the length required for connection/fusing.

3.14 AFTER PIPE BURSTING

A. Upon completion of the pipe bursting, certain tasks must be followed through in order to complete the overall process including removal of temporary mains.

3.15 PIT CONDITION PRIOR TO TAPS OR JOINING SYSTEM

A. Maintaining sanitary conditions within the product pipe after pipe bursting must take high priority. Should any foreign matter, including ground water be allowed to enter the pipe interior, the condition of the pipe is no longer suitable for connection to the system. For this reason connections may not be made in standing water. Such water must be pumped or bailed prior to making the connection or unsealing the pipe. Areas under connections should be excavated below the pipe invert.

B. Before joining a surface and before any special surface preparation to accommodate that joining, external surfaces should be clean and dry. Dust may be removed by wiping with clean, lint free cloth. Heavier deposits must be washed from the surface with soap and water and dried with a clean, lint free cloth.

C. Incidental exposure of the interior of the pipe to any foreign matter shall require that one of the two following remedies be carried out:

1. Complete chlorination per AWWA specifications for buried pipe.

2. Localized contamination at the end of the pipe may be removed and the contaminated interior surface of the pipe wiped with a solution of 1 to 5% hypochlorite disinfecting solution.

3.16 SERVICE TAPS AND SERVICE LINES

A. Service taps shall be of a type approved by the City and must meet AWWA C906. Construction of taps shall be per the manufacturer's recommendation. Acceptable choices include:

1. Electro-fusion type and/or mechanical saddles with a minimum working pressure of 100psi

2. Socket Fusion

B. Replacement or rehabilitation of service lines, if required, shall be according to contract.

Note: HDPE pipe is the preferred material for service line replacements to curb stops.

3.17 POST CHLORINATION

A. The section of main will be super-chlorinated to 300 ppm by inserting a swab at one end. The swab shall travel the entire length of the pipe section.

3.18 SERVICE REINSTATEMENT

A. Prior to connection of the newly installed pipe, the section of pipe shall be fully flushed with

the use of a de-chlorination unit and ascorbic acid to neutralize the residual chlorine. Following flushing, the newly installed section may be connected to the main at both ends and service reinstated.

3.19 BACKFILL AND SURFACE REINSTATEMENT

A. Backfill used to restore pits shall be per applicable sewer and water construction standards applicable in the municipality.

B. Lawn restoration shall be per applicable sewer and water construction standards applicable in the municipality.

C. Asphalt, concrete or other roadway surface restoration shall be per applicable sewer and water construction standards applicable in the municipality.

3.20 DOCUMENTATION FINALIZATION

Within (15) days of completion of the job, all records including manifests, marked up construction plans or documents pertinent to describing the system as installed shall be provided to the City.

3.21 TABLES AND EQUATIONS

Makeup Water Allowance Table 6.1

Nominal Pipe Size In Inches	2	4	6	8	10	12	14	16	18	20	22	24	30
Makeup Water Allowance (Gallon/100 ft)	.1	.2	.6	1.0	1.3	2.3	2.8	3.3	4.3	5.5	7.0	8.9	12

Allowance for Leakage Due to Fittings Equation 6.2

L = [ND(P^.50)]/[7,400]

Where:
L = Maximum allowable leakage, Gallons/Hour
N = Number of joints in the tested pipe (connections for pipes or fitting, not fuse joints)
D = Nominal inside diameter of pipe, Inches
P = Test Pressure, PSI

3.22 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on the actual quantities installed as more specifically discussed and described in SECTION 01025 for MEASUREMENT AND PAYMENT.

END OF SECTION 02420

SECTION 02510
CONCRETE SIDEWALK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this Section.

1.02 WORK INCLUDED

A. The work specified in this Section consists of the construction of concrete sidewalk in accordance with these Specifications and in conformity with the lines, grades, dimensions and notes shown on the plans.

1.03 RELATED WORK

A. Section 02200 - Earthwork
B. Section 02110 - Clearing
C. Section 02515 - Portland Cement Concrete Paving
D. Section 03010 - Concrete
E. Section 03300 - Cast-In-Place Concrete
F. Section 03370 - Concrete Curing

PART 2 - PRODUCTS

2.01 CONCRETE

A. Concrete shall be Class I Concrete, with a minimum compressive strength of 3,000 psi in accordance in accordance with Section 522, Florida Department of Transportation Standard Specifications for Road and Bridge Construction.

2.02 FORMS

A. Forms for this work shall be made of either wood or metal and shall have a depth equal to the plan dimensions for the depth of concrete being deposited against them. They shall be straight, free from warp or bends, and of sufficient strength when staked, to resist the lateral pressure of the concrete without displacement from lines and grade. Forms shall be cleaned each time they are used and shall be oiled prior to placing the concrete.

2.03 SUBGRADE AND GRADING

A. Excavation shall be made to the required depth, and the foundation material upon which the sidewalk is to be set shall be compacted to a firm, even surface, true to grade and cross-section, and shall be moist at the time that the concrete is placed.

2.04 JOINTS

A. Contraction joints may be of the open type or may be sawed. Staking a metal bulkhead in place and depositing the concrete on both sides shall form open type contraction joints. After the concrete has set sufficiently to preserve the width and shape of the joint, the bulkhead

shall be removed. After the sidewalk has been finished over the joint, the slot shall be edged with a tool having a 1/2-inch radius.

If the CONTRACTOR elects to saw the contraction joints, a slot approximately 1/8 inch wide and 1-1/2 inches deep which shall be cut with a concrete saw after the concrete has set, and within the following periods of time:

Contraction joints shall be constructed at intervals equal to the sidewalk width, and shall be in place within 12 hours after finishing.

PART 3 - EXECUTION

3.01 PLACING

A. The concrete shall be placed in the forms to the required depth and shall be vibrated and spaded until mortar entirely covers its surface.

3.02 FINISHING

A. Screeding: The concrete shall be struck-off by means of a wood screed, used perpendicular to the forms, and floated in order to obtain the required grade and remove surplus water and laitance.

B. Surface requirements: The concrete shall be given a broom finish. The surface variations shall not be more than 1/4 inch under a ten-foot straightedge, nor more than 1/8 inch on a five-foot transverse section. The exposed edge of the slab shall be carefully finished with an edging tool having a radius of 1-1/2 inch.

3.03 CURING

A. The concrete shall be continuously cured for a period of at least 72 hours. Curing shall be commenced after finishing has been completed and as soon as the concrete has hardened sufficiently, to permit application of the curing material without marring the surface.

B. Wet burlap, white-pigmented curing compound, waterproof paper or polyethylene sheets may be used for the curing of grey concrete only.

3.04 COLORED CONCRETE (NOT USED)

A. Colored – Conditioned Concrete shall be placed, finished, and cured in strict accordance with applicable requirements of this Section and Sections 03010, 03370, and the requirements of the chosen manufacturer.

3.05 MEASUREMENT AND PAYMENT

A. There shall be no special measurement or payment for the work under this section, it shall be included in the unit price per square yard bid for concrete sidewalk when listed separately in the Bid Schedule and shall be included in the cost of all other work called out in the Bid Schedule requiring concrete sidewalk restoration.

END OF SECTION 02510

SECTION 02513
ASPHALTIC CONCRETE PAVING - GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

1.02 WORK INCLUDED

A. This section of the specifications covers the control and general conduct of asphalt paving construction for roads, parking, walks and court areas.

B. All work within the right-of-way shall be constructed using materials and methods in accordance with the drawings, City of North Miami Beach, Miami-Dade County and Florida Department of Transportation Standard Specifications for Road and Bridge Construction (latest edition).

C. Provide all labor, materials, necessary equipment and services to complete the Asphaltic Concrete Paving work, as indicated on the drawings, as specified herein or both.

D. Including, but not necessarily limited to the following:

1. Preparation of subgrade.

2. Installation and compaction of base course.

3. Spreading of asphalt surface course.

1.03 RELATED WORK

A. Section 02200 – Earthwork

B. Section 02515 - Portland Cement Concrete Paving

1.04 TRAFFIC CONTROL

A. The CONTRACTOR shall provide and maintain access to and from all properties along the line of CONTRACTOR'S work. The CONTRACTOR shall also provide temporary bypasses and maintain them in a safe and usable condition whenever the public cannot do detouring of traffic to parallel routes without hardship or excessive increases in travel. Wherever required by the public authorities having jurisdiction, the CONTRACTOR shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time fixed by said authorities before proceeding with the final restoration of improvements. Temporary resurfacing activities and material shall be included under Mobilization and no additional payment shall be made.

1.05 SPECIAL SUBGRADE CONDITIONS

A. When special subgrade conditions are encountered for which these "Asphaltic Concrete Paving Specifications" are not applicable, portions of these specifications shall be deleted or revised to provide a properly finished paved surface. A requested revision or deletion of the

specifications shall be accompanied with reports and laboratory tests on existing field conditions. Any change from these "Asphaltic Concrete Paving Specifications" shall be approved by the ENGINEER and shall be in effect only for a specified area or paving project.

1.06 QUALITY ASSURANCE

A. FDOT Standard Specifications.

1. Work and materials shall conform to all applicable requirements of Florida Department of Transportation "Standard Specifications for Road and Bridge Construction – Latest Edition" (referred to herein as FDOT).

B. American Society for Testing and Materials.

1. ASTM 3515-80 "Standard Specification for Hot-Mixed, Job Laid, Bituminous Paving mixtures."

1.07 SUBMITTALS

A. Provide copies of materials, notarized certificates of compliance signed by material producer and CONTRACTOR, certifying that each material item complies with, or exceeds, specified requirements.

1.08 JOB CONDITIONS

A. Apply prime and tack coats when ambient temperature is above 50 degrees, and when temperature has not been below 35 degrees for 12 hours immediately prior to application. Do not apply when base is wet or contains an excess of moisture.

B. Construct asphalt concrete surface course only when atmospheric temperature is above 40 degrees, and when base is dry. Base course may be placed when air temperature is above 30 degrees, and rising.

1.09 LOCATIONS, LAYOUT AND GRADES

A. Locate and layout paved areas and right-of-ways with reference to benchmarks, property lines or buildings according to the drawings and as accepted by the ENGINEER.

B. Determine locations of paved edges and right-of-way line from surveyor's permanent reference monuments and information on the drawings.

C. Where permanent reference monuments are not available, obtain proper line locations from authorities having jurisdiction.

D. Establish and maintain required lines and elevations.

1.10 PAYMENT ADJUSTMENT – BITUMINUS MATERIALS

A. On Contracts having an original Contract time of more than 365 calendar days, the OWNER will adjust the bid unit price for bituminous material, excluding cutback and emulsified asphalt to reflect increases or decreases in the Asphalt Price Index (API) of bituminous material from

that in effect during the month in which bids were received. The Contractor will not be given the option of accepting or rejecting this adjustment. Bituminous adjustments will be made only when the current AFI (CAPI) varies by more than 5% of the API prevailing in the month when bids were received BAPI, and then only on the portion that exceeds 5%.

FDOT will determine the API for each month by averaging quotations in effect on the first day of the month at all terminals that could reasonably be expected to furnish bituminous material to projects in the State of Florida.
The API will be available on the Construction Office website by the 15th of each at the following URL:

http://www.dot.state.fl.us/construction/fuel&bit/Fuel&Bit.shtm

Payment on progress estimates will be adjusted to reflect adjustments in the prices for bituminous materials in accordance with the following:

$ Adjustment = (ID) (Gallons)

Where ID = Index Difference = [CAPI - 0.95(BAPI)] when the API has decreased between the month of bid and month of this progress estimate.

Where ID = Index Difference = [CAPI – 1.05(BAPI)] when the API has increased between the month of bid and month of this progress estimate.

Payment will be made on the current progress estimate to reflect the index difference at the time work was performed.

For asphalt concrete items payable by the ton, the number of gallons will be determined assuming a mix design with 6.25% liquid asphalt weighing 8.58 lb/gal.

Asphalt concrete items payable by the square yard will be converted to equivalent tons assuming a weight of 100 lb/yd^2 per inch.

PART 2 - PRODUCTS

2.01 FILL

A. All fill shall be clean rock and sand (maximum rock size = 1 inch).

B. Fill shall be compacted thoroughly as per Section 02200 - Earthwork.

2.02 LIME ROCK

A. Lime rock shall be obtained from pits for which all overburden has been removed previous to blasting and shall show no tendency to air slake and must meet the following chemical requirements.

		Percent
1.	Carbonates of Calcium	Min.70.0 (Miami Lime rock) and Magnesium.
		95.0 (Ocala Lime rock)

2.	Oxides of Iron and Aluminum	Max. 2.0
3.	Organic Matter	Max. 0.5

4. Any constituents of other than the above shall be silica or inert material.

5. The material shall be crushed to such size that not less than 97% shall pass a 3-1/2" sieve and it shall be graded uniformly down to dust. All fine material shall consist entirely of dust of fracture.

6. Lime rock from on-site may be used if the material meets the requirements of this section of the specifications.

B. All lime rock shall comply with requirements set forth under FDOT Section 911.

C. Equipment: The equipment for constructing the rock base shall be in first class working condition and shall include:

1. Three wheel roller weighing not less than ten tons.

2. Self-propelled blade grader weighing not less than three tons. The wheelbase shall be not less than fifteen feet and blade length not less than ten feet.

3. Scarifiers shall have teeth space not to exceed 4-1/2 inches.

a. Provision for furnishing water at the construction site by tank or hose at a rate not less than 50 gallons per minute.

2.03 PRIME COAT

A. Prime coat shall meet the requirements of FDOT Section 916-2., latest edition.

B. Prime coat shall have full compatibility with surface treatment asphalt.

C. The bituminous material shall conform to the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Section 300-2.

D. The sand for cover shall be clean dry sand.

2.04 TACK COAT

A. The bituminous material to be used for the tack coat shall conform to the requirements of the Florida Department of Transportation Standard Specifications for Road and Bridge Construction, Section 300-2.

2.05 ASPHALT

A. The asphaltic concrete surface course shall be in accordance with City of North Miami Beach, Miami-Dade County and Florida Department of Transportation Standard Specifications (latest

edition) for Type SP-12.5, Type SP-9.5, Type S-I and Type S-III Asphaltic Concrete Friction Course.

B. Pavement within public road right-of-way, which has been disturbed by this construction, shall be replaced with the same type and thickness to match the existing pavement section.

2.06 SEAL COATING

A. Homogeneous mixture of emulsified coal tar pitch, asbestos, sand and other inert fillers. It shall be easily remixed if settlement occurs in storage (except in the case of freezing). It shall be capable of application and complete coverage by rubber squeegee, brush, or approved mechanical method, to the surface of bituminous pavements at the spreading rate of point two (.2) to point three (.3) gallons per square yard in two (2) coats.

B. Approved product: "TARFEX" manufactured by Bitucote Products Co. or approved equal.

PART 3 - EXECUTION

3.01 BARRICADES

A. Provide substantial temporary barricades around all areas of operation and maintain until work under this section is completed and approved.

B. Install temporary traffic markers, signals, and signs as per Miami-Dade County Typicals for Pavement Markings, Signing, and Geometrics and FDOT 600 Series Design Index to:

1. Eliminate potentially hazardous conditions.

2. Maintain adequate traffic patterns free of conflict with work under this Contract.

3.02 PREPARATION OF SUBGRADE

A. This work consists of bringing the bottom of excavations and top of embankments of the roadway between the outer limits of the shoulders or base course to a surface conforming to the grades, lines, and cross sections shown on the plans. The subgrade shall be of uniform density ready to receive the rock base of the paving course.

B. All soft and yielding material and other portions of the subgrade which will not compact readily shall be removed and replaced with suitable material and the entire subgrade brought to line and grade to provide a foundation of uniform compaction and supporting power.

C. Stumps, roots, and other deleterious organic matter encountered in the preparation of the subgrade shall be removed.

D. Where fills are required on areas covered or partly covered by existing paving, the entire area of such existing paving shall be scarified to a depth of at least six inches, and the scarified material spread evenly over the area to be filled to a width not less than that of the proposed paving.

E. Material for fills shall consist of sand or other suitable material approved by the ENGINEER free from stumps, roots, brushes, and other deleterious organic matter.

F. Where fill is more than one foot in depth, the backfill material above the ground water table shall be compacted on one (8") depth lifts. Each individual layer of fill under the rock base shall have a density as specified in Section 02200, Paragraph 3.14.I. unless shown otherwise on the plans. Each individual layer of fill under the shoulder area shall have a density as specified in Section 02200, Paragraph 3.14.I., unless shown otherwise on the plans.

G. The bottom of all excavated areas and the top of all fills where rock base is to be constructed shall be thoroughly compacted by rolling. Water shall be used to insure thorough compaction. The stability of the top 12 inch thickness of the subgrade immediately under the base, for the full base width plus one foot on each side, shall be at least LBR 40 as determined by AASHTO T-180.

H. Bring subgrade, which has been properly filled and shaped to a firm unyielding surface, by rolling an entire area with an approved vibratory power roller weighing a minimum of 10 tons.

1. Thoroughly compact area inaccessible to the roller with approved hand tamper.

2. Apply water sufficiently to compact the subgrade where the subgrade is of a dry, sandy nature and cannot be rolled.

I. The subgrade shall be maintained free from ruts, depressions or other irregularities until rock base material is spread.

J. For all roads and streets other than State Highway, the stabilized subgrade shall have a minimum Lime rock Bearing Ratio (LBR) of 40, unless otherwise noted on the plans.

K. Where the bearing value of the existing subgrade is adequate without addition of stabilizing material, the subgrade shall be scarified and disked, harrowed, bladed or tilled for removal of boulders, roots, etc. to assure uniformity and thorough mixing of material to the full width and depth of required stabilization. The compacted subgrade shall conform to the lines, grades and cross-section shown on the plans.

L. Test subgrade for crown and elevation after preparation and immediately before base of paving course is laid.

1. Remove or add material and compact to bring to a correct elevation and uniform bearing if the subgrade is found not to be at the specified elevation at all points.

2. Adjust the MAS rims, catch basin frames and valve boxes where necessary to match proposed finish grade.

3.03 CONSTRUCTION OF BASE COURSE

A. This work consists of construction of lime rock base course for the asphaltic concrete wearing surface. The base course shall be constructed on the prepared subgrade in an 8" thick lime rock bases constructed in two four inch lifts as shown on the drawings. Twelve (12) inch thick lime rock bases shall be constructed in two six-inch lifts. The lime rock base shall be a minimum LBR of 100.

B. Spreading Rock: The rock shall be transported to the points where it is to be used over rock

previously placed, and dumped on the end of the preceding spread. It shall then be spread uniformly with hand tools, or mechanical equipment. In no case shall rock be dumped directly on the subgrade. No hauling shall be done over the subgrade.

C. Compacting Rock

1. Following spreading, the rock shall be rolled with a three wheel roller weighing not less than ten tons, water being added as required, until the entire depth of base is compacted into a dense unyielding mass.

2. No greater area of rock base shall be placed during any one day than that which can be rolled and compacted on the same day.

D. Finishing Base

1. After watering and rolling, the entire surface shall be thoroughly scarified to a depth not less than four inches (4") and shaped to exact crown and cross section, re-watered and again thoroughly rolled. Rolling shall continue until the entire depth of base is bonded and compacted into a dense, unyielding mass, true to grade and cross section.

a. Any irregularities, which may develop in the surface during such finishing, shall be corrected by the removal or addition of rock as the case may be.

b. If at any time the subgrade material becomes churned up and mixed with the base rock, the CONTRACTOR shall dig out and remove the mixture, reshape and compact the subgrade and replace the materials removed with clean rock which shall be watered and rolled until satisfactorily compacted.

c. Where 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, the CONTRACTOR shall remove such cracks or checks by re-scarifying, reshaping, watering, rolling and adding rock where necessary.

d. During final compacting operations, if grading of any areas is necessary to obtain the true grade and cross section, the compacting operations for such areas shall be completed prior to making the density tests on the finished base.

