

**SPECIFICATIONS**  
**PERMIT SET**  
**VOLUME 4 of 4**  
**Divisions 31 - 33**

for

**The City of Key West**  
**City Hall**  
at **Glynn Archer School**



August 8, 2014

Submitted by:

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*Bender & Associates ARCHITECTS p.a.*

410 Angela Street □ Key West, FL 33040 305/296-1347



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### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Requirements for clearing and grubbing.
- B. Related Requirements:
  - 1. Section 003100 – Available Project Information; Attachment 1, Geotechnical Report.
  - 2. Section 015713 – Temporary Erosion and Sediment Control: Temporary erosion and sediment control features and requirements.
  - 3. Section 312200 – Finish Grading.

#### 1.02 DEFINITIONS

- A. Clearing: Cutting, removal, and proper disposal of trees, stumps, brush, shrubs, rubbish, and other material as required to construct improvements shown and specified.
- B. Grubbing: Removal and disposal of stumps larger than 1-1/2-inch in diameter and other similar items to a depth of not less than 12 inches below finish grade.

#### 1.03 SYSTEM DESCRIPTION

- A. Clear and grub project site as shown on the Drawings and specified in this Section.
- B. Clear and grub project site as required to complete project.

#### 1.04 SUBMITTALS

- A. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
  - 1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
  - 2. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill.

#### 1.05 PROJECT CONDITIONS

- A. Site Information: Data in the subsurface investigation report was used for the basis of the design. The report is available for review. Conditions are not intended as representations or warranties of accuracy or continuity between soil. The Owner will

not be responsible for interpretations or conclusions drawn from this data by Contractor.

- B. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's option; however, no change in the Contract Sum will be authorized for such additional exploration.
- C. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner's Representative and then only after arranging to provide temporary utility services according to requirements indicated:
  - 1. Notify Owner's Representative not less than two days in advance of proposed utility interruptions.
  - 2. Do not proceed with utility interruptions without Owner's Representative's written permission.
  - 3. Contact utility-locator service for area where Project is located before excavating.
- D. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

## PART 2 – PRODUCTS (not used)

## PART 3 – EXECUTION

### 3.01 CLEARING AND GRUBBING

- A. Clear and grub areas to be occupied by facilities to be constructed, including areas to be excavated, filled, paved, or planted as shown on the Drawings.
- B. Clear and grub as required to complete project. Clear and grub easements as required to complete project. Do not clear or grub more than required to complete project.
- C. Existing palm trees on project site shall be removed and relocated to a site within the Owner's property as designated by the Owner.

### 3.02 PROTECTION OF ADJACENT AREA

- A. Protect areas shown on the Drawings or designated by the Engineer to remain protected from damage by construction operations by erecting suitable barriers or other acceptable means.
- B. Areas outside limits of construction as shown on the Drawings shall be protected and no equipment or materials shall be stored on these areas or allowed to damage these areas.

### 3.03 DISPOSAL

- A. Remove roots, vegetation, and other debris from the site daily. Dispose of roots, vegetation, and other debris removed from the site at no cost to the owner.
- B. Do not burn any material on the site or other areas where burning is not permitted.

### 3.04 SOIL MATERIALS

- B. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- C. Satisfactory Soils: ASTM D 2487 soil classification groups GW, GP, SW, and SP, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- D. Unsatisfactory Soils: ASTM D 2487 soil classification groups GC, GM, SC, SM, ML, MH, CL, CH, OL, OH, and PT, or a combination of these group symbols.
  - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- E. Backfill and Fill: Satisfactory soil materials.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 97 percent passing a 3-inch sieve and not more than 5 percent passing a No. 200 sieve.
- G. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- H. Provide erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.
- I. Clear and strip all surface vegetation, topsoil, roots, grass, organics, structures, appurtenances, pavements, and other deleterious material. Depth of removal is anticipated to be on the order of 6 inches or less.
- J. Proof-roll soils at the stripped surface areas with a minimum of 10 passes (30% overlap with preceding pass) of a heavyweight vibratory drum roller (minimum impact force of 20,000 pounds per drum to the soil). Any areas that yield during the proof-rolling operation or areas of deleterious material that are exposed during proof-rolling operation shall be over excavated, compacted, and replaced with compacted satisfactory material. Satisfactory material shall be placed in lifts not exceeding 12 inches in loose thickness. Thoroughly compact each lift with the vibratory roller. Prior to compaction, document condition of adjacent structures. Compaction shall cease if deemed harmful

to adjacent structures. Compaction with a non-vibratory drum roller may be required to protect adjacent structures.

END OF SECTION

## SECTION 31 22 00 FINISH GRADING

### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Replacement of top soil and finish grading.
- B. Related Requirements:
  - 1. Section 31 11 00 – Clearing and Grubbing
  - 2. Section 31 23 00 – Excavation and Fill
  - 3. Section 32 12 16 – Asphalt Paving
  - 4. Section 32 92 00 – Sodding
  - 5. Section 32 93 00 - Landscape

#### 1.02 DEFINITIONS

- A. The phrase "DOT Specifications" shall refer to the most current Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

#### 1.03 PROJECT CONDITIONS

- A. Protect above and below grade utilities that remain.
- B. Protect plants, lawns, and other features to remain as a portion of final landscaping.
- C. Protect bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs from grading equipment and vehicular traffic.

### PART 2 – PRODUCTS

#### 2.01 MATERIALS

- A. Topsoil: ASTM D 2487 soil classification groups GW, GP, SW, and SP, or a combination of these group symbols; free of rock or gravel larger than 3 inches in any dimension, debris, waste, vegetation, and other deleterious matter.

### PART 3 – EXECUTION

#### 5.01 EXAMINATION

- A. Verify that bench mark and intended elevations for the work are as indicated.

## 5.02 PREPARATION

- A. Stake and flag locations of known utilities.
- B. Identify required lines, levels, contours, and datum.
- C. Protect site features that are to remain.

## 5.03 FINISH GRADING

- A. Before Finish Grading:

1. Verify building and trench backfilling have been inspected.
2. Verify subgrade has been contoured and compacted.

- B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size.
- C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.
- D. Place topsoil in areas where seeding, sodding, and planting are indicated.
- E. Place topsoil to the following compacted thicknesses:
  1. Areas to be Sodded: 6 inches.
  2. Shrub Beds: 18 inches.
  3. Flower Beds: 12 inches.
- F. Place topsoil during dry weather.
- G. Remove roots, weeds, rocks, and foreign material while spreading.
- H. Near plants spread topsoil manually to prevent damage.
- I. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.
- J. Lightly compact placed topsoil.

## 5.04 CLEANING

- A. Leave site clean and raked; ready to receive landscaping.

END OF SECTION

## SECTION 31 23 00 – EXCAVATION AND FILL

### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Requirements for excavation, and backfilling of trenches.
- B. Related Sections
  - 1. Section 01 57 13 Temporary Erosion and Sedimentation Control
  - 2. Section 31 11 00 Clearing and Grubbing
  - 3. Section 31 22 00 Finish Grading
- C. Lump Sum Prices
  - 1. Trenching and Backfilling
    - a. Trenching and backfilling for Work included in this project is included in the lump sum cost for work installed, unless otherwise stated herein, and the lump sum price for work includes trenching and backfilling in whatever nature of material may be encountered. No additional allowance to the lump sum price proposal by the Contractor for the project or any part thereof will be allowed on any claim for extra compensation because of trenching, backfilling, or trenching and backfilling being of a nature different from that contemplated by Contractor.
    - b. The Contractor is charged with the responsibility of actually investigating and examining the site of the project before preparing his proposal and satisfying himself in this respect.

#### 1.02 REFERENCES

- A. General: References to standards, specifications, manuals, or codes of any technical society, organization or association, or to the Laws or Regulations of any government authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of proposals (or, on the Effective Date of the Agreement if there were no proposals), except as may be otherwise specifically stated in the Contract Documents.
- B. ANSI/ASTM Standards
  - 1. ANSI/ASTM C33 Concrete Aggregates
  - 2. ANSI/ASTM D1557 Test Method for Laboratory Compaction Characteristics of Soil  
(AASHTO T-180) Using Modified Effort (56,000 ft.-lbf/ft<sup>3</sup>)(2,700 kN-m/m<sup>3</sup>)

- C. ASTM Standards
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  - 1. Excavation Safety Standards, 29 C.F.R.s.1926.650 Subpart P.

### 1.03 DEFINITIONS

- A. General: Soil classifications presented in this Article are applicable to natural soils and processed materials.
  
- B. ASTM D2487 Unified Soil Classification System (USCS)
  - 1. Class I: Angular, one-quarter inch (1/4") to one and one-half inch (1-1/2") graded stone, including a number of fill materials that have regional significance such as coral, slag, cinders, crushed shells and crushed stone.
  
  - 2. Class II: Coarse sands and gravels with maximum particle size of one and one-half inches (1-1/2"), including variously graded sands and gravels containing small percentages of fines, generally granular and non-cohesive, either wet or dry. The following soil types are included in this class:
    - a. GW (well-graded gravel)
    - b. GP (pea gravel or crushed stone mixed with sand)
    - c. SW (well-graded sand)
    - d. SP (poorly graded sands and gravelly sands with little or no fines)
  
  - 3. Class III: Fine sand and clayey (clay filled) gravels, including fine sands, sand-clay mixture and gravel-clay mixtures. The following soil types are included in this class:
    - a. GM (silty gravels)

- b. GC (clayey gravels)
  - c. SM (silty sands)
  - d. SC (clayey sands)
4. Class IV: Silt, silty clays and clays, including inorganic clays and silts of medium to high plasticity and liquid limits. The following soil types are included in this class:
- a. CH (Inorganic clays of high plasticity)
  - b. CL (Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays)
  - c. MH (inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts)
  - d. ML (Inorganic silts, very fine sands, rock flour, silty or clayey fine sands)
5. Class V: This class includes the following organic soils as well as soils containing frozen earth, debris, rocks larger than one and one-half inches (1-1/2") in diameter and other foreign materials:
- a. OL (Organic silts and organic silty clays of low plasticity)
  - b. OH (Organic clays of medium to high plasticity)
  - c. PT (Peat, muck, and other highly organic soils)
- C. Maximum Density: Maximum weight in pounds per cubic foot of a specific material.
- D. Optimum Moisture: Percentage of water in a specific material at maximum density.
- E. Rock: A natural aggregate of mineral particles connected by strong and permanent cohesive forces. Rock includes:
- 1. Limestone, lime rock, sandstone, dolomite, granite marble, lava, and coral.
  - 2. Boulders 1/3 cubic yard or more in volume.
  - 3. Material which by actual demonstration cannot, in the Engineer's opinion, be reasonably excavated with a backhoe or 3/4 cubic yard capacity power shovel equipped with two rippers, or similarly approved equipment and which is, in fact, systematically drilled and blasted or broken by power operated hand tools. Engineer may waive demonstration requirement if material encountered is well-defined rock.
- F. Deleterious Materials: Household and construction debris, organic debris, peat and organic soils,

#### 1.04 LEED SUBMITTALS

##### 1. General:

- A. Collect and submit data as required for completing Section 013516.05 LEED New Product Source Form and the applicable LEED On-line credit forms and supporting documentation.
2. Product Data for Credit MR 5.1 and Credit MR5.2: For building materials and products that are extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site, submit documentation required to complete the regional materials calculation table in the LEED Submittal Template, including but not limited to: product name for each such material; material manufacturer; total product cost certification for each such material; percentage of product (by weight) that meets both the extraction and manufacture criteria; distance between the project site and the extraction/harvest/recovery site; distance between the project site and the final manufacturing location.
  3. Cost certification shall include the actual material cost plus all expenses incurred to deliver the material to the project site, including taxes and delivery costs incurred by the subcontractor and general contractor. Excludes labor and equipment costs once the material is delivered to the site.

#### 1.05 SYSTEM DESCRIPTION

- A. Perform excavation required to construct underground piping systems to lines and grades shown on the Drawings.
- B. Provide, place, and compact pipe bedding and haunching as shown on the Drawings and specified in this Section.
- C. Provide, place, and compact initial fill as shown on the Drawings and specified in this Section.
- D. Provide, place, and compact final fill as shown on the Drawings and specified in this Section.
- E. Place, compact, and test fill as specified in this Section.
- F. Dispose of unsuitable and excess excavated material as specified in this Section.
- G. Grade final fill to elevations, lines, slopes, depths and cross-sections shown on the Drawings. Where no change in finish grade is indicated, grade final fill to elevations, lines, slopes, depths and cross-sections that existed prior to start of construction.

#### 1.06 QUALITY ASSURANCE

- A. General: Trenching and backfilling shall be performed by company with not less than five years of documented experience in underground utility construction.
- B. Soils Testing
  1. Owner will employ and pay for services of an independent testing agency to perform specified testing and inspection.

- A. For additional requirements, refer to Section 007200 – General Conditions and Section 007300 – Supplementary Conditions.
- 2. Schedule trenching and backfilling to permit a reasonable time for testing before placing succeeding lifts of installing pipe.
- 3. Keep testing laboratory informed of structural earthwork progress.
- C. General Monitoring: Trenching and backfilling shall be monitored on a periodic basis by the independent testing laboratory for general compliance with the intent of these specifications.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Contractor shall be responsible for delivery, storage, and handling of fill material from off-site sources.
- B. Comply with requirements of Federal, State, and County authorities regulating shipment of products.
- C. Contractor shall be responsible for storage and handling of on-site excavated suitable fill material.
- D. Do not allow fill material from off-site sources or on-site excavated suitable fill material to be mixed with unsuitable material.
- E. Do not allow stored fill material from off-site sources to be mixed with stored on-site excavated suitable fill material.
- F. Protect stored fill materials so that the composition of materials is not altered and materials are not otherwise degraded or contaminated.
- G. Prevent erosion of soil and fill materials and sedimentation of waterways, open drainage ways and storm and sanitary sewers due to construction activities, by complying with Section 015713 Temporary Erosion and Sedimentation Control, LEED Sustainable Sites Prevention requirements; Erosion Control Notes on Sheet C-1; Storm Water Pollution Prevention Plan C-5.

#### 1.08 PROJECT/SITE CONDITIONS

- A. Regulatory Requirements
  - 1. Conform to Federal and State regulatory requirements for excavations.
  - 2. Obtain excavation permit prior to starting trenching and backfilling. Conform to requirements of excavation permit.

3. Provide barricades, warning signs, and lights as required by law, regulation, or law and regulation.
- B. Excavation Protection
1. Protect excavations by shoring, bracing, sheet piling, underpinning, or other methods required to prevent cave-in or loose soil from falling into excavation.
  2. Grade top perimeter of trench to prevent surface water run off into trench.
- C. Protection of Adjacent Improvements
1. Underpin adjacent structures and utilities, including utility services, which may be damaged by excavation work.
  2. Repair damaged structures, utilities, or structures and utilities at no additional cost to the Owner.
- D. Protection of Benchmarks, Monuments, and Other Reference Points
1. Maintain benchmarks, monuments, and other reference points.
  2. Retain a Registered Land Surveyor who shall establish, for any benchmarks, monuments, and other reference points that might be disturbed by structural earthwork, references that will not be disturbed.
  3. Registered Land Surveyor shall replace benchmarks, monuments, and other reference points removed or otherwise disturbed.
- E. Geotechnical Data
1. Geotechnical data prepared for this project are available for review by the Contractor.
  2. Data and recommendations in the subsurface investigation report have been used by the Engineer in the preparation of the Drawings and Specifications.
  3. Geotechnical Data made available to the Contractor by the Owner, the Engineer, or the Geotechnical Consultant are not guaranteed as to accuracy or completeness. Geotechnical Data made available to the Contractor by the Owner, the Engineer, or the Geotechnical Consultant are not part of the Contract Documents. If Geotechnical Data made available to the Contractor by the Owner, the Engineer, or the Geotechnical Consultant are used by the Contractor, the Contractor shall assume all risks resulting from actual conditions differing from conditions set out in the Geotechnical Data.
- F. Unanticipated Conditions

1. Notify Engineer of unexpected subsurface conditions and discontinue work in affected area until notified by Engineer to resume work.
2. Take emergency measures as required to protect persons and improvements.

## PART 2 – PRODUCTS

### 2.01 SOURCE FOR BEDDING AND FILL MATERIALS

- A. Use excavated materials that meet the requirements specified in this Section.
- B. Furnish and install imported material if excavated material does meet the requirements of this Section.
- C. Excess excavated material that meets the requirements of this Section shall be stored at the project site until backfilling is completed. Do not remove excess excavated material that meets the requirements of this Section from the project site until backfilling is completed.

### 2.02 BEDDING

- A. Crushed Stone Bedding: Imported, graded stone meeting the requirements of Class I soil with maximum particle size equal to one-half inch (1/2").
  1. Size range and resulting high void ration of crushed stone bedding material makes it suitable for use to dewater trenches during pipe installation.
  2. The permeable characteristic of crushed stone dictates that use of crushed stone bedding material be limited to locations where pipe support will not be lost by migration of fine grained natural material from trench walls and bottom or migration of other embedment materials into crushed stone bedding material.
  3. When migration of fine grained natural material into crushed stone bedding is possible, minimum size range of crushed stone bedding shall be reduced to finer than one-quarter inch (1/4"), and gradation shall be selected to limit the size of the voids.
  4. An alternative to modifying the gradation is to use a geotextile fabric as a barrier to migration to fines.)
- B. Coarse Sand and Gravel Bedding: Coarse sands and gravels meeting the requirements of Class II soil with maximum particle size equal to three-quarter inch (3/4") and with less than five percent fines.
  1. Coarse-grained soils with less than 12 percent but more than five percent fines may be used for coarse sand and gravel bedding if approved by the Engineer.

2. Gradation of coarse sand and gravel bedding material influences density and pipe support strength of coarse sand and gravel when bedding material is loosely placed. Gradation of coarse sand and gravel bedding material may be critical to the pipe support and stability of the foundation and embedment, if the material is imported and is not native to the trench excavation. Gradation other than well graded, such as uniformly graded or gap graded, may permit loss of support by migration into void spaces of a finer grained natural material from the trench wall and bottom.
3. When migration of fine grained natural material into coarse sand and gravel bedding is possible, adjust gradation of bedding material to limit size of voids so there is no migration of fines from trench walls or trench bottom into bedding material.
4. An alternative to modifying the gradation is to use a geotextile fabric as a barrier to migration of fines.

#### 2.03 HAUNCHING

- A. Haunching material shall be on-site or imported non-cohesive, non-plastic material free of debris and gravel larger than one-half inch in diameter.
- B. Haunching materials shall be Class I or Class II soils as defined in this Section.

#### 2.04 SELECT FILL

- A. Select fill shall be on-site or imported non-cohesive, non-plastic material free of debris and gravel larger than one-half inch in diameter.
- B. Select initial and final fill materials shall be Class I or Class II soils as defined in this Section.

#### 2.05 COMMON FILL

- A. Common fill shall be on-site or imported non-cohesive, non-plastic material, free of debris and rocks larger than six inches in diameter.
- B. Common initial fill materials shall be Class I, Class II, or Class III soils as defined in this Section.
- C. Common final fill materials shall be Class I, Class II, Class III or acceptable dry, native Class IV soils as defined in this Section.

### PART 3 – EXECUTION

#### 3.01 INSPECTION OF SOURCE FOR BEDDING AND FILL MATERIALS

- A. Verify approval of full or limited use of stockpiled fill.

### 3.02 PREPARATION

- A. Identify required lines, levels, contours, and datum.
- B. Prior to trenching, cut or score pavement to straight edges, six inches outside each edge of the proposed trench. Do not damage pavement not removed.

### 3.03 EXCAVATION

- A. Dewater trenches as specified in Section 02240 Dewatering.
- B. Excavate trench so that piping can be installed to alignment and depth shown on the Drawings and as specified.
- C. Trench width shall be ample to permit piping to be laid and jointed properly. Minimum trench width shall be at least three feet, six inches or eight inches greater than the largest outside diameter of the pipe or bell, whichever is greater.
- D. If sheeting is used, sheeting may be removed provided removal can be accomplished without disturbing bedding, pipe or alignment. Should Engineer determine that removal of sheeting will damage pipe, sheeting shall be left in place at no additional cost to the Owner. If left in place, cut sheeting off two feet above top of pipe and leave sheeting in place below cut. Any damage to pipe bedding, pipe, or alignment caused by removal of sheeting shall be cause for rejection of the affected portion of the Work.
- E. Open no more than 100 feet of trench ahead of pipe laying operations at one time unless a greater length of trench is approved by the Engineer.

### 3.04 TRENCH BOTTOM

- A. Excavate trench to elevation required for pipe material.
  - 1. For piping that does not require bedding below bottom of pipe, excavate trench to bottom of pipe.
  - 2. For piping that requires bedding below bottom of pipe, excavate trench to bottom of bedding below pipe.
- B. Soil surface at trench bottom shall provide a firm, stable and uniform support for pipe. Soil surface at trench bottom shall be free of any protrusions which may cause point loading on any portion of pipe or bell.
- C. Do not over-excavate trench bottom if trench bottom material is stable undisturbed soil of the follow types:
  - 1. Class II soil including types GW, GP, SW and SP.
  - 2. Class III soil including types GM, GC, SM and SC.
  - 3. Class IV soil including types CL and ML.

- D. Do not bed pipe on solid rock, boulders, hardpan, unsuitable soils, organic material, or other materials that are not suitable for trench bottom. Remove soils and other materials that are not suitable materials for trench bottom. Remove soils and other materials that are not suitable materials for trench bottom to six inches under pipe, minimum.
1. Remove wet, yielding, or mucky soils. Remove the following soils:
    - a. Type CH and Type MH Class IV soils.
    - b. All Class V soils.
  2. Remove organic material including roots, mulch, or other vegetable matter, which in the opinion of the Engineer, will result in unsatisfactory foundation conditions.
  3. Remove soils containing cobbles, boulders or stones larger than one and one-half inches (1-1/2") in diameter.
  4. Remove ledge rock and hardpan. Remove rock and hardpan to provide bedding width 24 inches wider than pipe.
  5. Remove soils containing rubbish, trash, or other foreign materials.
- E. Replace ledge rock, hard pan, boulders, unsuitable soils, and soil containing material that is not suitable for trench bottom.
1. Over-excavation Replacement for Piping that Does Not Require Bedding below Bottom of Pipe
    - a. If trench is over-excavated more than six inches below the bottom of the pipe, but less than twelve inches below the bottom of the pipe, fill and compact over-excavation with acceptable Class I, II or III soil as defined in this Section.
    - b. If trench is over-excavated more than twelve inches below bottom of pipe, fill and compact over-excavation with crushed stone bedding.
  2. Over-excavation Replacement for Piping that Requires Bedding below Bottom of Pipe: Fill and compact over-excavation to bottom of bedding with Class I soil as defined in this Section.

### 3.05 BEDDING

- A. General: Properly bed pipelines, conduits and appurtenances as shown on Drawings and as specified in this Section.
- B. Bedding for PVC Pipe: Place and compact crushed stone bedding from a minimum of 1/4 diameter of pipe below invert of pipe to bottom of pipe.
- C. Bedding for Ductile Iron Pipe

1. If trench bottom at bottom of pipe is Class I, Class II, Class III or acceptable dry, native Class IV soils as defined in this Section, bed pipe on trench bottom.
  2. If trench bottom is not acceptable for bedding, place crushed stone bedding or coarse sand and gravel bedding from a minimum of 1/4 diameter of pipe below invert of pipe up to bottom of pipe.
- D. Preparation of Trench Bottom for Piping and Conditions that Do Not Require Bedding below Bottom of Pipe
1. Compact trench bottom as required to achieve density specified for bedding, haunching, and backfill. Minimum compaction for trench bottom shall be 90% of Modified Proctor Maximum Dry density (ASTM D1557).
  2. Bring trench bottom to grade prior to installation of pipe, fittings, and valves. Bring trench bottom to grade along entire length of pipe.
- E. Preparation of Trench Bottom for Piping or Conditions that Require Bedding below Bottom of Pipe
1. Excavate trench bottom and place bedding material, so that bedding grade is correct following compaction of bedding.
  2. Uniformly compact bedding. Use hand or mechanical tamping to compact bedding material.
  3. Compact bedding material as required to achieve density specified for haunching and backfill. Minimum compaction of bedding material shall be 95% of Modified Proctor Maximum Dry density (ASTM D1557).
  4. Bring bedding material to grade prior to installation of pipe, fittings, and valves. Bring bedding material to grade along entire length of pipe.

### 3.06 HAUNCHING

- A. Haunching for PVC Pipe: Place crushed stone bedding material from top of bedding to spring line (centerline) of pipe.
- B. Haunching for Ductile Iron Pipe
1. If trench bottom at bottom of pipe is Class I, Class II, Class III or acceptable dry, native Class IV soils as defined in this Section, place haunching material from trench bottom to spring line (centerline) of pipe.
  2. If trench bottom is not acceptable for bedding, place crushed stone bedding or coarse sand and gravel bedding material from top of bedding up to 1/8 diameter of pipe. Place haunching material from top of crushed stone bedding or coarse sand bedding material to spring line (centerline) of pipe.

- C. Piping Support: Support piping during placement and compaction of haunching.
- D. Placing Haunching Material
  - 1. Do not place haunching over porous, wet, or spongy trench bottom or bedding material.
  - 2. Hand place haunching material.
  - 3. Place haunching evenly along both sides of pipe, fittings, and valves so that equal load is maintained along both sides of pipe, fittings, and valves.
  - 4. Work haunching under pipe, fittings, and valves so that there are no voids in fill and so that pipe, fittings, and valves are properly supported.
  - 5. Place haunching so that piping materials, coatings, and encasement are not damaged.
- E. Haunching Material Compaction
  - 1. Compact haunching material
  - 2. Compact haunching so that pipe, fittings, and valves are properly supported.
  - 3. Compact haunching as required to achieve density specified for backfill material.
  - 4. Minimum compaction of haunching shall be 95% of Modified Proctor Maximum Dry density (ASTM D1557).

### 3.07 INITIAL BACKFILL

- A. Initial backfill shall extend from the top of haunching to one foot above top of pipe. Placement of initial backfill may be either by hand or mechanical means.
- B. Initial fill in trenches wholly or partially beneath paved areas as follows shall be select initial fill:
  - 1. Public streets, roads, and parking areas.
  - 2. Institutional roads, drives, and parking areas.
  - 3. Commercial roads, drives, and parking areas.
- C. Initial fill in trenches beneath unimproved areas, lawns, landscaping, private drives, and private parking areas shall be common initial fill unless otherwise shown on the Drawings.
- D. Keep initial backfill free from debris, rocks, clods, and other items larger than one-half inch (1/2").

- E. Do not compact initial fill directly over pipe, fittings, or valves until adequate cover has been provided to prevent damage to pipe, fitting, or valve. Adequate cover will depend on piping materials and type of compaction equipment used. Adequate cover shall be as accepted by the Engineer.
- F. Minimum compaction of initial fill shall be 95% of Modified Proctor Maximum Dry density (ASTM D1557).

### 3.08 FINAL BACKFILL

- A. Backfill trenches to contours and elevations shown on drawings, or to match existing grade if finish grade is not changed.
- B. Final backfill in trenches wholly or partially beneath paved areas as follows shall be select initial fill:
  - 1. Public streets, roads, and parking areas.
  - 2. Institutional roads, drives, and parking areas.
  - 3. Commercial roads, drives, and parking areas.
- C. Final backfill in trenches beneath unimproved areas, lawns, landscaping, private drives, and private parking areas shall be common initial fill unless otherwise shown on the Drawings.
- D. Backfill trench systematically, as early as possible, to allow maximum time for natural settlement.
- E. Place and compact select fill material in continuous layers not exceeding 6 inches in depth. Minimum compaction of select fill shall be 98% of Modified Proctor Maximum Dry density (ASTM D1557). Compaction of select fill shall be by small portable plate compactor or other approved method.
- F. Place and compact common fill material in continuous layers not exceeding 12 inches in depth. Minimum compaction of common fill shall be 95% of Modified Proctor Maximum Dry density (ASTM D1557). Compaction of common fill shall be by mechanical means or other approved methods.

### 3.09 COMPACTION

- A. Compaction Equipment
  - 1. Compaction shall be accomplished by use of appropriate compaction equipment.
  - 2. Compact each lift by repeated passes of appropriate compaction equipment.
  - 3. Select and operate compaction equipment so that pipe and structures are not damaged by compaction operation.

B. Moisture Control

1. Control moisture content of soil during compaction as required to achieve specified compaction.
2. Moisture content of fill and backfill material shall be within plus or minus 2% of optimum moisture content during compaction of fill and backfill material.
3. If necessary, add water or allow material to dry until the proper moisture content for the specified compaction is obtained.

C. Compaction Testing

1. Test compaction of bedding, haunching, initial backfill, and final backfill as specified in this Section.
2. Test each compacted soil layer, in place, prior to placement of succeeding layers.

3.10 TESTING

- A. Retain a laboratory approved by Engineer to make field density tests and Proctor Tests as specified below.
1. Contractor shall pay the cost of initial density test(s).
  2. Contractor shall pay cost for any additional testing required as a result of failure of any initial test.
- B. Perform one Proctor Test, according to ASTM D1557, for each source of fill used on the Project. If material from excavation is used as backfill material, take a test proctor from the best available location as determined by the testing lab.
- C. Determine Optimum moisture content of fill, subgrade, and backfill material by Modified Proctor Method (ASTM D1557).
- D. Test the density of compacted bedding, haunching, and initial fill. Test the density of each compacted final fill layer in place. Field density tests shall meet the requirements of ASTM D1556, ASTM D2922, or ASTM D2937.
- E. Perform density tests for initial backfill and final backfill as follows:
1. Initial Backfill                      1 test per layer for each 300 foot length of trench  
(minimum 1 test per day)
  2. Select Final Backfill              1 test per layer for each 300 foot length of trench  
(minimum 1 test per day)
  3. Common Final Backfill: 1 test for each 1,000 feet of trench.
- F. Perform additional field density tests as follows:
1. If test density of compacted backfill or fill is less than specified density, make additional tests at locations directed by Engineer.

2. Make additional field density tests at no additional cost to the Owner.

G. Allow for inspection of import fill by Engineer at the source before delivery to site.

3.11 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL

A. Remove unsuitable material and excess excavated suitable material from the Project.

B. Dispose of unsuitable material and excess excavated suitable material off of the Project.

END OF SECTION

## SECTION 31 23 19- DEWATERING

### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Requirements for dewatering excavations and trenches.

#### 1.02 SYSTEM DESCRIPTION

- A. Obtain permits required by regulatory authorities having jurisdiction and required by the Owner for installation, operation, and removal of dewatering systems.
- B. Furnish and install dewatering systems including well points, wells, pumps, piping, chemical grouting, water tight sheeting, ground freezing, tremie wall, or any other technology as may be necessary to accomplish dewatering in a safe and proper manner.
- C. Provide labor, equipment, and services required to operate dewatering systems.
- D. Remove dewatering systems.
- E. Plug and seal dewatering wells.

#### 1.03 SUBMITTALS

- A. General: As specified in:
  - 1. General Conditions;
  - 2. Division 1;
- B. Submit copy of dewatering permit prior to installing dewatering system, or systems.
- C. Submit dewatering plan, or plans, prior to installing dewatering system, or systems.
  - 1. Contractor is responsible for the de-watering plan; should the contractor require additional de-watering requirement this shall be done at no additional cost to the owner.
  - 2. Dewatering shall be done to the cities sewer system.

