishing or provide new units as required.

E. Restore protective coverings which have been damaged during shipment or installation of the work. Remove protective coverings only when there is no possibility of damage from other work yet to be performed at the same location.

1. Retain protective coverings intact and remove simultaneously from similarly finished items to preclude nonuniform oxidation and discoloration.

F. Field Welding: Comply with applicable AWS specification for procedures of manual shielded metal-arc welding, for appearance and quality of welds made, and for methods used in correcting welding work. Weld connections which are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Grind exposed welded joints smooth and restore finish to match finish of adjacent surfaces.

G. Corrosion Protection: Coat concealed surfaces of aluminum, which will be in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint or zinc chromate primer.

3.03 HANDRAILS, RAILINGS AND FENCES

A. Adjust handrails and railing systems prior to anchoring to ensure matching alignment at abutting joints. Space posts at interval indicated but not less than that required by design loadings.

B. Concrete-Anchored Posts in Sleeves: Insert posts in present sleeves cast into concrete and fill annular space between posts and sleeve solid with nonshrink, nonmetallilc grout, mixed and placed to comply with grout manufacturer's directions.

1. Cover anchorage joint with flange or escutcheon plate attached to post after filling of annular space.

2. Posts shall be installed plumb to 1/4 inch in 10 feet.

C. Anchor posts to metal surfaces with fittings designed for this purpose.

D. Nonwelded Connections: Use mechanical or adhesive joints for permanently connecting railing components. Use wood blocks and padding to prevent damage to railing members and fittings. Seal recessed holes of exposed locking screws using plastic filler cement colored to match finish of handrails and railing systems.

E. Welded Connections: Use fully welded joints for permanently connecting railing components by welding. Cope or butt components to provide 100 percent contract or use fittings designed for this purpose.

F. Expansion Joints: Provide expansion joints at locations indicated or, if not indicated, at intervals not to exceed 40 feet. Provide slip-joint internal sleeve extending 2 inches beyond joint on either side; fasten internal sleeve securely to one side, locate joint within 6 inches of post.

3.04 FOUNTAINS

A. Install fountains in accordance with manufacturer's recommendations and as indicated and as specified.

1. Fountains shall be installed plumb and level to 1/8 inch in 10 feet.

3.05 ADJUSTING

A. Protect finishes of ornamental metalwork from damage during construction period by use of temporary protective coverings approved by ornamental metalwork fabricator. Remove protective covering at time of Substantial Completion.

B. Restore finishes damaged during installation and construction period so that no evidence remains of correction work. Return items which cannot be refinished in the field to the shop; make required alterations and refinish entire unit, or provide new units as required.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Types of work in this section include rough carpentry for:

1. Wood Fences, including posts, rails, gates and gate hardware

1.02 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General Conditions and Division - 1 Specification sections, apply to work of this section.

1.03 SUBMITTALS

A. Make submittals in accordance with the Contract Documents.

B. Product Data: Submit manufacturer's specifications and installation instruction for materials listed below:

1. Fence posts

2. Fence rails

3. Gate material

4. Gate hardware

5. Paint and primer

C. Wood Treatment Data: Submit chemical treatment manufacturer's instructions for handling, storing, installation and finishing of treated material.

D. Preservative Treatment: For each type specified, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained and conformance with applicable standards.

1. For water-borne treatment include statement that moisture content of treated materials was reduced to levels indicated prior to ship to project site.

1.04 PRODUCT HANDLING

A. Delivery and Storage: Keep materials under cover and dry. Protect again exposure to weather and contact with damp or wet surfaces. Stack lumber; provide for air circulation within and around stacks and under temporary coverings including polyethylene and similar materials.

1. For lumber pressure treated with waterborne chemicals, sticker between each course to provide air circulation.

1.05 PROJECT CONDITIONS

A. Coordination: Fit carpentry work to other work; scribe and cope as required for accurate fit. Correlate location of furring, nailers, blocking, grounds and similar supports to allow attachment of other work.

PART 2 - PRODUCTS

2.01 LUMBER, GENERAL

A. Lumber Standards: Manufacture lumber to comply with PS 20 "American Softwood Lumber Standard" and with applicable grading rules of inspection agencies certified by American Lumber Standards Committee's (ALSC) Board of Review.

2.02 MISCELLANEOUS LUMBER

A. Provide lumber of sizes indicated, worked into shapes shown, and as follows:

B. Moisture content: 19 percent maximum for lumber items not specified to receive wood preservative treatment.

C. Grade: Standard Grade light framing size lumber, Southern Pine or board size lumber as required. No. 2 Common or Standard grade boards per WCLIB or WWPA rules or No. 2 boards per SPIB rules.

2.03 MISCELLANEOUS MATERIALS

A. Fasteners and Anchorages: Provide size, type, material and finish as indicated and as recommended by applicable standards, complying with applicable Federal Specifications for nails, staples, screws, bolts, nuts, washers and anchoring devices. Provide metal hangers and framing anchors of the size and type recommended by the manufacturer for each use including recommended nails.

1. Where rough carpentry work is exposed to weather, in ground contact, or in area of high relative humidity, provide fasteners and anchorages with hot-dipped galvanized coating (ASTM A525-83).

2.04 WOOD TREATMENT BY PRESSURE PROCESS

A. Preservative Treatment: Where lumber is specified to be treated, comply with applicable requirements of AWPA Standards C2 (Lumber and C9 Plywood) and of AWPB Standards listed below. Mark each treated item with the AWPB Quality Mark Requirements.

1. Pressure-treat above-ground items with water-borne preservatives to comply with AWPB LP-2. After treatment, kiln-dry lumber and plywood to a maximum moisture content, respectively, of 19 percent and 15 percent. Treat indicated item.

2.05 PAINT

A. Paint: Duron "Dura Stain Oil Solid Hide Stain", or approved equivalent

B. Color: White

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Discard units of material with defects which might impair quality of work, and units which are too small to use in fabricating work with minimum joints or optimum joint arrangement.

B. Set carpentry work to required levels and lines, with members plumb and true to line and cut and fitted.

C. Securely attach rails and gates to posts by anchoring and fastening as shown and as required by recognized standards. Countersink nail and screw heads on exposed carpentry work.

D. Use galvanized steel screws, except as otherwise indicated. Select fasteners of size that will not penetrate members where opposite side will be exposed to view. Make tight connections between members. Install fasteners without splitting wood; predrilling shall be required.

3.02 WOOD GROUNDS, NAILERS, BLOCKING AND SLEEPERS

A. Provide wherever shown and where required for screeding or attachment of other work. Form to shapes as shown and cut as required for true line and level of work to be attached. Coordinate location with other work involved.

B. Attach to posts as required to support applied loading. Countersink bolts and nuts flush with surfaces, unless otherwise indicated.

3.03 FINISHING (PAINTING)

A. Following construction of the posts, fences and gates, clean all pressure-treated wood components to remove all dirt, debris and loose wood fragments.

B. Apply two coats of stain per the manufacturer's recommendations and a rate of one gallon per 400 square feet of surface area. Allow sixteen (16) hours between coats.

3.04 CLEANUP

A. Perform cleaning during installation of the work and upon completion of the work. Cleaning includes, but is not limited to excess materials, soil, debris, and equipment. Repair damage resulting from installation operations.

END OF SECTION