E. Inferior Rock: If in the opinion of the ENGINEER at any time during the progress of the work, rock of inferior quality is being delivered to the construction site, a laboratory analysis of the rock shall be made. Should the results of such tests indicate that the rock does not conform to specifications, the CONTRACTOR shall, at CONTRACTOR's own expense, remove such inferior material from the area indicated and deliver and spread satisfactory rock on said area.

F. Testing Surface: The finished surface of the rock base shall be true to the required cross section. Any irregularities in the grade greater than 1/4", as determined by placing a ten foot straight edge parallel with the centerline, shall be corrected by scarifying to a depth of three inches (3"), removing or adding rock as may be required and again watering, rolling, and compacting the scarified area. In testing the surface for irregularities, the measurements under the straight edge shall not be taken in small holes caused by individual pieces of rock having been pulled out by the road grader.

G. Thickness Determination: Thickness of the base shall be measured by intervals as required by the ENGINEER. Measurements shall be taken at various points on the cross section. The measurements shall be taken in holes through the base of not less than three inches (3") in diameter. Where the base is more than 1/2" less than the required compacted thickness, the CONTRACTOR shall correct such areas by scarifying and adding rock. The affected areas shall then be watered, rolled and brought to a satisfactory state of completion, and of required thickness and cross section.

H. Density: Density determinations shall be made by the CONTRACTOR or at intervals required by the ENGINEER. An average required density shall be as specified in Section 02200, Paragraph 3.14.I. No section of base shall be accepted when more than 10% of tests fall below 98% of maximum density and in no case shall a density of less than 96% of maximum be accepted.

I. Testing: The CONTRACTOR shall coordinate with ENGINEER for all testing. One test shall be made in accordance with AASHTO, T-180 for each class of material in the subgrade and base.

1. In place density tests in accordance with AASHTO T-147 shall be made in the locations shown on the plans. Two copies of the test reports will be sent directly to the ENGINEER for evaluation.

2. Any material, which fails to meet these specifications, shall be removed, replaced, and retested, all at the CONTRACTOR's expense.

3. Tests shall be taken at least every 1,000 square yards and taken at locations and lifts as directed by the ENGINEER.

3.04 PRIME COAT FOR BASE COURSE

A. Cleaning the prepared base:

1. Before any bituminous material is applied, all loose material: dust, dirt, caked clay and foreign matter which might prevent proper bond with the existing surface shall be moved to the shoulders, to the full width of the treatment, by means of revolving brooms or approved mechanical sweepers and by mechanical blowers, of approved types, supplemented by hand sweeping. Dust and other loose materials not removed by mechanical means shall be removed with hand brooms. Particular care shall be taken to clean the outer edges of the strip to be treated in order to insure that the prime coat will adhere. Sweeping and blowing shall be continued until all the loose dust and dirt is removed from the surfaces.

2. Application of bituminous material shall be made during the same day surface has been swept and as soon as practical thereafter.

B. Application for prime coat:

1. The bituminous material shall be applied to the clean dry surface of the rock base at such temperature as will insure uniform distribution. The amount applied will be at the rate of approximately 0.10 to 0.20 gallons per square yard of base area. The application shall be made by means of self-propelled pressure distributor operating

under a pressure not less than 20 pounds per square inch. Application of bituminous material shall be made on only one-half of the width of base at one time.

2. The primed base shall then be covered with a uniform layer of clean sand, and kept thoroughly and uniformly covered by additional sand or sweeping until it shows no signs of picking up under traffic. For a period of one week after priming, the CONTRACTOR shall again broom any area where insufficient cover sand or excess of bituminous material causes "bleeding" and, if necessary, spread additional sand on such area.

C. Prime coat finish: After prime has cured or sat and been sanded, the shoulder shall be shaped to conform to all grade lines and cross sections and the entire area shall be rolled and compacted with a rubber tired roller or a power roller before asphalt surface is laid on the finished base.

3.05 BITUMINOUS TACK COAT

A. Before applying any bituminous material, all loose material: dust, dirt and foreign material, which might prevent proper bond with the existing surface, shall be removed for the full width of the application.

B. Application for tack coat:

1. The surface to receive the tack coat shall be clean and dry. The tack coat shall be clean and dry. The tack coat shall be applied with a pressure distributor except that on small jobs, if approved by the ENGINEER, the application may be made by other approved mechanical methods or by hand methods. The pressure distributor shall operate at a pressure not less than 20 pounds per square inch and at a consistency such that it can be properly pumped and sprayed uniformly over the surface.

2. The bituminous material shall be applied in a thin uniform layer. The rate of application shall be between 0.02 and 0.10 gallon per square yard. The tack coat shall be applied sufficiently in advance of the laying of the wearing surface to permit drying, but shall not be applied so far in advance that it might lose adhesiveness as a result of being covered with dust or other foreign material. The tack coat surface shall be kept free from traffic until the wearing surface is laid.

3.06 ASPHALTIC CONCRETE WEARING SURFACE COURSE

A. Cleaning and preparing base:

1. Prior to the laying of the asphaltic concrete, the base of pavement to be covered shall be cleaned of all loose deleterious material by the use of power brooms or blowers. A tack coat shall be applied on all pavements. The tack coat shall not be applied so far in advance of laying operations as to allow shifting and sand or weather conditions to nullify its effectiveness.

2. After the surface has been thoroughly cleaned, all holes shall be filled with asphaltic concrete, if necessary, and thoroughly compacted to conform to the existing surface and to form a smooth surface.

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ASPHALTIC CONCRETE PAVING - GENERAL

B. Placing asphaltic concrete: The asphaltic concrete surface course shall be applied after the tack coat may be permitted a reasonable time for drying but not to an extent that the tack coat is allowed to lose its adhesiveness.

1. Machine spreading: Upon arrival the mixture shall be dumped into the approved mechanical spreader and immediately spread and struck off to the full width required and to such appropriate loose depth for each successive course that when the work is completed the required weight of the mixture per square yard or the specified thickness will be secured. An excessive amount of mixture shall be carried ahead of the screen at all times. Hand raking shall be done behind the machine as required.

2. Hand spreading: In limited areas, where, on account of irregularities or unavoidable obstacles, the use of mechanical spreading and finishing equipment is impractical, the mixture may be spread by hand, when so authorized by the ENGINEER.

3. The mixture shall be laid only when the surface to be covered is dry and only when weather conditions are suitable.

4. All structures which will be in actual contact with asphaltic mixture, including the face or surface of curbs or gutters and their vertical faces of existing pavements, shall be painted with a uniform coating of asphalt material to provide a closely bonded, watertight joint.

5. Where necessary, due to the traffic requirements, the mixture shall be laid in strips in such manner as to provide for the passage of traffic.

6. Any mixtures caught in transit by a sudden rain may be laid at the CONTRACTOR's risk. In no case shall the mixture be laid while rain is falling or when there is water on the surface to be covered.

7. The depth of the layer being spread shall be gauged as directed, and where the thickness fails to average the specified thickness, immediate steps shall be taken to correct the depth.

8. Before any rolling is started, the course surface shall be checked, any inequalities adjusted, and all drippings, fat sand accumulations from the screed and fat spots from any source shall be removed and replaced with satisfactory material.

9. Straight-edging and back patching shall be done after initial completion has been obtained and while the material is still hot. Any irregularity greater than 1/4" either longitudinally or transversely shall be corrected at this time.

10. No skin patching shall be done. When a depression is to be corrected while the mixture is hot, the surface shall be well scarified before the addition of fresh mixture. If irregularities occur and are not corrected while the mixture is still hot, the irregularities shall be cut out the full depth of the layer and replaced with fresh mixture.

C. Compacting mixture: After the spreading, the mixture shall be rolled when it has set sufficiently or come to the proper condition to be rolled, and when the rolling does not cause undue displacement or shoving.

1. The motion of the roller shall at all times be slow enough to avoid displacement and shall at once be corrected by the use of rakes and fresh mixture where required. The rolling shall include all transverse, longitudinal, and diagonal rolling, as may be necessary to obtain the maximum density.

2. The seal rolling with tandem steel rollers weighing from five to eight tons shall follow as close behind the spreader as is possible without picking up, or displacing or blistering the material.

3. Rolling with the self-propelled pneumatic-tired rollers shall follow as soon as possible and as close behind the seal rolling as the heat of the mixture will permit. The rolling shall be done while pavement temperature is between 175° and 240°F, and to such an extent that the self-propelled traffic roller shall cover every area of the surface with at least ten passes. Final rolling with tandem steel rollers shall be done after the rolling with self-propelled pneumatic tired rollers is completed. This final rolling shall be done before the pavement temperature is lower than 175°F., and shall be continued until all roller marks or tire marks are eliminated.

4. Self-propelled pneumatic rollers shall be used for the rolling of patching and leveling courses. At the option of the CONTRACTOR, a steel-wheeled roller may be used to supplement the self-propelled pneumatic-tired rollers but not more than one steel-wheeled roller may be used in conjunction with the necessary number of self-propelled pneumatic-tired rollers. After final completion, the finished pavement shall at no point have a density less than 95% of the laboratory compacted density.

5. Rolling with the self-propelled pneumatic-tired roller shall proceed at a speed from six to twelve miles per hour and the rate of rolling shall not exceed 3,000 square yards per hour per roller. A sufficient number of self-propelled pneumatic-tired rollers shall be used so that the rolling of the surface for the required number of 10 passes within this maximum rolling rate shall not delay any other phase of the placing operation and not result in excessive cooling of the mixture before the rolling is complete. In the event that the rolling is not properly maintained to schedule as outlined above, the laying operation shall be discontinued until the rolling operations are sufficiently caught up.

6. In all places inaccessible to a roller, such as adjacent to curbs, headers, gutters, bridges, MAS'S, etc., the required compaction shall be secured with tamps. Depressions, which may develop before the completion of the rolling, shall be remedied by loosening the mixture laid and adding new material to bring such depressions to a true surface.

7. Should any depressions remain after final compaction has been obtained, the mixture shall be removed sufficiently and new material added to form a true and even surface. All high spots, high joints and honeycombs shall be adjusted as directed by the ENGINEER.

8. The mixture, after compaction, shall be of the thickness shown on the plans. The surface, after compactions, at no place shall snow an excess of asphalt and any area showing such excess or other defect, shall be cut out and replaced with fresh mixture and immediately compacted to conform with the surrounding area. Any mixture which becomes loose or broken, mixed with dirt in the wearing course shall be removed and replaced with fresh mixture which shall be immediately compacted to conform with

surrounding areas.

9. Gasoline or oil from rollers shall not be allowed to deposit on the pavement and any pavement damaged by such deposits shall be removed and replaced as directed by the ENGINEER.

10. Any mixture remaining unbonded after rolling shall be removed and replaced.

D. Protection of pavement: After the completion of the pavement, no vehicular traffic of any kind shall be permitted on the pavement until it has set sufficiently as approved by the ENGINEER.

3.07 ABUTTING EXISTING PAVING

A. Meet elevation of existing paving and structures, facilities and utilities where applicable by sawcutting and removing no less than two (2) feet from abutment. Milling of asphalt for a width of two (2) feet is an alternative if approved by engineer. Do not cover access covers, MAS tops, water meters or other similar devices.

3.08 PAVEMENT EDGES

A. Make edges of paved area conform to details and sections as shown on drawings.

3.09 SEAL COATING

A. Preparation of Surface: Pavement to be sealed must be sound and free of loose dust, dirt, stones, or other foreign matter:

1. Repair any breaks or holes.

2. Scrape off accumulations of oil or fuel drippings and scrub with detergent and water. Remove all traces of detergent.

3. Soft or damaged spots must be repaired.

4. Flush entire area with clean water.

5. Pavement should be damp (no puddles or excess water) when seal coating is applied.

B. MIXING: Stir seal coating to a uniform consistency, use no solvents for thinning. Dilute seal coating with ten (10) percent to twenty (20) percent clean water, stirring to uniform consistency.

C. Application:

1. Seal coat may be applied to dampened surface with a rubber squeegee, soft bristled push broom, or approved mechanized equipment.

2. Seal coating may be poured directly onto pavement in a ribbon or windrow. Squeegee is placed on pavement at a slight angle to edge line of pavement and pulled in a window along pavement in parallel lines, always working excess material toward bottom edge of squeegee.

3. Seal coating should be applied in two (2) thin coats. After first coat is completely dry to touch, a second coat may be applied at right angles to the first. Rate of application will depend on porosity of surface.

4. Allow to cure for twenty-four (24) hours before opening to traffic.

5. Do not apply seal coating when temperature is below fifty (50) degrees Fahrenheit, or falling, before sealer is dry, or rain appears imminent or forecast.

6. Apply in strict accord with manufacturers published instructions.

3.10 FIELD QUALITY CONTROL

A. Test in place asphalt concrete course for compliance with requirements for thickness and surface smoothness. Repair or remove and replace unacceptable paving as directed by OWNER's Representative and ENGINEER.

1. In-place compacted thickness will not be acceptable if exceeding following allowable variation from required thickness:

a. Base Course: Not greater than 1/2" of specified thickness.

b. Surface Course: Not greater than 1/4" of specified thickness.

2. Test finished surface of each asphalt concrete course for smoothness, using 10' straight edge applied parallel with, and at right angles to centerline of paved area. Surfaces will not be acceptable if exceeding the following tolerances for smoothness.

a. Base Course Surface: 1/4".

b. Wearing Course Surface: 1/8".

B. Check surface area at intervals as directed by the ENGINEER.

C. Finish grade shall be within ±0.01 feet of the grades indicated on the plans or ± 0.05 feet as long as no ponding of water is observed after final paving.

3.11 CLEAN UP

A. Remove all debris and excess material immediately from project site.

B. Take down all barricades and temporary traffic markers, signals and signs only after all work included in this section is finished and inspected, and only after so directed by the ENGINEER.

C. Leave project area clean, orderly and free of any hazardous conditions.

3.13 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on the actual quantities installed as more specifically discussed and described in SECTION 01025 for MEASUREMENT AND PAYMENT.

END OF SECTION 02513

SECTION 02515
PORTLAND CEMENT CONCRETE PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this Section.

1.02 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the Portland Cement Concrete Paving work, as indicated on the drawings, as specified herein or both, except as for items specifically indicated as “NIC ITEMS”.

B. Including, but not necessarily limited to the following:

1. Fill, subgrade, and lime rock base.
2. Concrete formwork.
3. Concrete reinforcement.
4. Expansion and contraction joints.
5. Concrete paving.

1.03 RELATED WORK

A. Section 02200 - Earthwork

B. Section 02513 - Asphaltic Concrete Paving - General

C. Section 01410 – Testing Laboratory Services

1.04 QUALITY ASSURANCE

A. Requirements of Regulatory Agencies: Perform work in accordance with local building and other applicable codes.

B. Applicator Qualifications: Minimum of five years of experience on 5 comparable concrete projects.

C. Inspection and Testing: Performed in accordance with Section 01410 unless otherwise specified.

1. Test cylinders - as per ASTM C-39.
    a. Minimum of three (3) concrete test cylinders shall be taken for every 75 or less cubic yards of concrete placed.
    b. Minimum of one (1) additional test cylinder shall be taken during any cold weather concreting, and be cured on job site under same conditions as the concrete it represents.

2. Slump test - as per ASTM C-143:

   a. Minimum of one (1) slump test shall be taken for each set of test cylinders taken.

1.05 SUBMITTALS

A. Test Reports: Reports of concrete compression, yield, air content, and slump tests.

B. Certificates:

1. Manufacturer's certification that materials meet specification requirements.

2. Material content per cubic yard of each class of concrete furnished.

   a. Dry weights of cement.

   b. Saturated surface-dried weights of fine and coarse aggregate.

   c. Quantities, type and name of admixtures.

   d. Weight of water.

3. Ready-mix delivery tickets, ASTM C-94.

C. Shop Drawings:

1. Show sizes and dimensions for fabrication and placing of reinforcing steel and bar supports.

2. Indicate bar schedules, stirrup spacing, and diagrams of bend bars.

3. Detail items of form systems affecting appearance of Architectural concrete surfaces such as joints, tie holes liners, patterns and textures. Show items in relation to entire form system.

1.06 DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to project site in bundles marked with metal tags indicating bar size and length.

B. Handle and store materials to prevent contamination.

1.07 JOB CONDITIONS

A. Allowable concrete temperatures:

1. Hot weather: Maximum 90 degrees F as per ASTM C-94.

B. Do not place concrete during rain, unless protection is provided.

SECTION 02515
PORTLAND CEMENT CONCRETE PAVING

PART 2 - PRODUCTS

2.01 FILL

A. As specified in Section 02513 - Asphaltic Concrete Paving - general.

2.02 SUBGRADE

A. As specified in Section 02513 - Asphaltic Concrete Paving – general.

2.03 LIME ROCK BASE

A. As specified in Section 02513 - Asphaltic Concrete Paving - general.

2.04 READY-MIXED CONCRETE

A. Cement: ASTM C-150, normal Type 1.

B. Admixtures:

1. Air entraining: ASTM C-260.

2. Chemical: Type (as required) ASTM C-494.

3. Fly ash and pozzolans: ASTM C-618.

C. Coarse aggregate: Not less than 50% clean, hard, crushed stone conforming to requirements of Table 2, size number 467 ASTM C-33.

D. Slump Target of 3” and a range of (±) 1 inch - tested according to ASTM designation C143 (AASHTO T119).

E. Air content: 5% + 1%.

F. Mix proportioning:

1. 28 day compressive strength of cured laboratory samples 3,000 psi.

2. Minimum cement content 5-sacks/cubic yard.

G. Curing Material: Liquid membrane, ASTM C-309, Type 1.

H. Mixes:

1. ASTM C-94.

2. Mix concrete only in quantities for immediate use.

3. Do not re-temper or use set concrete.

SECTION 02515
PORTLAND CEMENT CONCRETE PAVING

2.05 REINFORCEMENT

A. Reinforcing Steel Bars: 60 psi yield strength; deformed billet steel bars; ASTM A-615, plain finish.

B. Welded Steel Wire Fabric: Plain type, ASTM A-185, hot dip galvanized, plain finish.

C. Tie Wire: FS QQ-W-461-G, annealed steel, black, 16-gage minimum.

D. Bar Supports: Conform to "Bar Support Specifications," CRSI Manual of Standard Practice.

2.06 FORMWORK AND ACCESSORIES

A. Formwork: Matched, tight fitting and adequately stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of concrete, conform with ACU 347, Chapter 3, Material and Form Work.

B. Lumber:

1. Softwood framing lumber: Kiln dried, PS-20.

2. Boards less than 1-1/2 inch thick and 2 inches wide, used for basic forms and form liners: Kiln dried.

3. Grade marked by grading rules agency approved by American Lumber Standards Committee.

4. Light framing or studs for board or plywood forms, 2 inches to 4 inches width and thickness, construction standard grade.

5. Boards for basic forms, construction standard grade.

6. Board surface: Smooth.

C. Plywood:

1. Exterior type softwood plywood, PS 1-66.

2. Each panel stamped or branded indicating veneer grades, species, type and identification.

3. Wood faced plywood for Architectural concrete surfaces.

a. Panel veneer grades: B-C.

b. Mill-oiled sides and mill-sealed edges of panels.

D. Ties:

1. Material: Steel

2. Type: Snap ties

3. Depth of Breakback: 1 in.

4. Maximum diameter, 1/4 in.

E. Form coatings:

1. Non-staining type.

2. Agent: Pine oil derivative.

2.07 EXPANSION AND CONTRACTION JOINTS

A. Minimum 3/4-inch thick asphaltic impregnated fiberboard as per ASTM D-1751.

2.08 OTHER

A. Water: Clean and potable.

PART 3 - EXECUTION

3.01 BARRICADES

A. Provide substantial temporary barricades around all areas of operation and maintain until work under this section is completed and approved.