#### 1.04 QUALITY ASSURANCE

- A. Regulatory Requirements

1. Obtain Dewatering Permit from South Florida Water Management District prior to dewatering of any areas. Make application and arrangements and pay fees and charges for dewatering and disposal of discharge from dewatering
2. Submit copy of dewatering permit.
3. Comply with requirements of dewatering permit. Meet regulatory requirements relative to dewatering and disposal of discharge water from dewatering.

#### 1.05 PROJECT/SITE CONDITIONS

##### A. Noise Limitations.

1. Dewatering systems and equipment shall comply with ordinances regulating noise.
2. Provide “residential” mufflers on engines.
3. Provide sound attenuating enclosures over dewatering system equipment if necessary to meet noise limit requirements of ordinances and regulations.
4. Do not shut off dewatering systems to meet noise limitations during non-work hours. Provide sound attenuating measures to meet noise limit requirements.
5. Provide sound attenuating equipment, devices, and measures at no additional cost to the Owner.
6. Modify dewatering system, or systems, as required to comply with ordinances regulating noise.

##### B. Damage Prevention

1. Dewatering shall not cause settlement of existing or new structures. Repair or replace structures damaged by settlement caused by dewatering. Repair or replace structures at no additional cost to the Owner.
2. Discharge from dewatering systems shall not cause erosion of turf or soil. Replace turf damaged by dewatering discharge. Replace soil displaced by dewatering discharge. Replace turf and soil at no additional cost to the Owner.
3. Discharge from dewatering systems shall not damage landscaping. Replace landscaping damaged by dewatering discharge. Replace landscaping at no additional cost the Owner.
4. Modify dewatering system, or systems, as required to eliminate conditions that cause damage.

##### C. Access

1. Dewatering systems and dewatering system operations shall not prevent emergency access or prevent persons living in the vicinity of construction from completing their normal daily pursuits.
2. Provide temporary access over dewatering system piping for vehicular and pedestrian traffic.

## PART 2 – PRODUCTS

### 2.01 DEWATERING SYSTEMS

- A. Contractor shall be responsible for the sizing and selection of dewatering systems, dewatering equipment, dewatering system piping, and appurtenances.

## PART 3 – EXECUTION

### 3.01 GROUNDWATER

- A. Contractor shall be responsible for evaluating and determining groundwater conditions.

### 3.02 DEWATERING PLAN

- A. Contractor shall prepare and submit dewatering plan for each dewatering system
- B. Ground water plan shall include the following:
  1. Groundwater data and assumptions relating to groundwater conditions.
  2. Description of proposed dewatering system with drawings, diagrams, and system component data as applicable.
  3. Proposed measures to insure dewatering system reliability.
  4. Description of discharge water disposal methods.
  5. Identification and location of private water supply wells, public water supply wells, lakes, and ponds that may be affected by dewatering.
  6. Anticipated affect upon private water supply wells, public water supply wells, lakes, and ponds that may be impacted by dewatering. Proposed measures to ameliorate effects of dewatering upon private water supply wells, public water supply wells, lakes, and ponds.
  7. Other data pertinent to the dewatering system.

### 3.03 DEWATERING SYSTEMS

- A. Provide, operate, and maintain dewatering systems including well points, wells, chemical grouting, water tight sheeting, ground freezing, tremie wall, or any other technology as may be necessary to accomplish dewatering in a safe and proper manner.
- B. Provide dewatering systems that control groundwater level in conformance with the requirements of this Section. Provide dewatering systems that lower groundwater to level shown, specified, or shown and specified in advance of excavation. Provide dewatering systems that continuously maintain groundwater level at, or below, level shown, specified, or shown and specified until backfilling and compaction have been completed to level shown, specified, or shown and specified.
- C. Provide automatic starting devices, standby pumps, and other equipment and controls required to provide continuous dewatering in the event of an outage of dewatering pump or other dewatering system component.
- D. Provide headers, suction piping, and discharge piping as required to convey water from well points, dewatering wells, and caissons to dewatering system discharge point designated in permit and accepted dewatering plan.
- E. Modify dewatering system during the course of construction as conditions that affect dewatering change.

#### 3.04 DEWATERING OPEN EXCAVATIONS

- A. Lower groundwater to level shown, specified, or shown and specified in advance of excavation. Provide monitoring wells or other means to measure groundwater level prior to starting excavation.
- B. Dewater excavation from outside the limits of excavation. Dewater excavation from below the bottom of excavation. Do not dewater excavation from sumps within excavation.
- C. Dewatering measures shall provide the following:
  - 1. Prevent instability of excavation due to groundwater.
  - 2. Prevent the disturbance of subgrade bearing materials due to groundwater.
  - 3. Keep excavation free from standing water and running water.
  - 4. Prevent tanks, pipes, and other structures from being displaced by hydrostatic pressures.
- D. Do not install or operate dewatering systems that allow movement of soil through excavation or excavation subgrade.
- E. Do not install or operate dewatering systems that allow movement of soil from beneath existing or previously installed structures or pipes.

### 3.05 DEWATERING TRENCHES

- A. Lower groundwater to level shown, specified, or shown and specified in advance of excavation. Provide monitoring wells or other means to measure groundwater level prior to starting excavation.
- B. Dewater trench from outside the limits of trench. Dewater trench from below the excavated trench bottom. Do not dewater trench from sumps within trench.
- C. Dewater trench to a minimum level of 24 inches below excavated trench bottom. Maintain water level a minimum of 24 inches below excavated trench bottom until backfill meets the following requirements:
  - 1. Backfilling and compaction have progressed as to a depth that installed piping will not be displaced by hydrostatic pressure.
  - 2. Backfilling and compaction have been completed above natural water table to a level that remaining backfill can be placed and compacted as specified in Section 31 23 00 Excavation and Fill.
- D. Dewatering measures shall provide the following:
  - 1. Prevent instability of trench due to groundwater.
  - 2. Prevent the disturbance of subgrade bearing materials due to groundwater.
  - 3. Keep trench free from standing water and running water.
  - 4. Prevent tanks, pipes, and other structures from being displaced by hydrostatic pressures.
- E. Do not install or operate dewatering systems that allow movement of soil through trench or trench subgrade.
- F. Do not install or operate dewatering systems that allow movement of soil from beneath existing or previously installed structures or pipes.

### 3.06 SURFACE WATER CONTROL

- A. Do not allow surface runoff to flow into excavations and trenches.
  - 1. Grade top perimeter of excavation to prevent surface water run-off to flow into excavation.
  - 2. Grade sides and ends of trench to prevent surface water run-off to flow into trench.

- B. Do not allow storm water to puddle or pond on construction site except in designated storm water retention areas. Grade construction areas so that storm water drains to storm water system.
- C. Do not allow storm water to flow off construction site except through permitted discharge structures and through permitted storm water pipes, conduits, and channels.
- D. Do not allow storm water to flow into or through stored fill and backfill materials.

### 3.07 DEWATERING DISCHARGE CONTROL

- A. Discharge water from dewatering system to storm drain systems in accordance with dewatering permit and as specified in this Section. Provide silting basins and other discharge treatment systems in accordance with dewatering permit and to meet discharge permit requirements.
- B. Do not allow discharge from dewatering system to puddle or pond on construction site except in areas designated and approved to receive discharge from dewatering system.
- C. Do not allow to discharge from dewatering system to flow off construction site except through permitted discharge structures and through pipes, conduits, and channels that have been designated and approved for discharge flow from dewatering systems.
- E. Do not use sanitary sewers for disposal of water from water control systems. Do not use sanitary sewer system under construction as conduit to remove ground water from trench.
- F. Do not use storm sewer under construction as conduit to remove ground water from trench. Do not use new storm water system for dewatering system discharge unless new storm water system has been approved for dewatering system discharge.
- G. Do not discharge water containing settleable solids into storm sewers.
- H. Do not contaminate or disturb the environment of properties adjacent to the Work.
- I. Do not contaminate streams or other surface waters.
- J. Provide temporary facilities and controls for dewatering system discharge. Temporary facilities and controls shall be appropriate to the project, including, but not limited to:
  - 1. Silting basin, or basins, of adequate size.
  - 2. Filters.
  - 3. Coagulants.
  - 4. Screens.
- H. Discharge onto pavement shall not damage pavement.

### 3.08 DEWATERING SYSTEM REMOVAL AND CLEANUP

- A. Completely remove dewatering systems installed for construction.
- B. Plug and seal dewatering wells after dewatering operations are concluded. Plug and seal dewatering wells in accordance with permit requirements.
- C. Remove and dispose of solids, including sand, mud, and other material, discharged from dewatering systems.

### 3.09 GENERAL ADDITIONAL REQUIREMENTS

- A. Contractor shall design and provide a ground water treatment system plan comprised of the following:
  - A large settling tank (silt box) with baffles for the removal of large solids and free product
  - Sock Bag filters shall be attached to the discharge hose into the sewer manholes for the removal of suspended solids. Contractor responsible for determining number of discharge hose's required from the settling tank to the manhole to maintain adequate flow.
- B. Well point systems must be efficient enough to lower the water level in advance of the excavation and maintain it continuously in order that the trench bottom and sides shall remain firm and reasonably dry. The well points shall be designed especially for this type of service, and the pumping unit used shall be capable of maintaining a high vacuum, and at the same time, of handling large volumes of air as well as of water. Pumps shall be capable of handling the water the contractor need removed to perform the work. Sock filters shall be provided on the pump discharge at the silt box and manhole discharge. Filter cloth draped in manhole shall not be used except for temporary basis of less than 4 hours.
- C. Silt boxes shall be capable of handling the water the contractor needs removed to perform the work. Silt box discharged into the sewer systems shall have filter socks on the discharge hose. The contractor shall provide multiple discharge hose with filtering sock if required to remove the water from the silt box. Silt boxes shall be cleaned daily. Socks shall be replaced as needed. Sock(s) with holes or cuts shall be replaced immediately. He shall not dam, divert, or cause water to flow in excess in existing gutters, pavements or other structures: and to do this he may be required to conduct the water to a suitable place of discharge may be determined by the Owner.
- D. The contractor shall not dewater into the permitted stormwater gravity injection well at the project site.

END OF SECTION

## SECTION 31 25 00 EROSION AND SEDIMENTATION CONTROLS

### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Requirements for erosion and sedimentation control.

#### 1.02 DEFINITIONS

- A. The phrase "DOT Specifications" shall refer to the most current Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

#### 1.03 SYSTEM DESCRIPTION

- A. Obtain permits required by regulatory authorities having jurisdiction and required by the Owner for installation, maintenance, and removal of erosion and sedimentation control measures.
- B. Furnish and install erosion and sedimentation control measures.
- C. Provide labor, equipment, and services required to maintain erosion and sedimentation control measures.
- D. Remove erosion and sedimentation control measures that are not a permanent part of Work.

#### 1.04 SUBMITTALS

- A. General: As specified in:
  - 1. Division 1;
  - 2. This Section
- B. Submit copy of Erosion Control Plan prior to installing erosion and sedimentation control measures.
- C. Submit erosion and sedimentation control plan approved by State, local, or State and local authorities.

#### 1.05 PROJECT/SITE CONDITIONS

- A. Regulatory Requirements
  - 1. Dewatering

- a. Obtain permit, or permits, for erosion and sedimentation control for earthwork and dewatering. Make application and arrangements and pay fees and charges for permit, or permits.
  - b. Obtain permit, or permits, for erosion and sedimentation control prior to starting earthwork. Obtain permit, or permits, for erosion and sedimentation control prior to installing dewatering system, or systems.
  - c. Comply with requirements of permits for erosion and sedimentation control.
2. Stormwater Pollution Prevention Plan
- a. Prepare "Notice of Intent to Use Generic Permit for Stormwater Discharge from Construction Activities that Disturb Five or More Acres of Land". Submit application and pay fee for review and approval of Notice.
  - b. Obtain response to Notice prior to starting construction.
  - c. Comply with requirements of Stormwater Pollution Prevention Plan and Generic Permit for Stormwater Discharge from Construction Activities that Disturb Five or More Acres, including modifications, addenda, and additions by Federal, State, and County regulatory authorities having jurisdiction.

## PART 2 – PRODUCTS

### 2.01 MATERIALS FOR EROSION AND SEDIMENT CONTROL

#### A. Filter Fabric

- 1. Filter Fabric Material: Nylon, polyester, propylene or ethylene yarn with ultraviolet ray inhibitors and stabilizers conforming to Section 985 of the DOT Specifications.
- 2. Filter Fabric Flow: 0.3 gallons per foot per minute, minimum.

#### B. Sediment Fence Posts

- 1. Post Material: Pine
- 2. Post Diameter: four inches
- 3. Post Length: Four feet, minimum.

#### C. Spillway Section Stone: Class "B" erosion control stone.

#### D. Stone Installed on Inside Spillway Face for Drainage Control: No. 67 washed stone conforming to Section 901 of the DOT Specifications.

## PART 3 – EXECUTION

### 3.01 EROSION CONTROL PLAN

- A. Excavation method shall be selected by the Contractor, unless otherwise shown on the Drawings or required by local regulations
- B. Contractor shall be responsible for erosion and sedimentation control.
- C. Prepare and submit an Erosion Control Plan based upon the proposed excavation method.
- D. Erosion Control Plan shall be reviewed and accepted by the Engineer prior to commencement of any land disrupting activities. Erosion Control Plan shall be reviewed and accepted by State, local, or State and local authorities having jurisdiction over erosion and sedimentation control prior commencement of any land disrupting activities.
- E. Submit erosion and sedimentation control plan approved by State, local, or State and local authorities.

### 3.02 LOCATION

- A. The type of sedimentation and erosion control (SEC) devices to be employed on the project will depend on location and adjoining features of the land at that location.
- B. Construct SEC devices in accordance with approved Erosion Control Plan.

### 3.03 TEMPORARY SEDIMENT TRAP CONSTRUCTION

- A. Clear, grub and strip area under embankment of vegetation and root mat.
- B. Clear retention area to elevation as approved by Engineer.
- C. Use fill material free of roots, woody vegetation and organic matter. Place fill in lifts not to exceed nine inches. Machine compact fill.
- D. Construct dam and stone spillway to dimensions, slopes and elevations shown on approved permit, or approved permit drawings.
- E. Construct spillway crest level ( $\pm 0.05$  feet) and at least 18 inches below top of dam at all points.
- F. Extend stone outlet section to vegetated road ditch on zero grade with top elevation of stone level with bottom of drain.
- G. Construct top of dam six inches above natural surrounding ground, minimum.
- H. Stabilize embankment and disturbed area above sediment pools as shown in vegetation plan.

### 3.04 SEDIMENT FENCE CONSTRUCTION

- A. Locate sediment fence down-slope from source of sediment. Extend sediment fence around source of sediment so that all run-off from source of sediment flows through sediment fence.
- B. Set posts down-slope of fabric.
- C. Bury toe of fence approximately eight inches deep.
- D. When joints are necessary, securely fasten fabric at support post with overlap to next post.

### 3.05 SILTATION AND BANK EROSION

- A. Take adequate precautions to minimize siltation and bank erosion in crossing canals or ditches, in discharging well point systems, or during other construction activities.

END OF SECTION

## SECTION 31 31 16 - TERMITE CONTROL

### PART 1 - GENERAL

#### 1.1 RELATED DOCUMENTS

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

#### 1.2 SUMMARY

- A. This Section includes the following:
  - 1. Soil treatment with termiticide.

#### 1.3 PERFORMANCE REQUIREMENTS

- A. Service Life of Soil Treatment: Soil treatment by use of a termiticide that is effective for not less than five years against infestation of subterranean termites.

#### 1.4 SUBMITTALS

- A. Product Data: For termiticide.
  - 1. Include the EPA-Registered Label for termiticide products.
- B. Qualification Data: For Installer of termite control products.
- C. Warranty: Special warranty and Certificate of Compliance as specified in this Section.

#### 1.5 QUALITY ASSURANCE

- A. Installer Qualifications: A specialist who is licensed according to regulations of authorities having jurisdiction to apply termite control treatment and products in jurisdiction where Project is located.
- B. Regulatory Requirements: Formulate and apply termiticides according to the EPA-Registered Label.
- C. Source Limitations: Obtain termite control products through one source.

#### 1.6 PROJECT CONDITIONS

- A. Environmental Limitations: To ensure penetration, do not treat soil that is water saturated. Do not treat soil while precipitation is occurring. Comply with requirements of the EPA-Registered Label and requirements of authorities having jurisdiction.

## 1.7 COORDINATION

- A. Coordinate soil treatment application with excavating, filling, grading, and concreting operations. Treat soil under footings, grade beams, and ground-supported slabs before construction.

## 1.8 WARRANTY

- A. Special Warranty: Manufacturer's standard form, signed by Applicator and Contractor certifying that termite control work, consisting of applied soil termiticide treatment, will prevent infestation of subterranean termites. If subterranean termite activity or damage is discovered during warranty period, re-treat soil and repair or replace damage caused by termite infestation.

- 1. Warranty Period: Five years from date of Substantial Completion.

- B. Certificate of Compliance: A certificate of compliance shall be issued to the Monroe County Building Department by the licensed pest control company that contains the following statement: "The building has received a complete treatment for the prevention of subterranean termites. The treatment is in accordance with the rules and laws established by the Florida Department of Agriculture and Consumer Services."

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

- 1. Termiticides:

- a. Bayer Corporation; Premise 75.
    - b. Dow AgroSciences LLC; Dursban TC.
    - c. Syngenta; Demon TC.

### 2.2 SOIL TREATMENT

- A. Termiticide: Provide an EPA-registered termiticide complying with requirements of authorities having jurisdiction, in an aqueous solution formulated to prevent termite

infestation. Provide quantity required for application at the label volume and rate for the maximum termiticide concentration allowed for each specific use, according to product's EPA-Registered Label.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine substrates, areas, and conditions, with Applicator present, for compliance with requirements for moisture content of soil, interfaces with earthwork, slab and foundation work, landscaping, and other conditions affecting performance of termite control.
  - 1. Proceed with application only after unsatisfactory conditions have been corrected.

### 3.2 PREPARATION

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's written instructions for preparation before beginning application of termite control treatment. Remove all extraneous sources of wood cellulose and other edible materials such as wood debris, tree stumps and roots, stakes, formwork, and construction waste wood from soil within and around foundations.
- B. Soil Treatment Preparation: Remove foreign matter and impermeable soil materials that could decrease treatment effectiveness on areas to be treated. Loosen, rake, and level soil to be treated except previously compacted areas under slabs and footings. Termiticides may be applied before placing compacted fill under slabs if recommended in writing by termiticide manufacturer.
  - 1. Fit filling hose connected to water source at the site with a backflow preventer, complying with requirements of authorities having jurisdiction.

### 3.3 APPLICATION, GENERAL

- A. General: Comply with the most stringent requirements of authorities having jurisdiction and with manufacturer's EPA-Registered Label for products.

### 3.4 APPLYING SOIL TREATMENT

- A. Application: Mix soil treatment termiticide solution to a uniform consistency. Provide quantity required for application at the label volume and rate for the maximum specified concentration of termiticide, according to manufacturer's EPA-Registered Label, to the

following so that a continuous horizontal and vertical termiticidal barrier or treated zone is established around and under building construction. Distribute treatment evenly.

1. Slabs-on-Grade and Grade Beams: Under ground-supported slab construction, including footings, grade beams, building slabs, and attached slabs as an overall treatment. Treat soil materials before concrete footings and slabs are placed.
  2. Foundations: Adjacent soil including soil along the entire inside perimeter of foundation walls, along both sides of interior partition walls, around plumbing pipes and electric conduit penetrating the slab, and around interior column footers, augers, and grade beams; also along the entire outside perimeter, from grade to bottom of footing. Avoid soil washout around footings.
  3. Penetrations: At expansion joints, control joints, and areas where slabs will be penetrated.
- B. Avoid disturbance of treated soil after application. Keep off treated areas until completely dry.
- C. Protect termiticide solution, dispersed in treated soils and fills, from being diluted until ground-supported slabs are installed. Use waterproof barrier according to EPA-Registered Label instructions.
- D. Post warning signs in areas of application.
- E. Reapply soil treatment solution to areas disturbed by subsequent excavation, grading, landscaping, or other construction activities following application.

END OF SECTION

SECTION 314000  
TEMPORARY BRACING

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Documents:
  - 1. Drawings and general provisions of the Subcontract apply to this Section.
  - 2. Review these documents for coordination with additional requirements and information that apply to work under this Section.
- B. Section Includes:
  - 1. Design of bracing.
  - 2. Selection of construction sequence.
  - 3. Temporary bracing of the structure or portions of the structure as required to prevent the structure from becoming unsafe during construction.
  - 4. Construction and removal of posts, timbers, lagging, braces, etc. required in connection with bracing of the structure during construction.
- C. Related Sections:
  - 1. Division 03 Section "Cast-in-Place Concrete."

1.2 REFERENCES

- A. General:
  - 1. The following documents form part of the Specifications to the extent stated. Where differences exist between codes and standards, the one affording the greatest protection shall apply.
  - 2. Unless otherwise noted, the referenced standard edition is the current one at the time of commencement of the Work.
  - 3. Refer to Division 01 Section "General Requirements" for the list of applicable regulatory requirements.

1.3 DESIGN REQUIREMENTS

- A. General: The stability and integrity of the structure during construction shall be maintained at levels generally acceptable within the construction industry by the use of temporary bracing. In no case shall the structure be allowed to become unsafe during construction as defined by the local governing jurisdiction. Design stresses in temporary bracing shall not exceed the allowable stresses of the materials. Temporary bracing shall be designed and constructed such that sufficient clearances are provided to permit all required construction activities to proceed unhindered.
- B. Temporary Bracing for Structures:
  - 1. The bracing systems required to provide temporary support of a structure or portions of a structure during construction shall be designed to support the dead, live, soil, earthquake and wind loads that may be imposed on the structure during construction in accordance with industry standards and generally accepted engineering principles.

2. The temporary bracing system shall be designed and constructed based on actual elevations and bracing dimensions in accordance with the contract and accepted submittals.
3. Temporary bracing shall be installed at the second floor and roof levels and shall be spaced at a maximum of 12'-0" on center.
4. The proposed bracing systems shall have foundations designed for allowable soil bearing pressures in accordance with the geotechnical investigation prepared for the Project. Foundations shall be concrete dead men embedded into the cap rock.

C. Temporary Bracing Design Criteria:

1. The temporary bracing shall be designed for a minimum ultimate design wind speed (3 second gust),  $V_{ult} = 130$  mph.

#### 1.4 SUBMITTALS

- A. Submit under provisions of Division 01 Section "General Requirements."
- B. Shop Drawings indicating layout, member sizes, connection details, and construction sequence for temporary bracing. No work related to bracing shall take place until the Engineer has reviewed the Shop Drawings.
- C. Design calculations of temporary bracing showing member stresses and connections due to imposed loads.

#### 1.5 QUALITY ASSURANCE

- A. Design calculations and Shop Drawings of proposed temporary bracing of the structure shall be prepared, stamped, and signed by a Structural Engineer registered in the State of Florida.

### PART 2 - PRODUCTS

#### 2.1 MATERIALS FOR TEMPORARY BRACING

- A. Materials for temporary bracing shall be undamaged, high quality materials.
- B. The Contractor shall be responsible for the supply, safe storage, and handling of all materials associated with this work.

### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION

- A. Construction of temporary bracing shall be in accordance with the reviewed Shop Drawings prepared by the Subcontractor's Engineer.
- B. The Subcontractor shall hire the Engineer responsible for the design of temporary bracing and inspection of the work as detailed on the bracing Shop Drawings, prior to sawcutting or removing portions of the structure.
- C. The Engineer responsible for design of temporary bracing shall write a letter to the Engineer certifying that construction of bracing was completed in accordance with the bracing Shop Drawings and meets its approval, prior to placement of concrete, sawcutting, and removal or modification of portions of the structure.

### 3.2 REMOVAL OF TEMPORARY BRACING

- A. Bracing shall not be removed until the entire integrated supporting structure, including floor and roof framing and composite concrete deck, has been completed and permanent connections to the walls are secure. In no case may bracing be removed until the time and sequence has been approved by the Engineer responsible for bracing and reviewed by the Engineer of Record.
- B. Care shall be taken not to damage any portion of the permanent work. Damage to the permanent work during installation or removal of the temporary work shall be repaired by the Contractor at his own cost to the satisfaction of the Engineer.

END OF TEMPORARY BRACING

## SECTION 32 12 16 ASPHALT PAVING

### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. Section Includes: This section covers the work necessary for the construction of the Asphalt / Pavement.

1. Type SP- 9.5..... 9.5 mm

#### 1.02 REFERENCES; FDOT LOCAL AGENCY SPECIFICATIONS (LAP) AND STANDARD SPECIFICATIONS / LOCAL AGENCY SPECIFICATIONS

- A. The term "Standard Specifications" is used; such reference shall mean the most current edition of Florida Department of Transportation Standard Specification for Road and Bridge Construction and LAP Specifications. The Standard Specifications shall be considered as part of this section of the Specifications; below are Listed references for the contractor's convenience; the contractor shall be responsible for obtaining and incorporation in the contract all of the Standard Specification's and the most current revisions that apply to this contract scope of work. The contractor shall document in his daily reports the required Standard Specifications that are used.

B. Reference(s):

1. SECTION 334 HOT MIX ASPHALT FOR LOCAL AGENCIES
2. SECTION 120 EARTHWORK AND RELATED OPERATIONS FOR LOCAL AGENCIES
3. SECTION 710 PAINTED PAVEMENT MARKINGS
4. SECTION 711 THERMOPLASTIC TRAFFIC STRIPES AND MARKINGS
5. 911 LIMEROCK MATERIAL FOR BASE AND STABILIZED BASE
6. SECTION 971 TRAFFIC MARKING MATERIALS

- C. Any reference of the "FDOT", "Agency" "Engineer" "Local Agency" in the LAP SPECS, and "Standard Specifications" shall be considered to be the Owner (City of Key West) for this contract. LAP SPECS are available at:

<http://www.dot.state.fl.us/specificationsoffice/Implemented/LAP/LapSpecs/Default.shtm>

#### 1.03 DEFINITIONS

- A. The phrase "FDOT Specifications" shall refer to the Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

#### 1.04 SYSTEM DESCRIPTION

- A. Furnish and install asphaltic concrete pavement as shown on the Drawings and specified in this Section. Furnish and install asphaltic concrete pavement in accordance with the lines, grades and typical section as indicated on the Drawings.
- B. Furnish and install new asphaltic concrete pavement required to complete the paving work.
- C. Furnish and install asphaltic concrete topping as indicated on the Drawings.
- D. Repair asphaltic concrete pavement damaged as a result of completing Work and damaged by construction operations.

#### 1.05 LEED SUBMITTALS

##### 1. General:

- A. Collect and submit data as required for completing Section 013516.05 LEED New Product Source Form and the applicable LEED On-line credit forms and supporting documentation.
- 2. Product Data for Credit MR 5.1 and Credit MR5.2: For building materials and products that are extracted, harvested or recovered, as well as manufactured, within 500 miles of the project site, submit documentation required to complete the regional materials calculation table in the LEED Submittal Template, including but not limited to: product name for each such material; material manufacturer; total product cost certification for each such material; percentage of product (by weight) that meets both the extraction and manufacture criteria; distance between the project site and the extraction/harvest/recovery site; distance between the project site and the final manufacturing location.
  - 3. Cost certification shall include the actual material cost plus all expenses incurred to deliver the material to the project site, including taxes and delivery costs incurred by the subcontractor and general contractor. Excludes labor and equipment costs once the material is delivered to the site.

#### 1.06 SUBMITTALS

##### A. General: As specified in:

- 1. Division 1;
- 2. This Section

##### B. Submit proposed formula for asphaltic concrete paving prior to starting pavement work.

#### 1.07 QUALITY ASSURANCE

- A. FDOT Specifications referred to in this Section are made a part of this Contract to the extent of such references, and shall be as binding upon the Contract as through reproduced herein in their entirety.

#### 1.08 DELIVERY, STORAGE, AND HANDLING

- A. General
  - 1. Product Delivery: As specified in Section 01650 Product Delivery Requirements.
  - 2. Product Storage and Handling: As specified in Section 01660 Product Storage and Handling.
- B. Asphaltic Concrete Pavement Materials: Delivery, storage, and handling of asphaltic concrete pavement materials shall meet the requirements of FDOT LAP / Specifications.

#### 1.09 PROJECT/SITE CONDITIONS

- A. Environmental Requirements
  - 1. Do not place base, prime coat, tack coat, or asphaltic concrete when rain is falling or when there is water on the surface to be covered.
  - 2. Monitor climatic conditions and anticipate conditions producing rainfall.
  - 3. Remove and replace materials damaged by rainfall or standing water.

### PART 2 – PRODUCTS

#### 2.01 MATERIALS

- A. Lime Rock Base: Lime Rock base shall be in accordance with Section 911 of the FDOT Specifications.
- B. Soil-Cement Base: Soil Cement base shall be in accordance with Section 270 of the FDOT Specifications.
- C. Prime Coat: Material used for prime coat shall be cut-back Asphalt Grade RC-70 conforming to Sections 300 and 916 of the FDOT Specifications for prime to be used on Miami Oolite formation lime rock.
- D. Tack Coat: Material used for tack coat shall be Emulsified Asphalt Grade RS-2 conforming to Sections 300 and 916 of the FDOT Specifications. All areas to be paved shall receive a final tack coat that provides a uniform finish for new and existing paving.
- E. Asphaltic Concrete: Materials and construction of asphaltic concrete patch and surface courses shall be Type SP-9.5

### PART 3 – EXECUTION

#### 3.01 INSTALLATION

A. Subgrade

1. Stabilize roadway subgrades to the minimum depth shown on the Drawings to a Limerock Bearing Ratio of not less than 40. Stabilizing shall be Type B as defined in Section 160 of the FDOT Specifications. Stabilization may require addition and thorough mixing in of crushed limerock, course limerock screenings, or any other stabilizing material acceptable to the Engineer. Apply stabilizing material in such quantity that, after mixing and blending, the subgrade will have a LBR of not less than 40. Mix, blend, or mix and blend stabilizing material into subgrade material by plowing, scarifying, disking, harrowing, blading and mixing with rotary tillers until mixed materials are of uniform bearing value throughout width and depth of layer being processed.
2. Make not less than three density determinations on each day's final compaction operations on each course. Make density determinations at more frequent intervals if deemed necessary by the Engineer.

B. Base

1. Construct Base in accordance with Section 230 of the FDOT Specifications, to the thickness and width indicated on the Drawings.
2. After spreading of the base material is completed, scarify entire surface and shape surface to produce the exact grade and cross section after compaction. For double course base, extend scarifying to a depth sufficient to penetrate slightly the surface of the first course. The maximum depth of each lift shall be 8 inches.
3. When the material does not have the proper moisture content to insure the required density, wetting or drying shall be required.
  - a. If the material is deficient in moisture, add and uniformly mix in water by disking the base course to the full depth of the base course.
  - b. If the material contains an excess of moisture, allow the material to dry to proper moisture content before compacting material.
4. As soon as proper conditions of moisture are attained, compact material to an average density not less than 98 percent maximum density as determined in more than one course, the density shall be obtained in each lift of the base.
5. During final compacting operations, if blading of any areas is necessary to obtain true grade and cross section, complete compacting operations for such areas prior to making density determination on finished base.
6. Unless otherwise directed by the Engineer, "hard-plane" the surface with a blade grader immediately prior to the application of the prime coat to remove the thin glaze or cemented surface and to allow free penetration of the prime material. Materials planed from the base shall be removed from base area.