B. Install temporary traffic markers, signals, and signs as per Miami-Dade County Standards and FDOT 600 Series Design Index to:

1. Eliminate potentially hazardous conditions.

2. Maintain adequate traffic patterns free of conflict with work under this Contract.

3.02 PREPARATION OF SUBGRADE

A. Ensure rough grading has brought subgrade to required elevations.

B. Fill soft spots and hollows with additional fill.

C. Level and compact subgrade, to receive lime rock base for concrete walks, curbs and gutters, to a density as specified in Section 02200, Paragraph 3.14.I.

3.03 FORMWORK

A. CONTRACTOR is responsible for the design, construction, removal and complete safety of formwork and shoring.

B. Form construction shall be provided to shape, lines dimensions of members shown: substantial, tight enough to prevent leakage, and properly braced or tied to maintain position and size, form sides and bottoms of members unless specifically excepted.

C. Fill voids of plywood joints with sealant and tool smooth.

D. Form vertical surfaces to full depth and securely position to required lines and levels. Ensure form ties are not placed so as to pass through concrete.

E. Arrange and assemble formwork to permit easy dismantling and stripping, and to prevent damage to concrete during formwork removal.

3.04 REINFORCING

A. Reinforce concrete curbs and gutters. Allow for minimum 1-1/2 inch concrete cover.

B. Do not extend reinforcing through expansion and contraction of joints. Provide dowelled joints through expansion and contraction joints, with one end of dowels fitted with capping sleeve to allow free movement.

3.05 FORMING EXPANSION AND CONTRACTION JOINTS

A. Place expansion and contraction joints at 20 foot intervals or as indicated on drawings. Where possible, make joints of curbs coincide with joints in paving slabs. When sidewalks abut building, provide continuous joint filled.

B. Fill joints with filler of required profiles set perpendicular to longitudinal axis of walks, curbs and gutters. Recess 1/4 inch below finished concrete surface.

3.06 INSPECTION

A. Assure that excavation and formwork are completed, and excess water is removed.

B. Check that reinforcement is secured in place.

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

3.07 PREPARATION FOR PLACEMENT

A. Notify the ENGINEER and other inspectors at least 36 hours prior to inspection.

B. Equipment forms, and reinforcing shall be clean and wet down, reinforcing firmly secured in place, runways set up and not resting on or displacing reinforcing.

3.08 PLACING CONCRETE

A. Place concrete, screed and wood float surfaces to a smooth and uniform finish, free of open texturing and exposed aggregate.

B. Avoid working mortar to surface.

C. Round all edges, including edges of expansion and contraction joints, with 1/2 inch of radius edging tool.

D. Where concrete curbs are adjacent to pavement slabs, make concrete curbs and gutters integral with slabs. Make expansion and contraction joints of curbs coincide with slab joints.

E. Ensure finished surfaces do not vary from true lines, levels or grade by more than 1/8 inch in 10 feet when measured with straightedge.

F. Apply curing compound on finished surfaces immediately after finishing. Apply in accordance with manufacturer's recommendations.

3.09 PROTECTION OF COMPLETED WORK

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

3.10 CLEAN UP

A. Remove all debris and excess material immediately from project site.

B. Take down all barricades and temporary traffic markers, signals and signs only after all work included in this section is finished and inspected, and only after so directed by OWNER's Representative.

C. Leave project area neat, orderly and free of any hazardous conditions.

3.11 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on the actual quantities installed as more specifically discussed and described in SECTION 01025 for MEASUREMENT AND PAYMENT.

END OF SECTION 02515

SECTION 02577
PAVEMENT MARKING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this section.

1.02 WORK INCLUDED

A. The work covered by this section shall include the furnishing of all labor, equipment and materials necessary to construct and install all pavement marking, striping and car stops in accordance with the plans and these specifications.

1.03 RELATED WORK

A. Section 02513 - Asphaltic Concrete Paving - General

B. Section 02515 - Portland Cement Concrete Paving

1.04 QUALITY ASSURANCE

A. Perform all work in accordance with the requirements of local agencies.

1.05 SUBMITTALS

A. Submit copies of product and material information and data..

PART 2 - PRODUCTS

2.01 Chlorinated rubber-alkyd type, as per Fed Spec. No. TT-P-115, Type III, or shall be Code T-1, conforming to Section 971-12.2 of the Florida Department of Transportation Standard Specifications.

1. Paint shall be factory mixed, quick drying and non-bleeding type.

2. Color shall be as per FDOT requirements.

3. Striping, arrows, lane markers and stop bars shall be provided with paint containing reflective additive.

2.02 Thermoplastic paint shall conform to the applicable Technical Specifications (Section 711) of the Florida Department of Transportation and Miami-Dade County Standards

2.03 Traffic paint shall conform to the applicable Technical Specifications (Section 710) of the Florida Department of Transportation and Miami-Dade County Standards

2.04 Reflectors shall be in accordance with Miami-Dade County Standards.

SECTION 02577
PAVEMENT MARKING

PART 3 - EXECUTION

3.01 TRAFFIC AND LANE MARKINGS

A. Sweep dust and loose material from the sealed surface.

B. Apply paint striping as indicated on the drawings, with suitable mechanical equipment to produce uniform straight edges.

1. Apply in not less than (2) two coats as per manufacturer's recommended rates of applications.

C. Protect pavement markings until completely dry in accordance with manufacturers recommendations.

3.02 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on the actual quantities installed as more specifically discussed and described in SECTION 01025 for MEASUREMENT AND PAYMENT.

END OF SECTION 02577

SECTION 02601
SUBTERRANEAN STRUCTURES

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1-General Requirements shall govern the WORK under this section.

1.02 WORK INCLUDED

A. The work covered by this section shall include the furnishing of all labor, equipment, services, materials, products and tests to perform all operations in connection with the construction of all new structures or modifications or abandonment of existing structures as shown on the plans, defined in these specifications and subject to the terms and conditions of this contract, including, but not limited to, maintenance access structures (MAS), conflict structures, catch basins, and inlets.

1.03 RELATED WORK

A. Section 02200 - Earthwork

B. Section 02221 - Excavation and Backfilling for Utilities

C. Section 02400 - Storm Drainage Facilities

1.04 SUBMITTALS

A. The CONTRACTOR shall furnish the ENGINEER shop drawings of the precast drainage structures and MAS for approval. Shop drawings should illustrate all dimensions, reinforcements and specifications.

PART 2 - PRODUCTS

2.01 MORTAR

A. Mortar for use in constructing and plastering sewer structures shall conform to ASTM C-270, "Specifications for Mortar for Unit Masonry". A Portland cement-hydrated lime mixture or a masonry cement may be used provided that the same materials are used throughout the project.

B. Mortar materials shall be proportioned by volume and shall consist of one part Type II Portland Cement to two parts aggregate (sand). Portland Cement shall conform to ASTM C-150, "Specifications for Portland Cement". Aggregate shall conform to ASTM C-144, "Specifications for Aggregate for Masonry Units."

2.02 PRECAST CONCRETE MAS

A. Precast MAS sections shall conform to ASTM C-478, Specifications for Precast Reinforce Concrete MAS Sections as modified thereto. Concrete shall attain a minimum compressive strength of 4,000 pounds per square inch at 28 days. Minimum wall thickness shall be 8 inches.

B. Unless otherwise specified on the plans, all joints shall be made with neoprene or rubber "O" ring compression joints; mastic joint sealing compound, or approved equal. After assembly, all joints shall be filled with mortar and painted to provide a smooth surface without joint voids.

C. The base and walls that compose the bottom section of precast MAS shall be of monolithic construction, minimum 8 inches thick, and the edge of the base slab shall project a minimum 4 inches beyond the outside diameter of the wall.

D. Holes for piping shall be 6 inches larger than the outside diameter of the respective pipe. After the pipe is set, the void space between the pipe and the hole perimeter shall be completely filled with non-shrinking, quick-setting, waterproof cement mortar and struck smooth.

E. The minimum height of precast base section shall be 36 inches from the bottom of the base slab; however, no holes for piping shall be cast less than 8 inches from the top of the base section or less than 2 inches from the top of the base slab.

F. The maintenance access structure walls shall be coated inside and outside with 2 coats of coal tar epoxy. The first coat shall be red and the second coat shall be black. Each coat shall have a thickness of 8 mil for a total thickness of 16 mil outside and 16 mil inside.

2.03 ENDWALLS, CATCH BASINS, INLETS AND JUNCTIONS BOXES

A. Endwalls, valve vaults, catch basins, inlets and junction boxes shall be constructed at the locations shown and to the dimensions indicated on site plans. Unless otherwise specified on the plans, inlets, junction boxes, catch basins, valve vaults and similar structures may be constructed of brick, concrete block, poured concrete or precast concrete. Precast catch basins shall conform to latest Portland Cement Association specifications. Concrete shall have not less than 4,000-pounds per square inch compressive strength at 28 days.

B. Unless otherwise specified on the plans, all concrete for these structures shall be Class I concrete as specified in the Florida Department of Transportation "Standard Specifications for Road and Bridge Construction", latest revision, Section 345. Mortar for use in constructing and plastering shall be as previously set forth in this section.

C. Brick shall be solid hard-burned clay conforming to ASTM Serial C-32-73, Grade MA. Concrete brick shall conform to ASTM Serial C-55-75, Grade P-I. Concrete block shall conform to ASTM Serial C-90-78, Grade PI.

D. All brick or concrete block structures covered in this Section shall be plastered inside and outside with 1/2 inch of cement mortar. Inside surfaces shall be smooth and even.

E. Base slabs and walls of concrete structures shall be constructed in a continuous pour between expansion joints.

F. For each grate type inlet, two layers of Mirafi 140 fabric of "Poly Filter X" polypropylene material or approved equal, shall be sandwiched between 2 x 2 x 10/10 welded wire fabric cut to the grate size and attached to the underside of the grate. The sandwiched filter material shall be wired to the cross members of the grate each way on 4-inch centers. After inlet construction and the roadway construction is completed and the project site work (including landscaping) has been established, the filter material and fabric shall be removed with any retained silt or sand.

2.04 CASTINGS (INCLUDING FRAMES, COVERS AND GRATINGS)

A. Iron castings shall conform to ASTM A-48, "Specifications for Gray Iron Castings", and shall be Class 30. Frames and grates may be Class 20.

B. All castings shall be made of clean, even grain, tough grey cast iron. The castings shall be smooth, true to pattern and free from projections, san holes, warp and other defects. The horizontal surface of the frame cover seats and the under surface of the frame cover seat which rests upon the cover seat shall be machined. After machining, it shall not be possible to rock any cover that has been seated in any position in its associated frame. Machining shall be required only on those frames and covers intended for vehicular traffic.

C. Bearing surfaces between cast frames, covers and grates shall be machined and fitted together to assure a true and even fit. Within areas of vehicular traffic, the frames, covers and gratings shall be machined-ground so that irregularity of contact will be reduced to a minimum and will be rattle-proof.

D. All MAS covers shall be provided with concealed pick holes. Manufacturer's name and catalog number shall be cast on all frames, covers, grates, etc. Covers shall be lettered "Storm Sewer" or "Sanitary Sewer" as applicable and shall be plainly visible as shown on the plans. The MAS frames and covers shall be flush with finished grade.

E. Grates and covers for inlets shall be as shown on the plans, set to the grades indicated and conforming with the requirements of the castings described above. Grates shall be furnished complete with frames specifically constructed to provide full bearing at all points of contract.

PART 3 - EXECUTION

3.01 CHANNELS

A. Channels shall be accurately and smoothly formed in accordance with the plans. Channels shall be constructed of concrete with trowel-finished surfaces. The upper surface of the MAS shall be sloped toward the channels as shown.

B. Drop pipe at sanitary sewer MAS shall be installed when the difference in elevation between the pipe invert and the invert at the center of the MAS exceeds two feet (2'), or where directed by the ENGINEER. The drop MAS structure shall be built according to the plans and specifications.

C. After channels are formed and section joints are pointed, the interior of the sanitary sewer MAS shall be painted with two coats of Koppers Bitumastic 300-M (7 mils per coat) or approved equal. The exterior shall be painted in a similar manner, if required by local regulations.

D. Storm drainage structures are not required to be painted inside or outside. Provide finish and water proofing as specified in 3.02 and 3.03 below.

3.02 BRICKS

A. All bricks shall be thoroughly wetted before being laid. Brick shall be laid by the above shove joint method so as to bond them thoroughly into the mortar. Headers and stretcher courses shall be so arranged as to bond and mass thoroughly. Joints shall be finished smooth and shall be not less than 1/4 inch or more than 1/2 inch in thickness.

SECTION 02601
SUBTERRANEAN STRUCTURES

3.03 MAS AND OTHER STRUCTURES

A. All joints shall be finished watertight; all openings for sewers, frames, etc., in precast MAS and catch basins shall be cast at time of manufacture. Spaces around all piping entering or leaving MAS shall be completely filled with Embeco mortar or approved equal.

B. All MAS shall be set plumb to line and grade and shall rest on a firm carefully graded subgrade which shall provide uniform bearing under base.

C. Grout for MAS bottoms shall consist of broken block, brick and 2:1 cement mortar.

3.04 CLEANING AND MAINTENANCE

A. All structures shall be cleaned and maintained in workable condition until accepted by the ENGINEER

3.05 ABANDONMENT OF EXISTING STRUCTURES IN PLACE

A. All structures shown on the drawings to be abandoned in place shall be removed to a minimum of 3 feet below existing grade and properly filled with material as in section 02200 paragraph 3.14. Excavation, backfill, and restoration shall be executed in accordance with requirements for removing existing and installing new structures.

3.06 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on the actual quantities installed as more specifically discussed and described in SECTION 01025 for MEASUREMENT AND PAYMENT.

END OF SECTION 02601

SECTION 02609
WATER DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this Section.

1.02 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the Water Systems work, as indicated on the drawings, as specified herein or both.

1.03 RELATED WORK

A. Section 02200 - Earthwork

B. Section 02221 - Excavation and Backfilling Utilities

C. Section 02610 - Piping, General

D. Section 02641 - Valves, General

1.04 EXISTING UTILITIES

A. Furnish temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, water mains, poles and other obstructions encountered in the progress of the work.

B. Where the grade or alignment of the pipe is obstructed by existing utility structure such as conduits, ducts, pipe branch connections to main sewers, or main drains, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the CONTRACTOR in cooperation with the OWNERs of such utility structures. No deviation shall be made from the required line or grade except as directed by the ENGINEER.

PART 2 - PRODUCTS

2.01 GENERAL

A. Materials referred to by brand name in this section of this Manual represent specific requirements of NMB Water. If desired, requests for substitutions of specified materials shall be made in writing to NMB Water prior to construction. Determination of the equality of the substitute materials will be at the sole discretion of NMB Water. All equipment and materials to be installed shall be new and unused.

B. All materials and chemicals in contact with potable water shall be NSF approved. All pipes and fittings for water and wastewater and systems shall be clearly marked with the name or trademark of the manufacturer, the batch number, pipe size, the location of the plant and the strength designation, as applicable.

2.01 PIPE

A. Ductile Iron (DI) Piping:

SECTION 02609
WATER DISTRIBUTION SYSTEM

1. Pipe shall be in accordance with ANSI/AWWA Standards A21.50/C-150 and A21.51/C-151. The minimum pressure Class shall be as shown in Table 2-1 below, unless heavier class required for design conditions.

Table 2-1
Minimum Pressure Class by Pipe Diameter

Size (inches)	Pressure Class
4	350
6	350
8	350
10	350
12	350
16	250
18	250
20	250
24	200

Note: 14-inch DI pipes shall require separate review and approval.

The Pressure Class for pipe greater than 24-inches will be designated case by case, based on actual design conditions and in accordance with ANSI/AWWA Standards A21.50/C-150 and A21.51/C151.

2. Ductile iron pipe fittings shall conform to ANSI Standard A21.10 or A21.53 and AWWA C-110 or C-153. A 250-psi minimum pressure rating is required. All ductile iron pipe and fittings shall be 3-inch coated for use in water applications and epoxy-coated for use in sanitary applications.

3. Joints:

   a. "Push-On" and mechanical type joints shall be in accordance with ANSI/AWWA Standard A21.11/C-111. Gaskets shall be Neoprene.

   b. Restrained joint ductile iron pipe and fittings shall be constructed using pipe and fittings with restrained "locked-type" joints manufactured by the pipe and fitting manufacturer and the joints shall be capable of withstanding withdrawal at the specified test pressure. Any restrained joints that allow for elongation upon pressurization will not be allowed. Restrained pipe joints that achieve restraint by incorporating cut out sections in the wall of the pipe shall have a minimum wall thickness at the point of cut out that corresponds with the minimum specified wall thickness for the rest of the pipe.

   c. Flexible type joints shall be of the boltless type, with a joint deflection of up to 15 degrees, and shall be specifically designed for flexible joint use.

   d. Flanged connections shall be in accordance with ANSI Standard B16.1, 125 lb. and shall have full faced type rubber gaskets 1/8-inch thick. Bolts and nuts shall be Grade B conforming to the ASTM Designation A307, for Steel Machine Bolts and Nuts and Tap Bolts.

e. Restraining devices may be substituted for the restrained "locked-type" joints and gaskets manufactured by the ductile iron pipe and fitting manufacturer. Mechanical joint restraint shall be incorporated in the design of the follower gland and shall include a restraining mechanism which, when actuated, imparts multiple wedging action against the pipe, increasing its resistance as the pressure increases. Flexibility of the joint shall be maintained after burial.

Glands shall be manufactured of ductile iron conforming to ASTM A536. Restraining devices shall be of ductile iron heat treated to a minimum hardness of 370 (Brinnell Hardness Number) BHN. Dimensions of the gland shall be such that the gland can be used with the standardized mechanical joint bell and tee-head bolts conforming to ANSI A21.11 and ANSI/AWWA C-153/A21.53. Twist off nuts shall be used to insure proper actuating of the restraining devices. The mechanical joint restraint device shall have a working pressure of at least 250 psi with a minimum safety factor of 2:1.

f. Thrust blocks shall be permitted only where approved by NMB Water.

4. Coatings:

a. Ductile iron pipe and fittings for underground service shall receive an exterior zinc coating, 1.0-mil film thickness in accordance with AWWA C-151 and ISO 8179-1.

b. Exposed ductile iron pipe and fittings shall receive a SSPCSP6 commercial blast cleaning followed by a factory applied exterior coating of a rust inhibitive primer, 6.0-mils DFT minimum, compatible with the finish. All field touchup shall be done using the same paint as used for the prime coat. The finished coat shall be a durable two-component, high solids, surface tolerant polyamide cured epoxy coating. Final color shall be blue for potable water and green for wastewater, unless otherwise directed by NMB Water.

B. Polyvinyl Chloride (PVC) Piping:

1. Potable water and wastewater force main pipe 4-inch through 12-inch, shall be manufactured from clean virgin Type I, Grade I rigid, unplasticized polyvinyl chloride resin conforming to ASTM Designation D1784, shall have the National Sanitation Foundation (NSF) seal, shall conform to AWWA C-900, and shall have a dimension ratio (DR) of not more than 18. PVC pipe shall be blue in color for watermain application and green in color for wastewater force main application. The PVC pipe shall have integral bell push on type joints conforming to ASTM D3139. Fittings used with PVC shall conform to 2.19. A. 2 of this Section.

2. All PVC pipe and accessories less than 4-inches in diameter shall be solvent weld Schedule 80 and shall be of rigid normal impact polyvinyl chloride. The pipe and accessories shall conform to ASTM Specification D1785 and Product Standard PS21-70.

3. PVC Pipe and PVC Fittings shall be in full compliance of the AWWA C900 and C-907 current Standards.

All 12-inch and smaller AWWA C-900 pipe and fabricated fittings, and AWWA C-907 injection molded fittings shall be restrained and installed, as indicated on the detail chart for footage restraint, and in compliance with AWWA C605. The pressure rating of the restraint shall be at least equal to that of either the pipe or fittings being installed to assure fully restraint system to the minimum pressure rating of the weakest component. All restraints shall be an internal restraint with the use of Stainless Steel locking struts embedded in and integral to the sealing gasket material. The restraining system shall be proof tested by the manufacturer to 500 psi. The manufacturer will certify that testing in written format.

The internal restraining system shall be in compliant with AWWA C-111 Sections 4 and 5 in aspect with Material Requirements for push-on SBR rubber gaskets. This would include the ASTM Standards D-395 for compression set, D-412 for tensile strength, D-573 for aging, D-1149 for surface ozone, and D-2240 for hardness, as shown on Table 8. Section 5 – verification can be met with a letter from the manufacturer of the restraining system confirming full compliance with these requirements.

The restraining system shall be approved by both NSF and FM. The internal restraining system shall be RieberLok as manufactured by Ransom Industries or a written approved equal by the municipality and design engineer. External restraints, such as PVC rated megalug type systems, are also acceptable.

C. High Density Polyethylene (HDPE) Pipe:

1. Pipe for directional bore, carrier pipe, and pipe bursting applications shall conform to ductile iron pipe size (DIPS) AWWA C-906, PE 4710, DR-11 and rated for 200 psi.

2. All HDPE pipe shall have 3 paired blue stripes co-extruded longitudinally into the pipes outside surfaces.

3. Connections of HDPE to DI fittings or valves shall require a 316 SS pipe stiffener in sections and in each end of the HDPE pipe prior to completing the fitting.

D. High Density Polyethylene (HDPE) Tubing:

1. Pipe for services shall conform to copper tubing size (CTS) DR-9, AWWA C-901 and be blue striped for use in water services.

E. Valves

1. The valve type, size, rating, flow direction arrow if applicable, and manufacturer shall be clearly marked on each unit. Valves shall open left (counterclockwise), with an arrow cast in the metal of the operating handwheels and nuts indicating the direction of opening.

F. Valve Boxes – ASTM A48, Class 30

1. Valve boxes shall be of the heavy duty, traffic bearing cast iron, adjustable screw type with a drop cover. The valve box assembly shall consist of a bottom section, top section and cover which is cast from gray iron, formulated to ASTM specification A-48 latest revision, class 30 minimum and shall be free from blowholes, shrinkage or other

imperfections not true to pattern. The shaft size shall be 5 ¼-inches and the adjustable length shall be from 18 to 24-inches. The wall thickness shall be 3/16 + 1/16-inches. The weight of the assembly shall be 61 lbs + 2 lbs, with the cover weight being a minimum of 12 lbs. Valve boxes shall be USF 7630 or equal. An alternate shall be requested in writing for review by NMB Water.

2. The name of the manufacturer and foundry of origin shall be cast into each of the components of the assembly in legible form. The assembly shall be suitable for highway traffic wheel loads of 16,000 lbs and shall withstand a proof test of 25,000 lbs without failure or permanent deflection, as per Federal Specification RR-F-621-C, latest version.

3. Covers shall be hexagonal for sanitary usage and round for water usage. The covers shall be cast with the applicable inscription in legible lettering on the top, "sewer" or "water", depending on the intended application.

G. Inspection of the pipe may also be made by the ENGINEER or other representatives of the OWNER after delivery. The pipe shall be subject to rejection at any time on account of failure to meet any of the specified requirements, even though pipes may have been accepted as satisfactory at the place of manufacture. Pipe rejected after delivery shall be marked for identification and shall immediately be removed from the job

H. The pipe material manufacturer shall provide an unconditional extended warranty for the pipe covering the cost of materials for repair or replacement plus installation manpower should the pipe fail within the warranty period. The manufacturer's extended warranty shall be for ten years after the final acceptance of the project by the OWNER. The manufacturer shall guarantee that the pipe furnished is suitable for the purpose intended and free from defects of material and workmanship for the duration of the extended warranty. In the event the pipe fails to perform as specified, the pipe manufacturer shall promptly replace defective pipe at no additional cost to the OWNER.

I. Detector Tape (4-mils min. thickness) shall be placed 18-inches above all pipes during pipe installation/backfilling. Metalized Detector Tape shall be utilized for non-metallic pipe and shall be one layer of metalized foil laminated between two layers of inert plastic film (minimum 5.5-mils thickness). Tapes shall be of the color and marked as follows:

1. Water lines - Blue continuously marked "Caution, Water Line Buried Below"

2. Sanitary Gravity Sewers – Green continuously marked "Caution, Sanitary Gravity Sewer Buried Below"

3. Wastewater Force Mains - Green continuously marked "Caution, Wastewater Force Main Buried Below"

J. All above ground pipe and fitting, valve boxes, air release valve covers, and any other marking device, shall be color coded in accordance with the Utility Location and Coordination Council Uniform Color code, which is as follows:

Red - Electrical powerline, cable, conduit, and lighting cable

Yellow – Gas, oil, steam, petroleum or gaseous materials

Orange – Communication, telephone, alarm, or signal lines, cable, or, conduit

Blue – Water Lines

Green – Gravity Sewer Lines, Wastewater Force Mains

K. All work in this section shall have a one year warranty from time of final completion.

2.02 SPECIAL ITEMS

A. Expansion Joints: Pipe expansion joints shall be suitable for the applicable service with a minimum 150 psi working pressure.

B. Flanged Coupling Adapters: Units shall be compatible with ANSI Standard B16.1, 125 lb. flanges.

C. Cast Iron Sleeves and Wall Pipes: Units shall have integral annular ring water-stops, and also conform to other requirements for cast iron fittings specified in this section. Sleeves and wall pipes to have laying length and ends required for proper installation.

D. Tapping Saddles: Units shall be fabricated of ductile iron in accordance with ASTM A536, and suitable for either wet or dry installation for connections 3-inches or less. Ductile iron body shall have a fusion bonded epoxy or nylon coating with a minimum thickness of 12-mils. The sealing gasket shall be the "O-Ring" type suitable for the applicable service. The outlet flange shall be ANSI B16.1, 125 lb. standard. Tie straps and bolts shall be of type 316 stainless steel. The gasket material shall be an elastomeric compound resistant to degration by oil, natural gas, acids, alkalies, aliphatic fluids, and chloramines.

E. Tapping Sleeves and Valves: Units shall be of the ductile iron for pressure connections 4-inches and larger. All taps shall utilize mechanical joint sleeves.

1. Sleeves for taps 4-inches and larger shall be either cast iron, mechanical joint type or stainless steel as further defined below.

a. Stainless steel sleeves may be used on less than full diameter taps. Stainless steel tapping sleeves shall be all 316 stainless steel, including flanges, bolts and nuts and shall be rated for 150 psi minimum operating pressure and 200 psi minimum test pressure. The tapping sleeve shall have a pilot flange recessed for tapping per MSS SP-60. The pilot flange shall be pressure rated Class D according to AWWA C207 with 125 lb. drilling conforming to ANSI B16. Each sleeve shall be supplied with a flange gasket bonded to the flange. The body gasket shall be a full circle, grid pattern, covering the entire length of the sleeve, cloth reinforced, with attached stainless steel bridge to support the gasket at the lugs. The gasket shall be made of SBR rubber or similar material, compounded for use with water, salt solution, mild acids, bases and sewage. The sleeve shall have a ¾-inch NPT bronze or stainless steel test plug. All welds shall conform to ASTM A380 and shall be fully passivated.

b. Cast iron sleeves shall be used only for asbestos cement taps where the tap is equal to the diameter of the tapped pipe, as directed by NMB Water, or at the option of the Contractor. Sleeves shall be of the mechanical joint type having a flat faced cast iron flange, recessed for a tapping valve. All end and side gaskets shall be totally confined. The throat section of tapping sleeves

through 12-inch size shall conform to MSS-SSP6-60. Test plug shall be provided on the outlet throat. Cast iron sleeves shall not be used with any type of material.

2. Tapping gate valves shall comply with AWWA Standard C500 latest revision. The valve port shall be free and full to allow for unobstructed flow. All gate valves are to be iron body, bronze, mounted, double disc, resilient seat nonrising stem, parallel fit type, opening left (counter clockwise). Non-geared valves shall be furnished with "O" ring packing (two (2) "O" rings).

F. Polyethylene Encasement: Encasement shall have a minimum thickness of 8-mils and comply with the applicable provisions of ANSI/AWWA C-105/A21.5, "Polyethylene Encasement for Gray and Ductile Iron Piping for Water and Other Liquids."

2.03 HYDRANTS

A. Hydrants shall be conform to all standards and requirements set forth by NMB Water and Section 02642 “Fire Hydrants”.

B. Hydrants shall be installed plumb and in true alignment with the connection pipes to the water main. They shall be secured with restraining assemblies. Final field location of all hydrants shall be approved by NMB Water. Hydrant guards per standard detail around fire hydrants are required when hydrants are placed within 4-feet of all driveways, turning radii, or parking areas.

C. Fire hydrants installed that have not been placed into service shall be tagged with a sign approved by OWNER to indicate that they are out of service.

2.04 SERVICE CONNECTIONS

A. All service lines shall be 1-inch, or 2-inch copper tube size (CTS) polyethylene tubing. Tubing shall be brass threaded and continuous between tap and meter box, splicing shall not be accepted.

HDPE pipe / tubing 2-inch and smaller shall comply with or exceed AWWA C901, ASTM D-3350, D-2737, D-1248, and D-2837 Standards latest revisions. All HDPE Tubing shall be manufactured with 4710 resins only and shall have NSF 14 Certification. The Cell Classification shall be 445574E external pipe and 445574D for virgin center core. The pipe shall have UV stabilizers for direct sunlight protections, but all tubing shall be certified to resist direct sunlight such as Florida or Arizona for a minimum of 5 years with no visible or physical effect to the tubing. The manufacture shall issue certifications for all the above mention standards, cell classification, UV protection or a minimum of 5 years, and NSF 14 certification. All tubing shall be SDR 9 CTS pipe with a minimum pressure rating of 250 psi. The tubing shall be supplied with an outer layer of 4710 resins with green coloring while the inter core shall be a virgin clear center of 4710 resins. The tubing shall have a life time warranty with certifications from the manufacture of compliance with purity of internal core and detailed outline of life time warranty. All Tubing shall be ENDOT EndoTrace or approval equal by utility chief engineer. All tubing shall come with the tracer wire pre-attached to the tubing with special adhesives evenly spaced to prevent any separation. The tracer wire shall be 10-gauge single strand copper clad steel by copperhead with a black insulation wall for protection. This wire shall meet or exceed the National Plumbing Code.

1. Tubing shall have a working pressure at 200 PSI at 73.4 degrees F.

2. All tubing furnished under these specifications shall conform to the following standards: AWWA C-901, ASTM D2239, ASTM D2737, ASTM D3350, ASTM D1248, ASTM F1248, ASTM D 1693, ASTM D2837 and ASTM D3140.

3. Polyethylene tubing surfaces shall be mirror smooth, and shall be free from bumps and irregularities. Materials must be completely homogeneous and uniform in appearance.

4. Tubing dimensions and tolerances shall correspond with the values listed in AWWA C901 with a dimension ratio (DR) of 9.

5. Tubing shall be fully labeled at intervals of not more than 5-feet with brand name and manufacturer, the nominal size, PE 4710, the word "Tubing" and DR9, PC 200 AWWA C901, and the seal, or mark, of the testing agency.

6. 2-inch tubing shall be used for both 1-½-inch and 2-inch meter sets.

B. Joints for polyethylene or copper tubing shall be of the compression type utilizing a totally confined grip seal and coupling nut. Stainless steel tube stiffener insert shall also be used for tubing services. Other type joints may be considered for specific installations upon submission of specifications and approved by the ENGINEER.

2.05 CASING PIPE

A. Casing pipe for water services shall be galvanized steel and shall conform to ANSI/AWWA C800 Section A.6 and ASTM Specification A 120 or Sch 80 PVC or DIP PVC C900.

B. Casing ends shall be sanded smooth and sealed using a polyurethane expandable foam.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. Unloading Material: The CONTRACTOR shall exercise care in unloading and handling pipe, valves, fittings, and all other material. Dropping pipe from trucks and allowing pipe to roll against other pipe will not be permitted.

B. Excavation: Pipeline trenches shall be excavated to required depth as shown on the drawings or as directed by the ENGINEER. In general, water distribution lines shall have a minimum of 30" cover for DIP pipe and 36” for 55 pipe. If rock is encountered, excavation shall be carried a minimum of 6" below bottom of pipe, and trench backfilled with sand or earth and thoroughly tamped. Width of trench shall be sufficient to allow workmen to perform all operations incidental to constructing the pipeline. Hand dug bell holes shall be provided to permit proper joint making. No section of pipe shall bear on rock or on placed blocking. All excavations will be dewatered to permit dry joints.

C. Sheeting: Work shall be properly braced where necessary. Where wood sheeting or certain designs of steel sheeting are used, the sheeting shall be cut off at a level two feet above the top of the installed pipe and that portion below that level shall be left in place. If interlocking steel sheeting of a design approved by the ENGINEER is used, it may be removed providing removal can be accomplished without disturbing the bedding or alignment of the pipe. Any damage to the pipe bedding, pipe or alignment of the constructed main caused by removal of sheeting shall be cause for rejection of the affected portion of the work.

3.02 PIPE

A. Installation of Pipe: All installation shall conform to latest AWWA C-600. Pipe shall not be rolled or pushed into the trench from the bank. Before pipe is lowered into the trench, it shall be thoroughly inspected by the CONTRACTOR, as necessary, to insure sound conditions and eliminate the possibility of leakage or bursting under test pressure.

B. Separation: Water mains shall be laid at least 6 feet horizontally (10 feet preferred) from any existing or proposed sewer mains. A vertical distance of at least 18" should be maintained when a sewer pipe crosses under a water main. If this is not possible, then the sewer pipe must be of water main quality with 20-foot lengths of pipe centering on the point of crossing. If a crossing where the sewer is laid above a water line is unavoidable, then the above-mentioned precautions shall be observed regardless of the distance of vertical separation between water mains and sewer piping.

C. Defective Material: Pipes and valves, fittings, and all other materials showing defects shall not be used for construction. All such defective materials shall be removed from the construction site immediately. Before pipe is lowered into the trench, it shall be swabbed or brushed to insure that no dirt or foreign matter will be in the finished line.

D. Support: Pipe shall be laid on a flat bottom trench in sand, gravel, or crushed stone to depth of 1/8 pipe diameter, 4-in minimum, with backfill compacted to top of pipe. Pipe installation shall conform to Type 4 laying condition as per AWWA. A firm even bearing shall be provided throughout the length of each section of pipe. Pipe shall not bear on any unyielding structures, nor shall it support any other structures. All dead ends shall be plugged or capped, anchored and held in place with restrained joints as required. Except while work is in progress, all pipe openings shall be suitably plugged to prevent entrance of water or any foreign matter. Material deemed unstable for providing adequate support for pipe shall be removed and replaced by suitable material. Adequate backfill shall be deposited on the pipe to prevent floating. Any pipe, which has floated, shall be removed from the trench and reinstalled as directed by the ENGINEER.

E. Joints: All joints shall be suitable for the type of pipe being jointed and shall be made in accordance with manufacturer's recommendations.

1. Mechanical joints: Mechanical joints shall be of the stuffing box type. The gland, followed by the rubber gasket, shall be placed over the plain end of the pipe, which is inserted into the socket. The gasket is then pushed into position so that it is evenly seated in the socket. The gland shall be moved into position against the face of the socket, bolts inserted and made finger-tight. Bolts shall be tightened by a ratchet wrench suitable for the size of pipe being connected alternately, bottom, then top, etc., until the joint is completed.

2. Compression Pipe joints: Compression joints shall be a rubber seal joint, made pressure tight by a molded rubber gasket and lubricated to facilitate assembly. The joint shall be made tight by inserting the plan end into the bell after lubrication. Joints shall be made up as recommended by the manufacturer.

3. Flanged joints: Flanged joints shall be made with rubber gaskets. Bolts shall have rough square hands and hexagonal nuts and made to American Standard rough dimensions and shall be recommended size trimmed. Bolts shall be recommended size for the diameter of the pipe being jointed and shall be tightened as to distribute evenly the stress in the bolts and bring the pipe into alignment.

4. Threads shall be neatly cut with sharp tools and the jointing procedure shall conform with the best practices. Before jointing, all scale shall be reamed. All pipe shall be screwed with an application of graphite and engine oil or other approved pipe compound applied to the threads. This application shall be thoroughly wiped off the inside of every joint.

3.03 INSTALLATION OF FITTINGS

A. Applicable portions of these specifications shall apply to installation of fittings. Reaction of restrained joints shall be applied at bends and tees and where changes in pipe diameter occur at reducers or in fittings.

B. Care shall be taken in the handling, storage, and installation of pipe and fittings to prevent injury to the pipe or coatings. All pipe and fittings shall be examined before installing, and no pipe shall be installed which is found to be defective. Pipe or fittings shall not be dropped. All damage to the pipe coatings shall be repaired according to the manufacturer's recommendations. All pipe and fittings shall be kept clean and shall be thoroughly cleaned before installation.

C. When installation is not in progress, including lunchtime, or the potential exists for dirt of debris to enter the pipe, the open ends of the pipe shall be closed with watertight plugs or other approved means.

3.04 INSTALLATION OF FIRE HYDRANTS

A. All hydrants shall stand plumb and burial line shall be set at finished grade. The pumper nozzle shall be set at 18" above finished grade.

3.05 INSTALLATION OF VALVES

A. All valves shall stand plumb unless otherwise shown on the plans or directed by the OWNER's Representative. The operation of installing tapping sleeves and valves shall be done by an experienced organization that has been engaged in this type of work not less than one (1) year with a representative list of successful installations. All valves shall be tagged per details.

3.06 PRESSURE TESTS

A. After pipe has been adequately backfilled all laid pipes shall be subjected to hydrostatic pressure of 150 PSI. The duration of the pressure test shall not be less than two (2) hours. Test sections shall be limited to a maximum length of 2,000 feet. Care shall be taken to ensure that all air has been removed from the pipe previous to pressure tests. The CONTRACTOR

shall provide such means of venting the pipe as are required. The CONTRACTOR shall replace any material or installation proving defective.

B. Payment for pressure and leakage testing shall be considered included in the price paid per linear foot of main installed.

C. Test records of pressure testing must include:

1. Date and time of testing.
2. Weather conditions and ambient temperature at the site during the test.
3. Identification of parties present during testing.
4. Testing liquid.
5. Backflow prevention devices, if used.
6. Testing pressure.
7. Type of test gages in the test section.
8. The placement of test gages in the test section, such as test gage location distances and elevations from the beginning of the section.
9. Test pressures recorded during test.
10. Any adjustments made to test pressure for elevated temperature.
11. Test duration.
12. Description of test section length, elevations, site location, components, and material.
13. Description of any leaks or failures and corrective measures taken.

3.06 LEAKAGE TEST

A. After the main has been brought up to test pressure, it shall be held at this pressure and make up water shall be carefully measured by use of displacement meter or by pumping water from a vessel of known volume. The pipeline shall be walked and all visible joints inspected for leakage and movement of pipe. All visible leaks shall be repaired. Should any section of pipeline disclose joint leakage greater than that permitted, the CONTRACTOR shall at CONTRACTOR'S own expense, locate and repair the defective joints until leakage is within the permitted allowance.