7. If cracks or checks appear in the base, either before or after priming, which in the opinion of the Engineer, would impair the structural efficiency of the base course, remove such cracks or checks by rescarifying, reshaping, adding base material where necessary and recompacting, at no additional cost to the Owner.
  8. If at any time the subgrade material shall become mixed with the base course material, dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean base material. Shape and compact clean base material as specified in this Article. Remove, replace, shape, and compact material at no additional cost to the Owner.
- C. Prime Coat: Apply prime coat at a rate of 0.15 gallons per square yard, and perform the Work in accordance with Section 300 of the FDOT Specifications.
  - D. Tack Coat: Apply tack coat at a rate between 0.02 and 0.10 gallons per square yard, and perform the Work in accordance with Section 300 of the FDOT Specifications.
  - E. Asphaltic Concrete: Spreading, compact, and joint the wearing surface in accordance with Sections 330, 332, 333 of the FDOT Specifications to the thickness indicated on the Drawings.

### 3.02 PAVEMENT REPAIR

- A. Repair damage to pavement as a result of Work under this Contract. Repair damage to pavement in a manner satisfactory to the Engineer and at no additional cost to the Owner. Pavement repair shall include preparation of the subgrade, placing and compacting of the limerock base, priming of the base, and placing and maintaining of surface treatment, as specified in this Section.
- B. Width of repairs shall extend at least 12 inches beyond the limit of damage. Edge of pavement to be left in place shall be cut to a true edge with a saw or other acceptable method that provides a clean edge to abut repair. Line of the repair shall be reasonably uniform with no unnecessary irregularities.

END OF SECTION

## SECTION 32 1313 - CONCRETE PAVING

### PART 1 - GENERAL

#### 1.1 SCOPE OF WORK

- A. The work covered in this Section consists of all gray concrete walks, terraces, plazas, and related items necessary to complete the work indicated on Drawings and described in Specifications.

#### 1.2 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete pavement mixture. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.
- C. Samples: 10-lb. sample of exposed aggregate. Information from aggregate supplier indicating source, type, color and gradation of aggregate shall accompany sample.

#### 1.3 QUALITY ASSURANCE

- A. Installer Qualifications: Experienced installer who has completed pavement work similar in material, design and extent to that indicated for Project and whose work has resulted in construction with a record of successful in-service performance.
- B. Manufacturer Qualifications:
  - 1. Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
  - 2. Manufacturer certified in according to the National Ready Mix Concrete Association's Plant Certification Program.
- C. Testing Agency Qualifications: An independent testing agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 to conduct the testing indicated as documented according to ASTM E 458.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant and each aggregate from one source.
- E. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete", unless modified by requirements in the Contract Documents.
- F. Mock-ups: Cast mock-ups of full-size sections of concrete pavement to demonstrate typical joints, surface finish, texture, color and standard of workmanship.

1. Build a 4' X 4' mockup on site. If location no indicated, as directed by Owner's representative.
2. Notify Owner's representative seven days in advance of dates and times when mock-ups will be constructed.
3. Obtain approval from Owner's representative before starting mockup construction.
4. Maintain approved mockups during construction in an undisturbed condition as a standard for judging the completed pavement.
5. Demolish and remove approved mockups from the site when directed by Owner's representative.

G. Pre-installation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section, "Project Meetings".

## PART 2 - MATERIALS

### 2.1 CONCRETE

- A. Concrete, and the equipment, workmanship and materials therefore, shall conform to applicable requirements of the concrete sections, except as hereinafter specified. Concrete shall be standard-weight, with minimum compressive strength of 3000 PSI at 28 days. Concrete shall have a slump of not more than 3 inches.

### 2.2 FORMS

- A. Forms shall be of wood or steel, straight, of sufficient strength to resist springing during depositing and consolidating concrete, and of a height equal to the full depth of the finished paving. Wood forms shall be surface plank, 3/4" nominal thickness.
  1. Use flexible or curved forms for curves of a radius 100 feet or less.
- B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and will not impair subsequent treatments of concrete surfaces.

### 2.3 EXPANSION JOINTS

- A. Expansion joint filler material shall be asphalt-impregnated fiber strips 1/2" thick, unless otherwise shown on drawings, equal to Celotex 'Flexcell' or Removable Expansion Board Cap.

### 2.4 ROCK SALT (If indicated)

- A. Shall be Morton's coarse grade or equal, graded for aggregated uniformity between 1/4"-3/8".

### 2.5 CONCRETE REINFORCEMENT

- A. Unless otherwise indicated, all paving shall be reinforced with 6" X 6" W1.4 X W1.4 welded wire mesh reinforcing. Lap all joints 6" and extend to within 2" of sides and ends of slabs.
- B. Unless otherwise indicated, all bands shall be reinforced with #4 steel reinforcing bars. Bars shall be continuous throughout length of all bands and shall be placed no closer than 3" from any surface. Cut bars true to length with ends square and free of burrs.
- C. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, or precast concrete or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:
  - 1. 1/2 inch steel bars 15 inch center.

## 2.6 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source throughout the Project:
  - 1. Concrete for exposed aggregate paving shall be Portland Cement ASTM C150, Type I, Gray as required to match color of concrete used on standard sidewalks.
- B. Exposed Aggregate: Exposed hard, sound, durable, and free of all deleterious materials and staining qualities. Provide aggregates from a single source.
  - 1. Store select seeding aggregates off the ground and protected from moisture.
  - 2. Aggregate Size & Color:
    - a. Brown River Rock: 3MM Min. - 5 MM Max.
    - b. Oyster Shell: 7MM Min. - 12 MM Max.
    - c. Coquina: 5MM Min.
  - 3. Water: Potable.

## PART 3 - INSTALLATION

### 3.1 SUBGRADE PREPARATION

- A. Subgrade shall be constructed true to grade and cross section as shown on Drawings. It shall be thoroughly watered and rolled or hand-tamped until firm before placing concrete. Completed subgrade shall be tested for grade and cross section with a template extending full depth of walk and supported between side forms. Subgrade and forms shall be thoroughly watered in advance of placing concrete.

### 3.2 FORMS

- A. Forms shall be set with upper edge true to line and grade and shall be held rigidly in place by stakes placed at intervals not to exceed 4'0". Wood forms may be thoroughly wetted with water before concrete is placed.
- B. Side forms shall not be removed for less than twelve hours after finishing has been completed.

### 3.3 EXPANSION JOINTS

- A. Dividers shall be placed flush with the surface and shall be held in place with steel pins or other devices to prevent warping of filler during floating and finishing. Immediately after finishing operations are completed, joint edges shall be rounded with an edging tool having a radius of 1/8". Expansion filler joints shall be formed about structures and features that project through or into the walk pavement, and at abutting buildings, using joint filler of type, thickness and width indicated. Filler shall be installed in such manner as to form a complete, uniform separation between structure and walk. At the end of the curing period, expansion joints shall be carefully cleaned and any material protruding above top of pavement shall be cut flush with pavement.

### 3.4 CONCRETE PLACEMENT AND FINISHING

#### A. Concrete Placement:

1. Place concrete in forms in one layer to thickness indicated. Use a strike-off guided by side forms to bring surface to proper section. Tamp and consolidate concrete with tamping bars, finish with wood and apply a smooth trowel finish across width of concrete paving using a trowel. The finished surface shall not vary more than 3/16" in 10'0". Provide control joints as indicated in plans and details. Form control joints in fresh concrete by cutting a groove in top surface to a depth of one-fourth the thickness of the concrete using a jointer with a radius of 1/8" and cutting blade not more than 1/8" thick. Unless otherwise indicated, all joints should always be perpendicular to the edge of paving. Surface shall be free of surface blemishes and tool marks.

#### C. Finishing (as indicated on drawings):

1. Broom Finish: Tamp and consolidate concrete with tamping bars, finish with wood and apply a light broom finish across width of paving. The finished surface shall not vary more than 3/16" in 10'0". Surface shall be uniform in color, and free of surface blemishes and tool marks.
2. Rock Salt Finish: As concrete has begun to set, rock salt shall be uniformly broadcast over the concrete to pit the surface. The pitting should be spaced at 3/4" uniformly over the surface and tapped in with a trowel flush to the finish grade of the concrete surface. The rock salt should be removed in no less than 12 hours with water.
3. Seeded Exposed Aggregate Finish: Immediately after floating, broadcast a single layer of aggregate uniformly onto the pavement surface. Tamp seeded aggregate

into plastic concrete, and float to entirely embed aggregate with mortar cover of 1/16 inch.

- a. Prior to the concrete placing operation, all select seeding aggregate shall be thoroughly washed so that it is free of all dust, dirt, and clay particles. The aggregate shall be in a damp condition but without free surface water at the time of seeding application. There shall be sufficient select aggregate on hand to complete the seeding once it has commenced.
- b. The seeding operation shall start immediately after the placement of concrete as described above. The select aggregate shall be carefully and uniformly seeded by suitable means so that the entire surface is completely covered with one layer of stone. Stacked stones and flat and slivery particles shall be removed at this time. The aggregate shall be embedded by suitable means. Care shall be taken to not over-embed and deform the surface. Under no circumstances shall areas lacking sufficient mortar be filled with small quantities of the base concrete mix.
- c. Without dislodging aggregate, remove excess mortar by lightly brushing surface with a stiff, nylon bristle broom.
- d. Fine-spray surface with water and brush. Repeat water flushing and brushing cycle until cement film is removed from aggregate surfaces to depth required.
- e. Work shall be planned so that the concrete placing and aggregate seeding procedures are coordinated with the capabilities of the washing and brushing crew.

#### 4. Sand-blast Finish:

- a. Blasting Operations & Requirements:
  - 1) Apply sandblasted finish to exposed concrete surfaces where indicated on drawings.
  - 2) Perform sand blasting at least 72 hours after placement of concrete. Coordinate with formwork construction, concrete placement schedule, and formwork removal to ensure that surfaces to be blast finished are blasted at the same age for uniform results.
  - 3) Abrasive blast corners and edge of patterns carefully, using back-up boards, to maintain uniform corner or edge line.
- b. Depths of Cut:
  - 1) Brush Sand Blast Finish: Remove cement matrix to expose face of fine aggregate; no reveal.
  - 2) Light Sand Blast Finish: Expose fine aggregate with occasional exposure of coarse aggregate; maximum 1/16 inch reveal.
  - 3) Medium Sand Blast Finish: Generally expose coarse aggregate; 3/16 inch to 1/4 inch reveal.

- c. Surface Continuity: Perform sand blast finishing in as continuous an operation as possible, utilizing the same work crew to maintain continuity of finish on each surface or area of work. Maintain patterns of variances in depths of cuts as indicated.

### 3.5 CURING AND PROTECTION

A. Curing: Immediately after finishing operations, the exposed concrete surfaces shall be cured in accordance with applicable requirements of concrete.

B. Protection:

1. After curing, debris shall be removed, and the area adjoining the paving shall be backfilled, graded and compacted to conform to the surrounding area in accordance with lines and grades indicated. Completed paving shall be protected from damage until accepted. Any damaged concrete or concrete that does not drain properly shall be removed and reconstructed at no additional cost to the Owner.
2. Protect adjacent materials and finishes from dust, dirt, and other surface or physical damage during abrasive blast finishing operations. Provide protection as required and remove from site at completion of work. Repair or replace other work damaged by finishing operations.

END OF SECTION 32 1313

## SECTION 32 17 23 PAVEMENT MARKINGS

### PART 1 - GENERAL

#### 1.01 SCOPE

- A. This section specifies the pavement traffic painting, marking, striping, and signing shown on the plans or called for in the test of the specifications.

#### 1.02 GENERAL

- A. In general, all pavement traffic painting, marking, striping, and signing shall comply with the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, 1991, latest revision, hereafter referenced "FDOTSPEC" and the Manual of Uniform Traffic Control Devices, U.S. Department of Transportation Federal Highway Administration, 1971 or latest revision, hereafter referenced as "MUTCD."

#### 1.03 SIGN PANELS AND POSTS

- A. Sign panels shall be aluminum. All sign posts shall be frangible aluminum and shall have a standard extruded aluminum sign bracket clamped to the post 12 inches below grade. Bracket size shall match post diameter.

#### 1.04 SIGN BLANKS AND FACES

- A. Regulatory and Warning signs as defined in the MUTCD shall be "High Intensity" reflectorized grade.
- B. Street Name and Guide signs as defined in the MUTCD shall be "Standard reflectorized grade."
- C. The Contractor shall submit documentation from the sign supplier which identifies the reflector grade of each sign. All materials shall meet the requirements of FDOTSPEC.

#### 1.05 SIGN HARDWARE

- A. The signs shall be attached to the posts with vandal-resistant nuts and carriage bolts with washers. Vandal-resistant nuts shall be Tufnut, Tamper-Pruf, Vandal-Pruf, or approved equal. The nuts and bolts shall be manufactured from high strength aluminum. Button head bolts shall not be used.

## 1.06 PAVEMENT STRIPING AND PAINTING

- A. Temporary Painting Traffic Stripes. Temporary Painted pavement striping shall conform to FDOTSPEC, Section 710. (For use on-site)
- B. Final Thermoplastic Striping & Marking. Final Thermoplastic pavement striping shall be reflective and shall conform to FDOTSPEC, Section 711. (For use within the rights-of-way)

## 1.07 REFLECTIVE PAVEMENT MARKERS

- A. Reflective pavement markers and their installation shall conform to FDOTSPEC, Section 706.

## 1.08 BASIS OF PAYMENT

- A. Payment for pavement marking, striping, and signing shall be on a unit price basis in accordance with the accepted proposal. Such payment shall constitute full compensation for furnishing all labor, materials, and equipment necessary to complete the construction in accordance with the plans and specifications. The Owner reserves the right to add to or deduct from the scope of the work, and such additions or deductions will be made at the unit price established in the proposal. The said additions or deductions shall not exceed twenty-five percent (25%) of the base bid of the successful bidder or bidders unless otherwise noted.

## PART 2 – PRODUCTS

## PART 3 - EXECUTION

END OF SECTION

SECTION 32 8400  
IRRIGATION

PART 1 - GENERAL

1.01 SCOPE OF WORK

- A. This Section shall govern the furnishing of all labor, materials, and equipment for a complete operating system for lawn irrigation as specified herein and shown on the applicable drawings.

1.02 SUBMITTALS

- A. Material List: Submit a clearly legible list of all materials and equipment for irrigation system. To Landscape Architect/Owner for approval prior to beginning construction.
- B. Maintenance Items: Provide the following:
  - 1. Two sets of sprinkler wrenches for adjusting, cleaning or dis-assembling each type of sprinkler.
  - 2. Two service manuals for all equipment installed. Manuals shall be loose leaf and show drawings or exploded views of equipment and catalog numbers and current prices.
  - 3. Operating instructions for all equipment installed.
- C. Project Record Documents: Correct daily to indicate changes from Contract Documents.
  - 1. Horizontally at 90 degree angles, dimension the location of the following items from two permanent points of reference, i.e. curb junctures, light standards, building corners, survey hub points, or coordinates with a tolerance of 12 inch maximum.
    - Sprinkler main lines routing.
    - Connections to the existing water supply lines.
    - Sprinkler control valves.
    - Gate valves.
    - Electrical control wire path diagrammatically.
  - 2. Vertical dimensions shall be given for mains when site conditions require installation deeper than 24 inches.

1.03 PRODUCT HANDLING

- A. Exercise care in handling, loading, unloading and storing irrigation system materials to avoid damage. Store under cover.

1.04 PROJECT CONDITIONS

- A. The Contractor shall make all temporary repairs as necessary to keep installed/existing portions of the irrigation system in operating condition. This exercise shall not affect the requirements to be performed under the Contract Documents.
- B. Coordinate work with that of other trades, all underground improvements, the location and planting of specimen trees and all other planting. Location of all planting requiring excavations 24 inch in diameter and larger shall be verified with Owner prior to installation of mainlines.

#### 1.05 INSPECTION

- A. Verify dimensions and grades at Job Site.
- B. Contractor shall make themselves completely familiar with all site conditions, including all underground utilities.

#### PART 2 - MATERIALS

- A. Plastic pipe: Extruded from 100% American made Virgin Polyvinyl Chloride (PVC).
  - 1. Plastic pipe (mainline) installed on pressure side of valves: (PVC) ASTM D2241 Class 200.
  - 2. Plastic pipe installed on non-pressure side of valves: (PVC) ASTM D2241 Class 200.
- B. Plastic Fittings: (PVC) 1120 ASTM D1785, Type 2, IPS, Schedule 40, NSF.
- C. Solvent & Cleaner: As recommended by pipe manufacturer.
- D. Automatic Controller: Refer to Drawings.
- E. Sprinkler Heads: Refer to Drawings.
- F. Wire: Copper, UL approved direct burial wire. Minimum of 14 gauge or as specified on the drawings.
- G. Remote Control Valve Boxes: Ametek 12"x18" Rectangular with green locking lids. Box lids shall be marked "R.C.V."
  - 1. Valve boxes for gate valves 3" and smaller: Ametek 10" round with locking lid, extensions as needed.
  - 2. Gate valve box lids shall be permanently marked "Irri. Gate" or "Water".
- H. Conduit for Control Wires: (PVC) ASTM D1785, Schedule 40 in locations as indicated or anywhere the control wires can not be placed under the main.
- I. Miscellaneous Materials: As hereinafter specified and as necessary to complete this work and as shown on Drawings.

J. Drip Tubing: Refer to the plan for specifications and details.

## PART 3 - EXECUTION

### 3.01 EXCAVATION AND BACKFILLING

#### A. Trenching - General:

1. Dig trenches straight.
2. Provide continuous support of the pipe by the bottom of trench. Lay pipe to even grade. Bottom of trench shall be free from rocks or other sharp edge objects.
3. Trenching shall follow layout indicated.
4. Minimum cover:           Pressure Lines: 18 inches  
                                  Non-pressure Lines: 12 inches  
                                  Control wires: 18 inches
5. All lines shall have a 6" minimum clearance from each other and from lines of other crafts. Do not install lines directly over another line.
6. Maintain 1" minimum between lines which cross at angles of 45 degrees to 90 degrees.
7. Exercise care in excavating, trenching and working near existing utilities.

#### B. Backfilling:

1. Compact to dry density equal to adjacent undisturbed soils.
2. Conform to adjacent grades without dips, sunken areas, humps or other irregularities.
3. Initial backfill on plastic lines shall be pulverized native soil no larger than 2" in diameter and free of foreign matter.
4. Restore grades and repair damage where settling occurs.

#### C. Routing of Piping:

1. Pressure and non-pressure piping lines are routed diagrammatically on Drawings.
2. Coordinate specimen trees and shrubs with routing of lines. Planting shall take precedence over sprinkler and piping location. Report any major deviation from routing indicated to Landscape Architect or Owner.
3. Install lines in such manner as to conform with Drawings without offsetting the various assemblies from the pressure supply line.

### 3.02 INSTALLATION

A. Water Supply: Provide and connect to water sources indicated.

B. Cathodic Protection: Provide in the piping systems where required by installing insulating couplings, flanges or unions between copper or brass pipe or tubing and steel or cast iron pipe.

C. Plastic Pipe: Install plastic pipe in accord with manufacturer's recommendations. Install sprinkler head on plastic pipe as indicated.

1. All welded joints shall be cleaned with manufacturer's cleaner prior to applying solvent.
    - a. Welded joints shall be given at least 15 minutes set-up curing time before moving or handling.
    - b. Pipe shall be partially center loaded to prevent arching and shifting under pressure.
    - c. No water shall be permitted in pipe until a period of at least four hours has elapsed for solvent weld setting or curing, or as required by solvent manufacturer.
  2. Backfilling shall be done when pipe is not in expanded condition due to heat.
    - a. Cooling of pipe can be accomplished by operating the system for a short time before backfill, or by backfilling in the early part of the morning before the heat of the day.
  3. Curing: When the temperature is above 80°F., soluble weld joints shall be given at least 24 hours curing time before water is introduced under pressure.
- D. Automatic Controller:
1. Install controller in accord with the Drawings and the manufacturer's instructions, and place readily accessible. Install electrical wiring in accord with applicable code.
  2. An operating diagram or schedule clearly indicating the sequence of operation shall be posted in the controller to facilitate the selection of the valve to be operated and setting of controller. The contractor shall be responsible to set the run times on the controller.
  3. A rain sensor shall be installed on each controller. Refer to the legend and controller detail on installation.
- E. Remote Control Valves:
1. Install at sufficient depth to provide not more than 6" nor less than 4" cover from the top of the valve to finish grade. Provide clearance for PRS-B device as needed.
  2. Install valves in a plumb position with 24" minimum clearance from other equipment for proper maintenance.
  3. All valves shall be installed in 11' x 17" sized valve boxes with cover.
- F. Wire Connections: All underground wire connections to electric remote control valves shall be made by using 3M dbry connectors.
- G. Gate Valves:
1. Line size and install where indicated and sufficient clearance from other materials for proper maintenance.
  2. Equip valves, sizes 3" and smaller, with standard hand operating wheel for operation. Valve bonnet packing shall be checked and tightened before backfill. All valves shall be 150 psi rated.
  3. All valves shall be installed in appropriate sized valve boxes with cover.
  4. Gate Valves shall be manufactured in the USA of American made materials.
- H. Sprinkler Heads:
1. Install in a plumb position at intervals not to exceed the maximum spacing indicated.

2. Heads in lawn or turf areas where grass has not been established shall be installed on temporary risers extending at least 2" above grades.
3. Where heads are installed along walks, roads, etc., they shall be permanently positioned.

I. Flushing of System:

1. Flush main and lateral systems to clean out all debris and sediment prior to installation of heads.
2. This does not relieve requirements of future adjustments of system or re-flushing system.
3. Any zone requiring repair from broken lateral lines shall be flushed prior to being returned to service.

### 3.03 ELECTRICAL

- A. Connect controller to the 120 volt power source per manufacturer recommendations. Be responsible for making electrical connections to the automatic controller and wire circuits from remote control valves to controllers. All wiring shall be in accord with applicable codes.
- B. Plan ahead to minimize control wire splices. All wire splices must occur within splice boxes (Ametek 10" round box with green locking lid), using wire connectors as specified in Section 3.02 F above.
- C. Provide for an earth ground per manufactures recommendations, but not more than 10ohms to ground.

### 3.04 PRESSURE TEST

- A. Test all pressure lines under hydrostatic pressure of 155 lbs. per square inch and all non-pressure lines shall be tested under the existing static pressure and both be proven watertight.
- B. Connect a calibrated pressure gauge to mainline. Pressure shall be sustained in the lines for not less than two hours. Should mainline lose pressure, the leak shall be found and repaired, or joints shall be replaced and the test repeated until the entire system is proven watertight.
- C. Perform tests prior to backfill.

### 3.05 LOWERING OF HEADS

- A. All sprinklers installed in lawn areas unless otherwise noted shall be set to finish grade within ten days following notification by the Owner.
- B. At the time of lowering heads, completely check and adjust the entire system and make any repairs that are necessary to complete this work.

### 3.06 ADJUST AND CLEAN

- A. Installations and Operations: Make such adjustments and repairs as requested as necessary for acceptance at no additional cost to the Owner. Field conditions may require minor adjustments to design to achieve 100% coverage.

### 3.07 COMPLETION AND ACCEPTANCE

- A. Completion of work shall mean the full and exact compliance and conformity with provisions expressed or implied in the drawings and specifications.
- B. All work under this contract shall not be finally accepted until expiration of the guarantee period.
- C. The Irrigation Contractor shall demonstrate and fully acquaint the Owner and/or Owner's Representative with the entire system, proving that all remote control valves are properly balanced, that all heads are properly adjusted for radius and arc of coverage, and that the system is workable, clean, and efficient. This shall be a requirement for acceptance of the work.
- D. Contractor shall upon request for final payment, give Owner three sets of bond copies of as-built irrigation system with all valves, tees and heads indicated as installed.
- E. Irrigation Contractor shall provide a letter (on his letterhead) to the Owner, stating that there are no outstanding liens against the property that may have resulted from any aspect of his work. This includes, but is not limited to, construction liens, material liens, or labor liens.

### 3.08 GUARANTEE AND REPLACEMENT

- A. The Irrigation 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 original manufacturer's warranties. Irrigation Contractor shall further see to the fulfillment of all manufacturers' warranties. Irrigation Contractor shall warrant the installation workmanship for a period of one (1) year from date of completion or acceptance of the job, or any accepted portion of the job.
- B. Should the Irrigation Contractor be notified that work or replacements are warranted under these conditions, he shall provide the required service and/or replacements promptly within two (2) days.

END OF SECTION

SECTION 32 9300  
LANDSCAPE

PART 1- GENERAL

1.1 SCOPE OF WORK

- A. This section covers furnishing and installing all landscape plants and non-plant materials covered by the drawings and these specifications. The work shall include materials, labor, equipment and services as described herein and indicated on the drawings. Also, the work shall include the maintenance of all plants and planting areas until acceptance by the Owner, and the fulfillment of all guarantee provisions as herein specified.

1.2 PLANTING LAYOUT

- A. Before beginning work, the Contractor shall investigate and verify, in the field, the existence and location of all underground utilities and irrigation piping, and take precautions to prevent their disturbance. It shall be the responsibility of the Contractor to obtain all such information as it is made available. Plans and specifications of related work may be obtained from the Owner.
- B. The Contractor shall locate all general reference points; take precautions to prevent their disturbance; perform the layout work; be responsible for all lines, elevations and measurements of work executed under the contract; exercise proper precaution to verify figures on drawings before laying out work; and be responsible for any error resulting from failure to exercise such precaution. The Contractor shall make field measurements for his own work and be responsible for its accuracy.
- C. Discrepancies between conditions existing on the site and conditions indicated on the drawings shall be called to the attention of the Owner before or at the time plant locations are staked out.
- D. In the event of a variation between the plant list and the actual number of plants shown on the plans, the plans shall control.

1.3 HORTICULTURAL STANDARDS

- A. Unless otherwise noted, plant material, including collected materials, shall be grade FLORIDA NO. 1 or better as outlined under Grades and Standards for Nursery Plants, Parts I and II, State Plant Board of Florida; and shall also conform to American Standard for Nursery Stock, ANSI (American National Standards Institute, Inc.) Z60.1-2004 as approved by the American Association of Nurserymen.
- B. All plant names shall conform to the names given in Standardized Plant Names, 1942 Edition, prepared by the American Joint Committee on Horticultural Nomenclature. Names of varieties not included therein shall conform generally with names accepted in the nursery trade. All plant materials shall be true to botanical, common and variety name. Botanical name shall have precedence over common name.

- C. The Landscape Architect shall have the right, at any stage of the operations, to reject any and all work and materials that, in his opinion, do not meet with the requirements of these Specifications. Such rejected material shall be removed from the site and acceptable material substituted in its place.

#### 1.4 CERTIFICATES OF INSPECTION

- A. All plant material shall be inspected by the Florida Department of Agriculture, as required by state law. Plants of a grade less than that specified in the article titled HORTICULTURAL STANDARDS will not be accepted.

### PART 2 - MATERIALS

#### 2.1 SOIL BACKFILL

- A. Soil for backfilling planting areas and plant pits shall be the existing surface soil, free from subsoil, objectionable weeds, litter, sods, stiff clay, stones, stumps, roots, trash, toxic substances, mortar, cement, limerock, asphalt, or any other material that may be harmful to plant growth or hinder planting operations. Poorly drained soil shall not be used.
- B. Soil amendments shall be added to the soil in the amount and manner prescribed by soil analysis to obtain a pH of 5.5 to 6.5. Results from soil analysis and a list of the prescribed amendments shall be presented to the Owner and verified by the Landscape Architect prior to being incorporated into the soil.
- C. If additional soil is required, it shall be furnished by the Contractor and shall be a natural, friable soil representative of productive, well-drained soils in the vicinity. It shall be obtained from well drained areas which have never been stripped before; and shall be free of admixture of subsoil and foreign matter, stones, toxic substances, and any material or substance that may be harmful to plant growth.
- D. The Contractor shall provide the following information on imported topsoil:
  - 1. Specific location from which topsoil will be (or was) stripped.
  - 2. Present Owner of that property.
  - 3. Approximate amount of topsoil available.
  - 4. Test results showing topsoil composition and analysis.
- E. Soil test shall be performed by a qualified soils laboratory, in accordance with "Methods of Soils Analysis - Agronomy #9" as published by the American Society of Agronomy, and shall be performed at the Contractor's expense.
- F. Planting soil backfill for raised architectural planters, if applicable, shall consist of 40% potting soil, 40% coarse washed builders sand and 20% horticultural perlite.

- G. Areas designated to be planted with flowering annuals, if applicable, shall be excavated to a depth of 8" and backfilled with a mixture consisting of 40% peat, 40% D.O.T. (coarse) sand, 10% pine bark (decomposed) and 10% cypress chips.
- H. Planting soil backfill for tree wells, if applicable, shall be 2/3 approved topsoil and 1/3 coarse washed builder's sand.

## 2.2 FERTILIZER

- A. Commercial fertilizer shall be Florikan18-6-8 Premium Ornamental formulation, 100 day slow release, available from ESA Corp., Sarasota, Florida USA, [www.florikan.com](http://www.florikan.com), Telephone (941) 377-8666, or approved equal. Fertilizer shall be uniform in composition, dry and free flowing.

## 2.3 DOLOMITIC LIMESTONE

- A. Dolomitic limestone shall be a natural limestone, designated for agricultural use, shall contain not less than 85 percent of total carbonates, and shall be ground so that 50 percent will pass a 100 mesh sieve and 90 percent will pass a 20 mesh sieve.

## 2.4 PRE-EMERGENCE WEED CONTROL

- A. Weed control shall be Ronstar 2G as manufactured by Bayer Environmental Science, Canada, Telephone 888.283.6847, [www.bayeres.ca](http://www.bayeres.ca) or Pendulum Aqua Cap as manufactured by BASF – The Chemical Company, Florida USA, [www.vmanswers.com](http://www.vmanswers.com) or contact product representative at [ChrisKey@basf.com](mailto:ChrisKey@basf.com), Telephone 813.758.2344, or an approved equal.

## 2.5 WATER

- A. Water will be available for use on site during the landscape installation at no cost to the Contractor. Care shall be exercised to assure that water is kept free of harmful chemicals, acids, alkalies, or any substance that might be harmful to plant growth.

## 2.6 ANTIDESICCANT

- A. Anti-desiccant shall be an emulsion type, film-forming agent designed to permit transpiration, but retard excessive loss of moisture from plants, such as Dowax by Dow Chemical Co., or Wilt-Pruf by Nursery Specialty Products, Inc., or an acceptable equal. The anti-desiccant shall be delivered in the manufacturer's fully identified containers and shall be mixed in accordance with manufacturer's instructions.

## 2.7 BORICIDE

- A. Boricide shall be Onyx manufactured by FMC Corporation, Memphis, TN USA, [www.pestsolutions.fmc.com](http://www.pestsolutions.fmc.com) Telephone 800.321.1362, or 901.565.0301, or an approved equal.