B. The leakage test shall be conducted in accordance with AWWA Specification C-600, latest revision. Leakage shall be less than the number of gallons per hour as determined by the formula:

$$L = \frac{SD\,P^{1/2}}{148{,}000}$$

in which L equals the allowable leakage in gallons per hour, S is the pipe length in the main tested in feet, D is the nominal diameter of the pipe in inches, and P is the average test pressure during the leakage test, in pounds per square inch, gauge. Pressure lost during test shall not exceed 5 psi. Length of test shall not be less than two (2) hours. Average test pressure shall not be less than 150 PSI. The test shall be conducted as directed by the ENGINEER.

C. The testing procedure shall include the continued application of the specified pressure to the test system, for the 2-hour period, by way of a pump taking supply from a container suitable for measuring water loss. The amount of loss shall be determined by measuring the volume displaced from said container. Should the test fail, necessary repairs shall be accomplished by the Contractor and the test repeated until it is within the established limits. The Contractor shall furnish the necessary labor, water, pumps, gauges, and all other items required to conduct the required water distribution system testing and perform necessary repairs. The Contractor shall provide, to the satisfaction of NMB Water, proof of calibration of all test equipment.

3.08 BACKFILL

A. No trenches or excavations shall be backfilled until the trench and installation has been inspected and written approval given by the ENGINEER. All backfill shall be carefully placed to avoid movement of the pipeline. Backfill shall be free from rock, large stones, boulders, brush, or other unsuitable material. It shall be placed in the trench uniformly on both sides of the pipe for full width of the trench and to the horizontal diameter of the full length of the pipe. This backfill shall be thoroughly tamped to provide support free from voids.

B. Additional backfill shall then be placed between joints to an average depth of 12" over the top of the pipe where pipe is of 8" and smaller diameter, and 24" over larger pipe. Pipe joints shall remain exposed until completion of the pressure and leakage tests unless otherwise directed by the ENGINEER.

C. On completion of pressure and leakage tests, the exposed joints shall be backfilled to a depth of 12" above the top of the pipe. Backfill shall be carefully compacted until 12" of cover exists over the pipe. The remainder of the backfill shall then be placed and compacted thoroughly by puddling and tamping as required. Where directed, puddling and tamping may be omitted, and backfill shall be neatly rounded over the trench to a sufficient height to allow for settlement to grade after consolidation.

3.09 DISINFECTION

A. Following pressure testing, the Contractor shall disinfect all sections of the water distribution system, and receive approval thereof from the appropriate agencies, prior to placing in service. In addition, any part of NMB Water's water system which has been out of service for repair, alteration, or replacement shall be disinfected. Two (2) days advance notice shall be provided to NMB Water before disinfecting procedures start. The disinfection shall be accomplished in accordance with the applicable provisions of AWWA Standard C-651, "Disinfecting Water Mains", and all appropriate approval agencies.

B. A suitable chlorinator shall be used to inject chlorine into the lines. All connections required for the introduction of chlorine into the water lines shall be made by the Contractor. Chlorine

and water shall be introduced at one end and shall be allowed to flow slowly through the lines to the other end where it shall be removed and disposed of at the Contractor's expense.

C. The concentration of chlorine introduced shall be at least 50 mg/l in the water flowing from the line, and a chlorine residual of not less than 25 mg/l remains in the water in the pipe after 24 hours. Chlorine may be applied as a liquid chlorine (gas-water mixture), or a mixture of water and calcium hypochlorite. The Contractor shall assume the responsibility for safe handling of chlorine, and shall meet the requirements of OSHA and other regulatory agencies for the safe handling of chlorine. Maximum distance between sampling points shall be determined by Miami Dade Department of Health (MD DOH).

D. Following chlorination, all treated water shall be thoroughly flushed from the newly laid pipe at its extremity until the replacement water throughout its lengths shows, upon test, the chlorine measurement not in excess of that normally carried in the system. After flushing, water samples shall be collected on two (2) successive days from the treated piping systems, as directed by NMB Water, and shall show acceptable bacteriological results. The Contractor is responsible for collecting and testing samples from the water main. Samples shall be taken from each main or section of main to be placed into service where designated by MD DOH before being placed into service. Test results shall be provided to MD DOH to obtain appropriate clearances for operation water mains.

E. Should the initial treatment result in an unsatisfactory bacterial test, the original chlorination procedure shall be repeated by the Contractor until satisfactory results are obtained.

3.10 POTABLE WATER SAMPLING STATIONS

A. All sampling stations shall be installed as shown on plans and shall be model 301-W SS as manufactured by Water Plus Corporation. The sampling station must be above ground with easy access but with tamper proof locking device, Pin Allen locking, built into the station. The sampling station shall come equipped with a stainless steel spigot and waterway. The main throttling valve, with stainless steel handles, shall be located with easy access after removal of top cover. The sample station shall have 3/4-in. female iron pipe inlet connection. The sampling tube and spigot must be equipped with a throttling valve to control the flow of water for sampling. The entire station must be covered with a blue polyethylene housing with a removable top section for easy access. The housing must have ultraviolet inhibitors to maximize protection and shall come equipped with locking device. Acceptable units shall be the Water Plus model 301-W SS or approved equal.

3.11 RESTORATION OF SURFACE AND/OR STRUCTURES

A. The CONTRACTOR shall restore and/or replace paving, curbing, sidewalks, fences, sod, survey points and other disturbed surfaces to a condition equal to that before the work was begun and to satisfaction of the ENGINEER, and shall furnish all labor and materials incidental thereto. Relative restoration of surfaces and/or structures, the CONTRACTOR shall comply with all governing agencies requirements including city, town, county and state.

3.12 CONNECTION TO EXISTING SYSTEM

A. The CONTRACTOR shall make proper arrangements for compliance with the regulations for connection to any existing distribution system with the OWNER of that system. Taps-in and

connection will be made in strict accordance with the ENGINEER. The CONTRACTOR shall perform all work necessary to locate, excavate and prepare for connection to the existing mains as shown on the Drawings and follow local, state, and federal regulations including regulations for pipe removal

3.13 ABANDONMENT OF EXISTING PIPELINE

A. All water mains to be abandoned in place as shown on the drawings shall be cut and plugged after new mains and services are installed and service is properly restored to the homeowner. The pipeline shall be filled with concrete 12 inches from the end of the pipe as specified in Division 3 - Concrete, section 03010 or as specified in the project drawings. Excavation, backfill and restoration shall be executed in accordance with the requirements of removing existing and installing new pipelines.

3.14 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on the actual quantities installed as more specifically discussed and described in SECTION 01025 for MEASUREMENT AND PAYMENT.

END OF SECTION 02609

SECTION 02610
PIPING, GENERAL

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this Section.

1.02 WORK INCLUDED

A. The CONTRACTOR shall furnish and install all piping systems shown and specified, in accordance with the requirements of the Contract Documents. Each system shall be complete with all necessary fittings, hangers, supports, anchors, expansion joints, flexible connectors, valves, accessories, heat tracing, insulation, lining and coating, testing, disinfection, excavation, backfill and encasement, to provide a functional installation.

B. The piping shown is intended to define the general layout, configuration, routing, method of support, pipe size, and pipe type. The mechanical drawings are not pipe construction or fabrication drawings. It is the CONTRACTOR's responsibility to develop the details necessary to construct all mechanical piping systems, to accommodate the specific equipment provided, and to provide and install all spools, spacers, adapters, connectors, etc., for a complete and functional system.

1.03 RELATED WORK

A. Division 2 as applicable.

B. Section 02200 - Earthwork.

C. Section 02221 - Excavation and Backfilling Utilities

D. Section 02609 – Water Distribution System

E. Section 02641 – Valves, General

F. Section 02650 – Horizontal Directional Drilling

1.04 REFERENCE STANDARDS

A. Codes: All codes, as referenced herein are specified in Section 01090, "Reference Standards".

B. Commercial Standards:

ANSI/ASME B1.20.1	Pipe Threads, General Purpose (inch).
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and other Special Alloys.
ANSI/AWWA C207	Steel Pipe Flanges for Water Works Service, Sizes 4 in through 144 in.
ANSI/AWWA C606	Grooved and Shouldered Joints.
ANSI/AWS D1.1	Structural Welding Code.

ASTM A 307	Specification for Carbon Steel Bolts and Studs, 6,000 psi Tensile.
ASTM A 325	Specification for High-Strength Bolts for Structural Steel Joints.
ASTM D 792	Test Methods for Specific Gravity and Density of Plastics by Displacement.
ASTM D 2000	Classification System for Rubber Products in Automotive Applications.

1.05 SUBMITTALS

A. The CONTRACTOR shall submit complete shop drawings and certificates, test reports, affidavits of compliance, of all piping systems, in accordance with the requirements in Section 01340, "Shop Drawings, Product Data and Samples", and as specified in the individual sections. The shop drawings shall include all necessary dimensions and details on pipe joints, fittings, fitting specials, valves, appurtenances, design calculations, and material lists. The submittals shall include detailed layout, spool, or fabrication drawings which show all pipe spools, spacers, adapters, connectors, fittings, and pipe supports necessary to accommodate the equipment and valves provided in a complete and functional system.

B. All expenses incurred in making samples for certification of tests shall be borne by the CONTRACTOR.

C. The CONTRACTOR shall submit as part of the shop drawings a certification from the pipe fabricator stating that all pipes will be fabricated subject to a recognized Quality Control Program. An outline of the program shall be submitted to the ENGINEER for review prior to the fabrication of any pipe

1.06 QUALITY ASSURANCE

A. Inspection: All pipes shall be subject to inspection at the place of manufacture. During the manufacture of the pipe, the ENGINEER shall be given access to all areas where manufacturing is in progress and shall be permitted to make all inspections necessary to confirm compliance with the Specifications.

B. Tests: Except where otherwise specified, all materials used in the manufacture of the pipe shall be tested in accordance with the applicable Specifications and Standards. Welds shall be tested as specified. The CONTRACTOR shall perform all tests at no additional cost to the OWNER.

C. Welding Requirements: All welding procedures used to fabricate pipe shall be pre-qualified under the provisions of ANSI/AWS D1.1. Welding procedures shall be required for, but not necessarily limited to, longitudinal and girth or spiral welds for pipe cylinders, spigot and bell ring attachments, reinforcing plates and ring flange welds, and plates for lug connections.

D. Welder Qualifications: Skilled welders, welding operators, and tackers who have had adequate experience in the methods and materials to be used shall do all welding. Welders shall be qualified under the provisions of ANSI/AWS D1.1 by an independent local, approved testing agency not more than 6 months prior to commencing work on the pipeline. Machines and electrodes similar to those used in the WORK shall be used in qualification tests. The CONTRACTOR shall furnish all material and bear the expense of qualifying welders.

SECTION 02610
PIPING, GENERAL

1.07 MANUFACTURER'S SERVICE REPRESENTATIVE

A. Where the assistance of a manufacturer's service representative is advisable, in order to obtain perfect pipe joints, supports, or special connections, the CONTRACTOR shall furnish such assistance at no additional cost to the OWNER

1.08 MATERIAL DELIVERY, STORAGE, AND HANDLING

A. All piping materials, fittings, valves, and accessories shall be delivered in a clean and undamaged condition and stored off the ground, to provide protection against oxidation caused by ground contact. All defective or damaged materials shall be replaced with new materials.

B. Follow manufacturer's recommendations for delivery, storage, and handling.

C. No staking of pipe is allowed, unless within a fenced contained workspace. Pipe stacking is to be in compliance with AWWA M55.

1.09 CLEANUP

A. After completion of the work, all remaining pipe cuttings, joining and wrapping materials, and other scattered debris, shall be removed from the site. The entire piping system shall be handed over in a clean and functional condition.

PART 2 - PRODUCTS

2.01 GENERAL

A. All water main pipe, including fittings, installed on or after August 28, 2003, except pipe installed under a construction permit for which the Health Department received a complete application before August 28, 2003, shall be color coded or marked using blue as a predominant color to differentiate drinking water from reclaimed or other water. Underground plastic pipe shall be solid wall blue pipe, shall have a co-extruded blue external skin, or shall be white or black pipe with blue stripes incorporated into, or applied to, the pipe wall; and underground metal or concrete pipe shall have blue stripes applied to the pipe wall. Pipe striped during manufacturing of the pipe shall have continuous stripes that run parallel to the axis of the pipe, that are located at no greater than 90-degree intervals around the pipe, and that will remain intact during and after the installation of the pipe. If tape or paint is used to stripe pipe during the installation of the pipe, the tape or paint shall be applied in a continuous line that runs parallel to the axis of the pipe and that is located along the top of the pipe; for pipes with an internal diameter of 24 inches or greater, tape or paint shall be applied in continuous lines along each side of the pipe as well as along the top of the pipe. Aboveground pipe at drinking water treatment plants shall be color coded and labeled in accordance with subsection 62-555.320(10), F.A.C., and all other aboveground pipe shall be painted blue or shall be color coded or marked like underground pipe.

B. All pipes, fittings, and appurtenances shall be furnished in accordance with the requirements of the applicable Sections of Division 2 and as specified herein.

C. Coating: All requirements pertaining to thickness, application, and curing of pipe coating, are in accordance with the requirements of the applicable Sections of Division 2, unless otherwise specified. Pipes above ground or in structures shall be field-painted as directed by the ENGINEER.

D. Grooved Piping Systems: Piping systems with grooved joints and fittings may be provided in lieu of screwed, flanged, welded, or mechanical joint systems for ductile iron yard piping. (All piping above and below ground within the property limits of treatment plants, pump stations, and similar installations). All grooved couplings on buried piping must be bonded. To assure uniform and compatible piping components, all grooved fittings, couplings, and valves shall be from the same manufacturer. The CONTRACTOR shall make the coupling manufacturer responsible for the selection of the correct style of coupling and gasket for each individual location.

2.02 PIPE FLANGES

A. Flanges: Where the design pressure is 150 psi or less, flanges shall conform to either ANSI/AWWA C207 Class D or ANSI B16.5 150-lb class. Where the design pressure is greater than 150 psi, up to a maximum of 275 psi, flanges shall conform to ANSI/AWWA C207 Class E, Class F, or ANSI B16.5 150-lb class. However, AWWA flanges shall not be exposed to test pressure greater than 125 percent of rated capacity. For higher test pressures, the next higher rated AWWA flange or an ANSI-rated flange shall be selected. Where the design pressure is greater than 275 psi up to a maximum of 700 psi, flanges shall conform to ANSI B16.5 300-lb class. Flanges shall have flat faces and shall be attached with boltholes straddling the vertical axis of the pipe unless otherwise shown. Attachment of the flanges to the pipe shall conform to the applicable requirements of ANSI/AWWA C207. Flanges for miscellaneous small pipes shall be in accordance with the standards specified for these pipes.

B. Blind Flanges: Blind flanges shall be in accordance with ANSI/AWWA C207, or with the standards for miscellaneous small pipes. All blind flanges for pipe sizes 12 inches and over shall be provided with lifting eyes in form of welded or screwed eyebolts.

C. Flange Coating: All machined faces of metal blind flanges and pipe flanges shall be coated with a temporary rust-inhibitive coating to protect the metal until the installation is completed.

D. Flange Bolts: All bolts and nuts shall conform to pipe manufacturers recommendations. Studs and bolts shall extend through the nuts a minimum of 1/4-inch. All-thread studs shall be used on all valve flange connections, where space restrictions preclude the use of regular bolts.

E. Insulating Flanges: Insulated flanges shall have boltholes 1/4-inch diameter greater than the bolt diameter.

F. Insulating Flange Sets: Insulating flange sets shall be provided where shown. Each insulating flange set shall consist of an insulating gasket, insulating sleeves and washers and a steel washer. Insulating sleeves and washers shall be one piece when flange bolt diameter is 1-1/2-inch or smaller and shall be made of acetal resin. For bolt diameters larger than 1-1/2-inch, insulating sleeves and washers shall be 2-piece and shall be made of polyethylene or phenolic. Steel washers shall be in accordance with ASTM A 325. Insulating gaskets shall be full-face.

G. Insulating Flange Manufacturers,shall be per NMB Water Approved Materials List or approved equal.

H. Flange Gaskets: Gaskets for flanged joints shall be full-faced, 1/16-inch thick compressed sheets of aramid fiber base, with nitrile binder and non-stick coating, suitable for temperatures to 700 degrees F, a pH of one to eleven, and pressures to 1000 psig. Blind flanges shall have gaskets covering the entire inside face of the blind flange and shall be cemented to the blind flange. Ring gaskets shall not be permitted.

I. Flange Gasket Manufacturers, shall be per NMB Water Approved Materials List or approved equal.

2.03 THREADED INSULATING CONNECTIONS

A. General: Threaded insulating bushings, unions, or couplings, as appropriate, shall be used for joining threaded pipes of dissimilar metals and for piping systems where corrosion control and cathodic protection are involved.

B. Materials: Threaded insulating connections shall be of nylon, Teflon, polycarbonate, polyethylene, or other non-conductive materials, and shall have ratings and properties to suit the service and loading conditions.

2.04 MECHANICAL-TYPE COUPLINGS (GROOVED OR BANDED PIPE)

A. General: Cast mechanical-type couplings shall be provided where shown. The couplings shall conform to the requirements of ANSI/AWWA C606. All gaskets for mechanical-type couplings shall be compatible with the piping service and fluid utilized, in accordance with the coupling manufacturer's recommendations. The wall thickness of all grooved piping shall conform with the coupling manufacturer's recommendations to suit the highest expected pressure. To avoid stress on equipment, all equipment connections shall have rigid-grooved couplings, or harness sets in sizes where rigid couplings are not available, unless thrust restraint is provided by other means. The CONTRACTOR shall have the coupling Manufacturer's service representative verify the correct choice and application of all couplings and gaskets, and the workmanship, to assure a correct installation.

B. Couplings for Steel Pipe, Manufacturers, shall be per NMB Water Approved Materials List or approved equal

C. Ductile Iron Pipe Couplings, Manufacturers, shall be per NMB Water Approved Materials List or approved equal:

Note: Ductile iron pipe couplings shall be furnished with flush seal gaskets.

2.05 SLEEVE-TYPE COUPLINGS

A. Construction: Sleeve-type couplings shall be provided where shown, in accordance with ANSI/AWWA C219 unless otherwise specified, and shall be of steel with steel bolts, without pipe stop, and shall be of sizes to fit the pipe and fittings shown. The middle ring shall be not less than 1/4-inch in thickness and shall be either 5 or 7 inches long for sizes up to and including 30 inches and 10 inches long for sizes greater than 30 inches, for standard steel couplings, and 16 inches long for long-sleeve couplings. The followers shall be single-piece contoured mill section welded and cold expanded as required for the middle rings. They shall be of sufficient strength to accommodate the number of bolts necessary to obtain adequate gasket pressures without excessive rolling. The shape of the follower shall be of such design as to provide positive confinement of the gasket. Buried sleeve-type couplings shall be epoxy-coated at the factory as specified.

B. Pipe Preparation: The ends of the pipe, where specified, shall be prepared for flexible steel couplings. Plain ends for use with couplings shall be smooth and round for a distance of 12 inches from the ends of the pipe, with outside diameter not more than 1/64-inch smaller than

the nominal outside diameter of the pipe. The middle ring shall be tested by cold-expanding a minimum of one percent beyond the yield point, to proof-test the weld to the strength of the parent metal. The weld of the middle ring shall be subjected to air test for porosity.