## 2.8 MULCH

- A. All mulch shall be shredded cypress bark mulch, 100 percent organic, fibrous type, Grade "B", or better. Alternative mulch types, if so identified on the drawings, shall be used.

## 2.9 GUYING AND STAKING MATERIAL

- A. Stakes for supporting trees shall be as detailed on the drawings. Wire for fastening trees to 'anchor brace' and turnbuckle shall be galvanized aircraft grade guying cable as specified in the detail. Wires in contact with trees shall be encased in two-ply reinforced garden hose. Material for wrapping tree trunks shall be burlap, heavy crepe paper, or other acceptable material in strips 6 to 10 inches wide.

## 2.10 DRAINAGE GRAVEL

- A. Where indicated on the drawings, or where soil conditions deem it necessary, the Contractor shall install gravel subdrains beneath trees and/or planting areas to aid in soil drainage and percolation. The subdrain shall be constructed as detailed on the drawings, or as directed by the Landscape Architect. Drainage gravel shall consist of washed, clean gravel 3/4 inch to 2 inches in size.

## 2.11 SOIL SEPARATION MATS/FILTER FABRIC

- A. Soil separation mats, if indicated on the drawings, shall be Mirafi 140N, as manufactured by Mirafi, 3500 Parkway Lane, Suite 500, Norcross, GA 30092 (phone 800.234.0484) or approved equal. Mats shall be installed as indicated on the drawings, and edges overlapped a minimum of 4 inches. Care shall be taken to prevent tearing or excessive crushing during the installation process.

## 2.12 QUALITY OF PLANT MATERIAL

- A. During inspection, as set forth hereinafter, all plant material will be judged, and rejections shall be based upon these standards. All plants shall comply with federal and state law requiring inspection for plant diseases and infestations. Inspection certificates required by law shall be made available to the Owner or Owner's Representative at his/her request.
- B. In determining the quality of plant material, the following elements will be valued:
  - 1. Root condition
  - 2. Plant size (above ground)
  - 3. Insect and disease free condition
  - 4. General appearance (color, shape, pruning)A deficiency in one or more of these areas will be sufficient reason to reject selectively or by lot.
- C. The Landscape Architect shall have the right, at any stage of the operations, to reject any and all work and materials which, in his opinion, do not meet with the requirements of

these Specifications. Such rejected material shall be removed from the site and acceptable material substituted in its place.

## 2.13 SIZE AND MEASUREMENTS

- A. Plants shall be measured when branches are in their normal position. Heights and spread dimensions specified refer to the main body of the plant and not to extreme branch tip to tip. The measurements specified are the minimum size acceptable and where pruning is required, these are measurements after pruning. When sizes are indicated as a range, the plant shall have the proper proportion as outlined in Florida Department of Agriculture, Grades and Standards for Nursery Plants Part I and II. Caliper of trees shall be taken 12 inches above the ground level and shall be the determining measurement for trees.
- B. Plants that have been headed back to conform to the size specified will not be acceptable. Plants larger than specified may be used if approved by the Owner; however, the use of such plants shall not increase the contract price.

## 2.14 LABEL

- A. Plant materials shall have durable, legible labels stating, in weather resistant ink, the correct botanical and common names and size as indicated in the Plant List. Each plant, or sufficient representative samples of each delivered shipment, shall have labels securely attached in a fashion that will not interfere with normal plant growth. Plant materials that have (or will have) a seasonal bloom shall be tagged with labels indicating the specific variety of that species' botanical and common name.

## 2.15 BALLED & BURLAPPED & WIRE BALLED & BURLAPPED PLANTS

- A. All ball sizes shall be of a diameter and depth to encompass the fibrous and feeding root system necessary for full recovery of the plant after planting. All balls shall be firm, shall not be broken or cracked, and shall be wrapped and securely tied with heavy twine or wire. All trees shall be root pruned a minimum of 6 weeks before delivery.

When the tree is root pruned, the tree crown shall be selectively thinned to reduce the volume of the crown. This shall consist of thinning and shaping only. Care shall be taken to assure that the plant form will not be distorted and will remain typical of the species growth characteristics.

- B. Plants designated B&B or WB&B in the Plant List shall be adequately balled with firm, natural balls of soil in sizes at least equal to those set forth in ANSI Z60.1-2004. Balls shall be firmly wrapped with jute burlap or equivalent cloth capable of rotting in the ground.

No balled plant shall be planted if the ball is cracked, mushroomed, or broken either before or during the process of planting. Trees grown in grow bags shall not be acceptable. Synthetic strings, straps, and burlap material shall be properly removed from the root ball. Synthetic burlap is to be totally removed from the root ball.

## 2.16 COLLECTED PLANTS

- A. All plant material (except Wax Myrtles and Sabal Palms) shall be nursery grown. Collected plants shall have been grown under climatic conditions similar to those in the locality of the project. All collected plants shall meet the requirements as specified and shall meet all specified grades and standards, unless otherwise qualified in the Plant List or these specifications. Root balls shall be increased in size one third greater than nursery grown plants.

## 2.17 CONTAINERIZED PLANTS

- A. All container grown plants shall be well rooted and established in the container in which they are delivered to the site. The plants shall have been in that container sufficiently long for the fibrous roots to hold the soil together when the plant is removed from the container. Container grown plants found to be root-bound during planting will not be acceptable. Containerized trees have a tendency to dry out quickly. The Contractor shall be responsible for hand watering the trees at time of delivery through the time of final acceptance at a rate consistent with the nursery watering schedule to assure that the tree does not go into shock.

## 2.18 SPECIMEN PLANTS

- A. After receiving the Notice to Proceed, the Contractor shall locate all plants specified as specimen. The Contractor shall notify the Owner so they may agree on a time to mutually inspect the selected plants. The Owner will inspect and tag those plants that are acceptable for use. Expenses incurred by the Owner for any subsequent inspection of specimen plants, at any time, in addition to the mutually agreed time, shall be the responsibility of the Contractor.

## 2.19 PALMS (If Required)

- A. Palms, except cabbage palms and unless otherwise indicated, shall be burlapped. Buds of palms shall be tied and supported in an upright position in accordance with the guidelines of Florida Department of Agriculture, Grades and Standards for Nursery Plants, Part II, Palms and Trees.
- B. Special care shall be applied to the handling and planting of palms. Unless otherwise indicated, palms shall have heavy straight trunks with full heads. Sabal palm root balls shall be dug with a minimum of 3' diameter ball 3' deep. The head shall be tied and supported during transport with a 2x4 tied parallel to the trunk extending up to the foliage. Avoid excessive pressure on the petioles when tying the head. Canary Island Date palm heads shall be tied using a 4x4 wood pole.

## 2.20 ANNUALS

- A. Landscape Contractor to submit "flowering annuals selections" to Owner's Representative and/or Landscape Architect for approval prior to purchasing. Flowering

annual selections to be based on availability, quality, and growing season. Locations and spacing as indicated on drawings.

## 2.21 SUBSTITUTIONS

- A. The use of materials differing in kind, quality or size from those specified will be allowed only after the Owner is convinced that all means of obtaining the specified materials have been exhausted.
- B. Where it is indicated that the Contractor may furnish or use a substitute that is equal to the material or equipment specified and if the Contractor is to furnish or use a proposed substitute, he shall, after the award of the contract, make written application to the Owner for acceptance of such a substitute. The substituted product or method shall be equal or superior in all respects to the specified product or method, shall perform adequately the duties imposed by the general design, shall be compatible with all other elements of the job, and shall be sufficient to complete the job. The substitution shall not add cost to the contract. Should it be necessary to accept a substitute of a quality less than specified, the unit price shall be used to adjust the contract price downward accordingly. No substitution shall be ordered or installed without the written permission of the Owner.

## PART 3 - EXECUTION

### 3.1 DELIVERY, STORAGE AND HANDLING OF PLANT MATERIAL

- A. The Contractor shall exercise care in handling, loading and unloading, storage and transporting all plant material and allied materials to prevent damage. The Contractor shall assume full responsibility for protection and safekeeping of products stored on the job.
- B. The Contractor shall dig and prepare B&B and WB&B plant material for shipment in a manner that will not damage roots, branches, shape and future development after planting.
- C. Trees indicated on the plans as WB&B and those where size, soil conditions and distance of transport to the site would warrant, shall be wireballed. Bottom wired baskets manufactured specifically for use in tree handling may be used.
- D. The Contractor shall handle all plants so that roots and branches are protected at all times from drying out, heating and from other injury. All plants shall be handled by the ball or container.
- E. Before moving plants from the nursery or storage area to the site, they shall be thoroughly sprayed with a solution of anti-desiccant. Anti-desiccant shall be applied to all collected pines, oaks and myrtles. Two weeks after planting, or as specified by the product manufacturer, the material shall be sprayed again with the anti-desiccant. The anti-desiccant shall be applied using power spray to provide an adequate film over trunks, branches, stems, twigs and foliage.

- F. When transporting plants to and at the site, the Contractor shall make provisions to protect plants from wind damage by avoiding high-speed highways, transporting in enclosed or partially enclosed vehicles, or covering the plants with burlap or other suitable material. Plants severely damaged by wind will be rejected.
- G. Any plant with signs of insects, their eggs or larvae, or disease will be rejected and shall be removed from the project site.
- H. Only the nursery stock intended for planting on a particular day shall be delivered and stored on the site during the day unless otherwise acceptable to the Owner. All plants shall be stored in one location as designated by the Owner, protected from wind and kept moist. The roots of all plants that cannot be planted immediately in soil shall be covered with mulch and other suitable material. No plants shall be taken from the temporary storage area for planting on the project until after the tree pits or holes for the plants in the section to be planted have been properly excavated and prepared ready to receive the trees and shrubs.
- I. Trees moved by winch or crane shall be thoroughly protected from chain marks, girdling, or other bark slippage by means of burlap, wood battens or other acceptable method.

### 3.2 DELIVERY, STORAGE AND HANDLING OF NONPLANT MATERIALS

- A. Fertilizer shall be delivered to the site in original, unopened containers bearing manufacturer's guaranteed chemical analysis, name, trade name, trademark and conformance to state law. In lieu of containers and provided that it is to be applied at the time of delivery, fertilizer may be furnished in bulk, and a certificate indicating the above information shall accompany each delivery.
- B. Pesticide and herbicide materials shall be delivered to the site in the original, unopened containers. Containers that do not have a legible label that identifies the Environmental Protection Agency registration number and the manufacturer's registered uses will be rejected.
- C. Storage of materials shall be in the area designated for use by the Owner. All materials shall be kept in dry storage and away from contaminants.

### 3.3 PREPARATION BEFORE PLANTING

- A. The Contractor shall verify that final grades have been established prior to beginning planting operations. All unsatisfactory grading shall be reported to the Owner, and the Contractor shall not proceed with the work until the unsatisfactory conditions have been corrected. When conditions detrimental to plant growth are encountered, such as rubble, fill or adverse drainage conditions, the Contractor shall notify the Owner for directions.
- B. Should undesirable existing vegetation be present on the site at the time of installation, the Contractor shall prepare the site for planting by use of chemicals, when used as recommended by the manufacturer, and/or mechanical means acceptable to the Owner.

Care shall be exercised to avoid any misuse of chemicals that would create detrimental residual conditions. Care must also be used not to alter final grades that have been established or cause damage to previously established turf areas.

### 3.4 SITE PREPARATION

- A. If so called for by the Owner, all plant locations and the areas of all planting beds shall be staked out on the ground, for acceptance by the Owner, before planting operations begin. The Contractor shall stake the location of the center of each tree and paint the outline of each shrub and groundcover bed. The stakes shall be oriented in a vertical manner so that they can be viewed and read from one direction. The Contractor shall give the Owner notice 24 hours prior to the completion of staking described herein.
- B. The Contractor shall verify the location of underground utilities, and irrigation heads and valves, and provide markers or other suitable protection, where necessary, to prevent damage.

### 3.5 EXCAVATION OF PLANTING AREAS

- A. No tree or shrub pit shall be dug or prepared until their location is acceptable to the Owner. Reasonable care shall be exercised to have pits dug and soil prepared prior to moving plants to their respective locations for planting to ensure that they will not be unnecessarily exposed to drying elements or to physical damage.
- B. Circular pits with vertical sides shall be excavated for all plants. The depth of all plant pits shall be enough to accommodate the ball or roots and the prepared soil in the bottom of the pit. Diameter of pits for trees shall be at least 1 foot greater than the diameter of the ball.
- C. Plant beds and pits shall be tested for proper drainage by filling with water twice in succession. Conditions permitting the retention of more than 6 inches of water in 1 hour shall be brought to the attention of the Owner. A written proposal and cost estimate for correction of such conditions shall be submitted to the Owner for acceptance, before proceeding with the work.
- D. All tree pits in curbed planting islands, tree wells, or in areas in which the soil has been compacted to an undesirable density, shall be excavated to a depth at least two feet greater than the measured depth & diameter of the ball. The minimum depth & diameter of an excavation shall be four feet. Soil backfill in areas of densely compacted soil must meet specification 2.01-C. It is the Contractor's responsibility to dispose of the unsuitable soil to an approved location.
- E. In shrub and groundcover beds where soils have been compacted to a density that is detrimental to plant growth, the Contractor shall loosen soils to a depth of 18" minimum to allow root penetration beyond the planting pit.

- F. If acceptable for use, existing topsoil in shrub and groundcover beds shall be treated with the specified soil amendments, at rates determined by soil tests. Amendments shall be incorporated into the soil to a depth of 12 inches. Where soil is not acceptable as determined by soil tests, the soil in the entire area shall be removed to a depth of 8 inches and replaced with the specified planting soil.

### 3.6 PLANTING

- A. All plants, except as otherwise specified, shall be centered in their pits, faced for best effect and set plumb for backfilling.
- B. Burlap on B&B and WB&B plants shall be removed from top one third of the ball. Burlap shall not be removed from under balls. If the ball is cracked or broken before or during planting process, the plant shall not be planted and shall be removed from the site. All synthetic strings, straps, and wire cages shall be removed from the top third of the root ball. Synthetic burlap shall be removed completely.
- C. Plants shall be removed from cans by cutting two sides of a container with an acceptable can cutter. Sides shall not be cut with a spade. Sides of knockout cans shall not be cut. Plastic containers with slanted sides shall not require cutting. Plants shall be removed from the container carefully, without injury or damage to the plant and root system.
- D. Bottom of plant boxes shall be removed before planting. Sides of the box shall be removed, without damage to the root ball, after positioning the plant and partially backfilling around it. The Contractor shall hand water containerized trees from the time of delivery until the time of final acceptance at a rate consistent with the nursery conditions from which the trees were obtained. Trees which go into shock due to insufficient water may be rejected.
- E. Plants shall be set in the center of pits and shall be plumb and straight and at such a level that after settlement the root crown will be level with the surrounding grade.
- F. Plant holes shall be backfilled with the specified planting mixture placed in layers around the roots or ball. Each layer shall be carefully tamped in place in a manner to avoid injury to the roots or ball or disturbing the position of the plant. When approximately two thirds of the plant hole has been backfilled, the hole shall be filled with water and the soil allowed to settle around the roots. Balled and burlapped plants shall have the burlap cut away or folded back from the top of the ball before applying the water. After the water has been absorbed, the plant hole shall be filled and tamped lightly to grade. Any subsequent settlement shall be brought to grade.
- G. Immediately after each tree pit is backfilled, a shallow basin slightly larger than the pit shall be formed with a ridge of topsoil to facilitate watering. This soil saucer shall be formed in a circle and tamped around each tree so that the saucer will retain water. Where curbing occurs around plant pits, the saucer shall be omitted.
- H. The Contractor shall include adding a water retentive additive Terra-Sorb AG for all shrubs, groundcovers, annuals, and trees at the manufacturers suggested rates.

### 3.7 FERTILIZING

- A. Each tree and shrub shall be fertilized by placing the manufacturer's recommended amount around the base of the ball before backfilling.

### 3.8 STAKING, GUYING AND WRAPPING

- A. Staking or guying and wrapping of trees shall be done immediately after they are planted. Each plant shall stand plumb after staking or guying has been completed. It shall be the Contractor's responsibility to ensure that all trees are plumb and secure after planting. Staking of trees of a 10 foot height or less shall be at the discretion of the Owner. All other trees shall be staked.
- B. Immediately after planting, trees shall be staked and guyed for support. "Anchor Brace" earth anchors as indicated shall be placed at sides of each tree, and shall be driven into undisturbed ground to a depth deep enough to sufficiently secure the tree. Care shall be taken when driving anchors to avoid damaging the tree roots. Except as otherwise indicated or directed, the tree shall be fastened to each anchor as indicated on the plans. The wires shall be encased in hose at the tree to prevent direct contact with the bark and shall be placed around the trunk in a single loop. Wires shall be tightened and kept taut by twisting the turnbuckle. A brightly colored flagging tape approximately 12" in length shall be securely tied to each guy wire immediately above the turnbuckles.
- C. If planted while void of foliage, the trunks of all deciduous trees shall be wrapped spirally from bottom to top, and shall be securely tied with cord at top and bottom and at 2 foot intervals along the trunk. The wrapping shall overlap and entirely cover the trunk from the ground to the height of the second branches and shall be neat and snug. Overlap of wrapping material shall be approximately 2 inches. Trees shall be inspected for injury to trunks, evidence of insect infestation and improper pruning before wrapping.

### 3.9 MULCHING

- A. Immediately after planting operations are completed, all tree and shrub saucers, and shrub and groundcover beds shall be covered with a 2 to 2 1/2 inch layer of shredded cypress bark mulch. Limits of the mulch shall be as indicated on the drawings.

### 3.10 PRUNING

- A. Each tree and shrub shall be pruned in accordance with standard horticultural practice to preserve the natural character of the plant and in the manner fitting its use in the landscape design. Pruning shall be done with clean, sharp tools and as indicated on the drawings.
- B. Approximately one third of the growth of large deciduous trees (those with 2 inch caliper or larger) shall be pruned by removal of superfluous branches. Main leaders of trees shall not be cut back. Branches shall be thinned out and not merely cut back. Long side

branches may be shortened. Shrubbery with extremely heavy tops shall have one fourth to one third of the weaker growth removed by thinning.

### 3.11 CLEANUP

- A. During the course of planting, excess and waste materials shall be continuously and promptly removed daily, lawns kept clear, and all reasonable precautions taken to avoid damage to existing structures, plants and grass. After completion of the work, the entire site shall be cleared of excess soils, waste material, debris and all objects that may hinder maintenance and affect the visual appearance of the site.

The Contractor shall clean all roads and walks of dirt film and soil clods. The Contractor shall also pressure clean and broom sweep all asphalt pavement prior to the final lift of asphalt to be laid.

### 3.12 DISTURBED AREAS

- A. All areas outside of the limits of work that are disturbed by the Contractor's construction activities shall be repaired and replanted to its original condition.

### 3.13 GUARANTEED PROVING PERIOD

- A. There shall be a guarantee period of 1 year for trees and specimen material and 3 months for shrubs. This guarantee period shall start at the final acceptance date. Contractor shall replace any and all plant material that die during this guarantee proving period. Replacement of plants necessary during the guarantee period shall be the responsibility of the Contractor, except for possible replacements of plants resulting from removal, vandalism, acts of neglect on the part of others, or acts of God. All replacement material shall have the same guarantee time (1 year from installation of replacement for trees and specimen material and 3 months for shrubs).
- B. Planting maintenance shall include all necessary watering, cultivation, weeding, pruning and spraying; wrapping and mulching; straightening of plants which lean or sag and which develop more than a normal amount of settlement; such adjustments to include excavating around and leveling or raising the ball when so directed; and all other incidental work necessary for proper maintenance as directed by the Owner until substantial completion and written release.
- C. Transplanted material (if applicable) shall not be guaranteed, however, good horticultural practices should be used before, during and after the material is transplanted. Good horticultural practices should include but not be limited to, all necessary watering, pruning and spraying; wrapping and mulching; fertilizing; moving; maintaining the same orientation and grade level from the original location; and all other incidental work necessary for proper transplanting.

### 3.14 FINAL INSPECTION AND ACCEPTANCE

- A. The Contractor shall notify the Owner in writing when the work has been completed in accordance with this Contract and request an inspection. The Owner will make the inspection of the work and report findings as to acceptability and completeness. Any work remaining to be done shall be subject to re-inspection before final acceptance. The Contractor will be notified in writing by the Owner of the final acceptance of the work.

### 3.15 CONTRACTOR'S RESPONSIBILITY AFTER ACCEPTANCE

- A. The Owner may elect to assume maintenance of all work, at the time of acceptance, or may elect to contract for maintenance by others for a specified period. Should maintenance after final acceptance be the responsibility of those other than the Contractor, the Contractor shall monitor all work for which he is responsible by guarantee, to assure that maintenance being performed will not jeopardize the condition and quality of the work and materials guaranteed by the Contractor. Any inadequate or damaging maintenance practices shall be reported immediately in writing to the Owner so that appropriate measures may be taken to correct the condition. Failure to so notify the Owner will invalidate any later claim of negligence or malpractice in maintenance.

### 3.16 ACCEPTANCE AND REPLACEMENT OF PLANT MATERIAL

- A. At the expiration of the proving period, an inspection of the plantings will be made by the Owner. Only those plants that are alive and normally healthy will be accepted. Unaccepted material shall be removed and replaced by the Contractor at his own expense, during the next planting season. Material and method of replacement planting shall be the same as specified for the original planting unless otherwise directed. The Contractor shall continue to make replacements until a plant shows vigorous and healthy growth for a period of 1 year from the date of acceptance by the Owner. All such replacements will be inspected for acceptance at the end of the proving period by the Owner.

END OF SECTION

## SECTION 33 11 00 WATER UTILITY DISTRIBUTION PIPING

### PART 1 - GENERAL

#### 1.01 WORK INCLUDED

- A. The work to be performed under this Section shall include the furnishing and installing of water mains and appurtenances as herein described and as shown on the Drawings. The Contractor shall perform all excavation, backfilling, and related work required for the construction of these mains, in accordance with the provisions set forth under the applicable items of this Specification and of the General Conditions of the Contract. Where not otherwise set forth, all work shall be in accordance with AWWA (ANSI) C600.

#### 1.02 REFERENCES

Standards applicable in this Specification include:

- A. American Water Works Association (AWWA) and American National Standards Institute (ANSI).
1. AWWA C104 (ANSI A21.4) Cement-Mortar Lining for Ductile-Iron and Gray Iron Pipe and Fittings for Water.
  2. AWWA C110 Gray-Iron and Ductile-Iron Fittings, 3-inch through 48-inch for Water and Other Liquids.
  3. AWWA C111 (ANSI A21.11) Rubber Gasket Joints for Ductile-Iron and Gray-Iron Pressure Pipe and Fittings.
  4. AWWA C150 (ANSI A21.50) Thickness Design of Ductile-Iron Pipe.
  5. AWWA C151 (ANSI A21.51) Ductile-Iron Pipe, Centrifugally Cast in Metal Molds or Sand Lined Molds for Water or Other Liquids.
  6. AWWA C605 Installation of PVC Pressure Pipe & Fittings.
  7. AWWA C601 Standard for Disinfecting Water Mains.
  8. AWWA C900 Polyvinyl Chloride Pressure Pipe 4" through 12"
  9. AWWA C901 Polyethylene Pressure Pipe and Tubing for Water Service.
- B. American Association of State Highway and Transportation Official (AASHTO).
- C. AASHTO T-180-82 The Moisture-Density Relation of Soils Using a 10-lb. (4.54 kg) Rammer and an 18-inch (457 mm) Drop.

### PART 2 - PRODUCTS

#### 2.01 PIPE

Ductile Iron Pipe: Ductile iron pipe shall conform to AWWA C151 (ANSI A21.51) and shall be thickness Class 52.

- A. Lining: Ductile iron pipe for water mains shall have an internal lining of cement mortar in accordance with AWWA C104/A21.4.
- B. Coating: Buried ductile iron pipe shall be bituminous coated per AWWA C151/A21.10 and wrapped in a 8 mil polyethylene encasement.
- C. Polyvinyl Chloride Pipe (PVC): PVC pipe shall meet requirements of AWWA C900 DR-18 for pipe 4" to 12" in diameter, and shall be furnished in cast-iron pipe equivalent outside diameters with rubber gasketed joints. Pressure class shall be 150 psi (DR-18).
- D. Polyethylene pressure pipe and tubing, ½" through 3" having standard PE code designations PE2406, PE3406 and PE3408, shall be in accordance with AWWA Standard C-901, have a standard dimension ratio (SDR) of 9 with a 200 psi working pressure and have cooper equivalent (CTS) outside diameters. Polyethylene pipe shall be used for all service connections.

## 2.02 FITTINGS

- A. Fittings shall be ductile iron mechanical joint type conforming to AWWA/ANSI C153/A21.53 with MEGALUGS, or approved equivalent restraint. All fittings shall have a working pressure of 350 psi in size 4" through 12", and shall be coated and lined as specified for ductile iron pipe. Ductile iron fittings on PVC pipe shall be wrapped in a 8 mil polyethylene encasement extending 1 foot from each end of the fitting.

## 2.03 JOINTS

- A. Pipe shall be furnished with integral bell joints with locked in rubber gaskets.
- B. Restrained joint pipe shall be used for changes in elevation or alignment as shown on the Drawings or as required in the field by the Engineer. Ductile iron pipe restrained joints shall be "TR-Flex" by U.S. Pipe, "Lok-Ring" by American or approved equal. PVC pipe restrained joints shall be Certainteed Certa-Lok, EBAA Iron Series 1500 Retainers, or approved equivalent restraint. All restrained joints shall have a working pressure of 350 psi.

## PART 3 - EXECUTION

The installation and testing of the water main shall be done in accordance with ANSI/AWWA C600 plus the additional requirements described herein or shown on the Plans.

### 3.01 PREPARATION

- A. The layout of some of the piping systems shown on the Drawings may be diagrammatic but shall be followed as closely as the work will permit.

- B. In shipping, delivery, and installing pipe and accessories, they shall be handled in such manner as to insure a sound, undamaged condition. Particular care shall be taken not to injure pipe coating and no other pipe or material of any kind shall be placed inside a pipe or fitting after the coating has been applied.

### 3.02 INSTALLATION

#### A. General

1. All pipe, fittings and valves shall be installed according to AWWA Specification C600 or C605. Prior to installation, all pipe and appurtenances shall be examined for damage and defects. Under no circumstances shall defective pipe be installed. All lumps, blisters and excess coating materials shall be removed from the bell and spigot ends of each pipe. While being placed in the trench, care shall be taken to prevent foreign material from entering the pipe. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade.
2. At times when pipe laying is not in progress, the open end of the pipe shall be closed by a watertight plug. When practical, the plug shall remain in place until the trench is pumped completely dry. When it is necessary to deflect the pipe from a straight line in either the vertical or horizontal plane, or where long radius curves are permitted, the amount of deflection shall not exceed that of Table 5 in AWWA Specification C600 or C605.

#### B. Ductile Iron Fittings

1. Ductile iron fittings for use with ductile iron or PVC pipe shall be bell fittings with machined grooves for use with rubber rings. Grooves shall be clean and free of all sand or other foreign material before the ring is inserted. The pipe shall be properly lubricated prior to pushing the joints together. On installation of all bolting materials the Contractor shall utilize a graphite base non-binding lubricant (non-corrosive).

#### C. Mechanical Joints

1. Mechanical Joints are to be made in accordance with manufacturer's recommendations and requirements of pipe joint specifications. Care shall be taken to tighten bolts evenly around circumference of pipe and in no case shall bolts be overstressed.

#### D. Flanged Joints

1. Before making up flanged joints in ductile iron pipe and fittings, the back of each flange under the bolt heads and the face of each flange shall have all lumps, blisters and excess bituminous coating removed and shall be wire brushed and

wiped clean and dry. Flange faces shall be kept clean and dry when making up the joint, and the workmen shall exercise caution to prevent damage to the gasket or the adherence of grease or particles of sand or dirt. Bolts and nuts shall be tightened by opposites in order to keep flange faces square with each other, and to insure that bolt stresses are evenly distributed.

E. Valve Settings

1. All valves placed on branch lines or bends shall be restrained via anchor couplings or anchor tees as specified hereinabove. Valves and valve boxes shall be set plumb at the locations indicated, and in accordance with the details shown on the Drawings. After being positioned, backfill shall be carefully placed and hand tamped. Before installation, care shall be taken to see that all foreign matter has been removed from the interior of the barrel. Stuffing boxes shall be tightened and the valves opened and closed to see that all parts are in working condition.

F. Connection to Existing Mains

1. Connection to existing water mains shall be made by the Contractor. The Contractor shall be responsible for making all necessary arrangements with the FKAA for these connections and shall bear any costs incurred at no additional cost to the FKAA. Prior to commencing the work of connecting to existing facilities, the Contractor shall uncover or expose the point of connection and insure himself that he has all materials, equipment and all other facilities required to complete the installation, and that such connections can be made in accordance with the details shown on the Drawings.
2. The Contractor shall take every precaution to insure that the alignment or gradient of the existing facilities are not disturbed, or otherwise damaged, as a result of his construction procedures. In the event the existing facilities are damaged or otherwise disturbed, the Contractor will be required to do such necessary repair, re-alignment, or replacement, so as to restore these facilities to a water tight, workable, acceptable condition.
3. No existing valves shall be operated by the Contractor. These valves shall only be operated by personnel of the FKAA. The Contractor shall advise the FKAA Engineering Department, 24 hours in advance of making these connections. This work shall be done under direct supervision of personnel of the FKAA. The valves and fittings to be employed in these connections, shall be thoroughly swabbed with a 300 ppm solution of chlorine and water. The connections shall be made as rapidly as possible, and any water in the excavation shall be kept below the level of pipe and fittings. The Contractor may have to make connections at off-peak hours. Shut-downs shall be kept to a maximum of 2 hours, unless previously approved by the FKAA, pending extenuating circumstances. Once valves are installed, they shall only be operated by FKAA personnel.

## G. Customer Service Connections

1. Service connections shall be installed of the type and size and at the locations shown on the Drawings. All materials shall be as shown on the Drawings and as stated in these specifications. All taps to the distribution main may be made with the main under pressure, or dry tapped. Customer Service connections shall be direct tapped on mains 6" in diameter or greater and shall have corporation stop Ford F-1000 or approved equal. For connections to 4" diameter mains, use brass tapping saddle Rockwell Style 323 or approved equal and corporation stop Ford F-1000 or approved equal. For connections to 2" diameter mains, use Pack Joint Tee Ford T441-774 or approved equal and corporation stop Ford F-1100 or approved equal.

## H. Miscellaneous

1. All excavated material shall be stockpiled in a manner that will not hinder the work or obstruct sidewalks, roadways, and driveways. All utility control structures shall be kept accessible. This shall be designed to mean those areas as designed by the Permitting Agency unless otherwise specified. Material stockpiles on private property must have written consent with a copy to FKAA.
2. Trench bottom shall be constructed to provide a firm, stable and uniform support for the full length of the pipe and/or fittings. Bellholes shall be provided at each joint to permit proper assembly and pipe support. When an unstable subgrade condition is encountered that could provide inadequate pipe support, additional trench bottom shall be excavated, refilled with suitable foundation material, and compacted as required to provide firm support.
3. All pipe shall be installed in dry trenches. Where conditions are such that running or standing water occurs in the trench bottom or the soil in the trench bottom displays a "quick" tendency, the water shall be removed by pumps until the pipe has been installed and the backfill has been placed over the top of pipe to a depth equal to 1 and ½ pipe diameters.

### 3.03 CUTTING AND CAPPING RETIRED WATER MAINS

1. As shown on the Drawings, some of the existing water mains are to be retired. The Contractor shall be responsible for cutting and capping or plugging, leak free, the existing water mains at the locations shown on the Drawings. Thrust blocks shall be installed at the capped end if required, dependent upon the type of existing pipe and method of capping to ensure that there is no movement in the pipe remaining in service. The Contractor shall obtain the approval of the FKAA prior to cutting any existing water mains.

### 3.04 CUSTOMER SERVICE LINES

#### A. Location of Meters

1. All meters and meter boxes shall be located in the right-of-way as shown on the Drawings. Where meter relocations are required, the Contractor shall also install new service piping between the relocated meter and the point of connection on the customer's property.
2. If the meters are in "back" easements or at the back of lots it may be better to install the new meter boxes and run the on-site customer service piping up to the point of connection prior to relocating any meter. The exact sequence of operations will be decided by the FKAA in the field.

#### B. On-Site Customer Service Piping

1. Portions of the work to be constructed under the terms and conditions of these Contract Documents are the installation and construction of on-site customer service piping. In all instances where existing water meters are located in easements along the rear property lines, or where the existing water meters are located outside of the rights-of-way, the Contractor shall install such piping as may be required to connect the new meter locations with the customer's existing house potable water system. The point of connection will generally be at the old meter location, but, may be at some other point closer to, or at, the customer's house. Each new on-site customer service line shall be installed with a valve near the point of connection to the existing house potable water system. On-site customer service lines will be buried a minimum of 6-inches below existing grade and will be thoroughly flushed before connecting to the existing house potable water system. The inspector will determine the exact point of connection in the field so as to minimize future maintenance problems of the customer and the FKAA. All such work within private property shall be performed by or under the direct supervision of a licensed master plumber. Service lines from the meter to the customer's existing potable water system shall be schedule 40 PVC and shall be in accordance with requirements of the Standard Plumbing Code applicable in Monroe County, Florida.

#### C. Removal of Existing Meter Boxes and Service Lines

1. After water service has been restored through the existing meters and new service lines, the old meter boxes and service lines shall be removed from the site. Meter boxes which are no longer in use shall be carefully removed and delivered to a storage area designated by the Florida Keys Aqueduct Authority. Old service pipes above ground, or not more than two inches underground, except in paved areas, shall be removed and disposed of as directed. Service lines more than three inches below ground and those lines under paved areas shall be capped,

abandoned and left undisturbed. All old service pipe and fittings located within 3 feet of the new meter box shall be removed.

D. Installation

1. New service line pipes installed by the Contractor shall be of the same size and type as the service lines being replaced, except that no new service lines shall be less than 3/4-inch size, and any galvanized steel service lines shall be replaced with Schedule 80 PVC pipe, ASTM SPEC. D1785, PVC 1120. Connections to existing house potable water systems shall be at the most practicable and suitable locations for satisfactory water service as determined by the FKAA. The FKAA will only furnish the new meters. The Contractor shall install the meters and make all connections thereto. All meter installations that are not T-10 meters will require a new dual check valve as shown on detail drawing no. 12. T-10 meter installations will require a second meter stop on the customer's side of the meter instead of a dual check valve.

E. Types of Service Connections:

1. Type "D". Furnish and install 1" polyethylene tubing including all fittings, adaptors and/or specials to connect the proposed service pipe to the existing meter (or new meter provided by FKAA) at the location shown. Any adjustment of the meter or meter box within a five (5) foot radius shall be considered incidental and will not be paid under a separate item.
2. Type "E". Furnish and install 1" polyethylene tubing including all fittings, adapters and/or specials to connect the proposed dual service pipes to the existing meter (or new meter provided by FKAA) at the location shown. Any adjustment of the meter or meter box within a five (5) foot radius shall be considered incidental and will not be paid under a separate item.
3. Type "F". Furnish and install new meter box, 1" polyethylene tubing including all fittings, adapters and/or specials to connect the proposed new service connections to the new on-site service connection at the new location shown. The new meter box should be located as close to property line as possible within the public right-of-way. New on-site customer piping required to connect the new meter installation to the customer's potable water shall be considered a part of this item.
4. Type "G". Furnish and install two single meter boxes, 1" polyethylene tubing from the proposed main to the new meter boxes located within the right-of-way, meter valve or valves, meter idler or idlers, check valve or valves, all in accordance with the details shown on the drawings. New on-site customer piping required to connect the new meter installation to the customer's potable water shall be considered a part of this item.

5. Type "H". Relocate one (1) meter box, furnish and install 1" polyethylene tubing including all fittings, adapters and/or specials to connect the proposed dual service pipe to one (1) existing and one (1) relocated meter at the location shown. The relocated meter box shall be located as close to the property line as possible, within the public right-of-way and adjacent to the existing meter box. The new on-site customer piping required to connect the relocated meter installation to the customers potable water system shall be considered a part of this item. Any adjustment of the existing meter box within a five foot (5') radius shall be considered incidental and shall not be paid under a separate item.

### 3.05 FIELD QUALITY CONTROL

#### A. Hydrostatic Tests

1. The Contractor shall provide all necessary material and shall perform all work required in connection with the test, including temporary plugs where required. All pipe on low pressure side of pressure reducing valves on distribution systems shall be tested to a hydrostatic pressure of 150 P.S.I. The required pressure as measured at the point of highest elevation shall be applied for not less than two hours, and all pipe, fittings, valves, and joints shall be made water tight if leakage is evident.
2. No pipe installation will be accepted unless and until the leakage is less than that as specified under Section 4.2 of the AWWA (ANSI) C600.

#### B. Pigging

1. All water main installations shall be cleaned with a polypropylene pigging device to clean all dirt, sand, and debris from the newly installed water main where determined by the FKAA field representative. The FKAA field representative shall determine the extent and type of pigging required. At a minimum, a "bare" type, B3 style pig shall be used as manufactured by Pipeline Pigging Products Inc., or approved equal.

#### C. Sterilization of Complete Line

1. Before being placed in service, each line shall be sterilized in accordance with the directions of the Florida State Board of Health and in accordance with AWWA C601.

#### D. Connections to the Existing System

1. Connections to be made by the Contractor are shown on the Drawings. Connections shall not be made until the new main is cleared by DEP.

#### E. Density Tests

1. Locations for density tests shall be as required by the FKAA to determine adequacy of the compaction operation. Density tests will be performed by FKAA personnel. Proctor tests will be performed by a certified lab at FKAA expense.

### 3.06 ADJUSTING AND CLEANING

#### A. Restoring Surfaces

1. The top surfaces of the backfill shall be restored to present standards or better conditions. Trenches shall be carefully examined upon the completion of backfilling and surface irregularities, which are dangerous or obstructive to traffic, are to be removed.
2. Paved sections shall conform in grade with adjacent areas and shall be of at least equal quality. Design mixes for flexible pavement shall be subject to approval by the FDOT, Monroe County, and City of Key West. All damaged or undermined areas of existing pavement, not previously removed, shall be removed and restored to original conditions or in the specified manner.
3. Equipment shall not travel over loose rock fragments, or other hard material, lying on sections or pavements which are not to be removed. Removal, replacement and restoration of areas of pavement shall be as indicated on drawings.

END OF SECTION

## SECTION 33 12 00 WATER UTILITY DISTRIBUTION EQUIPMENT

### PART 1 - GENERAL

#### 1.01 WORK INCLUDED

- A. Gate valves
- B. Ball Valve Curb Stops
- C. Residential Meter Dual Check Valves
- D. Ball Valve Meter Stops
- E. Saddles
- F. Pack Joint Tees
- G. Corporation Stops
- H. Pump Suction Control Valves
- I. Fire Hydrants
- J. Tapping Sleeves and Valves
- K. Valve Boxes Polyethylene Tubing
- L. Valve Identification Systems
- M. Pressure Reducing Valves
- N. Detectable Warning Tape

#### 1.02 RELATED WORK

- A. Section 02661: Water Mains

#### 1.03 REFERENCES

- A. AWWA - American Waterworks Association.

B. ASTM - American Society for Testing Materials

C. FS - Federal Specification.

#### 1.04 SHOP DRAWINGS

A. Submit detailed Shop Drawings in accordance with Section 014000 – Quality Requirements. Clearly indicate make, model, location, type, size, and pressure rating.

### PART 2 - PRODUCTS

#### 2.01 VALVES - GENERAL

A. All valves shall be furnished with affidavits from the manufacturers that the valves furnished under this Contract comply with all the applicable provisions of the respective AWWA Specifications, cited below. All valves shall be factory tested in accordance with AWWA Standard Leakage and Hydrostatic Tests and a certified test report shall be furnished stating that the valves have met the requirements of the test.

B. Valves shall be furnished with mechanical joint or flanged ends. Valve ends with mechanical joints or flanged joints shall conform to AWWA Standard C110, “Gray-Iron and Ductile Iron Fittings, 3" through 48" for Water and other Liquids”. In addition, mechanical joints shall conform to ANSI/AWWA Standard C111/A21.11. Bolt holes in the flanges of the mechanical joint shall straddle the vertical and horizontal centerline. Flanges shall be ANSI Standard Class 125, plain faced and drilled.

C. All valves three inches through 16 inch in diameter, shall be resilient seated or resilient wedge gate valves and all valves 18 inch in diameter and larger, shall be as specified and shown on the Drawings. All valves shall be polyethylene encased, from one foot on each side of the valve.

#### 2.02 GATE VALVES

A. Gate valves shall be resilient seated or resilient wedge gate valves for 150 psi working pressure, on low pressure side of pressure reducing valves conforming to AWWA Standard C-509 and C-500. The gate valves shall have a high strength bronze non-rising stem. Valves shall be EPD only, but not natural rubber, O-ring stem seals (compatible with chloramines) and be of a design that permits the replacement of the O-ring seals while the valve is in service under pressure. The valves shall open by turning the operating nut counterclockwise. Operating nuts shall be AWWA two inch square nuts with skirts.

B. Valve body, bonnet, and gate shall be Ductile Iron conforming to ASTM A-536. Shell

thickness of body and bonnet components shall conform to Table 2 Section 4.4 AWWA C-509 and C-500. So-called “thinwall” valves, not included in this Standard, are not allowed. Valve body and bonnet shall be coated on all exterior and interior surfaces with a fusion bonded epoxy conforming to the requirements of AWWA Standard for Protective Epoxy Interior Coatings for Valves and Hydrants; C-550. Manufacturer shall certify that the coating will conform to following sections of the Standard:

1. Section 2 - Materials (relating to the suitability of the coating for use in a potable water system).
  2. Section 4 - Testing and Inspection (relating to qualification and production testing).
- C. Gate shall be covered with rubber over all interior and exterior ferrous surfaces. The rubber shall be securely bonded to the gate body, including the part which houses the stem nut. The stem hole through the gate shall be full opening top to bottom and shall also be covered with rubber.
- D. Body and bonnet shall be coated inside and out with a fusion bonded epoxy that meets or exceeds requirements of AWWA C550.
- E. Direct buried gate valves shall be polyethylene encased and shall have Type 304 stainless steel bonnet bolts.
- F. Gate valves shall be as manufactured by American Flow Control Series 2500, U.S. Pipe Metroseal 250, or an approved equal.

### 2.03 BALL VALVE CURB STOPS

- A. Curb stops shall be Ford Series B-11, Mueller H10283 or approved equal. Ball valves shall have locking lugs and 2" square operating nut which opens to the left on 1½ " and 2" valves.

### 2.04 RESIDENTIAL METER DUAL CHECK VALVES

- A. Meter check valves shall be dual check valve assemblies suitable for installation on 5/8-inch, 3/4-inch, 1-inch, and 1-1/2-inch lines, and shall be Ford HHS31, Mueller H-14242, or an approved equal.

### 2.05 BALL VALVE METER STOPS

- A. Meter stops shall be Ford Series B43 or BF13, or an approved equal. Valves shall have lockable padlock wings, and open to the left.

### 2.06 SADDLES

- A. Saddles shall be Rockwell International, Type 323, style double strap bronze saddles, for PVC and ductile iron pipe, or approved equal. Tapping saddles shall be used for all taps on 4" PVC pipe.

#### 2.07 PACK JOINT TEES

- A. Pack joint tees shall be used to connect services to 2" water mains. They shall be Ford T441-774 or approved equal.

#### 2.08 CORPORATION STOPS

- A. Corporation stops shall be Ford F-1000, FB-1000, or approved equal. The largest corporation stop which can be tapped directly into the pipe is 1-inch.

#### 2.09 PUMP SUCTION CONTROL VALVES

Pump suction control valves shall be Cla-Val Model 50B-5KG.

#### 2.10 FIRE HYDRANTS

- A. Fire hydrants shall be 6-inch, mechanical joint pipe connection with a minimum 5.25 inch valve opening. Hydrants shall be of AWWA approved type, designed for a 150 psi working pressure. Provisions shall be made for two 2.5 inch hose nozzles and one 4.5 inch pumper nozzle, open left (counter clockwise). All base threads shall conform to the national standard hose coupling thread specifications. Fire hydrants shall have a safety stem coupling to prevent bending of the operating stem, and a safety flange to prevent breaking of the hydrant barrel if hit by a vehicle. The hydrant base (shoe) shall be coated with a two-part thermo-setting epoxy, not less than 4 mils thick. Weather cap shall be metal. The maximum pressure loss allowable for the 5-1/4" valve opening shall be 2.2 psi at 1000 gpm flow based on 5 foot bury with 6" diameter inlet. The hydrant shall be a Mueller Figure No. A-423 American Darling B-84-B. The drain hole in the foot of the fire hydrant shall be plugged and all buried bolts shall be AISI Type 316 stainless steel.
- B. Fire hydrants shall be painted with one coat of rust proof primer and two finish coats of an approved paint of the color directed.

#### 2.11 TAPPING SLEEVES AND VALVES

- A. Tapping Sleeves shall be ASTM 285 Grade C Steel or ASTM A-36 Carbon Steel with Fusion applied epoxy coating (AWWA C213-70). Tapping Sleeves shall utilize AISI Type 304 (ASTM A320 Grade B8) stainless steel bolts and nuts. Tapping Sleeves shall be as manufactured by JCM Industries Model 412, Romac Industries Model FTS420, or approved equal.

- B. Tapping valves shall be as specified for gate valves, hereinabove, and as further specified herein. Valve body, bonnet, and gate shall be Ductile Iron conforming to ASTM A-536. Tapping valves for use in tapping distribution mains shall be resilient seat gate valves. Inlet shall be Class 125, ANSI B16.1, ductile iron flange with centering ring to match tapping sleeve. Outlet shall be a mechanical joint. Tapping valves shall be compatible for use with a drilling machine. Tapping valves shall be attached to tapping sleeves with stainless steel nuts and bolts which shall be heavy hex-head AISI Type 316 (ASTM A320 Grade B8) stainless steel. Approved tapping valves include American Flow Control Series 2500, or approved equal.

## 2.12 VALVE BOXES

- A. Furnish, assemble, and place a valve box over the operating nut for each buried valve. The valve box shall be installed so as to prevent the transmission of surface loads directly to the valve or piping. Valve boxes shall be U.S. Foundry No. 7615, No. 7630 or approved equal.
- B. Valve extension stems shall be provided for all buried valves when operating nut is deeper than 3 feet below final grade.

## 2.13 POLYETHYLENE TUBING

- A. Service lines shall be polyethylene tubing conforming to ASTM D2737; SDR 9 with a minimum working pressure of 200 psi.

## 2.14 VALVE IDENTIFICATION SYSTEMS

### A. Buried Valves:

1. In paved areas, tops of valve box covers shall be set flush with pavement. Following paving operations, a 30-inch square shall be neatly cut in the pavement around the box and the paving removed. The top of the box shall then be adjusted to the proper elevation and a 30-inch square by 6-inch thick concrete pad poured around the box cover. Concrete pads in traffic areas shall be reinforced with No. 4 reinforcement bars as shown on the drawings. Concrete for the pad shall be 3,000 psi compressive strength.
2. In unpaved areas, tops of valve box covers shall be set 0.20 foot above finished grade. After the top of the box is set to the proper elevation, a 30-inch square by 6-inch thick concrete pad shall be poured around the box cover. Concrete for the pad shall be 3,000 psi compressive strength.
3. Shall have valve boxes protected by a concrete pad. The concrete pad for the

valve box cover shall have a 2 ½ -inch diameter, bronze disc embedded in the surface as shown on the drawings. The bronze disc shall have the following information neatly stamped on it:

- a. Size of valve, inches
- b. Type of valve:
  - i. GV - Gate Valve
  - ii. BFV - Butterfly Valve
  - iii. Ball Valve
- c. Number of turns to fully open
- d. Direction to open
- e. Year of installation

## 2.15 PRESSURE REDUCING VALVES

- A. The pressure reducing valve shall be hydraulically operated, diaphragm actuated in globe pattern. The valve shall maintain a constant downstream pressure regardless of inlet pressure variations. It shall contain a resilient synthetic rubber disc having a rectangular cross section, contained on three and one-half sides by a disc retainer.
- B. The seat ring shall be firmly held in place and not pressed into the body. The diaphragm assembly shall be fully guided to assure positive contact with the seat. The diaphragm assembly shall be the only moving part.
- C. The diaphragm shall consist of a nylon fabric reinforced BUNA-N rubber and shall not be used as a seating surface. All necessary repairs shall be possible without removing the valve from the line.
- D. All main valve interior components shall be manufactured from non-corrosive materials.
- E. The pilot valve shall be adjustable, direct acting, spring loaded and normally open. The reducing pilot shall be supplied with a stainless steel seat ring.
- F. The valve shall be CLA-VAL 90-01D, and shall be Pressure Class 300. The valve shall have 304L stainless steel body, stainless steel trim, and Class 250 flanged ends. The valve shall be piloted in reverse flow for fail-safe operation.

## 2.16 DETECTABLE WARNING TAPE

- A. Detectable warning tapes shall be provided for all water mains. Such tape shall be
- B. magnetic type, 5 mils thick, ½ mil thick aluminum center core, encased in mylar. Tape shall be blue imprinted with the words "Caution: Water Line Below". Printing shall appear on both sides of the tape. The tape shall be placed between 6 and 12 inches below finish grade.

## PART 3 - EXECUTION

### 3.01 INSTALLATION OF VALVES

- A. Valves of the size and type shown on the Drawings shall be set plumb and installed at the locations indicated on the Drawings. Valves shall be installed in accordance with manufacturer's installation instructions and with the details shown on the Drawings.
- B. Valves shall be installed such that they are supported properly in their respective positions, free from distortion and strain. Valves shall be installed such that their weight is not borne by pumps and equipment that are not designed to support the weight of the valve.
- C. Valves shall be carefully inspected during installation; they shall be 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. Check and adjust all valves for smooth operation.
- D. Install valves with the operating stem in either horizontal or vertical position as shown on the drawings.
- E. Allow sufficient clearance around the valve operator for proper operation.
- F. Clean iron flanges before installing flanged valves. Clean carbon steel flange bolts and nuts by wire brushing, lubricate threads with oil or graphite, and tighten nuts uniformly and progressively.
- G. For buried valves, a valve box shall be centered accurately over the operating nut and the entire assembly shall be plumb. The tops of valve boxes shall be adjusted to the proper elevation as specified below and as shown on the Drawings.
- H. Valves shall be tested hydrostatically, concurrently with the pipeline in which they are installed. Protect or isolate any parts of valves, operators, or control and instrumentation systems whose pressure rating is less than the pressure
- I. test(s). If valve joints leak during pressure testing, loosen or remove the nuts and bolts, reseal or replace the gasket, reinstall or retighten the bolts and nuts and hydrostatically retest the joints.
- J. All buried valves shall be wrapped with polyethylene (8mils).

END OF SECTION

## SECTION 331300 - DISINFECTING OF WATER UTILITY DISTRIBUTION

### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Requirements for disinfection and bacteriological testing of potable water piping.
- B. Payment Procedures
  - 1. Water
    - a. Contractor shall pay Owner for water used for disinfection and flushing of new potable water piping.
    - b. Initial water to fill new potable water piping following disinfection will be provided by the Owner. Contractor shall pay Owner for addition water used to repeat disinfection, flushing, and filling.
    - c. Payment for water shall be at Owner's bulk rate.
  - 2. Bacteriological Testing: Bacteriological testing will be provided by the Owner.

#### 1.02 REFERENCES

- A. General: References to standards, specifications, manuals, or codes of any technical society, organization or association, or to the Laws or Regulations of any government authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.
- B. AWWA Standards
  - 1. AWWA C651 Disinfecting Water Mains

#### 1.03 SYSTEM DESCRIPTION

- A. Furnish and install equipment and connections required to complete disinfection of potable water piping as specified in this Section.
- B. Provide labor, services, and equipment required to complete disinfection of potable water piping specified in this Section.
- C. Disconnect and remove equipment, piping, and appurtenances after water mains have been successfully disinfected, bacteriological testing has been completed, and water mains have been approved for connection to existing water distribution system.

## 1.04 SUBMITTALS

- A. General: As specified in:
  - 1. General Conditions; and
  - 2. Division 1.
- B. Submit copy of permit for flushing water disposal prior to starting installing of pressure piping system.

## 1.08 PROJECT/SITE CONDITIONS

- A. Bacteriological Clearance: New potable water piping shall not be placed in service prior to receipt of bacteriological clearance from regulatory authority having jurisdiction.
- B. Flushing Water Disposal
  - 1. Obtain permit from South Florida Water Management District prior to starting installation or pressure piping system. Make application and arrangements and pay fees and charges for disposal of discharge from flushing.
  - 2. Submit copy of permit for flushing water disposal.
  - 3. Comply with requirements of permit for flushing water disposal. Meet regulatory requirements relative to disposal of discharge water from flushing.

## **PART 2 – PRODUCTS**

### 2.01 DISINFECTION SYSTEM

- A. Contractor shall be responsible for the sizing and selection of disinfection system, disinfection equipment, disinfection system piping, and appurtenances.

## **PART 3 – EXECUTION**

### 3.01 DISINFECTION SEQUENCE

- A. The following shall be done prior to disinfection:
  - 1. Potable water pipe, fitting, valves, and appurtenances shall be installed.
  - 2. Cleaning and flushing of potable water piping shall be completed.
  - 3. Pressure testing of potable water piping shall be completed.
  - 4. Any repairs required on potable water piping shall be completed.
- B. Disinfect and flush potable water piping as specified in this Section.

- C. Following flushing of chlorine solution, samples shall be collected and bacteriological testing shall be performed as specified in this Section.
- D. Do not place potable water piping in service without approval of the Engineer. Piping for dry connections shall be disinfected and installed as specified in Section 02501 Installation of Buried Pressure Piping Systems and placed in service when approved by the Engineer. No other new potable water piping shall be placed in service prior to receipt of bacteriological clearance and approval of the Engineer.

### 3.02 PREPARATION

- A. Obtain approval of Engineer prior to starting disinfection of potable water piping system.
- B. Furnish and install taps and connections required to inject chlorine solution into potable water piping system.

### 3.03 BACTERIAL SAMPLE POINTS

- A. Install bacteriological sample points. Bacteriological sample points shall be as shown on the Drawings.
- B. Provide bacteriological sample points at following locations:
  - 1. Test Sections 1,000 Feet and Smaller: One sample for each section of piping tested placed at farthest point from chlorine injection.
  - 2. Test Section Greater Than 1,000 Feet: One sample for every 1,000 feet of line, places at regular intervals along water pipe section.
  - 3. Dead Ends: One sample at each dead end in section.
  - 4. Other Locations: As shown on the Drawings.
- C. Appropriately located fire hydrants may be utilized for sampling points. Under this circumstance, the Contractor will be solely responsible for maintaining the hydrants in a satisfactory environment for conducting the bacterial testing.
- D. Bacteriological sample points will be utilized by Utilities personnel for water main bacterial clearance procedures.

### 3.04 DISINFECTANT

- A. Disinfect potable water piping with chlorine.
- B. Chlorinating agent shall be as selected by the Contractor and accepted by the Engineer.
- C. Acceptable chlorinating agents include the following:
  - 1. Chlorine gas.
  - 2. Calcium hypochlorite

### 3. Sodium hypochlorite

- D. Select the chlorinating agent appropriate to the size and length of piping to be disinfected and to the location of piping system. Do not use chlorine gas in residential, commercial, or institutional areas.
- E. Placing chlorine tablets or powder in the piping is not an acceptable method of disinfection.
- F. Provide equipment and feed system for chlorinating agent that is appropriate to the chlorinating agent and the piping to be disinfected.
- G. If disinfection cannot be achieved with system furnished and installed, modify or replace disinfection system, until disinfection of potable water piping can meet the requirements of this Section.

#### 3.05 DISINFECTION OF POTABLE WATER PIPING

- A. Fill potable water piping with water containing 50 to 100 parts per million available chlorine. Quantity of disinfectant required for 100 feet of pipe is presented in tables at end of this Section. Tables are to be used only as a guide and are not guaranteed.
- B. Perform disinfection using the following schedule unless otherwise approved by the Engineer:
  - 1. Friday: Inject chlorine solution;
  - 2. Saturday and Sunday: Allow chlorine to remain in piping system.
  - 3. Monday: Flush lines.
  - 4. Tuesday and Wednesday: Collect bacteriological samples.
- C. Feed chlorinating agent at or near the point from which potable water piping is to be filled. Control flow and proportioning of water and chlorinating agent so that specified chlorine concentration is achieved throughout piping to be disinfected. Eliminate air pockets as piping is filled.
- D. Allow chlorine solution to stand in piping for not less than 48 hours.
- E. Operate valves and other appurtenances during disinfection to assure sterilizing mixture is dispersed into all parts of system being disinfected.
- F. Check chlorine residual at sample points after chlorine solution has remained in piping for 48 hours or longer.
  - 1. If chlorine solution contains at least 25 parts per million of chlorine, flush the piping and take bacteriological samples at sample points.
  - 2. If chlorine solution contains less than 25 parts per million of chlorine, flush the piping and repeat disinfection of piping.

- G. Prior to taking samples for bacteriological testing, flush chlorine solution from piping until replacement water has a chlorine content not more than 0.1 parts per million in excess of the residual in water from supplying main.

### 3.06 DISPOSAL OF CHLORINE SOLUTION

- A. After chlorine solution has been retained for the required time, pipes shall be flushed and filled with potable water from distribution system in service.
- B. Discharge water from flushing to storm drain systems in accordance with permit for disposal of flushing water and as specified in this Section.
- C. Reduce chlorine concentration to level that will not harm plants or animals in ditches, streams, canals, ponds, lakes, waterways, bays, estuaries, or any other location that could be impacted by disinfectant discharge. Provide temporary dechlorination tanks, equipment, and chemicals as required to reduce chlorine concentration to level that will not harm plants or animals. Chlorine concentration in discharge to storm drain system shall not exceed 0.1 parts per million.

### 3.07 BACTERIOLOGICAL SAMPLING AND TESTING

#### A. Sampling

- 1. Collect and submit samples for bacteriological analysis.
- 1. Sampling: Water samples for bacteriological examination shall be taken by the Owner after receiving adequate notice, 48 hours minimum, from the Contractor.
- 2. Numbers of samples collected shall meet the requirements of the regulatory authority having jurisdiction.

#### B. Testing

- 1. Bacteriological test shall meet the requirements of AWWA C651.
- 2. Bacteriological test shall be performed by independent testing laboratory certified by State of Florida for bacteriological testing.
- 2. Bacteriological tests shall be performed by the Owner.
- 2. Bacteriological tests shall be performed by regulatory authority having jurisdiction.
- 3. Repeat disinfection and bacteriological testing until piping is approved for service by regulatory authority having jurisdiction.
- 3. Repeat disinfection and bacteriological testing until piping is approved for service by the Owner.

### 3.08 PLACING POTABLE WATER PIPING IN SERVICE

- A. Do not place potable water piping in service until Engineer has approved placing potable water piping in service.

- B. Do not place potable water piping in service until disinfection of potable water piping has been completed and bacteriological clearance for potable water piping has been received.

Quantity of Chlorine Gas

Required to Produce 50 mg/l of Available Chlorine per 100 feet of Pipe

<u>Pipe Size</u>	<u>Pounds per 100 feet</u>
¾"	0.001
1"	0.002
1¼"	0.003
1½"	0.004
2"	0.007
2½"	0.011
3"	0.015
4"	0.027
6"	0.061
8"	0.11
10"	0.17
12"	0.24
14"	0.33
16"	0.44
18"	0.55
20"	0.68
24"	0.98
30"	1.5
36"	2.2
42"	3.0
48"	3.9
54"	5.0
60"	6.1
64"	7.0

Quantity of Calcium Hypochlorite Solution (70% Available Chlorine)  
 Required to Produce 50 mg/l of Available Chlorine per 100 feet of Pipe

<u>Pipe Size</u>	<u>Pounds per 100 Feet</u>	<u>Ounces per 100 Feet</u>
½"	0.001	0.01
¾"	0.002	0.02
1"	0.003	0.04
1¼"	0.004	0.06
1½"	0.006	0.09
2"	0.010	0.16
2½"	0.015	0.25
3"	0.022	0.35
4"	0.039	0.62
6"	0.087	1.4
8"	0.16	2.5
10"	0.24	3.9
12"	0.35	5.6
14"	0.48	7.6
16"	0.62	10
18"	0.79	13
20"	0.97	16
24"	1.4	22
30"	2.2	34
36"	3.1	50
42"	4.3	69
48"	5.6	90
54"	7.2	110
60"	8.8	140
64"	10	160

Quantity of Sodium Hypochlorite Solution (5.25% to 14.7% Available Chlorine)

Required to Produce 50 mg/l of Available Chlorine per 100 feet of Pipe

Pipe Size	Ounces per 100 Feet		Quarts per 100 Feet	
	14.7% available chlorine	5.25% available chlorine	14.7% available chlorine	5.25% available chlorine
½"	0.05	0.1	0.001	0.004
¾"	0.10	0.3	0.003	0.010
1"	0.20	0.5	0.006	0.020
1¼"	0.30	0.8	0.009	0.030
1½"	0.40	1.2	0.013	0.040
2"	0.80	2.1	0.023	0.070
2½"	1.2	3.3	0.036	0.10
3"	1.7	4.7	0.052	0.15
4"	3.0	8.3	0.093	0.26
6"	6.7	19	0.21	0.58
8"	12	33	0.37	1.0
10"	19	52	0.58	1.6
12"	27	75	0.83	2.3
14"	36	100	1.1	3.2
16"	47	130	1.5	4.1
18"	60	170	1.9	5.2
20"	74	210	2.3	6.5
24"	110	300	3.3	9.3
30"	170	470	5.0	14
36"	240	680	7.2	21
42"			9.8	28
48"			13	36
54"			16	46
60"			20	56
64"			23	64

END OF SECTION

## SECTION 3316 00 SIDEWALKS, CURBS & GUTTERS

### PART 1- GENERAL

- 1.1 **WORK INCLUDED:** This section covers all formed concrete work reinforced and non-reinforced as required by the Project indicated on the plans or specified by the Engineer. **The Contractor is responsible for all site work and construction supervision required to meet ADAAG/ADA specifications when placing concrete.**
- 1.2 **SUBMITTALS DURING CONSTRUCTION:**
- A. Submittal during construction shall be made as required in General Requirements.
- 1.3 **SUBMITTALS REQUIRED FOR:**
- A. Concrete - Submit data sheets
  - B. Granular fill - Submit data sheets
  - C. Expansion joint fillers - Submit data sheets
  - D. Traffic paint - Submit data sheets
  - E. Asphalt concrete cold patch - submit data sheets
  - F. Asphalt Hot Mix – submit data sheets
  - G. Sod - submit data sheets
  - H. Stamped and Colored concrete-submit data sheets
  - I. Detectable Warnings System:- submit data sheets
  - J. Concrete Sealer - submit data sheets

### PART 2- PRODUCTS

- 2.1 **FORMS:**
- A. Materials for curb forms shall be 2-inch dressed dimension lumber, fiberglass, or metal of equal strength, free from defects which would impair the appearance or structural quality of the complete curb. Where short-radius forms are required, 1-inch dressed lumber or plywood may be used. Form material for the face of the curb shall not have any horizontal joints closer than 7-inches from the top of the curb. Provide stakes and

bracing materials as required to hold forms securely in place. Metal forms shall be subject to approval by the Engineer. Forms are incidental to the Contract Price.