C. Gaskets: Gaskets for sleeve-type couplings shall be rubber-compound material that will not deteriorate from age or exposure to air under normal storage or use conditions. Gaskets for wastewater and sewerage applications shall be Buna "N," grade 60, or equivalent suitable elastomer. The rubber in the gasket shall meet the following specifications:

1. Color - Jet Black

2. Surface - Non-blooming

3. Durometer Hardness - 74 ± 5

4. Tensile Strength - 1000 psi Minimum

5. Elongation - 175 percent Minimum

The gaskets shall be immune to attack by impurities normally found in water or wastewater. All gaskets shall meet the requirements of ASTM D 2000, AA709Z, meeting Suffix B13 Grade 3, except as noted above. All gaskets shall be compatible with the piping service and fluid utilized.

D. Insulating Couplings: Where insulating couplings are required, both ends of the coupling shall have a wedge-shaped gasket which assembles over a rubber sleeve of an insulating compound in order to obtain insulation of all coupling metal parts from the pipe.

E. Restrained Joints: All sleeve-type couplings on pressure lines shall be harnessed unless thrust restraint is provided by other means. Harnesses shall be in accordance with the requirements of the appropriate reference standard.

F. Manufacturers shall be per NMB Water Approved Materials List or approved equal.

2.06 FLEXIBLE CONNECTORS

A. Flexible connectors shall be installed in all piping connections to engines, blowers, compressors, and other vibrating equipment, and where shown. Flexible connectors for service temperatures up to 180 degrees F shall be flanged, reinforced Neoprene or Butyl spools, rated for a working pressure of 40 to 150 psi, or reinforced, flanged duck and rubber, as best suited for the application. Flexible connectors for service temperatures above 180 degrees F shall be flanged braided stainless steel spools with inner, annular, corrugated stainless steel hose, rated for minimum 150 psi working pressure, unless otherwise shown. The connectors shall be 9 inches long, face-to-face flanges, unless otherwise shown. The manufacturer shall approve the final material selection. The CONTRACTOR shall submit manufacturer's shop drawings and calculations.

2.07 EXPANSION JOINTS

A. All piping subject to expansion and contraction shall be provided with sufficient means to compensate for such movement, without exertion of undue forces to equipment or structures. This may be accomplished with expansion loops, bellow-type expansion joints, or sliding-type expansion joints. Expansion joints shall be of stainless steel, monel, rubber, or other materials,

best suited for each individual service. The CONTRACTOR shall submit detailed calculations and manufacturer's shop drawings, guaranteeing satisfactory performance of all proposed expansion joints, piping layouts showing all anchors and guides, and information on materials, temperature and pressure ratings.

2.08 PIPE THREADS

A. All pipe threads shall be in accordance with ANSI/ASME B1.20.

PART 3 - EXECUTION

3.01 GENERAL

A. All pipes, fittings, and appurtenances shall be installed in accordance with the requirements of the applicable Section of Divisions 2. The lining manufacturer shall take full responsibility for the complete, final product and its application. All pipe ends and joints at screwed flanges shall be epoxy-coated, to assure continuous protection.

B. Where core drilling is required for pipes passing through existing concrete, core drilling locations shall be determined by radiograph of concrete construction to avoid damage to embedded raceways and rebars.

C. All exposed piping shall be painted. All piping to be painted shall be color coded in accordance with OWNER's standard color code. Color samples shall be submitted to ENGINEER for final color selection.

3.02 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on the actual quantities installed as more specifically discussed and described in SECTION 01025 for measurement and payment.

END OF SECTION 02610

SECTION 02641
VALVES, GENERAL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDED

A. The CONTRACTOR shall provide all tools, supplies, materials, equipment, and labor necessary for furnishing, epoxy coating, installing, adjusting, and testing of all valves and appurtenant work, complete and operable, in accordance with the requirements of the Contract Documents. Where buried valves are shown, the CONTRACTOR shall furnish and install valve boxes to grade, with covers, extensions, and position indicators.

B. The provisions of this Section shall apply to all valves and valve operators specified in the various Sections and Division 2 of these Specifications except where otherwise specified in the Contract Documents. Valves and operators in particular locations may require a combination of units, sensors, limit switches, and controls specified in other Sections of these Specifications.

C. Manufacturers shall be per NMB Water Approved Materials List or approved equal.

1.03 RELATED WORK

A. Section 02221 - Excavation and Backfilling for Utilities

B. Section 02610 - Piping, General

1.04 REFERENCE STANDARDS

A. Codes: All codes, as referenced herein, are specified in Section 01090, "Reference Standards".

B. Commercial Standards:

ANSI B16.1	Cast Iron Pipe Flanges and Flanged Fittings, Class 25, 125, 250, and 800.
ANSI B16.5	Pipe Flanges and Flanged Fittings, Steel Nickel Alloy and Other Special Alloys.
ANSI/ASME B31.1	Power Piping.
ASTM A 36	Specification for Structural Steel.
ASTM A 48	Specification for Gray Iron Castings.
ASTM A 126	Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings.

ASTM A 536	Specification for Ductile Iron Castings.
ASTM B 61	Specification for Steam or Valve Bronze Castings.
ASTM B 62	Specification for Composition Bronze or Ounce Metal Castings.
ASTM B 148	Specification for Aluminum-Bronze Castings.
ASTM B 584	Specification for Copper Alloy Sand Castings for General Applications.
ANSI/AWWA C500	Gate Valves for Water and Sewerage Systems.
ANSI/AWWA C502	Dry-Barrel Fire Hydrants.
ANSI/AWWA C503	Wet-Barrel Fire Hydrants.
ANSI/AWWA C504	Rubber-Seated Butterfly Valves.
ANSI/AWWA C507	Ball Valves 6 Inches Through 48 Inches.
AWWA C508	Swing-Check Valves for Waterwork Service, 2 Inches Through 24 Inches NPS.
ANSI/AWWA C509	Resilient-Seated Gate Valves for Water and Sewage Systems.
ANSI/AWWA C511	Reduced-Pressure Principle Backflow-Prevention Assembly.
AWWA C550	Protective Interior Coatings for Valves and Hydrants.
SSPC-SP-2	Hand Tool Cleaning.
SSPC-SP-5	White Metal Blast Cleaning.

1.04 SUBMITTALS

A. Shop Drawings: Shop drawings of all valves and operators including associated wiring diagrams and electrical data, shall be furnished as specified in Section 01340, "Shop Drawings, Product Data and Samples".

B. Valve Labeling: The CONTRACTOR shall submit a schedule of valves to be labeled indicating in each case the valve location and the proposed wording for the label.

C. Operation and Maintenance Manuals shall be submitted to ENGINEER and OWNER by CONTRACTOR for installed valves prior to construction closeout.

1.05 QUALITY ASSURANCE

A. Valve Testing: Unless otherwise specified, each valve body shall be tested under a test pressure equal to twice its design water-working pressure.

B. Bronze Parts: Unless otherwise specified, all interior bronze parts of valves shall conform to the requirements of ASTM B 62, or where not subject to dezincification, to ASTM B 584.

C. Certification: Prior to shipment, the CONTRACTOR shall submit for all valves over 12 inches in size, certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc.

PART 2 – PRODUCTS

2.01 VALVES, GENERAL

A. General: The CONTRACTOR shall furnish all valves, gates, valve-operating units, stem extensions, and other accessories as shown or specified. All valves and gates shall be new and of current manufacture with counter-clockwise opening functions unless otherwise approved by ENGINEER. All shut-off valves, 6-inch and larger, shall have operators with position indicators. Where buried, these valves shall be provided with valve boxes and covers containing position indicators, and valve extensions. Shut-off valves mounted higher than 5 feet-6 inches above working level shall be provided with chain operators.

B. Valve Flanges: The flanges of valves shall be in accordance with Section 02610, "Piping, General".

C. Gate Valve Stems: Where subject to dezincification, gate valve stems shall be of bronze conforming to ASTM B 62, containing not more than 5 percent of zinc nor more than 2 percent aluminum. Gate valve stems shall have a minimum tensile strength of 60,000 psi, a minimum yield strength of 40,000 psi, and an elongation of at least 10 percent in 2 inches, as determined by a test coupon poured from the same ladle from which the valve stems to be furnished are poured. Where dezincification is not a problem, bronze conforming to ASTM B 584 may be used.

D. Protective Coating: Except where otherwise specified, ferrous surfaces, exclusive of stainless steel surfaces, in the water passages of all valves 4-inch and larger, as well as the exterior surfaces of all submerged valves, shall be coated with 2 part thermal setting epoxy coatings. Flange faces of valves shall not be epoxy coated. The valve manufacturer shall certify in writing that such coating has been applied and tested in the manufacturing plant prior to shipment, in accordance with these Specifications.

E. Valve Operators: Where shown, certain valves and gates shall be furnished with electric operators, provided by the valve or gate manufacturer. The same manufacturer shall furnish all operators of a given type. Where different manufacturers supply these operators, the CONTRACTOR shall coordinate their selection to provide uniformity of each type of electric operator. All valve operators, regardless of type, shall be installed, adjusted, and tested by the valve manufacturer at the manufacturing plant.

F. Valve Labeling: Except when such requirement is waived by the ENGINEER in writing, a label shall be provided on all shut-off valves. The label shall be a 3-inch diameter bronze disk anchored to concrete collar or asphalt, as shown on the drawings. Valve labels shall be photographed and marked on the As-Built Drawings. In addition, reflective pavement marker shall be installed in the drive lane(s) adjacent to the valve as specified by the OWNER.

G. Nuts and Bolts: All nuts and bolts on valve flanges and supports shall be in accordance with manufacturers recommendations. Where submerged or buried, all nuts and bolts on valve flanges and valve bodies shall be stainless steel.

2.02 GATE VALVES

A. Gate valves 2-inches and larger shall be resilient seat gate valves manufactured to meet or exceed the requirements of AWWA C-509. The valve body, bonnet, and bonnet cover shall be cast iron and comply with ASTM A126, Class B. The valves shall be non-rising stem with the stem made of cast, forged, or rolled bronze as specified in AWWA C-509. Two stem seals shall be provided and shall be "O-Ring" type. The stem must be independent of the gate. Resilient seat of valve shall be formed by a special corrosion and chloramine resistant, synthetic elastomer (EPDM or equal) which is permanently bonded to and completely encapsulates a cast iron valve disk. The resilient sealing mechanism shall provide zero leakage at the system working pressure when installed with the line flow in either direction. All ferrous surfaces inside and outside shall have a fusion-bonded epoxy coating. All nuts, bolts, washers and springs shall be 316 stainless steel. If coatings are desired for these appurtenances, they shall be coated in kind with the valves. The valves shall have an unobstructed waterway equal to or greater than the full nominal diameter of the valve.

1. Valves for underground service shall be mechanical joint and shall be equipped with 2-inch square cast iron wrench nuts. 2-inch valves shall be threaded.

2. Valves for above ground service shall be flanged and shall be outside screw and yoke (OS&Y), rising stem type. Valves shall have cast iron handwheels or chain operators with galvanized steel chains, as required.

3. Valves 16-inches and larger shall be equipped with approved gearing actuators with sealed enclosures for buried or submerged service, installed horizontally and shall be furnished by the valve manufacturer. Position indicators shall be furnished as required. Valves shall be additionally equipped as specified under the applicable section of AWWA C-500.

4. Valves 2-inches and smaller shall be bronze, wedge disc, 150 psi minimum working pressure equipped with wrought steel or cast-iron operating handwheels.

2.03 BUTTERFLY VALVES

A. Butterfly Valves shall be cast or ductile iron body that conforms to ASTMA126, Class B. All retaining segments and adjusting devices shall be of corrosion resistant material. The valves shall have bonded or mechanically restrained seats as outlined in AWWA C-504. Valve seats shall be a natural rubber or synthetic rubber compound. The valve shaft shall be turned, ground and polished, constructed 18-8 stainless steel, and designed for both torsional and shearing stresses when the valve is operated under its greatest dynamic or seating torque. The shaft shall be a one-piece unit extending full size through the valve disc. The valves shall be long body type, with the valve class, shaft size and other special requirements selected in accordance with the specific design and shall comply with the provisions of AWWA C-504, "Rubber Seated Butterfly Valves". Valve operation shall be approved gear actuators, with sealed enclosures for buried or submerged service. Position indicators shall be furnished, as required. Units shall be equipped with actuating nuts, cast iron handwheels or chain operators, with galvanized steel chains, as appropriate for the installation. All exposed nuts, bolts, springs and washers shall be 316 stainless steel. Appurtenances shall be furnished by the valve manufacturer.

B. The use of any butterfly valves are not typical if larger than 12-inches and shall only be used with prior specific written approval by NMB Water.

2.04 AIR/VACUUM RELEASE VALVES

A. All potable water lines shall have combination air/vacuum release valve installed as they are indicated on the plans. The body/base of these valves shall be made from high strength lightweight non-corroding fiberglass reinforced nylon 6, with total weight of no more than 10 pounds, and all operating parts are to be made of engineered corrosion resistant plastic materials. The rolling resilient seal shall provide smooth positive opening, closing, and leak free sealing over the fluctuation of pressure differentials. The valve shall be designed to allow larger than normal automatic orifice providing efficient air release and minimize potential debris build up and clogging. The working pressure shall be 200 psi and shall have a ¾-in., 1-in., 2-in. threaded connection, or 3-in. and 4-in. flange connection. All air and vacuum release valves shall be model ARI D-040P or approved equal. The connection to the system shall be a direct threaded connection, or flange, on the top of the pipe with a saddle, with an isolation valve. The height of valve shall not be more than12-inches. If room does not allow for a direct connection, the use of a 90-deg. bend can be used to offset the connection to the side. This connection must have a grade that increases as it leaves the connection at the pipe a minimum of 5-percent. All ARV valves must be ISO-9000 and NSF 61 certified and must have FDEP approval for application on potable water system.

B. All potable water lines that require automatic air release only, shall have as shown on the plans a ½-in., ¾-in., or 1-inch threaded air release valve. This valve shall be made from lightweight non-corroding fiberglass reinforced nylon plastic, with a total weight of no more than 3 pound, with all non-metallic operating parts. The rolling resilient seal shall provide smooth positive opening, closing, and leak free sealing over the fluctuation of pressure differentials. The valve shall be designed to allow larger than normal automatic orifice providing efficient air release and minimize potential debris build up and clogging. The working pressure shall be 200 psi and tested to 350 psi. All air release valves shall be model ARI 5D25 or approved equal. The connection to the system shall be a direct connection to the pipeline with the use of a saddle and an isolation valve. All ARV valves must be ISO-9000 certified, and those valves for potable water applications must have NSF 61 certification.

C. All potable water valves shall be installed above grade and enclosed with a color-coded cover. The ARV must be at least 12-inches above grade to disallow for cross-connection contamination with ground water. All installations shall be equipped with and Air Gap Fitting as supplied by RUTT Inc. This fitting shall be 316 SS with a below connection the size of the outlet of the ARV. The top outlet for the Air Gap fitting shall be at least twice the diameter of the bottom connection. The outlet extension of the ARV shall be installed 1 to 1 ½ -inches inside the top outlet of the Air Gap fitting to allow for full vacuum protection. Below grade installations will not be allowed unless under special conditions which will only be approved by Direct of Utility and design engineer. The enclosure shall be color coded blue for potable water with venting to match the ARV.

D. All air release valves shall be enclosed above ground in Water Plus Model ARV-H-30 or larger unit; blue for water and green for wastewater. For ARV's that are of a size larger than can be

installed in the standard enclosure referenced above, other Water Plus enclosure shall be used.

E. All enclosures shall be constructed of quality, UV resistant poly-plastic with a galvanized stable bar in back - for aerial crossings, the stabilizing bar may removed. All enclosures shall have the same shade and type of color as stated above. All enclosures shall be equipped with a locking device as approved by owner. The Standard enclosures (H-30) shall be equipped with a Pin Allen lock and keys (Pin Allen) shall be provided with each installation. All ARV enclosures shall be supplied by Water Plus in the above models, or pre-approved by owner standards committee. All ARVs and odor control units shall be installed above ground and enclosed in the Water Plus enclosures with locks.

2.05 CURB STOPS/METER VALVES

A. Valves shall be ball type, of bronze construction in accordance with ASTM Specification B62 valves shall be closed bottom design and resilient O-ring sealed against external leakage at the top. The ball shall be fluorocarbon coated brass and shall be held in position by and seal off against seats of Buna-N rubber that are held securely in place with epoxy adhesive. Valves shall be water-tight against flow in either direction. The waterways shall be no smaller than the normal size of the valve and shall be smooth, with no abrupt changes in size to create resistance to flow. The stem that turns the ball shall exert no other force on it except to open or close the ball and shall be held securely in place by means of a bronze ring. The seal around the stem shall consist of two "O" rings. Each valve shall have a substantial T-head for the operation of opening and closing with a quarter turn of a standard slotted wench with rings for use of locking the valve in the event NMB Water needs to prevent water usage. The stops or lugs for controlling the motion of the T-head shall be enclosed and properly positioned to the line up the waterways through the ball with the water passage through the valve body.

B. Standard meter boxes and lids, when specified, shall be constructed of polymer concrete consisting of sand and aggregate bound together with a polymer resin. Reinforcement may be provided by means of fiberglass, steel rods, or combination of the two. The use of chopped fiberglass strands applied with a “chopper gun” or the use of high-density polyethylene or high-density polystyrene is not allowed. Material shall comply or exceed ASTM D-790, ASTM C-496, and ASTMD-2444 standards for strength. All boxes shall be supplied in load ratings of 8 Tier, 15 Tier and 22 Tier as specified and shall have straight sides. The loading characteristics shall conform to the Western Underground Committee recommended guide WUC 3.6. The material shall be non-conductive and constructed of fire-retardant materials. The boxes shall be provided in an off-white color and shall have one or more mouse hole in each end sized 2 ½ x 6-inches. The lids will be skid-resistant and shall have the words “meter” or “Water Meter”, and “NMB Water” molded in the top of the lid and the manufactures name and place of manufacturing facility shall mold in to the lid for ease identification. The lids will be interchangeable and will be secured in place with Penta head bolts. The box shall be open bottom with a reinforced ribbed rim on top to support the drop-in lid. The approved manufacture and model numbers are as follows:

DFW Box 5/8” Small – DFW1325C AF 1MPT
DFW Box 1” Medium – DFW1730C AF 1 MPT

Meter boxes and lids shall be DFW Plastics or approved equal. All meter boxes may be supplied with a solid base and gaskets upon request. The above standards shall be certified

by the manufacture prior to installation.

2.06 CORPORATION STOPS

A. Corporation stops shall be manufactured of brass alloy in accordance with ASTM Specification B62 latest revision. Corporation stops shall be ball valve type with quarter turn operation.

B. Inlet thread shall be AWWA taper thread in all sizes in accordance with AWWA Standard C800 latest revision. Outlet connections shall have a compression type fitting as specified in Section C of this volume.

2.07 BACKFLOW PREVENTERS

A. Backflow preventers shall work on the reduced pressure principle. The assembly shall consist of two (2) spring loaded check valves, automatic differential pressure relief valve, drain valve and shut-off valves. The body material shall be bronze or cast iron for a working pressure of not less than 150 psi, with bronze or stainless-steel trim. Drain lines with air gaps shall be provided.

PART 3 -EXECUTION

3.01 VALVE INSTALLATION

A. General: All valves, gates, operating units, stem extensions, valve boxes, and accessories shall be installed in accordance with the manufacturer's written instructions and as shown and specified. All gates shall be adequately braced to prevent warpage and bending under the intended use. Valves shall be firmly supported to avoid undue stresses on the pipe.

B. Access: All valves shall be installed to provide easy access for operation, removal, and maintenance and to avoid conflicts between valve operators and structural members or handrails.

C. Valve Accessories: Where combinations of valves, sensors, switches, and controls are specified, it shall be the responsibility of the CONTRACTOR to properly assemble and install these various items so that all systems are compatible and operating properly. The relationship between interrelated items shall be clearly noted on shop drawing submittals.