- B. Materials for sidewalk forms shall be 2-inch dressed lumber straight and free from defects or fiberglass or standard metal forms may be used. Where short radius forms are required, 1-inch dressed lumber is required to hold forms securely in place.

## 2.2 GRANULAR FILL:

- A. Natural sand not having any piece of material larger than 1-inch, free from dirt, clay balls, or organic material, well graded from coarse to fine, containing sufficient finer material for proper compaction and less than ten (10) percent by weight passing the No. 200 sieve. Payment shall incidental to the concrete unit Price bid.

## 2.3 EARTH FILL:

- A. Earth must be free from rocks 2-inches or larger and other foreign materials. Earth fill is incidental to contract Prices. Payment shall incidental to the concrete unit Price bid.

## 2.4 EXPANSION JOINT FILLERS:

- A. Expansion joint fillers shall conform to F.D.O.T. Standard Specifications for Road and Bridge Construction 2004. Submit complete information regarding joint fillers for approval by the Engineer. Payment shall incidental to the concrete unit Price bid.

## 2.5 CONCRETE:

- A. Concrete shall be ready-mixed conforming to ASTM C 94 and shall have a compressive strength of 3,000 psi at 28 days. All exposed aggregate concrete applications shall be comprised of 3 MM – 5 MM maximum size brown river rock aggregate. Limerock aggregate is acceptable for all other concrete applications. Submit complete information regarding mix to the Engineer for review in accordance with the requirements of the referenced ASTM Specification.

## 2.6 DETECTABLE WARNING SYSTEM:

- A. Detectable Warning Systems on walking surfaces shall be “Endicott Handicap Detectable Warning Paver” or equal with raised truncated domes and specified color and must meet federal ADAAG guidelines.

## 2.7 TRAFFIC MARKING PAINT:

- A. Traffic marking paint shall conform to F.D.O.T. Specifications Section 971. Paint for curbs shall be Pride Baker Paint brand traffic marking paint or approved equal. Paint and labor shall be incidental to contract price for replacement markings and the unit price bid for new markings.

## 2.8 ASPHALT:

- A. Cold patch asphalt. Asphalt and labor shall be incidental to the contract price for patches surrounding curbs and sidewalks.

## 2.9 ACCEPTANCE OF MATERIALS:

- A. All materials shall be subject to inspection for suitability, as the Engineer may elect, Prior to or during incorporation into the work.

## PART 3- EXECUTION

### 3.1 EXCAVATION AND BACKFILL:

- A. Cut the existing sidewalk regardless of the thickness, with an approved pavement saw or approved pavement cutter wherever sidewalk edges do not follow straight lines. Saw cutting of concrete shall be wet down to reduce air borne contamination. Remove and dispose of sidewalk at the Contractor's expense.
- B. Prior to excavation of the sidewalk the Contractor's superintendent and the Owner's Engineer or designee shall, together, walk the length of the site marking the limits of the excavation and marking any other pertinent information. Paint shall be supplied by the Contractor, incidental to the cost of the Contract.
- C. At the time of each walk through described in Section 3.1.2, each water meter box and sewer cleanout shall be inspected for structural integrity. Those which are deemed in need of replacement at that time will be supplied by the contractor at the unit price bid or the Florida Keys Aqueduct Authority. Those which meet normal structural and functional standards, and are broken by the Contractor during the construction Process shall be replaced by the Contractor at his cost.
  - 1. Sewer cleanout boxes shall be made from 100% homogenous polyethylene material having a minimum wall thickness of .550 inch, a compartment size of 12-inches by 20-inches with a clear opening of 10-inches by 17-inches. Provide knockouts or notches in each end sized to allow placement of a 6-inch PVC pipe inside the box. Vertical crush to exceed 20,000 pounds and sidewall loading to exceed 180 pounds per square inch. A flange shall encircle the top area for installation in concrete. Cleanout covers shall be cast of ductile conforming to ASTM A-536-84, grade 60-40-18. The meter box covers shall meet or exceed Federal specifications RR-F-621D for a minimum Proof load of 25,000 pounds on 9"x 9" area. All boxes and covers shall be manufactured by Mid- States Plastics, Mount Sterling, KY. Florida Master Distributor: Ferguson Water Works (561-844-3222) or approved equal.
  - 2. Water meter boxes shall be Mid- States MS # 15P meter box or equal, covers shall have cast iron reading lid.

- D. As directed by the Engineer remove any unsuitable material to such a depth that the addition of the sub grade and granular fill can be placed and compacted. Unsuitable material shall consist of and not be limited to top soil, wood, root matter, stumps, trunks, roots or root systems. Excavation that cannot be accomplished without endangering present structures shall be performed with hand tools.

### 3.2 PREPARATION OF SUBGRADE:

- A. Bring the areas on which curbs and sidewalks are to be constructed to required grade and compact to 95 percent ASTM D 1557 by sprinkling and rolling or mechanical tamping. As depressions occur, refill with approved material and recompact until the surface is at the proper grade.

### 3.3 PLACING GRANULAR FILL:

- A. After the sub grade for sidewalks and curbs is compacted and at the Proper grade, spread 4-inches or more of granular fill. Sprinkle with water and compact to 95 percent ASTM D 1557 by rolling or other method. Top of the compacted fill shall be at the proper level to receive the concrete. Granular fill shall be used, when needed, to raise the level of grade to allow for proper thickness of concrete. After spreading fill, compact to 95 per cent.

### 3.4 SETTING FORMS:

- A. Construct forms to the shape, lines, grades, and dimensions as required for proper installation or as called for on the drawings or as directed by the Engineer. Stake wood or steel forms securely in place, true to line and grade.
- B. Forms on the face of the curb shall not have any horizontal joints within seven (7) inches of the top of the curb. Brace forms to prevent change of shape or movement in any direction resulting from the weight of the concrete during placement. Construct short-radius forms to exact radius. Tops of forms shall not depart from grade line more than 1/8-inch when checked with a ten-foot straightedge. Alignment of straight sections shall not vary more than 1/8-inch in ten (10) feet.

### 3.5 CURB/GUTTER CONSTRUCTION:

- A. Construct curbs to line and grade of curbs and gutters removed, as shown on plans or as established or directed by the Engineer. Curbs shall conform to F.D.O.T. type "D" or "F" or as directed by the Engineer.
- B. Handicap ramps shall be constructed at locations shown on the drawings or as directed by the Engineer and in conformance with legal requirements.
- C. Place preformed asphalt-impregnated expansion joints at intervals not exceeding 100 feet, at the beginning and ends of the curved portions of the curbs and at inlets.

- D. Place contraction joints in the curb at intervals not exceeding fifteen (15) feet. Contraction joints shall be of the open joint type and shall be Provided by inserting a thin, oiled steel sheet vertically into the fresh concrete to force coarse aggregate away from the joint. The steel sheet shall be inserted the full depth of the curb. Place, process, finish and cure concrete in conformance with the applicable requirements of ACI 614, and this Specification. Whenever the requirements differ, the higher shall govern. After initial set has occurred in the concrete and prior to removing the front curb form, the steel sheet shall be removed with a sawing motion. Finish top of curb with a steel trowel and finish edges with a steel edging tool.
- E. As soon as the concrete has set sufficiently to support its own weight, remove the front form and finish all exposed surfaces. Finish formed face by rubbing with a burlap sack or similar device that will produce a uniformly textured surface, free of form marks, honeycombs and other defects. All defective concrete shall be removed and replaced at the Contractor's sole expense.
- F. Upon completion of the curing period, backfill the curb with earth, free from rocks 2-inches and larger and other foreign materials. Tamp backfill firmly in place.
- G. Finished curb shall present a uniform appearance for both grade and alignment. Remove any section of curb showing abrupt changes in alignment or grade, or which is more than 1/4-inch away from its location as staked, and construct new curb in its place at the Contractor's sole expense.
- H. Upon completion of the curing period fill with asphalt any street side holes or ruts in the asphalt paving that was created by the installation of the sidewalk or the curb. When required by Engineer, saw cut, remove and replace sections as directed.
- I. Where curbs that were painted for legal traffic markings (i.e., loading zones, driveways, no parking zones) prior to construction are removed, replaced, repaired or installed. These and any newly constructed curbs and sidewalks shall be repainted by the Contractor. Painting shall be performed upon completion of the curing period, but not less than seven (7) days have elapsed since pouring the concrete. Curbs are to be painted from the inside edge of the curb to the edge of the pavement.

### 3.6 SIDEWALK CONSTRUCTION:

- A. Sidewalks shall be four-inches and driveways shall be 6 inches thick as directed by the City.
- B. Place preformed expansion joints as in the adjacent curb, where the sidewalk ends at a curb, around posts, poles, concrete buildings or walls or other objects protruding through the sidewalk, and at locations shown on the Drawings.
- C. Provide dummy joints transversely to the walks at locations opposite the contraction joints in the curb and at intervals not exceeding five (5) feet. These joints shall be 1/4-inch by 1-inch weakened plane joints. They shall be straight and at right angles to the surface of the walk.

- D. Place, process, finish, and cure concrete in conformance with the applicable requirements of ACI 614 and this Specification. Where the requirements differ, the higher shall govern.
- E. Surface finish shall be as depicted on the Landscape Drawings.
- F. Sidewalks shall be placed to slope towards the street at a maximum slope of 2% or as otherwise directed by the Engineer.
- G. Where sidewalks or curbs which were painted for legal traffic markings (i.e., loading zone, driveways, no parking zones) are removed and replaced with new curb or sidewalk or repaired, the Contractor shall be responsible to paint the new portions of the curbs or sidewalks.
- H. Upon completion of the curing period fill with asphalt, any street side holes or ruts in the asphalt paving that were created by the installation of the curbs or sidewalks.

### 3.7 GRANITE CURB RESTORATION:

- A. Granite Curb Restoration shall take place in locations as directed by the Engineer.
- B. The existing granite curb shall be removed from the ground and stored in a manner to preserve their quality and quantity as specified in the General Requirements. The Contractor shall be solely and directly responsible to the Owner for any curbing removed during the contract period.
- C. Curbing shall be reset, prior to sidewalk pour, as specified in the drawings, or as otherwise directed by the Engineer.
- D. Any pavement disturbed by curb restoration shall be repaired as specified in Section 3.5.8
- E. Curbs that were painted with legal traffic markings (i.e., loading zones, driveways) prior to removal shall be repainted as directed by the City.

### 3.8 STAMPED AND COLORED CONCRETE

- A. Stamped and colored concrete shall be as depicted on the Landscape Drawings.

END OF SECTION

## SECTION 33 25 10 DRILLING OF DRAINAGE WELLS

### CLASS V STORMWATER DISPOSAL INJECTION WELL CONSTRUCTION TECHNICAL SPECIFICATIONS

#### PART 1 GENERAL

##### 1.1 Requirements

- A. The WATER WELL CONTRACTOR must be licensed as a Florida Water Well Contractor accordance with F.A.C. 62-531. Water Well contractor must have a properly structured State Of Florida Business. The WATER WELL CONTRACTOR shall submit for the Construction / Clearance Permit Application for Class V well to the FDEP.
- B. The WATER WELL CONTRACTOR shall construct each well as shown on the Civil Construction Drawings and Details, and perform all appurtenant work in accordance with the Technical Specifications. The wells shall be constructed with an open-hole completion. The wells shall be complete and operable, in accordance with Chapter 62-528, F.A.C. The Construction of the well shall be in accordance with Chapter 62-523, F.A.C.
- C. Site Sound Proofing: The WATER WELL CONTRACTOR shall furnish sound proofing barriers, provide mufflers on equipment, and undertake other steps necessary during drilling, pumping, testing, and incidental operations, to ensure that noise levels conform to all applicable noise ordinances.
- D. Access Control: The WATER WELL CONTRACTOR shall undertake necessary measures to limit access to drilling sites, to minimize public hazards.
- E. Sequence of Work: The sequence may be changed by the ENGINEER. Change may include alternations to the order of occurrence, deletions, or additions. The WORK schedule and operations shall continue without interruption until all WORK is completed by the CONTRACTOR.
  - 1. Preparation and Mobilization shall be completed as specified in Mobilization Section, including, but not limited to:
    - a. Site and access video
    - b. Clear site and establish vertical and horizontal control with reference to NGVD 1929.
    - c. Install temporary services, as needed
    - d. Mobilize drilling rig and provide temporary piping for water supply and disposal.

- e. Prepare Onsite staging areas and disposal sites as needed
2. Drill Bore Hole including open hole to depth of 120 feet below top of casing elevation specified on the project plans. Overdrill shall be a minimum of 6 inches greater than the outside diameter of the well casing at the casing joint.
3. Provide lithology description and casing seat request to FDEP.
4. Install Casing upon Approval from FDEP.
5. Notify FDEP in Fort Meyers (David Rhodes, P.G.) and Marathon (Steve Johnson) at least 72 hours prior to grouting.
6. Grout Casing.
7. Install temporary cap on well.
8. Process Certification for well completion. Provide AS-built drawings to Engineer
9. Attach storm water / pretreatment structures as required.
10. Clean site / demobilize.

#### F. Personnel Requirements

1. The WATER WELL CONTRACTOR shall furnish capable personnel, experienced in the work required to construct the Class V injection well(s).
2. The Drill Rig Operator shall work under the direct supervision of the Florida licensed WATER WELL CONTRACTOR, using equipment that is under the direct control of the Florida licensed WATER WELL CONTRACTOR. The Florida Licensed Water Well Contractor is required to be onsite to supervise the well construction operation.
3. The Drill Rig Operator shall maintain the drilling equipment, pumps, and drill pipe. The driller shall be competent in the use and application of drilling fluids and additives.
4. The Drill Rig Operator shall monitor the progress of the drilling operation, and keep the record of the rate and progress of drilling, development and pump testing operations, including well logs and reports. The daily reports shall be submitted with the water well contractor's portion of the well completion report.
5. The Drill Rig Operator shall be capable of recognizing and making lithologic classifications of the formations to be encountered during the drilling. The Drill Rig Operator shall ensure that the necessary amount of overdrill is determined and executed to ensure that the 60 feet of casing and grout below land surface is accomplished along with ensuring the required amount of casing is provided above the land surface according to the Civil Engineering Drawings.

6. The Cementing Supervisor shall have a working knowledge of down hole pumping, an understanding of displacement, volume of cement, pump pressure, bottom hole pressure, casing lift pressure. Cementing Supervisor shall ensure that casing collapse pressure is not exceeded.

## 1.2 Record Keeping, Well Logs, and Reports

### A. General

1. The WATER WELL CONTRACTOR shall establish horizontal and vertical (top of casing elevation) control by a licensed land surveyor in the State of Florida.
2. The WATER WELL CONTRACTOR shall ensure the depth of the well as shown on the construction plans is established. The depth of the well is measured from either the actual surveyed land surface or the surveyed top of casing in a pretreatment structure if applicable.
3. Measurement of the total well depth (including open hole) shall be accomplished by using a heavy duty tape measure or cord with a weight attached to the end. The tape measure shall be lowered to the bottom of the hole, maintaining a vertical alignment. Tape should be read or cord marked equal to the top of the casing elevation. If cord used, measure the cord length. Contractor can submit alternate method to Engineer and FDEP for approval if desired.

- B. Drilling Log: The WATER WELL CONTRACTOR shall maintain the Drilling Log. The report forms shall include, at a minimum, location of well, county, TSR, street address, property owner name and address, well depth, method of drilling, lengths and numbers of drill rods used, well use, casing type, grout type used, method of installation, depth of installation, bucket assembly information, drilling additives, fluid losses, water and fluid level changes, footage drilled and formations encountered, and cementing operations, pump information, and a record of any situation encountered (well stuck, collapse of hole).

1. The Drilling Log shall detail the cutting and disposal method, listing the quantity of cuttings, storage location onsite, and transport and final disposal site. The Final Disposal site shall be approved by FDEP. A letter shall be sent to FDEP providing the site owner's permission to use the site for cutting disposal.
2. The Drilling Log shall list information relating to maintenance and repair of the drilling rig.
3. The Drilling Log shall be available on site for inspection at all times.
4. The Drill Log in this specification section can be used or a contractor log submitted to the Engineer for approval can be used. The Drilling Log does not eliminate or replace the well completion report required to be submitted to the water management district, and the certification of class five well construction

completion to be submitted to FDEP. The Drilling log shall be included in the water well contractor's completion report.

- C. Record Drawing: The final well description shall conform to the permit drawings and specifications, any deviations from the originally permitted design drawings shall be noted and accompanied by written approvals from FDEP. The record drawing shall show the final diameter, wall thickness, depth and length of the casing, borehole diameter, cemented casing, depth and thickness of annular seals, pretreatment structure and piping, quantity of material removed during development operations, and all other pertinent details. The Record Drawings shall be updated by the well contractor if needed with the actual constructed well information and be submitted with the Engineer's Certified Completion Report.
- D. Records Required by Law: The WATER WELL CONTRACTOR shall maintain all records required by governmental agencies having jurisdiction, and shall submit such records to as may be required. Two copies of all records and submitted material shall be furnished to the ENGINEER.
- E. Permits: The WATER WELL CONTRACTOR shall apply for all necessary drilling and testing permits with local and state regulatory agencies. The WATER WELL CONTRACTOR shall be required to provide certain information to the permitting agencies, in order to complete the permitting process. It is the WATER WELL CONTRACTOR's responsibility to obtain any and all other permits associated with the drilling and testing of the well.
- F. Completion Report: A Well Completion Report (Form 62-528.900(4)) must be filed with the permit issuing agency along with a signed copy of the well completion report from the water management district within thirty (30) days of well completion. The well completion report and the as-built drawings that the WATER WELL CONTRACTOR has updated should be submitted together. The as-built drawings of the injection well and the associated site stormwater structures are required to be reviewed, and signed and sealed by the engineer of record.
- G. Grout: Samples of grout shall be collected during the cementation of all casings, with the CONTRACTOR collecting dry and mixed samples of the cement being used. Mixed cement samples shall include at least three (3) 2-inch cubes suitable for tests of compressive strength.
  - 1. Grout samples shall be collected a minimum of three (3) times during each cement stage: Prior to pumping, at the middle and at the end of the stage. The specified slurry density shall match the specified slurry density indicated on the delivery certificate, if grout is not mixed on site.
  - 2. Only 2-inch cubes, suitable for tests of compressive strength, will be acceptable as representative cement samples.

H. Calibration Data: Calibration records for each measuring instrument used in the construction of the well shall be submitted to the ENGINEER for review prior to the installation or use of the instruments. Calibration of instruments shall have been performed within 45 days prior to use in testing. All calibration records shall be submitted to the ENGINEER prior to use. The calibration records shall contain the following information:

1. Meters: The CONTRACTOR shall supply flowmeters and other meters for use in testing the well. The flowmeter for use in the pumping test shall have major gradations of 100 gpm and minor gradations of 10 gpm. Accuracy shall be ¼ of 1 percent of full scale.

Serial number, model number, gears, test apparatus size, meter reading and flow rate for at least three (3) steps, percent error for each step, and tester's name and title must be included in the submittal.

2. Gauges: The pressure gauges used in pressure tests shall have 0 to 50 psi scales with major gradations of 10 psi and minor gradations of 0.5 psi or smaller. Pressure gauges for use during aquifer tests, if required, shall have scales from 0 to 50 psi with 1 psi gradations. Gauge accuracy shall be ¼ of 1 percent of full scale.

The gauge's serial number, model number, scale range, meter reading and inches of mercury for at least three (3) steps covering the entire range of the gauge, percent error for each step, and tester's name and title must be included in the submittal.

### 1.3 Quality Insurance

- A. Remedial Work: Remedial work performed prior to final acceptance, as required to meet the regulatory requirements or the Technical Specifications, due to defective materials, accident, loss of equipment or equipment malfunction, or any other cause directly attributable to the WATER WELL CONTRACTOR's actions or inaction, shall be performed by the WATER WELL CONTRACTOR at the WATER WELL CONTRACTOR's expense deemed as required.

In the event of a problem, the ENGINEER, and FDEP shall be notified immediately, and the following shall apply:

1. The WATER WELL CONTRACTOR shall propose a method of correcting the problem, to the ENGINEER, and FDEP. The ENGINEER, FDEP and OWNER shall review the proposed method of corrective action. Only after approval from the ENGINEER, and FDEP shall the corrective action plan be implemented.
2. All work on the well must be in accordance with the applicable local, state, and federal regulations.
3. If the well is deemed unacceptable by the ENGINEER, it shall be abandoned and backfilled by the WATER WELL CONTRACTOR, after obtaining a permit, at contractor's expense, for plugging and abandonment of the well from FDEP. The WATER WELL CONTRACTOR shall not be paid for services and work deemed incomplete or unacceptable. Reason for the well deemed unacceptable shall be provided to FDEP.

- B. Repeat Work: All work repeated as a result of the WATER WELL CONTRACTOR's performance shall be furnished at the expense of the WATER WELL CONTRACTOR. No claim for additional compensation shall be made or be allowed, including all materials, labor, and equipment costs. FDEP Approval shall be obtained prior to and repeat work being done.
- C. State Standards: Department of Environmental Protection Rules and Regulations for UIC Wells in Chapter 62-528, Florida Administrative Code (F.A.C.).
- D. Commercial Standards: All work specified herein shall conform to or exceed the requirements of the applicable codes and standards, relating to the referenced portions of the following documents, only to the extent that the requirements therein are not in conflict with the provisions of this section. Where such documents have been adopted as a code or ordinance by the public agency having jurisdiction, such a code or ordinance shall take precedence.

Commercial Standards:

ASTM C 150	Specification for Portland Cement.
ASTM D 1784	Specification for Rigid PVC Compounds and Chlorinated PVC Compounds.
ASTM D-2564	Standard Specification for Solvent Cements for Poly (Vinyl Chloride) (PVC) Plastic Piping Systems
ASTM D 2837	Standard Test Method for Obtaining Hydrostatic Design Basis for Thermoplastic Pipe Materials.
ASTM F 480	Specification for Thermoplastic Well Casing Pipe and Couplings Made in Standard Dimension Ratios (SDR), Sch 40, and Sch 80.
AWWA A 100	Standard for Water Wells.

- E. Guarantee: The WATER WELL CONTRACTOR guarantees that the workmanship, materials and equipment supplied or used in the execution of work to be free from defects and flaws. The WATER WELL CONTRACTOR further guarantees that the performance test requirements shall be fulfilled. The WATER WELL CONTRACTOR shall repair, correct, or replace all damaged work covered by failures under the guarantee, at the WATER WELL CONTRACTOR's expense, only AFTER approval from FDEP. The guarantee shall remain in effect for a period of five (5) years from the date of final acceptance by the OWNER.
- F. Abandonment of Well by Contractor: If, at any time the WATER WELL CONTRACTOR voluntarily stops work, and/or fails to complete the bore hole in a satisfactory manner, in accordance with governing regulations, the bore hole will be considered abandoned. The WATER WELL CONTRACTOR shall not be paid for all or part of a bore hole declared as abandoned by the OWNER.

1. The cost of properly plugging and sealing the well or bore hole, in accordance with applicable local, state or federal regulations, shall be paid by the WATER WELL CONTRACTOR
  2. All salvageable material furnished by the WATER WELL CONTRACTOR may be removed and remain his property, after approval from FDEP.
  3. The WATER WELL CONTRACTOR shall propose his method of abandonment of the well or bore hole, in writing to the ENGINEER. The WATER WELL CONTRACTOR shall apply for and obtain an Application for Class V Well Plugging and Abandonment Permit. The ENGINEER, and FDEP shall review the method of abandonment. The FDEP and the ENGINEER'S approval of the plan must be obtained, in writing, prior to the implementation of the abandonment plan. All work on the well must be in accordance with all applicable local, state, and federal regulations.
- G. Abandonment of Well by OWNER: If information indicates that the completion of a well on the site is not warranted, the OWNER reserves the right to terminate all further work at the site. In such an event, the WATER WELL CONTRACTOR will be paid the value of work completed to that time, based on standard unit prices.
1. The WATER WELL CONTRACTOR shall be required to abandon the bore hole, as directed by the ENGINEER, in accordance with regulations formulated by governmental agencies having such jurisdiction, including Chapter 40D-3.531 F.A.C. The WATER WELL CONTRACTOR shall apply for and obtain an Application for Class V Well Plugging and Abandonment Permit. Costs associated with the abandonment will be paid by the OWNER.
  2. The OWNER reserves the right upon termination of work on the site to have the WATER WELL CONTRACTOR move to another location on the site selected by the OWNER to drill another bore hole. The location must be approved by the ENGINEER and FDEP. In such circumstances; The WATER WELL CONTRACTOR shall apply for and obtain an Application for Class V Well Plugging and Abandonment Permit. Costs associated with the abandonment will be paid by the OWNER. FDEP shall be advised prior to relocation of the well. If deemed necessary by FDEP, a permit modification will be done at the OWNER's expense.
- H. Environmental Considerations: All regulated materials, liquids and/or substances shall be stored within secondary containment, in compliance with applicable regulations of the State. It is the responsibility of the WATER WELL CONTRACTOR to obtain the regulated materials list from the appropriate State office and to provide the ENGINEER with an inventory of all regulated materials to be used on the job site. The integrity of the secondary containment area shall be demonstrated by the WATER WELL CONTRACTOR for the ENGINEER, upon request. At any time if existing contamination either is soil or water is found to be above state of federal limits; work shall be stopped and the ENGINEER and FDEP notified of the finding. Work shall only proceed with authorization from the ENGINEER and FDEP.

#### 1.4 STORAGE AND PROTECTION OF MATERIALS

- A. General: All materials shall be delivered in an undamaged condition and stored to provide protection against damage. All defective or damaged materials shall be replaced with new materials.
- B. Defective Materials: Materials that are defective or damaged prior to use are unacceptable and shall be replaced with new materials, at the WATER WELL CONTRACTOR's expense.
- C. Drilling Waste Disposal: Prior to beginning drilling operations, the CONTRACTOR will submit to the ENGINEER verification of his disposal site in writing from the FDEP. The CONTRACTOR shall be responsible for providing and maintaining all necessary trucks, pipe, pumps, and equipment necessary to pump and haul excess drilling fluid, drill cuttings, and produced water to a pre-determined disposal site(s) in accordance with federal, state and local regulations, or subcontract with a firm capable of providing these services when necessary.
- D. Field Relocation: During construction, it is expected that minor relocation of proposed facilities may be necessary. Field revisions will only be made at the direction of the ENGINEER. If existing structures are encountered that prevent construction as shown, the WATER WELL CONTRACTOR shall notify the ENGINEER prior to continuing work. All relocations must be communicated to FDEP prior to relocating the well. Relocations within a 10 foot radius generally will not require written FDEP approval. Relocations outside of the 10 foot radius will require approval, in writing; and some cases may require a permit modification prior to work commencing at the selected site.
- E. Storage Area: The WATER WELL CONTRACTOR shall prepare an area, within the limits of a location approved by the ENGINEER, for the storage of materials required for this work.
- F. Protection: The WATER WELL CONTRACTOR is responsible for protecting his own work from theft, vandalism, and unauthorized entry.

#### 1.5 CONTRACTOR EQUIPMENT

- A. General: The WATER WELL CONTRACTOR's equipment shall be clean, well maintained, and in good operating condition when delivered to the site and during the entire operation.
  - 1. The equipment shall be of adequate size, strength, horsepower, and capacity for the project and shall be of the type successfully utilized for the construction of similar or larger wells.
  - 2. All equipment shall be provided with safety devices, as required by governmental authorities having jurisdiction.

- B. Equipment Use: Reaming and setting of casing shall be done with the same equipment. No resetting of equipment will be allowed after the bore hole is reamed.
- C. Equipment Operation: All equipment shall be carefully maintained during the WATER WELL CONTRACTOR's operations. Any damage to the well or surrounding property and/or facilities, due to the WATER WELL CONTRACTOR's operations shall be repaired or replaced.
- D. Safety Equipment: The WATER WELL CONTRACTOR must provide and utilize safety equipment, as required by all applicable federal and state regulations.

#### 1.6 MOBILIZATION AND SITE RESTORATION

- A. Mobilization: The WATER WELL CONTRACTOR shall mobilize its equipment and personnel to effectively commence its drilling operations, within the specified time limit.
- B. Unused Materials and Equipment: During construction, the WATER WELL CONTRACTOR shall regularly remove all accumulated debris and surplus materials. Unused tools or equipment shall be stored at the WATER WELL CONTRACTOR's yard or base of operations.
- C. Periodic Cleaning: The WATER WELL CONTRACTOR shall perform clean-up work on a regular basis and as requested by the ENGINEER.
  - 1. Basic site restoration shall be accomplished immediately following installation or substantial completion, or as directed by the ENGINEER.
  - 2. If the WATER WELL CONTRACTOR fails to perform periodic clean-up and basic restoration of the site to the ENGINEER's satisfaction, the ENGINEER may, upon five days written notice to the WATER WELL CONTRACTOR, employ such labor and equipment as he deems necessary for this purpose, at the WATER WELL CONTRACTOR's expense.
- D. Protection of Water Quality: The WATER WELL CONTRACTOR shall take all necessary precautions to prevent contaminated water, gasoline, or other hazardous substances from entering the ground, either through the well or through seepage from ground surface. The WATER WELL CONTRACTOR shall maintain precautions during and after construction of the well, and until acceptance of the well by the OWNER. If the WATER WELL CONTRACTOR fails to prevent contaminants from entering the groundwater, remedial action, as required by the governing regulatory agencies shall be performed by the WATER WELL CONTRACTOR, at the sole expense of the WATER WELL CONTRACTOR. A temporary well cap shall be installed on the well casing, when the well is complete, until the baffle box is connected to the well. The Contractor shall ensure the well cap is maintained on the well.

- E. Work Completion and Final Cleanup: Upon completion of work, the WATER WELL CONTRACTOR shall promptly remove all his equipment and unused materials, from the drill site, approved storage areas and approved disposal sites. He shall dismantle any temporary structures erected for his purposes that are not part of the final product. He shall promptly effect minor repairs. The WATER WELL CONTRACTOR shall thoroughly clean the drill site, and approved storage areas. All excess drilling fluids, debris, and other materials used during construction shall be removed and disposed of, by the WATER WELL CONTRACTOR. Mud sumps and other work excavations shall be filled, compacted, graded, and the site returned to a condition equal to or better than its condition at the start of the work. These requirements must be completed within one month after the completion of drilling and testing.

## PART 2 PRODUCTS

Products are listed and described throughout Part 3 Execution. Products shall conform to all requirements of Part 1 General.

## PART 3 EXECUTION

### 3.1 GENERAL

Changes from the specifications as permitted by FDEP, shall require FDEP concurrence and written approval via a permit modification if deemed necessary by FDEP. All changes from FDEP permit specifications require notification and concurrence from FDEP.

The work shall be performed by a competent crew with equipment that is adequate to complete all phases of well construction.

The depths and lengths for boreholes and casings shall be as shown on the drawings, unless otherwise determined by the ENGINEER. Payment will be based on actual quantities furnished, installed, or constructed, in accordance with the schedule of values.

All work required to be repeated, resulting from the WATER WELL CONTRACTOR's performance, or lack thereof, including all additional materials, labor and equipment required, shall be furnished at the expense of the WATER WELL CONTRACTOR. No claim for additional compensation shall be made or allowed, except as specifically provided herein.

Well drilling shall begin after approved maintenance of traffic, if applicable.

### 3.2 DRILLING AND REAMING OPERATIONS

- A. Drilling: The WATER WELL CONTRACTOR shall take all measures necessary to protect the top portions of the test hole from caving or raveling.

- B. Centralizers: Verification of the casing to be centered shall be done. Centralizers shall be used on the pipe to ensure the alignment of the casing and an even distribution of grout around the casing. Centralizers shall be placed every 20 feet.
- C. Casing: The first 60 feet, cased part of well, shall be drilled with 6" overdrill. Upon reaching 60 feet or elevation at which the casing will be seated; the open hole shall be drilled. To drill open hole the WATER WELL CONTRACTOR shall center the drill rig in the drilled hole, and drill the open hole at 22 inch diameter.
- D. Rotary Bucket Auger: The drilling fluid shall possess such characteristics as are required to adequately condition the walls of the hole to prevent caving as drilling progresses, and to permit recovery of representative samples of cuttings.
  - 1. Only fresh water from the designated source shall be used in drilling fluids whether employed alone or in combination with drilling additives. Any other drilling additives to be used will require acceptance by the ENGINEER.
  - 2. The WATER WELL CONTRACTOR shall maintain complete control over drilling fluid characteristics during the entire operation of well construction. If proper control of the drilling fluid is not maintained, the WATER WELL CONTRACTOR may be required, at the WATER WELL CONTRACTOR's expense, to retain or employ an experienced, qualified mud engineer on the job during all operations, to supervise and maintain drilling fluid characteristics.
  - 3. The WATER WELL CONTRACTOR shall provide holding tanks for handling the drilling fluid. The WATER WELL CONTRACTOR shall provide adequate protection for the public at all times. Upon completion of the drilling, drilling mud and cuttings from the well shall be removed from the approved staging site and disposed of by the WATER WELL CONTRACTOR. The ground surface shall be restored to its original condition.
  - 4. All additives shall be approved by the ENGINEER, prior to use.
  - 5. If large boulders are encountered that are larger than the bucket, the use of common drilling tools, orange-peel bucket, or stone tongs shall be used to remove the boulder.
- E. Drilling Method: The well shall be drilled using the Rotary Bucket Auger Method. Alternative methods can be submitted with the FDEP Construction permit. Alternative method has to be approved by ENGINEER also.
- F. Drilling Samples: The WATER WELL CONTRACTOR shall collect representative drill cutting samples every 15 feet and labeled with the well ID, date, depth, and stored in 1 pint permeable cloth soil sample bag.

### 3.3 CASING

- A. Casing Installation: When the reaming operation has been completed, casing will be

installed. The casing lengths will be 20 feet sections.

- B. Seating Casing: Casing seat request shall be sent to FDEP (David Rhodes, Ft. Myers Office) along with lithology description. Seat request shall include the requested casing seat elevation. Casing to be set only with FDEP approval.
- C. PVC Casing: The casing shall be un-plasticized PVC compounds having a minimum cell classification of 12454-B, as defined in ASTM D 1784. PVC pipe used for well construction or repair shall at a minimum meet the specifications for Standard Dimension Ratio (SDR) 21. All PVC pipe used for well casing shall be new, factory assembled in 20-foot lengths. Shorter pieces will be allowed at the end of the casing if required to ensure the 60 feet of casing is provided. Amount of casing installed shall account for the overlap of bell ends that are on the casings when joined. The CONTRACTOR shall install additional casing to account for the bell ends so that the designed depth of 60 feet is obtained. Additional casing shall be readily available if more than 60 feet is required to seat the casing.
- D. Tension: The casing shall be suspended in tension from the surface. The bottom of the casing shall be at a sufficient distance above the bottom of the reamed hole as to insure that none of the casing will be supported from the bottom of the hole. The casings shall be lowered into the borehole open-ended, and the weight of the casing shall be supported by the drilling rig. The hook load of the drilling rig must exceed the maximum casing weight to be encountered during construction of the well. The method used to join the casings together, shall be able to withstand the tension pressures without separation during the casing installation procedure.
- E. Failure to Complete: If the casing cannot be landed in the correct position or at a depth acceptable to the ENGINEER, the WATER WELL CONTRACTOR shall construct another well immediately adjacent to the original location, and complete this well in accordance with the Civil Construction Drawings, Details, and Technical Specifications. The abandoned hole shall be permitted and approved before being sealed, in accordance with all State of Florida regulations.
- F. Collapsed Casing: Should the casing collapse for any reason prior to well completion, FDEP shall be notified. Casing can be withdrawn and replaced at the WATER WELL CONTRACTOR's expense only after FDEP approval.

### 3.4 GROUTING OF CASING

- A. General: After installation of the casing, the annular space between the borehole wall and the casing shall be filled with cement grout from the bottom of the casing to the ground surface. The cement shall be pumped as a slurry of thoroughly mixed components, in stages that are designed to fill the annular space without exceeding the collapse pressure of the casing pipe to which the cement is applied. It is the WATER WELL CONTRACTOR's responsibility to conduct the cementing operations in such a

manner that the burst/collapse strengths of the casing (with safety factor) are not exceeded and casing failure does not occur. Cement will be pumped or placed so that the pressure of the slurry and the pressure applied inside the casing pipe do not affect the bond.

A cement basket shall or packer assembly shall be used at the bottom of the casing to provide a seal for the grout on the bottom of the annulus.

Grout shall be placed into the annular space using the pressure grouting technique using a tremie pipe. The grout shall be pumped under pressure from the bottom of the casing. In the event the borehole collapses prior to placement of the grout seal, the WATER WELL CONTRACTOR shall take whatever steps are necessary to re-open the hole and place the seal as specified.

Material used in the casing seal shall be neat cement grout, consisting of Type I or Type III Portland cement, conforming to ASTM C-150. Neat cement grout shall contain between 5.0 and 6.0 gallons of water per 94-pound sack of cement, with a slurry density of 15.0 to 15.5 lbs/gallon. .

Additives may be added to the sealing material to speed the setting time or expand the material. Additives shall not exceed the follow:

- Not more than 2 percent, by weight, calcium chloride.
- Not more than 4 percent, by weight, bentonite.

No other additives will be allowed, unless approved by the Department, in writing, prior to use.

The WATER WELL CONTRACTOR will be responsible for adding or releasing water from the casing to maintain the required pressure.

Minimum setting time between stages is 8 hours, if more than one stage is required. The well shall remain undisturbed for at least 24-hours after cementing of the casing is complete.

### 3.5 PVC CASING JOINTS

- A. PVC Casing Joints: Where specified, casing joints shall be attached in accordance with the requirements of ASTM F-480. Pipe shall be joined using a pipe cement that meets the requirements of ASTM D-2564. No external pipe-to-pipe restraining devices that clamp onto or otherwise damage the pipe surface as a result of point-loading shall be permitted. The CONTRACTOR is responsible for ensuring the suitability of all connections for the well casing string and associated work.

### 3.6 DISPOSAL

- A. Water Disposal: The WATER WELL CONTRACTOR shall remove all pumped water and Spoils produced during reverse air drilling, well development, and testing, from the well site to an FDEP approved location. The WATER WELL CONTRACTOR shall design a system that protects the site from erosion. The system shall settle the discharge water so that turbidity is 0 NTU. The WATER WELL CONTRACTOR shall be responsible for meeting local, state and federal requirements for discharge of water produced during drilling, development, and testing.
1. The WATER WELL CONTRACTOR shall conform to all waste discharge requirements, and shall obtain all required permission, if necessary, to discharge waters into a flood control storm drain. All actions necessary to conform to the discharge requirements shall be performed by the WATER WELL CONTRACTOR, as a part of his scope of work and contract.
  2. If necessary to avoid erosion, minimize area flooding, promote settling of turbid water, conform to County, City, State or Owner requirements, the WATER WELL CONTRACTOR shall be responsible for providing on-site tanks or a constructed basin of sufficient size and construction to accommodate development and pumped discharge from the well. The tanks or basin shall be constructed with baffles to encourage sediment settlement.
  3. Discharge piping shall be equipped with an in-line meter with 6-digit, straight reading totalizer, registering in units of 100 gallons, together with a rate of flow indicator dial, which reads in units of gallons per minute, and is suitable for the expected flow range. Any necessary crossings over discharge piping shall be constructed and maintained by the WATER WELL CONTRACTOR.
- B. A Cuttings, fluids and mud Disposal Plan will need to be submitted and approved by FDEP prior to construction of the wells. A letter from the property owner indicating understanding and acceptance of the materials onto the property will be required.

## PART 4 PAYMENT

### 4.1 GENERAL

- A. No final payment will be made until Well Certificates are submitted to applicable permitting agencies and certified as-builts are received. Payment for work specified in this section will be made per computation of quantities as indicated for each item and shall be considered full compensation for furnishing all labor, materials, and equipment to complete the work as specified under this section.



## SECTION 33 25 20 STEP DRAWDOWN PUMPING TEST

### PART 1 - GENERAL

#### 1.1 WORK INCLUDED

- A. This Section covers the work, materials, and equipment necessary for testing, for furnishing, setting, operating, and removing test pumps from the wells, complete including any traffic routing or other work associated with the testing and routing of the discharge water.

#### 1.2 SUBMITTALS

- A. Submit descriptions and diagrams (if necessary) of two devices for measuring discharge flows and pressures.
- B. Submit proposed method of routing fluid discharge from the well to the disposal point.

### PART 2 - PRODUCTS

#### 2.1 GENERAL

- A. All testing equipment shall be in good operating condition at all times and operated and maintained in strict conformance with manufacturer's recommendations.
- B. The CONTRACTOR shall have the appropriate equipment and trained personnel to perform the work as specified.
- C. The CONTRACTOR shall be solely and directly responsible to the OWNER for any damage caused to OWNER's property by CONTRACTOR's operations.

#### 2.2 STEP DRAWDOWN PUMPING TEST EQUIPMENT

- A. Furnish, install, and operate a horizontal centrifugal or submersible test pump, driver, and discharge piping capable of pumping 1800 gpm at 80 feet of total dynamic head (TDH) from a nominal 24-inch diameter well.
- B. Provide a butterfly valve, or gate valve, or equal on the discharge side of the pump for adjustment of flow rate.
- C. The pumping unit prime mover (e.g. engine drive) controls, and appurtenances shall be capable of being operated without interruption for 12 hours.
- D. Electrical power is not available at each well site. It shall be the responsibility of the CONTRACTOR to supply the necessary power for the pump test. Any additional wires, adapters, GFCI receptacles, etc., are the responsibility of the CONTRACTOR.

- E. Provide machined orifice plate(s), piezometer tube, and calibrated (within the last 60 days) flowmeter(s) devices capable of measuring the pump discharge within plus or minus 5 percent of true flow or flow rates from 500 gpm to 2,000 gpm. Provide at least two methods of measuring the flow. The type of device shall be submitted for approval by ENGINEER prior to mobilization.
- F. Furnish, install, maintain, and operate discharge piping for the pump unit or sufficient size to conduct pumped water to the disposal location specified herein and as approved by the ENGINEER.
- G. Provide a minimum clearance of 3 inches between the horizontal centrifugal suction pipe or submersible pump column pipe and the 24-inch well casing will allow the ENGINEER to measure water levels with a water level recorder above the well vaults.
- H. The CONTRACTOR shall provide a calibrated, electric water level probe for water level measurements during testing. The unit shall be a Hemit Model 1000 by In-Situ, or approved equal.

**2.3 DOCUMENTATION**

- A. ENGINEER shall be responsible for collecting and recording water levels (reference point, static depth to water, pumping depth to water, etc.) and SDI measurements. CONTRACTOR shall provide ENGINEER with the following additional data from each step drawdown pumping test.
  - 1. Date and time the test was started.
  - 2. Pressure and discharge rate at 15-minute intervals.
  - 3. A sample data reporting form is provided at the end of this section.

**PART 3- EXECUTION**

**3.1 STEP DRAWDOWN PUMPING TESTS**

- A. Perform Four Step Drawdown Pumping Tests on Each Well:

<b>Step</b>	<b>Flow Rate (gpm)</b>	<b>Duration (Minutes)</b>
1	600	180
2	1000	180
3	1400	180
4	1800	180

- B. The ENGINEER or OWNER shall record data from each test as specified on the Sample Data Reporting Form provided at the end of this Section.
- C. For this purpose, the CONTRACTOR shall operate the pump without interruption, at no more than two percent fluctuation in the designated rates of discharge, during the full

period of the step-drawdown test as determined by the ENGINEER. If the pumping test is started and then must be stopped due to equipment breakdown, failure of any water level recorder, or inadequate supervision by the CONTRACTOR, no extra payment shall be made for the time spent pumping before the test is restarted. If any part of the pumping equipment fails to operate properly, or impairs the proper functioning of another element or instrument involved in the test, the equipment shall be removed and repaired at the expense of the CONTRACTOR and no extra payment shall be made for the delay.

### 3.2 INSTALLATION OF PUMPING EQUIPMENT

- A. A test pump, flow measuring devices, discharge piping, level measuring devices, and other necessary appurtenances shall be installed in the well when requested by the ENGINEER. The test pump discharge pipe, and appurtenances to be provided by CONTRACTOR shall be free of sand and other visible deleterious material from the pump assembly prior to installation.

### 3.3 DISPOSAL OF WATER

- A. All water produced during step drawdown pumping test shall be disposed of in an appropriate manner in accordance with all applicable regulations and requirements.
- B. Disposal of water shall include, but be limited to:
  - 1. Discharge to nearby canal.
  - 2. Discharge to storm or sanitary sewer.
  - 3. Collection of water in storage tank for offsite disposal by CONTRACTOR.
  - 4. Other method to be determined by the CONTRACTOR and approved by the ENGINEER and OWNER.
- C. For each of these methods of disposal, it is the CONTRACTOR's responsibility to obtain written permission or approval from the responsible agency or government entity to dispose of the water.
  - 1. Storm or Sanitary Sewer: City of Key West.
  - 2. Disposal Offsite: Copies of manifest and/or written permission from hauling companies and disposal locations.
  - 3. Other: CONTRACTOR to provide written permission or approval from entity
  - 4. accepting disposal of the water.
- D. It is the CONTRACTOR's responsibility to examine each well site and develop a written plan for disposal of the water prior to pumping of any water. The plan shall include at a minimum well number(s), methods of disposal, quantity or rate limitations, location of disposal pointy, and written permission or approval from responsible agency or government or private entity. The plan shall be reviewed and approved by the ENGINEER and OWNER.
- E. Provide all equipment and appurtenances necessary to dispose of the water in accordance with the requirements of the permits or appropriate responsible agency or government or private entity.

### 3.4 SUPPLEMENTS

A. The supplements listed below, following “END OF SECTION,” are part of this Specification.

1. Step Drawdown Pump Test Data Sheet.

**END OF SECTION**

**Step Drawdown Pump Test Data Sheet**

Well \_\_\_\_\_ Water level reference  
 point \_\_\_\_\_

Date \_\_\_\_\_ Static Depth of Water (DTW) (feet)  
 below reference point) \_\_\_\_\_

Time \_\_\_\_\_

Personnel \_\_\_\_\_

<b>Minutes</b>	<b>DTW (feet)</b>	<b>GPM</b>	<b>PSI</b>
0			
15			
30			
45			
60			
75			
90			
105			
120			
135			
150			
165			
180			

## SECTION 33 30 00 SANITARY SEWERAGE UTILITIES

### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. Section Includes: Requirements for gravity sanitary sewerage systems.

#### 1.02 REFERENCES

- A. General: References to standards, specifications, manuals, or codes of any technical society, organization or association, or to the Laws or Regulations of any government authority, whether such reference be specific or by implication, shall mean the latest standard, specification, manual, code, or Laws or Regulations in effect at the time of opening of Bids (or, on the Effective Date of the Agreement if there were no Bids), except as may be otherwise specifically stated in the Contract Documents.

B. ANSI/AWWA Standards

1. ANSI/AWWA Ductile-Iron Pipe, Centrifugally Cast, for Water and Other Liquids C151/A21.51
2. ANSI/AWWA Polyvinyl Chloride (PVC) Pressure Pipe 4 In. Through 12 In. for Water C900 Distribution
3. ANSI/AWWA Polyvinyl Chloride (PVC) Water Transmission Pipe, Nominal Diameters C905 14 In. Through 36 In.

C. ASTM Standards

1. ASTM A48 Specification for Gray Iron Castings
2. ASTM C32 Specification for Sewer and Manhole Brick (Made from Clay or Shale)
3. ASTM C55 Specification for Concrete Building Brick
4. ASTM C91 Specification for Masonry Cement
5. ASTM C144 Specification for Aggregate for Masonry Mortar
6. ASTM C150 Specification for Portland Cement
7. ASTM C270 Specification for Mortar for Unit Masonry
8. ASTM C478 Specification for Precast Reinforced Concrete Manhole Sections
9. ASTM D792 Test Methods for Specific Gravity and Density of Plastics by Displacement
10. ASTM D1598 Test Method for Time-to-Failure of Plastic Pipe Under Constant Internal Pressure
11. ASTM D1599 Test Method for Short-Time Hydraulic Failure Pressure of Plastic Pipe, Tubing, and Fittings

12. ASTM D1784 Specification for Rigid Poly(Vinyl Chloride) (PVC) Compounds and Chlorinated Poly(Vinyl Chloride) (CPVC) Compounds
13. ASTM D2321 Specification for Underground Installation of Flexible Thermoplastic Sewer Pipe
14. ASTM D3034 Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
15. ASTM D3139 Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
16. ASTM D3212 Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
17. ASTM F477 Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
18. ASTM F679 Specification for Poly(Vinyl Chloride) (PVC) Large-Diameter Plastic Gravity Sewer Pipe and Fittings

D. AWWA Standards

1. AWWA C600 Installation of Gray and Ductile Cast Iron Water Mains and Appurtenances

1.03 DEFINITIONS

- A. Pipe sizes and references to pipe diameter on the Drawings and in the Specifications are intended to be nominal size or diameter, and shall be interpreted as nominal size or diameter.
- B. Lateral shall consist of pipe, fittings, and appurtenances required to reach from main sewer to point where lateral will connect to building or facility service.

1.04 SYSTEM DESCRIPTION

- A. Furnish and install gravity sanitary sewerage systems as shown on the Drawings and specified in this Section.
- B. Furnish and install pipe, fittings, manholes and appurtenances required for complete and properly functioning gravity sanitary sewage systems.
- C. Test pipe, fittings, manholes and appurtenances as specified in this Section.

1.05 SUBMITTALS

- A. General: As specified in:
  1. Section 01331 Submittals;
  2. This Section

- B. Submit the following prior to product shipment:
  - 1. Shop drawings and product data.
  - 2. Shop drawings for gravity sanitary sewage systems layout and installation, including dimensions and elevations in each gravity sanitary sewage system.
- C. Submit the following prior to product delivery: Affidavit of Compliance.
- D. Submit video tapes of sewer inspections as specified in this Section.

#### 1.06 QUALITY ASSURANCE

- A. Marking
  - 1. Mark pipe, fittings, and castings.
  - 2. Markings shall meet the requirements of applicable Standards.
- B. Factory Tests
  - 1. Test materials used in the manufacture of the pipe, fittings, castings, and precast structures.
  - 2. Tests shall meet the requirements of applicable Specifications and Standards.
- C. Castings
  - 1. Casting manufacturer shall provide letter of guarantee for a period of 15 years.
  - 2. Upon request of Engineer, manufacturers shall also furnish an independent testing laboratory's report of castings supplied.
  - 3. Frame and cover surfaces shall be machined and any tendency to rattle, as determined by tests before or after installation, will be sufficient cause for rejection of the frame and cover.
- D. Field Tests: As required by the City and Florida Building Codes.

#### 1.07 DELIVERY, STORAGE, AND HANDLING

- A. Piping Products
  - 1. Deliver pipe, fittings, and accessories in a clean and undamaged condition. Store pipe, fittings, and accessories off the ground.
  - 2. Keep interior of pipe, fittings, and appurtenances free from dirt and foreign matter.

3. Store plastic pipe and fittings, and other products which will be deteriorated by sunlight in a cool location out of direct sunlight.
4. Gaskets shall not come in contact with petroleum products.

## 1.08 PROJECT/SITE CONDITIONS

### A. Horizontal Separation

1. Sewers shall be laid at least 10 feet horizontally from any existing or proposed water main. The distance shall be measured edge of pipe to edge of pipe.
2. Sewers shall be laid at least 3 feet horizontally from any existing or proposed reuse (reclaimed) water main. The distance shall be measured edge of pipe to edge of pipe.

### B. Vertical Separation

1. Sewers crossing potable water mains or reuse (reclaimed) water mains shall be laid to provide a minimum vertical distance of 18 inches between the outside of the water main and the outside of the sewer. This shall be the case where the water main is either above or below the sewer.
2. Crossings shall be arranged so that joints of sewer pipe are equidistant and as far as possible from water main joints.

### C. Carrier Pipe: Where it is impossible to obtain horizontal, vertical, or horizontal and vertical separation specified in this Section, furnish and install carrier pipe as follows:

1. Either the sewer pipe, potable water pipe, or reuse (reclaimed) water pipe shall be installed in a watertight carrier pipe.
2. Carrier pipe shall extend to a point where separation between sanitary sewer and potable water piping shall not be less than 10 feet measured edge of pipe to edge of pipe.
3. Carrier pipe shall extend to a point where separation between sanitary sewer and reuse (reclaimed) water piping shall not be less than 3 feet measured edge of pipe to edge of pipe.
4. Carrier pipe shall be installed and tested to 150 psi before conveyance pipe is installed in carrier pipe.

## PART 2 – PRODUCTS

### 2.01 SEWER PIPE AND FITTINGS

#### A. PVC Pipe and Fittings (Non-pressure Rated)

1. Non-pressure Rated PVC Pipe and Fitting Material Standard: ASTM D1784, Cell Classification 12454-B.
  2. Non-pressure Rated PVC Pipe and Fitting Standard
    - a. 4" through 15" Pipe and Fittings: ASTM D3034, SDR 26
    - b. 18" through 36" Pipe and Fittings: ASTM F679, T-1 wall thickness
  3. Joints for Non-pressure Rated PVC Pipe and Fittings
    - a. Type: Bell and spigot with rubber gaskets.
    - b. Joint Standard: ASTM D3212.
    - c. Gasket Standard: Elastomeric rubber gasket conforming to ASTM F477
  4. Maximum Pipe Section Length: 12' - 6".
  5. Non-pressure Rated PVC Pipe and Fitting Color: Green.
- B. PVC Pipe and Fittings (Pressure Rated)
1. Application for Main Sewer and Laterals
    - a. Where pressure rated gravity sewer pipe is shown on the Drawings.
    - b. Where required to meet horizontal and vertical separation requirements specified in this Section.
    - c. At conflict crossings, minimum 10 feet on both sides of conflict piping.
    - d. Where cover over top of pipe is less than 30 inches.
  2. Pressure Rated PVC Pipe
    - a. Pressure Rated PVC Pipe Standard: AWWA C900 or C905.
    - b. Pressure Rated PVC Pipe Pressure Class: 200.
    - c. Pressure Rated PVC Pipe Dimension Ratio: 14.
  3. Pressure Rated PVC Fittings
    - a. Fitting Material for Pressure Rated PVC Pipe: PVC
    - b. Material Standard for Pressure Rated PVC Fitting: ASTM D1784
    - c. Test Standards for Pressure Rated PVC Fittings
      - 1) ASTM D1599, 755 psi quick burst pressure
      - 2) ASTM D1598, 500 psi for a minimum of 1,000 hours.
  4. Joints for Pressure Rated PVC Pipe and Fittings
    - a. Joint Type

- 1) Joints for pressure rated PVC sewer pipe and fittings shall be bell and spigot with rubber gaskets.
  - 2) Provide joint restraint for deflected pipe joints, elbows, and fitting branches as required to restrain joints during leakage test specified in this Section.
- b. Joint Standard for Pressure Rated PVC Pipe
    - 1) 4” through 12” PVC Pipe: AWWA C900
    - 2) 14” through 36” PVC Pipe: AWWA C905
  - c. Joint Standard for Pressure Rated PVC Fittings: ASTM D3139
  - d. Gasket Standard: Elastomeric rubber gasket conforming to ASTM F477
  - e. Joint Restraint
    - 1) Acceptable restrained joints for sewer pipe and fittings include the following:
      - a) Manufactured restrained joints
      - b) Joint restraint devices
      - c) Trust blocks
    - 2) Restrained Joints: CertainTeed Corporation, Cera-Lok VIP; or equal.
    - 3) Joint Restraint: Uni-Flange Corporation, Sines 1390 Restrainer; or equal
5. Pressure Rated PVC Pipe and Fitting Color: Green.

## 2.02 BRANCH CONNECTIONS

- A. Branch Connections for New Sewers: Fittings for branch services in new sewers shall be same material and joints as sewer pipe.
- B. Branch Connections for Existing Sewers: Connections to existing sewers shall be made with factory fabricated tapping saddle or by use of factory fabricated, gasketed fitting in conjunction with a repair sleeve coupling with all stainless steel clamps.

## 2.03 PIPE GASKET LUBRICANT

- A. Pipe gasket lubricant shall be supplied by the pipe manufacturer.
- B. Pipe gasket lubricant shall be water soluble, non-toxic, and inhibitor to bacterial growth.
- C. Pipe lubricant shall be non-detrimental to the elastomeric seal and pipe.

- D. Do not use mineral oil, petroleum jelly, or hydrogenated vegetable fat, such as Crisco, cooking oil, or grease, as a pipe gasket lubricant.

## 2.04 MANHOLES

### A. Precast Base and Risers

1. Manhole Type: Shaft Construction and Eccentric Cone Top Section
2. Manhole Construction: Reinforced precast concrete monolithic base and riser sections.
3. Manhole Standard: ASTM C478.
4. Manhole Floor: Integral with bottom riser section.
5. Manhole Wall Thickness: 8 inches, minimum.
6. Cement for Concrete Used in Manhole Construction: Type II Portland cement.
7. Manhole Reinforcement
  - a. Manhole Base Reinforcement
    - 1) Base Reinforcement for Manholes with 4-foot Inside Diameter: # 5 bars at 12 inches, each way, minimum.
    - 2) Base Reinforcement for Manholes with 5-foot or 6-foot Inside Diameter: #6 bars at 9 inches, each way, minimum.
  - b. Manhole Wall Reinforcement: Meet requirements of ASTM C478.
8. Manhole Riser Joints
  - a. Joint Type: Tongue-and-groove.
  - b. Joint Seal
    - 1) Provide rubber gasket plus flexible bitumastic sealing material in interior and exterior voids in pipe joint.
    - 2) Flexible bitumastic sealing material shall be Ram-Neck, manufactured by R.K. Snyder and Co., or equal.
    - 3) Rubber gaskets and flexible bitumastic seal shall be furnished by the precast manhole section manufacturer.
9. Pipe Connections
  - a. Description

- 1) Pipe connections to manholes shall be by flexible boot cast into manhole riser section.
  - 2) Flexible boot shall be secured to pipe with clamp.
  - b. Materials
    - 1) Flexible Boot: Neoprene
    - 2) Clamp and Appurtenances: Stainless steel
  - c. Location: No pipe connection opening shall be within 12 inches of the end of any riser section.
- B. Manhole Brick
1. Type: Brick used in construction of manhole inverts and to adjust manhole ring and cover to grade shall be shall be clay brick or concrete brick
  2. Brick Standard
    - a. Clay Brick: ASTM C32
    - b. Concrete Brick: ASTM C55
  3. Brick Nominal Size: 2-1/4 inches by 3-5/8 inches by 8 inches
- C. Mortar
1. Type: Mortar used in construction of manhole inverts, construction of brick risers to adjust manhole ring and cover to grade, and to fill manhole joints shall be Portland Cement mortar.
  2. Mortar Standard: ASTM C270, Type MM
  3. Mortar Mix
    - a. Proportion mortar material by volume as follows:
      - 1) 1 part Type II Portland Cement, ASTM C150
      - 2) 3 parts aggregate (sand), ASTM C144
    - b. Addition of masonry cement, ASTM C91, will be permitted to improve workability of mortar
- D. Coating and Lining for Manholes
1. Exterior Coating
    - a. Provide manholes with factory applied exterior coating.

- b. Coating shall be coal tar base. Coating shall be Koppers Bitomastic Super Service, or equal.
- c. Apply two coats with a total dry film thickness of 16 to 18 mils.
- d. Coating shall be aged then top coated to minimize weathering effects.
- e. Coating shall be certified by the manufacturer prior to leaving the plant.

2. Interior Lining

- a. Furnish and install field applied lining to interior of manholes.
- b. Interior lining shall be 100% solids polymorphic resin.
- c. Interior lining shall be three-coat system.
- d. Interior lining system shall include polymorphic grout for filling of cracks, spall areas, and other damage to the interior concrete surfaces of manholes. Grout shall be applied between the prime coat and intermediate coat of the lining system.
- e. Interior lining shall be IET System 3.

2.05 CASTINGS

A. Casting Manufacturers

- 1. USF No. 420;
- 2. Neenah;
- 3. Or equal.

B. Casting Standard: ASTM A48, Class 30.

C. Molds for Castings: Closed molds with controlled sand.

D. Casting Quality

- 1. Free from blow holes and porosity.
- 2. Well cleaned, with fine and sharp edges ground smooth.

E. Casting Finish: Machined bearing surfaces that prevent rattling under traffic.

F. Lettering

- 1. General: Cast "SANITARY SEWER" on covers.

2.06 LOCATOR DISCS

A. Manufacturer and Model

1. 3M Dynatel Systems Division, ScotchMark™ Marker;
  2. Or equal.
- B. Type: Passive antenna encased in polyethylene.
- C. Operating Depth: 2 feet to 6 feet
- D. Operating Temperature Range: -22°F to 125°F
- E. APWA Color Code: Green

## PART 3 – EXECUTION

### 3.01 EXCAVATION

- A. Excavate trenches as specified in Section 312300 Excavation and Fill.

### 3.02 INSPECTION

- A. Verify that trench cut is ready to receive work, and excavations, dimensions, and elevations are as indicated on the Drawings.
- B. Correct defects prior to installing products.

### 3.03 PREPARATION

- A. Hand trim excavations to required elevations. Correct over excavation with select backfill material.
- B. Remove large stones or other hard matter which could impede consistent backfilling or compaction.