D. Butterfly Valves: All exposed butterfly valves shall be installed with a means of removing the complete valve assembly without dismantling the valve or operator.

3.02 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on the actual quantities installed as more specifically discussed and described in SECTION 01025 for MEASUREMENT AND PAYMENT.

END OF SECTION 02641

SECTION 02642
FIRE HYDRANTS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 WORK INCLUDED

A. The CONTRACTOR shall provide all tools, supplies, materials, equipment, and labor necessary for removing and delivering retired fire hydrants to NMB Water and installing and testing all new fire hydrants, in accordance with the requirements of the Contract Documents.

B. The CONTRACTOR shall perform a hydrant flow test in accordance with NMB Water and Miami-Dade County Fire Department standards prior to commencement of construction on any portion of the existing water system. Flow tests shall be performed on hydrants located near the intersection of NE 35th Ave with NE 165th Street and with NE 169th Street with results delivered to ENGINEER and OWNER immediately following test completion. Flow tests shall be coordinated with NMB Water and Miami-Dade County Fire Department as required.

1.03 RELATED WORK

A. Section 02221 - Excavation and Backfilling for Utilities

B. Section 02515 - Portland Cement Concrete Paving

B. Section 02610 - Piping, General

C. Section 02641 – Valves, General

1.04 REFERENCE STANDARDS

A. Codes: All codes, as referenced herein, are specified in Section 01090, "Reference Standards".

B. Commercial Standards:

ANSI C 502	Dry Barrel Fire Hydrants.
NSF 61	Health Effects for Drinking Water System Components.
AWWA C550	Protective Interior Coatings for Valves and Hydrants.

1.05 SUBMITTALS

A. Shop Drawings: The Contractor shall furnish four (4) sets of shop drawings for approval showing all the essential features including arrangement and descriptions of parts of the equipment offered as specified in Section 01340, "Shop Drawings, Product Data and Samples".

1.06 QUALITY ASSURANCE

A. Testing: Unless otherwise specified, each fire hydrant assembly shall be tested under a test pressure equal to twice its design water-working pressure.

B. Certification: Prior to shipment, the CONTRACTOR shall submit certified, notarized copies of the hydrostatic factory tests, showing compliance with the applicable standards of AWWA, ANSI, ASTM, etc.

PART 2 – PRODUCTS

2.01 HYDRANT CHARACTERISTICS

A. All hydrants shall meet the flow requirements of Section 2-103.21(B), Metropolitan Dade County Code. A certification for compliance with this standard must be made available to ENGINEER and OWNER with shop drawing submittal.

B. Type of shutoff shall be compression type closing, with the line pressure, and a 5-1/4-inch valve opening.

C. Barrels - Upper barrel with breakaway-from-lower-barrel feature shall be designed with a breakable safety connection of the flange and collar bolt-connected type joining the two barrels together. Lower barrel shall be of the same material as the hydrant shoe (inlet connection), and shall be designed so that the barrel can be removed from the hydrant shoe when the shoe (and valve) are under pressure. The drain outlets normally provided shall be omitted.

D. Main valve stem - Upper stem shall have breakaway-from-lower-stem feature. Top of the lower stem shall be below the top of the lower barrel to prevent a vehicle tire from depressing the stem and opening the valve, or damaging both lower stem and lower barrel. Stem and seat removal shall be easily accomplished from the upper part of the lower barrel or the upper barrel.

E. Main valve seat ring shall be bronze threaded into a fixed bronze bushing and shall be equipped with upper and lower O-ring seals, the lower of which shall seal against the hydrant elbow.

F. Sealed lubricant reservoir shall provide lubrication to all threaded and bearing surfaces automatically, and shall be located in the bonnet. All hydrants shall be supplied with factory pre-lubrication.

G. Inlet connection - Side inlet, 6-inch mechanical joint.

H. Delivery classification - Two (2) hose and one (1) pump nozzle 18 inches above ground (bury line).

I. Hose and pumper nozzles - Threaded, with O-ring seal, and the nozzle retained by stainless steel screws, or a left hand thread lug, slot and pipe plug lock system. Hose nozzle diameter shall be 2-1/2 inches, and threads shall be in accordance with American National Standard. Pumper nozzle (Dade County Standard) shall have 4 and ½-inch diameter threads conforming to American National Standard.

J. Bury length shall be as shown on the Plans or specified elsewhere herein.

K. Operating and cap nuts (Dade County Standard) shall be bronze to bronze, pentagonal, National Standard 1-1/2 inch point to flat, with operating nut weather cap.

L. Stuffing box - O-ring pressure seal.

M. Direction to open shall be counterclockwise.

N. Markings - Hydrants shall be cast marked or outside design shall be such that visible identification can be made as to manufacturer model (type). In addition, all hydrants approved as a "special" or "modified" hydrant shall be cast marked "Dade County, Florida".

O. Body color shall be chrome yellow, top cap shall be blue, and nozzle caps shall be orange.

P. Harnessing lugs and nozzle cap gaskets will not be required.

Q. Concrete slab shall be cast in accordance with Section 02515 “Portland Cement Concrete Paving”.

2.02 MATERIALS

A. Approved manufacturers and models are as follows:

1. A 423 Centurion - Mueller Company
2. K81-MD - Kennedy Valve
3. Medallion #F2545 - Clow Valve
4. 5-¼" B-84-B - American-Darling Co.

PART 3 -EXECUTION

3.01 HYDRANT INSTALLATION

A. Six-inch branch runs to the fire hydrant shall be constructed in accordance with all applicable portions of Section 02610 "Piping, General", including making thrust resistant joints, installing 6-inch gate valve, tie-rods, riser pipe and valve boxes. Where the distance of any branch run from the main shall be fifty feet or greater, it shall be constructed with 8-inch diameter piping and valves.

B. New fire hydrants and branch runs shall be installed by the CONTRACTOR where shown on the Plans. Installation of a new fire hydrant shall include excavation, installation of the branch run, installation of the hydrant on the branch run, the concrete anchor at the hydrant elbow, protective concrete slab in non- sidewalk areas, replacing concrete sidewalk when in sidewalk area; steel posts filled with concrete, where required; backfilling and compaction. Fire hydrants shall be touched up or repainted, as specified, where necessary, and the same type of paint shall be used to paint the guard posts after treating the galvanized surface with a neutralizer.

C. Some fire hydrants are factory lubricated, while others require lubrication after installation. The CONTRACTOR shall verify which type of hydrant has been furnished hereunder with the ENGINEER, and if required, shall lubricate each hydrant after its installation and prior to its operation.

D. Lubricating hydrants will be considered as incidental to the hydrant installation, and no extra

compensation will be provided for this work. Where existing fire hydrants are removed they shall be cleaned and returned to NMB Water, as directed by OWNER or ENGINEER.

E. Fire hydrants being retired shall be salvaged by excavating the entire hydrant assembly including the bottom shoe. Using caution so as not to damage any component of the hydrant assembly, remove the entire hydrant assembly including the shoe, carefully clean of any thrust block concrete, clean, load, transport, unload and store in a NMB Water storage yard as directed by the OWNER or ENGINEER. Fire hydrant feed mains shall be cut, plugged and thrust blocked if they are to remain connected to an active main line. Lines which are deactivated (ie not connected to an active main) shall be abandoned or removed as called for on the Plans.

F. Unless otherwise objected by the City of North Miami Beach or governing agency having jurisdiction over the work, the Contractor shall furnish and install concrete-filled steel guard post in accordance with the plan details.

G. All fire hydrants shall be installed such that the pumper nozzle is facing the adjacent roadway.

3.02 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on the actual quantities installed as more specifically discussed and described in SECTION 01025 for MEASUREMENT AND PAYMENT.

END OF SECTION 02642

SECTION 02710
ELECTRICAL CONDUITS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1 - General Requirements shall govern the work under this Section.

1.02 WORK INCLUDED

A. Provide all labor, materials, necessary equipment and services to complete the electrical conduit work, as indicated on the drawings, as specified herein or both.

1.03 RELATED WORK

A. Section 02200 - Earthwork

B. Section 02221 - Excavation and Backfilling Utilities

1.04 EXISTING UTILITIES

A. Furnish temporary support, adequate protection and maintenance of all underground and surface utility structures, drains, sewers, water mains, poles and other obstructions encountered in the progress of the work.

B. Where the grade or alignment of the pipe is obstructed by existing utility structure such as conduits, ducts, pipe branch connections to main sewers, or main drains, the obstruction shall be permanently supported, relocated, removed, or reconstructed by the CONTRACTOR in cooperation with the OWNER of such utility structures. No deviation shall be made from the required line or grade except as directed by the ENGINEER.

1.05 REFERENCE STANDARDS

A. Codes: All codes, as referenced herein, are specified in Section 01090, "Reference Standards" and as specified below:

UL 514	Standard for Conduit, Tubing, and Cable Fittings
UL 651	Standard for Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings.
Fed Spec W-C-1094	Conduit and Conduit Fittings Plastic, Rigid
NEMA TC-2	Electrical Polyvinyl Chloride (PVC) Conduit
NEMA TC-3	Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing

PART 2 - PRODUCTS

2.01 GENERAL

SECTION 02710
ELECTRICAL CONDUITS

A. All electrical conduit work shall comply with the applicable rules of the National Electrical Code, the National Fire Protection Association, and the South Florida Building Code, and shall be in accordance with the requirements of OSHA, and the best commercial and industrial practice. Conduit and cable shall be sized as specified in the National Electrical Code, where sizes are not shown on the Plans.

2.02 PIPE

A. Polyvinyl Chloride (PVC) Piping:

1. Electrical conduits shall be solvent weld Schedule 40, heavy-walled rigid, rated for 90 degree C cables conforming to UL 651, Fed Spec W-C-1094 and NEMA TC-2 as manufactured by Carlon or OWNER approved equal.

2. PVC Pipe and PVC Fittings shall be in full compliance with UL 514 and NEMA TC-3 Standards.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. The Plans are generally indicative of the work to be installed, but do not show all bends, fittings, boxes, and specialties which may be required or the exact location of all conduits. The Contractor shall carefully investigate the site and conditions affecting all of his work and arrange his work accordingly. Any changes from locations shown on the Plans must be approved by the ENGINEER.

B. Conduits shall be installed in such a manner that wires may be installed, removed and replaced at a later date and to ensure against collection of condensation or rainwater. Where bends are made, they shall be made with an approved conduit bending machine. Crushed or deformed conduit shall not be used.

C. All conduit ends shall be square cut and reamed to remove burrs. Running threads will NOT be permitted. Approved couplings shall be used. All conduit joints shall be made up wrench tight, using strap wrenches, and shall be made waterproof in such a manner as not to interrupt the electrical bonds.

D. As soon as installed, all open conduit ends shall be plugged or capped and so maintained during construction to prevent the entrance of moisture and dirt.

3.02 INSTALLATION OF PIPE AND FITTINGS

A. Care shall be taken in the handling, storage, and installation of pipe and fittings to prevent injury to the pipe or coatings. All pipe and fittings shall be examined before installing, and no pipe shall be installed which is found to be defective. Pipe or fittings shall not be dropped. All damage to the pipe coatings shall be repaired according to the manufacturer's recommendations. All pipe and fittings shall be kept clean and shall be thoroughly cleaned before installation.

B. When installation is not in progress, including lunchtime, or the potential exists for dirt of debris to enter the pipe, the open ends of the pipe shall be closed with watertight plugs or other approved means.

SECTION 02710
ELECTRICAL CONDUITS

3.03 BACKFILL

A. No trenches or excavations shall be backfilled until the trench and installation has been inspected and written approval given by the ENGINEER. All backfill shall be carefully placed to avoid movement of the pipeline. Backfill shall be free from rock, large stones, boulders, brush, or other unsuitable material. It shall be placed in the trench uniformly on both sides of the pipe for full width of the trench and to the horizontal diameter of the full length of the pipe. This backfill shall be thoroughly tamped to provide support free from voids.

B. Backfill shall be carefully compacted until 12" of cover exists over the pipe. The remainder of the backfill shall then be placed and compacted thoroughly by puddling and tamping as required. Where directed, puddling and tamping may be omitted, and backfill shall be neatly rounded over the trench to a sufficient height to allow for settlement to grade after consolidation.

3.04 RESTORATION OF SURFACE AND/OR STRUCTURES

A. The CONTRACTOR shall restore and/or replace paving, curbing, sidewalks, fences, sod, survey points and other disturbed surfaces to a condition equal to that before the work was begun and to satisfaction of the ENGINEER, and shall furnish all labor and materials incidental thereto. Relative restoration of surfaces and/or structures, the CONTRACTOR shall comply with all governing agencies requirements including city, town, county and state.

3.05 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on the actual quantities installed as more specifically discussed and described in SECTION 01025 for MEASUREMENT AND PAYMENT.

END OF SECTION 02710

SECTION 02810
IRRIGATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1-General Requirements shall govern the WORK under this section.

1.02 SUMMARY

A. This Section includes the following:

i. Pipe and fittings, valves, sprinkler heads and accessories; and,

ii. Irrigation control system.

1.03 WORK INCLUDED

A. The work is to include the furnishing of all labor, supplies, equipment and materials necessary to complete the installation of the pipe and fittings, valves, and sprinkler heads, controller, etc as shown on the Drawings as well as all other related responsibilities described in these Specifications and accompanying plans.

B. The system is a fully automatic system comprised of numerous zones operated by the controller. This system has been designed to provide 100% coverage. It is the responsibility of the Contractor to insure the entire system is installed according to applicable laws, rules, regulations and conventions.

1.04 RELATED WORK

A. Section 02110 – Clearing

B. Section 02200 – Earthwork

C. Section 02221 – Excavation and Backfilling for Utilities

D. Section 02610 – Piping, General

E. Section 02641 – Valves, General

F. Section 02900 – Landscape Work

1.05 REFERENCE STANDARDS

A. American Society of Testing and Materials

1. ANSI/ASTM D2282 – Acrylonitrile-Butadiene-Styrene (ABS) Plastic pipe (SDR-PR);

2. ANSI/ASTM D2564 – Solvent Cement for Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings;

i. ASTM B32 – Solder Metal;

ii. ASTM B42 – Seamless Copper Pipe, Standard Sizes;

iii. ASTM B88 – Seamless Copper Water Tube;

iv. ASTM D1784 – Rigid and Chlorinated Polyvinyl Compounds

v. ATSM D2235 – Solvent Cement for Acrylonitrile - Butadiene - Styrene (ABS) Plastic Pipe and Fittings;

vi. ASTM D2466 – Polyvinyl Plastic Pipe Fittings, Schedule 40; and,

vii. ASTM D2467 – Polyvinyl Plastic Pipe Fittings, Schedule 80.

B. FS O-F-506 – Flux, Soldering; Paste and Liquid.

C. NEMA 250 – Enclosures for Electrical Equipment (1000 Volts Maximum).

1.06 QUALITY ASSURANCE

A. Responsibility for Assuring Quality Work:

1. The CONTRACTOR's Superintendent shall be well versed in standard plumbing procedures, PVC assembly procedures, blueprint reading and coordination with other contracts or services in the project area.

2. All employees shall be competent and highly skilled in their particular job in order to properly perform the work assigned to them. The CONTRACTOR shall be responsible for maintaining the quality of material on the job throughout the duration of contract responsibility.

B. Requirements of Regulatory Agencies:

1. All work and materials shall be in full accordance with the latest rules and regulations of safety order of Division of Industrial Safety; the Florida Building Code, the Uniform Building Code and other applicable laws and regulations, including any regulatory authorities having jurisdiction, and Plumbing Codes; and,

2. Should the contract documents be at variance with the aforementioned rules and regulations, notify the OWNER for instructions before proceeding with work affected.

C. Testing:

1. Preliminary inspection of completed installation will be made prior to backfilling of trenches and during hydrostatic testing; and,

2. Final inspection shall be made in conjunction with the final inspection of lawn, shrub and tree planting.

D. Permits and Inspections:

1. Any permits for the installation or construction of any work included under this contract, which are required by any of the legally constituted authorities having jurisdiction, shall be obtained and paid for by the CONTRACTOR, each at the proper time; and,

2. The CONTRACTOR shall also arrange for and pay all costs in connection with any inspection and examination required by these authorities.

1.07 SUBMITTALS

A. Shop drawing or irrigation system design, including but not limited to piping, sprinkler heads, valves, wiring, and controls, if not provided in drawings.

B. CONTRACTOR shall furnish 2 manufacturer's service manuals to the OWNER. Manuals may be loose-leaf and shall contain complete drawings of all equipment installed showing components and catalog numbers together with the manufacturer's name and address.

C. Loose equipment to furnish: Loose irrigation equipment, operating keys and spare parts if shown on the drawings.

1. 3 quick coupler keys and matching swivel hose cells;

2. 2 valve keys for gate valves;

3. 2 keys for each controller;

4. 2 sets of special tools required for removing, disassembling and adjusting each type of sprinkler and valve supplied on this project; and,

5. 2 cover lifting tools for valve boxes.

D. Record Drawings:

The CONTRACTOR shall maintain one record set of blueline prints of the irrigation system in good condition at the site and mark on them the exact 'RECORD'. The CONTRACTOR shall make a daily record of all work installed during each day. Drawings shall indicate the exact location of check valves, gate valves, wire locations, head layout, automatic valves, quick couplers, irrigation, drainage piping, etc. Locations should be shown by the triangular system of measurements from easily identified permanent features, such as buildings, curbs, fences, walks, and by GPS, etc. Drawings shall show approved substitutions if any, of material including manufacturer's name and catalogue number. Drawings shall be to scale and all information shall be recorded in a neat, orderly way.

1. At the time of the irrigation mainline test, the CONTRACTOR shall provide a preliminary set of 'RECORD' drawings to the OWNER; and,

2. On or before the date of substantial inspection, the CONTRACTOR shall deliver 2 sets of As-Built drawings to the OWNER. The delivery of the prints shall not relieve the CONTRACTOR of the responsibility of furnishing required information that may have been omitted.

3. Immediately upon installation of any work which deviates from what is shown on the prints, the CONTRACTOR shall clearly indicate such changes in red pencil on the prints. Such changes shall include, but not be limited to, changes in (1) material, (2) sizes of material, (3) location, and (4) quantities. Dimensions shall be used where required such as, but not limited to underground utilities.

E. Substitutions:

1. The CONTRACTOR shall use materials as specified herein. Material other than that specified will be permitted only after written application by CONTRACTOR and written approval by the OWNER;

2. Substitutions will only be allowed when in the best interest of the OWNER; and,

3. The installation of any approved substitution is the CONTRACTOR's responsibility. Any changes required for installation of any approved substitution must be made to the satisfaction of the OWNER and without additional cost to the OWNER.

1.08 LOCATION

A. Bidders shall personally examine the sites and fully acquaint themselves with all of the existing conditions in order that no misunderstanding may afterwards arise as to the character or as to the extent of the work to be done; and, likewise, in order to advise and acquaint themselves with all precautions to be taken in order to avoid injury to persons or property of another. No additional compensation will be granted because of any unusual difficulties which may be encountered in the execution or maintenance of any portion of the work.

PART 2 - MATERIALS

All materials to be as specified below or approved equal.

2.01 PIPE

A. Pipe locations shown on the plan are schematic and shall be adjusted in field.

B. All PVC pipe shall be new and free from defects and shall be continuously marked indicating size, schedule, type and Department of Commerce Standard Reference. Pipe shall be furnished in standard length of 20 feet.

C. Main: Main line shall be solvent weld schedule 40 PVC pipe sized as noted on plans.

D. Laterals: All lateral pipe shall be Polyvinyl Chloride (PVC) 1120-1120, Class 160. Threaded connections shall be schedule 80 unless noted otherwise on the Plans or Specifications.