### 3.04 INSTALLATION

#### A. Sewer Pipe and Fittings

1. Install pipe, fittings, and accessories in accordance with ASTM D2321 and manufacturer's instructions. Seal joints watertight.
2. Lay sanitary sewer pipe in trenches commencing at lowest point, with spigot ends pointing in direction of flow. Interior of pipe and jointing seal shall be free from sand, dirt and trash. Jointing of pipe shall be in accordance with manufacturer's instruction and shall be done entirely in trench. Lay pipe to slope as shown on Drawings.
3. Grade trench bottom for all types of pipe to proposed elevation of pipe line and shape trench bottom to fit lower quadrant of pipe. Excavate holes at each bell so

that pipe is supported along entire length of barrel only. Each pipe shall be solidly and evenly bedded.

4. When pipe laying operations are not in progress (including lunch hours), place a suitable stopper in end of pipe to prevent water, mud, or other foreign material from entering pipe.
5. Lay no length of pipe until preceding pipe has been thoroughly embedded in place. Lay no pipe except in presence of Engineer or his representative.
6. Lay sewer accurately to line and grade. Tolerances are 1/4-inch in grade and 1/2-inch on line in any section between manholes. Deviations exceeding those tolerances shall be grounds for rejection of line. Set batter boards at maximum intervals of 25 feet. Contractor may use a laser for control of line and grade in place of batter boards. Qualified personnel shall operate laser equipment. Inspect stubs and laterals for line and grade prior to backfilling.
7. Lubricate gaskets in accordance with pipe manufacturer's written instructions.

#### B. Manholes

1. For manhole base, excavate to sufficient depth to permit construction on undisturbed bottom of excavation.
2. Set base of precast manhole on a minimum of 12 inches of crushed stone bedding. Extend crushed stone bedding one-foot, minimum, beyond periphery of manhole base. Grade crushed stone bedding so that manhole shaft is plumb.
3. Install rubber gaskets and flexible bitumastic seal in accordance with manufacturer's written instructions
4. Pipe connections to manholes shall be water tight. Provide seal or water stop as follows:
  - a. Manhole coupling providing elastomeric gasket seal. Unit shall be grouted into manhole wall.
  - b. Manhole coupling providing elastomeric compound grouted and locked into manhole.
  - c. Elastomeric connection parts precast into manhole wall.
5. Provide drop connection from influent sewer to manhole flow channel when difference in invert elevation between connecting sewer and manhole flow channel exceeds two feet. Construct drop connections as shown on the Drawings.
6. Provide invert channel in manhole.
  - a. Construct invert channel bottom smooth and semicircular in shape conforming to inside of sewer pipe connecting to manhole. Channels shall be

shall be shaped and constructed to permit placement of a television inspection camera into sewers connecting to manhole. Make changes in direction of flow with a smooth curve of as large a radius as size of manhole will permit. Make changes in size and grade of channels gradually and evenly.

- b. Channel height shall match crown of outlet sewer from manhole.
  - c. Floor of manhole outside channels shall be smooth and shall slope towards channels.
7. Adjust manhole frame and cover.
- a. In paved areas, set top of frame and cover flush with top of pavement.
  - b. In unpaved area, set top of frame and cover 0.2 feet above finish grade unless otherwise shown on the Drawings.
- C. Backfilling
- 1. Backfill trenches and compact backfill material as specified.
  - 2. Do not displace or damage pipe when compacting.

### 3.05 BRANCH CONNECTIONS TO EXISTING SEWERS

- A. Clean existing pipe as required to provide water connection.
- B. Install saddles and fittings in accordance with manufacturers' written instructions.
- C. Use template and properly located holes in exiting sewer for connection. Make holes in existing sewer with a hole cutter or keyhole type saw. Make holes to dimensions provided by branch connection fitting manufacturer, required for the branch connection, or both. De-burr and bevel holes.

### 3.06 SERVICE LATERALS

- A. Install service laterals as indicated on the Drawings.
- B. Laterals shall be six inch, minimum.
- C. Lateral invert elevation at property line shall be three feet below finish grade, unless otherwise shown on the Drawings.
- D. Install laterals on a uniform grade.
  - 1. Slope of six inch laterals shall not be less than 0.65 feet per 100 feet or more than 30 feet per 100 feet, unless otherwise shown on the Drawings.
  - 2. If depth of sewer is such that a uniform slope from the sewer to the property line would exceed 30 feet in 100 feet, provide riser with 45° slope from horizontal

from sewer pipe to elevation that will permit installation of riser on uniform slope between 0.65 feet per 100 feet and 6.50 feet per 100 feet.

3. If directed by Engineer or shown on Drawings, provide riser with 45° slope from horizontal from sewer pipe to elevation that will permit installation of riser on uniform slope between 0.65 feet per 100 feet and 6.50 feet per 100 feet.
- E. If laterals are installed in open-cut trench, cut, remove, and replace curbs, gutters, and sidewalks, do not tunnel under curbs, gutters, or sidewalks.
- F. Provide following at end of lateral as applicable to details shown on Drawings:
  1. Wye connection with plug in branch
  2. Clean-out
  3. Plug in end of lateral
  4. Locator disc
  5. Stake marker
- G. Record data provided by Contractor shall include horizontal and vertical location of laterals as follows:
  1. Provide horizontal location for end of each lateral as follows:
    - a. Distance in feet along main sewer from nearest down stream manhole.
    - b. Offset distance in feet perpendicular to main sewer from centerline of main sewer to end of lateral.
    - c. Offset direction, left or right, when facing upstream along centerline of main sewer.
  2. Provide flow line elevation of lateral at end of lateral or wye branch, as applicable to lateral connection.

### 3.07 TESTING AND INSPECTION REQUIREMENTS FOR NON-PRESSURE RATED PIPE

- A. General
  1. Perform infiltration/exfiltration test and deflection test on completed sections of non-pressure rated pipe.
  2. Notify Engineer at least 48 hours prior to any inspection or test being run for acceptance. Engineer or his representative shall be present during all tests for acceptance. Prior to giving notice to Engineer, determine the sewer sections to be tested for acceptance will pass required tests.
  3. If any section fails to pass tests for acceptance, make repairs needed and retest section including notification. Repair and retest sewer sections until sewer system

meets infiltration requirements and deflection requirements specified in this Section. Repair and retest sewer sections at no additional costs to the Owner.

**B. Infiltration/Exfiltration Tests**

1. Conduct infiltration/exfiltration tests on main lines, lateral lines, and manholes for a minimum test period of 24 hours. Provide materials, equipment and labor necessary to perform infiltration/exfiltration tests as set forth herein. Maximum allowable amount of infiltration/exfiltration measured by test shall not exceed 50 gallons/inch of pipe diameter/mile/24 hours with no additional allowance for manholes or service and house laterals. Maximum increment of testing shall be 1,000 linear feet. Test pipe as the job progresses and begin testing after 2,000 feet of pipe are laid.
2. Test pipe for infiltration when crown of pipe is below natural ground water table at time and place of testing. Install suitable watertight plugs and pump section of pipe to be tested dry before start of test.
3. Where crown of the pipe is above the natural water table, test pipe for exfiltration by installing necessary plugs and filling pipes and manholes with water.
  - a. During exfiltration test, maintain a static head as specified in this Section. During exfiltration test, static head shall not be less than whichever of the following criteria is most severe for the pipe section being tested:
    - 1) Two feet above highest service lateral.
    - 2) Two feet above ground water level.
    - 3) Five feet above the crown of pipe at the upstream manhole.
  - b. The water level or internal pressure to be used for exfiltration tests shall be determined by the Contractor and approved by the Engineer.
  - c. During exfiltration test, maximum internal pressure at lowest end of pipe section being tested shall not exceed 25 feet of water, or 10.8 pounds per square inch gage pressure (psig).
4. Repair visible leaks, regardless of results of infiltration or exfiltration tests. Replace broken or cracked pipes, manhole sections, or pipes and manhole sections.

**C. Deflection Test**

1. Maximum allowable deflection (reduction in vertical inside diameter) of non-pressure rated pipe shall be five percent.
2. Perform deflection test with deflectometer, calibrated television or photography, or a properly sized “go, no-go” mandrel or sewer ball.

3. Maximum allowable deflection shall be applied to base inside diameter specified in ASTM D3034, Appendix, Table X1.1, ASTM F679, Appendixes, Table X2.1, and in this Section. For the purpose of deflection measurements the base inside diameter without deflection shall be as follows:
  - a. Base Inside Diameter for ASTM D3034, DR 35 PVC Pipe
    - 1) 6" Pipe: 5.742 inches
    - 2) 8" Pipe: 7.665 inches
    - 3) 10" Pipe: 9.563 inches
    - 4) 12" Pipe: 11.361 inches
    - 5) 15" Pipe: 13.898 inches
  - b. Base Inside Diameter for ASTM D3034, DR 26 PVC Pipe
    - 1) 6" Pipe: 5.612 inches
    - 2) 8" Pipe: 7.488 inches
    - 3) 10" Pipe: 9.342 inches
    - 4) 12" Pipe: 11.102 inches
    - 5) 15" Pipe: 13.575 inches
  - c. Base Inside Diameter for ASTM F679 PVC Pipe with T-1 Wall Thickness
    - 1) 18" Pipe: 16.976 inches
    - 2) 21" Pipe: 20.004 inches
    - 3) 24" Pipe: 22.480 inches
    - 4) 27" Pipe: 25.327 inches

### 3.08 CLEANING

- A. Following installation, testing, and repair of sewers, remove dirt and debris from the interior of sanitary sewers and manholes.
- B. Clean sewers with sewer cleaning ball or high velocity jet.

### 3.09 FINAL INSPECTION

- A. General
  1. Following installation, testing, repair, and cleaning of sewers, perform final inspection of sewer system.
  2. Final inspection of sewer pipe shall be by television inspection or by direct visual inspection. Final inspection shall be by television as specified in this Section unless otherwise shown or specified.

3. Perform visual inspection of manholes installed, repaired, or installed and repaired.

B. Television Inspection

1. Video tape each sewer section in color on standard high quality VHS tape.
2. Tape shall display the following data:
  - a. Date;
  - b. Time;
  - c. Location;
  - d. Pipe size;
  - e. Pipe type;
  - f. Invert depth;
  - g. Lateral location in footage from manhole;
  - h. Locations of leaks, cracked or broken pipe, and other abnormal conditions in footage from manhole.
3. Repair or replace defective sewer pipe, fittings, and appurtenances.
4. If repairs, replacements, or repairs and replacements are required, repeat television inspection following completion of repairs.
5. Submit two copies of video tapes.

C. Direct Visual Inspection of Sewer Pipe

1. Conduct visual inspection of sewer sections not requiring video tape.
2. Provide lights, mirror, means of ingress and egress, and safety equipment required to conduct visual inspection.
3. Each section of pipe from manhole to manhole shall show a full circle of light from either end.
4. Repair or replace defective sewer pipe, fittings, and appurtenances.
5. If repairs, replacements, or repairs and replacements are required, repeat visual test or perform television inspection following completion of repairs.

D. Visual Inspection of Manholes

1. Conduct visual inspection of manholes.
2. Provide lights, mirror, means of ingress and egress, and safety equipment required to conduct visual inspection.

3. Manholes shall be to specified from and size, to the proper depth, and watertight. Manhole lining shall be smooth, uniform and shall show no visible defects. Manhole castings shall be installed at specified grade and shall be free of visible defects.
4. Repair or replace defective manhole sections, channels, castings, and lining.
5. If repairs, replacements, or repairs and replacements are required, repeat visual test following completion of repairs.

END OF SECTION

## SECTION 33 40 00 STORM DRAINAGE UTILITIES

### PART 1 - GENERAL

#### 1.01 SUMMARY

- A. The work includes storm drain pipe, culverts and structures in accordance with the lines, grades and details shown on the drawings.

#### 1.02 SUBMITTALS

- A. Submit certification that materials supplied are as specified.
- B. As-builts / Record Drawings required for permit certification shall be provided by the contractor. As-Builts / Record Drawings shall include the following:
  - 1. All pipe inverts elevations, bottom of structures elevation, pipe grade, LF of new pipe installed;
  - 2. All rim elevations. All grate elevations.
  - 3. Locations of Catch basins, Well structures, and Manholes.
  - 4. Limits of construction.
  - 5. Submit record drawings (four) 1 full size 3 11 x 17 signed and sealed by a Surveyor currently licensed in the State of Florida. Provide to the owner three DISCS with electronic copies in AUTOCAD and PDF.

#### 1.03 REFERENCE STANDARDS

- A. The Florida Department of Transportation Standard Specifications for Road and Bridge Construction, latest edition, referred to hereafter as the Standard Specification. References to the Standard Specifications are used to specify materials, application and installation. Administrative, contractual and measurement and payment requirements are not applicable.

### PART 2 - PRODUCTS

#### 2.01 PIPE FOR CULVERTS AND UNDERDRAINS

- A. ADS PIPE N-12
- B. Provide ADS Pipe Adapter flexible watertight Waterstop connection with pipe adapter for ADS Corrugated HDPE Pipe to storm structures, or approved equal ADS Pipe Adapters meeting the requirements of ASTM F 2510 and ASTM C 1478 for watertight flexible connections. Rapid set mortar shall be used with potable water; ground water shall not be used.

## 2.02 JOINT MATERIALS FOR PIPE

- A. Concrete pipe in accordance with Paragraph 430-7 of the Standard Specifications.

## 2.03 MITERED END SECTION

- A. In accordance with FDOT Roadway and Traffic Design Standards - Index No. 272.

## 2.04 FILTER AGGREGATE FOR UNDERDRAINS

- A. In accordance with Paragraph 902-4 of the Standard Specifications.

## 2.05 MATERIALS FOR INLETS, MANHOLES, JUNCTION BOXES, ENDWALLS, FLUMES, DITCH PAVEMENT, AND BOX CULVERTS

- A. Concrete structures shall meet the requirements of FDOT 400; Concrete structures. All structures shall be H-20 rated

## 2.06 PRECAST INLETS, MANHOLES AND JUNCTION BOXES

- A. In accordance with Paragraph 425-5 of the Standard Specifications and FDOT Roadway and Traffic Design Standards - Index No. 201.

## 2.7 PRECAST BAFFLE BOX SECTIONS

- A. Precast manhole sections shall size shall be as specified on the drawings, conforming to ASTM C478. Precast sections shall meet the permeability test requirements of ASTM C14. Minimum wall thickness top, bottom, and sides shall be 8 inches. All manholes shall have epoxy-coated reinforcing bars. Reinforcing bars shall be 3" minimum from the edge. Top and bottom of all sections shall be parallel. The Contractor's attention is directed to Paragraph MORTAR herein before. Baffle Boxed shall support H20 loading.

## 2.8 MANHOLE AND BAFFLE BOX EXTENSIONS

- A. Concrete grade rings shall be H-20 rated and for extensions shall be a maximum of 6 inches high and shall be approved by Engineer before installation.
- B. HDPE adjustment rings shall be H-20 Rated and shall be approved by Engineer before installation
- C. Clay Brick and Shale Brick. This brick shall meet the requirements of AASHTO M 114, for Grade MW. and shall be approved by Engineer before installation
- D. Concrete Brick. Concrete brick shall meet the requirements of ASTM C 55 for Grade S-I, and shall be approved by Engineer before installation

1. In general, manhole and baffle box extensions will be used on all manholes in roads or streets or in other locations where a subsequent change in existing grade may be likely. Extensions will be limited to a maximum height of 12 inches. Finish grade for manhole covers shall conform to finished ground or street surface unless otherwise directed by the Engineer. The Contractor will be responsible for coordinating with the Engineer and Owner to determine the finish grade for manhole and baffle box covers and will make all adjustments necessary to bring manhole covers to that grade. Extensions shall lined with polypropylene and be watertight. Extensions shall meet the H-20 load rating; brick is used contractor is required to submit a shop drawing with an 18 inch concrete collar 4000 PSI 1-6 inches thick. Brick shall be installed using Rapid Set Mortar Mix or equal. This cost shall be incidental to the cost of installing the structure. Masonry unit's manufacturer shall submit six test certificates furnished to the Engineer. Such certificates shall be signed by an authorized agent of the manufacturer, and identified by project number.

#### 2.9 BAFFLE BOX / MANHOLE FRAMES AND COVERS:

- A. Cast iron of size and shape detailed on the Drawings. Covers shall have the word STORM SEWER, as appropriate, in 2-inch raised letters. Castings shall be tough, close-grained gray iron, sound, smooth, clean, free from blisters, blowholes, shrinkage, cold shuts, and all defects, and shall conform to ASTM A-48, Class 30B. Plane or grind bearing surfaces to ensure flat, true surfaces. Covers shall be true and seat within ring at all points.

#### 2.10 WATERTIGHT

- A. Provide water tight manhole ring and covers, and extensions.
- B. Provide ADS Pipe Adapter flexible watertight Waterstop connection with pipe adapter for ADS Corrugated HDPE Pipe to storm structures, or approved equal ADS Pipe Adapters meeting the requirements of ASTM F 2510 and ASTM C 1478 for watertight flexible connections. Rapid set mortar shall be used with potable water; ground water shall not be used.

#### 2.11 NUTRIENT SEPARATING BAFFLE BOX

- A. Nutrient Separating Baffle Box and associated cage screen, skimmer, well screen, and turbulence deflectors, shall be as manufactured by Suntree Technologies, Inc., Cocoa, Fl.
- B. Hydrocarbon boom shall be Type 4 Polymer Absorbent as specified by Suntree Technologies, Inc., Cocoa, Fl. or approved equal.
- C. Baffle boxes requiring catch basin – frames and grates shall be USF # 4160-6611 galvanized; cost shall be included in the bidder's proposal. Note; all grates are required to be galvanized.

## PART 3 - EXECUTION

### 3.01 INSTALLATION OF PIPE

- A. Concrete pipe, in accordance with Paragraph 430-4 of the Standard Specifications.
- B. Underdrains in accordance with Paragraphs 440-3, 440-4 and 440-5 of the Standard Specifications.

### 3.02 CONSTRUCTION OF INLETS, MANHOLES, JUNCTION BOXES, ENDWALLS, FLUMES, DITCH PAVEMENT, AND BOX CULVERTS

- A. Placing concrete and reinforcing steel in accordance with Section 03300 - CONCRETE WORK.
- B. Setting frames and grates in accordance with Paragraph 425-6.3 of the Standard Specifications.
- C. Laying brick in accordance with Paragraph 425-6.5 of the Standard Specifications.
- D. Placing pipe in accordance with Paragraph 425-6.6 of the Standard Specifications.
- E. Concrete box culverts in accordance with Paragraphs 400-7.16, 400-9, and 415-5.11 of the Standard Specifications.

### 3.03 ADJUSTING EXISTING STRUCTURES

- A. In accordance with Paragraph 425-6.8 of the Standard Specifications.

### 3.04 MITERED END SECTIONS

- A. In accordance with FDOT Roadway and Traffic Design Standards - Index No. 272.

### 3.05 UNDERDRAINS

- A. In accordance with Paragraphs 440-4 and 440-5 of the Standard Specifications.

### 3.06 SAND-CEMENT RIP-RAP ENDWALLS

- A. In accordance with Paragraph 530-3.1 of the Standard Specifications.

END OF SECTION

## SECTION 33 46 00 SUBDRAINAGE

### PART 1 – GENERAL

#### 1.01 SUMMARY

- A. This Section includes subdrainage systems for areas on site including landscaped areas. This section is not to be used for subsurface drainage for structures.
- B. Related Requirements:
  - 1. Section 33 40 00 – Storm Drainage Utilities

#### 1.02 DEFINITIONS

- A. The phrase "DOT Specifications" shall refer to the most current Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

#### 1.03 SUBMITTALS

- A. Product Data: For pipe and fittings and filter fabric

### PART 2 – PRODUCTS

#### 2.01 PIPING MATERIALS

- A. Refer to the "Piping Applications" Article in Part 3 for applications of pipe, fitting, and joining materials.

#### 2.02 PERFORATED-WALL PIPES AND FITTINGS

- A. Perforated PE Pipe and Fittings: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
  - 1. Couplings: Manufacturer's standard, band type.

#### 2.03 SOLID-WALL PIPES AND FITTINGS

- A. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.
  - 1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.

## 2.04 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. when tested according to ASTM D 4491.
- B. Structure Type: Nonwoven, needle-punched continuous filament or woven, monofilament or multifilament per drawings.

## PART 3 – EXECUTION

### 3.01 EARTHWORK

- A. Excavating, trenching, and backfilling are specified elsewhere in these specifications.

### 3.02 PIPING APPLICATIONS

- A. Underground Subdrainage Piping: Use as indicated on drawings.
  - 1. Perforated PE pipe and fittings, couplings, and coupled joints.
- B. Header Piping:
  - 1. PE drainage tubing and fittings, couplings, and coupled joints.

### 3.03 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
  - 1. Lay perforated pipe with perforations down.
  - 2. Lay all pipe per drawings or with minimum slope of 0.5 percent.
  - 3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install PE piping according to ASTM D 2321.

### 3.04 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

### 3.05 FIELD QUALITY CONTROL

A. Testing: After installing drainage course to top of piping, test drain piping with water to ensure free flow before backfilling. Remove obstructions, replace damaged components, and repeat test until results are satisfactory.

### 3.06 CLEANING

A. Clear interior of installed piping and structures of dirt and other superfluous material as work progresses. Maintain swab or drag in piping and pull past each joint as it is completed. Place plugs in ends of uncompleted pipe at end of each day or when work stops.

END OF SECTION

## SECTION 337119

### ELECTRICAL UNDERGROUND DUCTS AND MANHOLES

#### PART 1 - GENERAL

##### 1.01 SECTION INCLUDES

- A. Metal conduit.
- B. Nonmetallic duct.
- C. Manholes.

##### 1.02 RELATED REQUIREMENTS

- A. Section 031000 – Concrete Forming and Accessories.
- B. Section 032000 – Concrete Reinforcing.
- C. Section 033000 – Cast-in-Place Concrete.
- D. Section 071113 – Bituminous Damproofing.
- E. Section 221006 – Plumbing Piping Specialties.
- F. Section 312316 – Excavation.
- G. Section 312323 – Fill: Bedding and backfilling.
- H. Section 312316.13 – Trenching: Excavating, bedding, and backfilling.

##### 1.03 REFERENCE STANDARDS

- A. For requirements relating to reference standards, see Section 014219 - Reference Standards.
- B. American National Standards Institute (ANSI):
  - 1. ANSI C80.1 –American National Standard for Electrical Rigid Steel Conduit (ERSC).
- C. American Society for Testing and Materials (ASTM):
  - 1. ASTM A48/A48M – Standard Specification for Gray Iron Castings.
  - 2. ASTM C857 – Standard Practice for Minimum Structural Design Loading for Underground Precast Concrete Utility Structures.
  - 3. ASTM C858 -- Standard Specification for Underground Precast Concrete Utility Structures.
  - 4. ASTM C891 -- Standard Practice for Installation of Underground Precast Concrete Utility Structures.
  - 5. ASTM C1037 -- Standard Practice for Inspection of Underground Precast Concrete Utility Structures.
- D. National Electrical Manufacturer’s Association
  - 1. NEMA FB 1 – Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
  - 2. NEMA TC 2 – Electrical Polyvinyl Chloride (PVC) Conduit.

3. NEMA TC 3 – Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing.
  4. NEMA TC 6 & 8 – Polyvinyl Chloride (PVC) Plastic Utilities for Underground Installation.
- E. National Fire Protection Association (NFPA):
1. NFPA 70 – National Electrical Code.
- F. Underwriters Laboratories Inc. (UL):
1. UL 651A – Type EB and A Rigid PVC Conduit and HDPE Conduit.
  2. UL 1684 – Standard for Safety for Reinforced Thermosetting Resin Conduit (RTC) and Fittings.

#### 1.04 SUBMITTALS

##### A. General:

1. For submittal procedures, refer to Section 007200 – General Conditions (AIA A201-20075P, including but not limited to Section 3.12) and Section 013000 – Administrative Requirements.

##### B. Product Data: Provide for metallic conduit, nonmetallic conduit.

##### C. Shop Drawings: Indicate dimensions, reinforcement, size and locations of openings, and accessory locations for precast manholes.

##### D. Manufacturer’s Instructions: Indicate application conditions and limitations of use stipulated by product testing agency specified under Quality Assurance. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

##### E. Project Record Documents: Record actual routing and elevations of underground conduit and duct, and locations and sizes of pullboxes.

#### 1.05 QUALITY ASSURANCE

##### A. Conform to requirements of NFPA 70.

##### B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience and with service facilities within 100 miles (160 km) of Project.

##### C. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

### PART 2 - PRODUCTS

#### 2.01 MANUFACTURERS

#### 2.02 CONDUIT AND DUCT

- A. Rigid Steel Conduit: ANSI C801.
1. Fittings: NEMA FB 1, steel.

- B. Rigid Plastic Conduit: NEMA TC 2, Schedule 49 PVC, with fittings and conduit bodies to NEMA TC 3.
  - 1. Fittings: NEMA FB 1, steel.
- C. Rigid Plastic Underground Conduit: UL 651A, Type A PVC.
- D. Plastic Utilities Duct: NEMA TC 6 & 8; PVC Type EB.
  - 1. Duct Fittings: NEMA TC 9.
- E. Plastic Communications Duct and Fittings: NEMA TC 7 & 8, Type EB.
- F. Reinforced Resin Conduit and Fittings: Complying with UL 1684.
  - 1. Joining Method: Tapered bell and spigot joints.

### 2.03 ACCESSORIES

- A. Underground Warning Tape: 4 inch (100 mm) wide plastic tape, detectable type colored red with suitable warning legend describing buried electrical lines.

## PART 3 - EXECUTION

### 3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify routing and termination locations of duct bank prior to excavation for rough-in.
- C. Verify locations of manholes prior to excavating for installation.
- D. Duct bank routing is shown in approximate locations unless dimensions are indicated. Route as required to complete duct system.
- E. Manhole locations are shown in approximate locations unless dimensions are indicated. Locate as required to complete ductbank system.

### 3.02 DUCT BANK INSTALLATIONS

- A. Install duct to locate top of ductbank at depths as indicated on drawings.
- B. Install power, communications, and CATV duct to locate top of ductbank minimum 36 inches below finished grade.
- C. Cut duct square using saw or pipe cutter; de-burr cut ends.
- D. Insert duct to shoulder of fittings; fasten securely.
- E. Join nonmetallic duct using adhesive as recommended by manufacturer.
- F. Wipe nonmetallic duct dry and clean before joining. Apply full even coat of adhesive to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- G. Install no more than equivalent of three 90degree bends between pull points.
- H. Provide suitable fittings to accommodate expansion and deflection where required.
- I. Terminate duct at manhole entries using end bell.

- J. Stagger duct joints vertically in concrete encasement 6 inches (150 mm) minimum.
- K. Use suitable separators and chairs installed not greater than 4 feet (1200 mm) on centers.
- L. Band ducts together before backfilling.
- M. Securely anchor duct to prevent movement during concrete placement.
- N. Place concrete under provisions of Section 033000. Use mineral pigment to color concrete red.
- O. Provide minimum 3 inch (75 mm) concrete cover bottom, top, and sides of ductbank.
- P. Provide two No. 4 steel reinforcing bars in top of bank under paved areas.
- Q. Connect to existing concrete encasement using dowels.
- R. Connect to manhole wall using dowels.
- S. Provide suitable pull string in each empty duct except sleeves and nipples.
- T. Swab duct. Use suitable caps to protect installed duct against entrance of dirt and moisture.
- U. Interface installation of underground warning tape with backfilling. Install tape 6 inches (150 mm) below finished surface.

END OF SECTION 337119

SECTION 337900  
SITE GROUNDING

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Electrodes. Connectors, and conductors.
- B. Grounding wells.
- C. Treatment wells.

1.2 RELATED REQUIREMENTS

- A. Section 033000 – Cast-in-Place Concrete.
- B. Section 260526 – Grounding and Bonding for Electrical Systems.
- C. Section 264113 – Lightning Protection for Structures.
- D. Section 312316 – Excavation: Trenching for grounding.
- E. Section 312316.13 – Trenching: Trenching for grounding.

1.3 REFERENCE STANDARDS

- A. For requirement related to reference standards, see Section 01429 – Reference Standards.
- B. Institute of Electrical and Electronic Engineers (IEEE):
  - 1. IEEC C2 – National Electrical Safety Code.
  - 2. IEEE 80 – IEEE Guide for Safety in AC Substation Grounding.
  - 3. IEEE 142 – IEEE Recommended Practice for Grounding of Industrial and Commercial Power Systems.
- C. National Fire Protection Association (NFPA):
  - 1. NFPA 70 – National Electrical Code.

1.4 SYSTEM DESCRIPTION

- A. Conform to IEEE 142.
- B. Provide grounding systems that provide overall resistance to ground of 5 ohms.

## 1.5 SUBMITTALS

- A. General:  
For submittal procedures, refer to Section 007200 – General Conditions (AIA A201-20075P, including but not limited to Section 3.12) and Section 013000 – Administrative Requirements.
- B. Shop Drawings: Indicate layout of grounding system and installation details.
- C. Product Data: Provide for grounding electrodes and connectors.
- D. Test Reports: Indicate overall resistance to ground at each system.
- E. Manufacturer's Instructions: Include instructions for storage, handling, protection, examination, preparation and installation of exothermic connectors.
- F. Project Record Documents: Accurately record actual locations of electrodes and connections.

## 1.6 QUALITY ASSURANCE

- A. Confirm to requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.
- C. Products: Furnish products listed and classified by Underwriters Laboratories In., as suitable for purpose specified and shown.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Product: Erico.
- B. Substitutions: See Section 016000 – Product Requirements.

### 2.2 MATERIALS

- A. Rod Electrodes: Copper.
  - 1. Diameter:  $\frac{3}{4}$ " inch.
  - 2. Length: 10 feet (1.5 m).
  - 3. Product:
  - 4. Substitutions: See Section 016000 – Product Requirements.
- B. Exothermic Connections:
  - 1. Product: Erico.
  - 2. Substitutions: See Section 016000 – Product Requirements.

- C. Wire: Stranded copper.
  - 1. For Horizontal Electrodes: 4/0 AWG, minimum size.
  - 2. For Connections to Electrodes: 3/0 AWG, minimum size.
  - 3. For Bonding Other Objects: 2/0 AWG, minimum size.
  - 4. Mechanical Connectors: Bronze.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Very completion of filling and backfilling before beginning grounding work.
- B. Verify that trenching is completed before installing horizontal electrodes.

### 3.2 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install rod electrodes in vertical position with bottom at least 5 feet (1,600 mm) below frost line.
- C. Install rod electrodes minimum 6' apart.
- D. Install interconnecting wire 2 feet (600 mm) below finished grade level.
- E. Provide grounding wells and grounding boxes as indicated.
- F. Interface with lightning protection system installed under Section 264113.
- G. Interface with grounding and bonding provided under Section 260526.
- H. Interface with chain link fence specified in Section 323113.

### 3.3 FIELD QUALITY CONTROL

- A. Perform field inspection and testing in accordance with Section 014000 – Quality Requirements.
- B. Make final grounding system measurements three or four days after chemical treatment.
- C. Test Procedures: IEEE 142, fall of potential method.

### 3.4 CLOSEOUT ACTIVITIES

- A. Demonstrate to facility operation and maintenance personnel the location of each accessible grounding connection.

END OF SECTION 337900