E. Galvanized Steel Pipe: All pressure mains which are exposed to possible damage, such as above ground, shall be threaded end, standard weight, Schedule 40 galvanized or coated steel.

F. Sleeves: All sleeves to be Polyvinyl Chloride (PVC) Schedule 40 and sized as twice the size of the pipe it is carrying.

G. Chaseways: All chaseways shall be PVC Schedule 40 and sized as needed for present and future use.

2.02 PIPE FITTINGS AND JOINTS

A. All PVC lateral pipe shall have PVC solvent weld Schedule 40 fittings and joints. The primer and solvent glue shall be compatible with the pipe and fittings. No male threaded PVC fittings are to be used, with the exception of street ells and riser adapters.

B. Galvanized steel pipe shall have threaded standard, 150 pound galvanized malleable fittings. All sprinkler heads shall be connected to the supply line with flexible pipe and ells, (Rainbird flex pipe and barbed ells O.A.F. or approved equal) or Schedule 80 swing joints as shown on the details.

C. Main line pipe joints shall be "belled" solvent-weld type.

2.03 SPRINKLER HEADS

A. Shrub heads and bubblers shall be installed on ½ inch schedule 40 PVC risers. Paint all risers with black paint. Shrub heads shall be installed to a standard height of 6 inches above plants, and shall be installed within planted masses to be less visible. Bubblers shall be installed at the base of trees for low level watering.

B. All pop-up heads shall be mounted on flexible type swing joints.

C. All pop up and shrub heads shall be pressure compensating.

D. Use screens in all heads.

2.04 IRRIGATION CONTROL WIRE

A. All irrigation control wire from the controller to the electric valve shall be UL approved PE irrigation control wire, single conductor insulated utilizing low density high molecular weight polyethylene insulation suitable for operating at 600 volts and conductor temperatures up to 60° C. The conductor shall be soft drawn bare copper meeting the requirements of ASTM Specification B-3 or B-8. Temperature rating shall be from –55° to +60° C. Thickness of insulation for conductor size 14 AWG through 12 AWG solid shall be 3/64 inches. Wire size, number and color as follows: #12 White for Common; #14 Red for Hotwires; #14 Yellow for Spares.

2.05 WIRE CONNECTORS

A. All splices in irrigation control wire shall be accomplished by using 3M Dry Direct Bury Splice Kit or approved equal.

2.06 SLEEVING AND CONDUIT

A. Sleeving and conduit shall be PVC, Schedule 40 for pipe sizes through 3 inches, and Class 160 for sizes 4 inches diameter or greater. Size as required by code or as shown on the Plan, whichever is larger in size. Electric conduit shall be gray PVC with Underwriters' Laboratories label.

2.07 RISERS

A. Risers to be Schedule 80 NPT riser threshold, height to be determined by use.

2.08 AUTOMATIC CONTROL VALVES

A. The automatic valves are to be Rainbird PEB series or approved equal.

2.09 GATE VALVES & ISOLATION VALVES

A. Gate valves 3 inches and smaller shall be Crane No. 438 (screwed end) with all bronze body, wedge disc and non-rising stem, or approved equal.

B. Isolation valves shall be iron body resilient seat gate valves with modified wedge disc NRS type, with slip on joint ends installed with thrust blocks.

2.10 VALVE BOXES

A. Valve boxes shall be made of Superflexon 1203 as manufactured by Nelson Irrigation or Ametek or approved equal. Boxes shall be 16 inch x 12 inch x 10 ¾ inch and black with a green cover marked "Irrigation" on top.

2.11 PAINT FOR RISERS

A. All risers to be painted black.

2.12 CONTROLLER

A. Controller shall be after Irrigation LEIT 4000 or approved equal with stainless steel enclosure as specified on Contract Documents.

2.13 VACUUM BREAKER

A. Unless specified on the plans, no vacuum breaker is required.

PART 3 - EXECUTION

3.01 GENERAL

A. The Irrigation Contractor shall carefully schedule his work with the Landscape Contractor and all other site developments.

B. Sleeves are required wherever piping or electrical wires are placed under paved surfaces. Install sleeves prior to commencement of paving.

C. No consideration will be given to any design changes. Should any changes be deemed necessary after award of contract, for proper installation and operation of the system, the OWNER shall negotiate such changes.

D. Lay out work as accurately as possible to the submitted shop drawings.

E. Full and complete coverage is required. CONTRACTOR shall make any necessary minor adjustments to layout as required to achieve full coverage of irrigated areas at no additional cost to the OWNER.

F. Where piping is shown on drawings to be under paved areas but running parallel and adjacent to planted areas, the intent is to install piping in planted areas. Do not install directly over another line in same trench.

G. It shall be the CONTRACTOR's responsibility to establish the location of all sprinkler heads in order to assure proper coverage of all areas. In no case shall spacing of sprinkler head exceed distances shown on the drawings and/or those specified. Pipe sizes shall conform to those shown on the drawings. No substitutions of smaller pipe sizes will be permitted, but substitutions of larger sizes may be approved. All pipe damaged or rejected because of defects shall be removed from the site at the time of said rejection, at no additional cost to the OWNER.

H. Install irrigation system after completion of site grading. The irrigation system shall be installed and completely operational three days prior to the installation of any planting operations.

3.02 PREPARATION

A. Layout of Main and Laterals: The sprinkler main lines and all laterals shall be laid out by the CONTRACTOR and approved by the OWNER or ENGINEER, prior to excavation. The sprinkler lines, as shown on the Plans, are drawn for clarity and are schematic in nature. No sprinkler lines shall be under paved areas unless in sleeves or specifically noted on the Plans. Any adjustment or site modification shall be done prior to the excavation operation.

B. Layout of Sprinkler Heads: All sprinkler heads locations shall be staked by the CONTRACTOR and approved by the OWNER or ENGINEER, prior to installation to insure uniformity and correctness to both pattern and coverage.

C. Valve Locations: The location of all valves shall be in landscape areas. The location of all valves shall be staked by the CONTRACTOR and approved by the OWNER or ENGINEER, prior to installation to insure ease of access for maintenance and to insure that they do not conflict with other elements on the project. Each valve shall be installed in a separate valve box. The valve locations shown on the plan are drawn for clarity and are schematic in nature. Sequence all valves so that the farthest valve from the point of connection operates first and the closest to the point of connection operates last.

D. Valve boxes must be placed a minimum of 12 inches and a maximum of 15 inches from the edge of pavement and the top of the box shall be 2 inches above finish grade. Valve boxes to be installed in shrub beds only. Using 3 inches high number stencils, paint the valve number in white on the lid of each valve box.

E. Irrigation Plans: The irrigation system indicated on the drawings is drawn for clarity and is essentially diagrammatic. Spacing of the heads shown on the Plans shall not be modified unless approved in writing by the OWNER and ENGINEER.

3.03 TRENCHING

A. Perform all excavations as required for installation of work included under this Section, including shoring of earth banks, if necessary. Restore all surfaces, existing underground

installation, etc., damaged or cut as a result of the excavations, to their original condition.

B. Should utilities not shown on the drawings be found during excavations, CONTRACTOR shall promptly notify the OWNER for instructions as to further action. Failure to do so will make the CONTRACTOR liable for any and all damage thereto arising from his operations subsequent to discovery of such utilities. Indicate such utility crossings on the record drawings promptly.

C. Trenches shall be open, vertical sided construction wide enough to provide free working space around work installed and to provide ample space for backfilling and compacting.

D. When 2 pipes are to be placed in the same trench, a 6 inch space is to be maintained between pipes. The CONTRACTOR shall not install 2 pipes with one directly above the other.

E. Backfill and compaction shall be in accordance with Section 02221, Excavation and Backfilling for Utilities. Depth of trenches shall be sufficient or provide a minimum cover above the top of the pipe as follows or as shown on the drawing if greater:

12 inches over non-pressure lateral lines
18 inches over non-pressure lateral lines under paving
18 inches over control wires
18 inches over sprinkler main line
24 inches over sprinkler main line under paving

F. The CONTRACTOR shall cut trenches for pipe to required grade lines and compact trench bottom to prove accurate grade and uniform bearing for the full length of the line.

G. All laterals and mainline shall be sufficiently sloped to provide positive drainage through drain valves.

H. The CONTRACTOR shall be held responsible for any damages caused by these operations and shall immediately repair or replace damaged parts.

3.04 INSTALLATION

A. Ground Level Areas: The CONTRACTOR shall do all necessary excavating and backfilling required for the proper installation of the work. Minimum depth of cover over lateral lines shall be 12 inches, over main line shall be 18 inches, over sleeving shall be 24 inches. Backfill material shall be clean fill. If existing material has rock, then clean sand must be used. In rocky areas, the trenching depth shall be two inches below normal trench depth to allow for a 2 inch bed of sand below the pipe. There shall be no rock in contact with PVC pipe. The CONTRACTOR shall use backfilling equipment that will tamp backfill to its original density. The CONTRACTOR shall barricade or light the excavation to prevent hazards to the public. Objectionable materials such as coral rock, asphalt, limerock and bricks that are encountered during working operations, shall be removed from the project by the CONTRACTOR.

B. Modifications Due to Field Conditions: Conditions that occur on the site that cause the system to be modified, shall be presented as shop drawings by the CONTRACTOR and approved by the ENGINEER, prior to construction.

C. The existence and location of utilities (overhead, above ground and underground) shall be thoroughly investigated and verified by the CONTRACTOR before the work begins in the area of said utilities. The CONTRACTOR shall exercise care in digging and working so as not to damage utilities or endanger the safety and lives of people. Should overhead, above ground

or underground obstructions be encountered which interfere with the work, the ENGINEER shall be consulted in order for a decision to be made on the relocation of the work to clear such obstruction. The CONTRACTOR shall be responsible for the immediate repair of any damage to utilities caused by the CONTRACTORs work.

D. PVC Sleeves and Electrical Conduit

1. All PVC sleeves shall be a minimum of twice (2x) the diameter of the pipe to be sleeved; and,

2. All PVC control wire conduit shall be of sufficient size to hold the required quantity of control and common wires. Electrical wires are not to be placed in the same sleeve with water pipes.

3.05 PVC PIPE ASSEMBLY

A. All PVC pipe shall be cut to the proper length prior to assembly. The cut shall be neat and square, 90 degrees to the axis of the pipe. Prior to assembly, the cut end shall be de-burred. The fitting and pipe end shall both be cleaned with a PVC High Etch Primer. This primer shall have a purple tint to aid in visual inspection.

B. A thin even flow coat of slow drying, heavy duty PVC solvent/glue shall be applied to both the inside of the fitting and the pipe mating surface.

C. The pipe shall be inserted into the fitting until it bottoms, then given a quarter turn to insure proper sealing. The pipe and fittings shall be out of service during the curing time as recommended by the manufacturer or 24 hours, whichever is longer. The finished joint shall be water-tight and shall have a strength equal to or greater than that of the pipe being joined. The direct tapping of PVC pipe or fittings shall not be permitted.

D. Threaded Joints for PVC Pipes

1. Use Teflon tape on all treaded PVC fittings;

2. Use strap-type friction wrench only. Do not use metal-jawed wrench; and,

3. At threaded joints between PVC and metal pipes, the metal shall contain the socket end and the PVC end shall contain the spigot. A metal spigot shall not, under any circumstances, be screwed into a PVC socket.

3.06 IRRIGATION CONTROL VALVES

A. Valves shall be carefully inspected during installation; they shall be opened wide and then tightly closed and tested for tightness. Special care shall be taken to prevent any foreign matter from becoming lodged in the valve seat. Valves shall be set plump at the locations indicated and in accordance with the details shown on the drawings.

B. Install control valves in valve boxes grouping together where practical. Place no closer than 12 inches to walk edges, buildings and walls.

C. Pressure regulating remote control valves shall be adjusted so that the most remote sprinkler heads operate at the pressure specified.

D. Valves shall be installed as shown in details and in accordance with manufacturer's instructions and the specifications.

3.07 QUICK COUPLING VALVES

A. Shall be set a minimum of 12 inches from walks, curbs or paved areas where applicable or as otherwise noted. Quick coupling valves shall be housed in valve boxes.

B. Valves shall be installed on 3 elbow PVC Schedule 80 swing joint assembly.

3.08 VALVE BOXES

A. Valve boxes shall be set flush with finish grade in lawn areas and ½ inch above finish grade in ground cover and shrub bed areas.

3.09 SPRINKLER HEADS

A. Sprinkler Heads: All sprinkler heads shall be installed as shown on the Drawings. Backfill around the sprinkler shall be free of rocks, roots, or debris. If finished grade has not been established, the line shall be temporarily capped at the head and a stake marker placed. After grading has been completed, the sprinkler head shall be set. The CONTRACTOR shall coordinate his operations with the various phases of the work. Adjust heads for proper coverage avoiding excess water on walks, walls and paving.

B. All sprinkler heads within a zone shall have matched precipitation rates.

C. All heads operating on one valve (zone) shall do so at the same pressure.

D. All heads shall be pop-up type heads. Permanent shrub risers are not permitted.

E. Do not mix different types of heads within zone.

F. Shrub beds and lawn areas are to be on separate valves (zones).

G. Place part-circle pop-up sprinkler heads 6 inches from edge of adjacent walks, curbs and mowing bands, or paved areas at time of installation.

H. All sprinkler nozzles shall be adjusted for the proper radius and direction of spray pattern. Make adjustments where possible to prevent overspraying into walks, pavement or buildings.

I. Sprinkler heads and quick coupling valves shall be set perpendicular to finished grade unless otherwise designated on the drawings.

3.10 DRAIN VALVES

A. All laterals shall be provided with manual drain valves.

B. The mainline shall be drained with manual drain valves.

C. Drain valves are to be provided at sufficient intervals to provide complete drainage of all piping.

3.11 AUTOMATIC CONTROLLER

A. The automatic controller shall be installed at the approximate location shown on the irrigation drawings. Solar power supply unless otherwise directed and then power supply will be provided by the Electrical Subcontractor.

B. All regulatory authorities having jurisdiction and other applicable codes shall take precedence in connecting the 110-volt electrical service to the controller.

C. Install per regulatory authority having jurisdiction code, manufacturer's latest printed instructions, and as detailed.

D. Connect remote control valves to controller in sequence to correspond with station setting beginning with 1, 2, 3, etc.

E. Affix controller name (i.e., 'Controller A') on inside of controller cabinet door with letters minimum of 1 inch high. Affix a non-fading copy of irrigation diagram to cabinet door below controller name. Irrigation diagram to be sealed between two sheets of 20 mil (minimum) plastic. Irrigation diagram shall be a reduced copy of the as-built drawing and shall show clearly all valves operated by the Controller, showing station number, valve size and type of planting irrigated.

3.12 CONTROL WIRING

A. Control Lines: All electric control lines shall be installed in the same trench with the pipe lines in a neat and orderly fashion. They shall be installed in the main and lateral trenching or in their own trenches, and where necessary, bundled together and taped every 5 feet.

B. Connections: any connections to existing pipe systems shall be made after consultation and approval of regulatory agencies.

C. All electrical equipment and wiring shall comply with regulatory authorities having jurisdiction and be installed by those skilled and licensed in the trade.

D. Wiring shall occupy the same trench and shall be installed along the same route as pressure supply or lateral lines wherever possible, and shall have a minimum of an 18 inch cover.

E. Control wires shall be installed to the side of the main line whenever possible. Placement over pipes is not permitted.

F. Where more than 1 wire is placed in a trench, the wiring shall be taped together at intervals of 10 feet.

G. An expansion curl shall be provided within 3 feet of each wire connection and at least every 100 feet of wire length on runs of more than 100 feet in length. Expansion curls shall be formed by wrapping at least 5 turns of wire around a 1 inch diameter pipe, then withdrawing pipe.

H. Control wire splices at remote control valves to be crimped and scaled with specified splicing materials. Line splices will be allowed only on runs of more than 500 feet and they must be located in 10 inch round splice boxes, which are green in color. The connector shall be 3MD BY splice kit by 3M Corporation, or 'Snip-Snap' connector by Imperial, or equal. Use one splice per connector sealing packs.

I. Wire: Tape and bundle control wires every 10 feet and run alongside mainline. At all turns in direction make a 2 foot coil or wire. At all valve boxes coil wire around a ¾ inch piece of PVC to make a coil using 30 inches of wire. Provide 1 spare for every 10 hot wires – a minimum of 2 extra. Number all wires, using an electrical book of numbers, according to the plans. Number wires in all valve boxes, junction boxes and at the controller.

3.13 SHUT-OFF VALVES

A. Shall be located in the following locations:

1. After backflow preventer and prior to main supply loop;

2. Between mainline and each remote-control valves; and,

3. To be located within planting and lawn areas.

B. All shut-off valves shall be located in valve boxes.

3.14 CLOSING OF PIPE AND FLUSHING OF LINES

A. All testing shall be done under the supervision of the OWNER or ENGINEER. Submit written requests for inspections to the OWNER at least 3 days prior to anticipated inspection date.

1. Flushing: All lines shall be flushed prior to any installation of automatic sprinkler valves or sprinkler heads to remove all sand and other foreign matter with velocity of the flushing water not less than 4 feet per second. Flushing shall be terminated at the direction of the ENGINEER. The CONTRACTOR shall dispose of the flushing water without causing a nuisance or property damage.

2. Thoroughly flush out all water lines under a full head of water before installing heads, valves, quick couplers assemblies, etc. Maintain flushing for a minimum of three minutes at the valve located furthest from water supply;

3. After flushing, cap or plug all openings to prevent entrance of materials that would obstruct the pipe or clog heads. Leave in place until removal is necessary for completion of installation;

4. Test as specified below;

5. Upon completion of testing, complete assembly and adjust sprinkler heads for proper distribution; and,

6. All sprinkler heads and quick coupling valves shall be set perpendicular to finished grades unless otherwise designated on the drawings, or otherwise specified. Sprinkler heads adjacent to existing walls, curbs and other paved areas, shall be set to grade. Sprinkler heads, which are to be installed in lawn areas where the turf has not yet been established, shall be set 1 inch above the proposed finish grade. Heads installed in this manner will be lowered to grade when the turf is sufficiently established to allow walking on it without appreciable destruction. Such lowering of heads shall be done by this CONTRACTOR as part of the original contract with no additional cost to the OWNER.

3.15 TESTING

A. Pressure and Leakage Testing:

1. General: All pumps, gauges, and measuring devices shall be furnished, installed and operated by the CONTRACTOR and all such equipment and devices and their installation shall be approved by the ENGINEER.

2. Pressure Tests for Lines: Pressure piping installed under this contract shall be subjected to a pressure test after the pipe has been installed and partially backfilled for underground installations. Each pressure test shall be maintained for at least one hour at 150 psi during which time all joints shall be examined for leaks.

3. Before application of test pressure, all air shall be expelled from the pipe. If permanent air vents are not located at all high points, the CONTRACTOR shall install corporation cocks or fittings and valves at such points so the air can be expelled as the pipe system is slowly filled with water. After expulsion of air, the corporation cocks, or other blowoff devices shall be closed and the test pressure applied.

4. All exposed pipe, fittings, valves, and joints shall be carefully examined for leaks. All cracked, broken, or defective pipe, fittings, or valves discovered as a consequence of this pressure test shall be removed and replaced with sound material. All leaking, or defective joints shall be repaired, replaced, or corrected. After all necessary replacements and corrections, the test shall be repeated until satisfactory to the ENGINEER.

5. Leakage Testing for Pressure Piping: After completion of satisfactory pressure tests of piping, the lines shall be subjected to leakage tests. The duration of each leakage test shall be at least two hours and the pressures maintained during each leakage test shall be as specified above for the pressure tests.

6. Leakage is defined as the quantity of water that must be supplied into the newly laid pipe or any valved section thereof to maintain the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water. The allowable limits for leakage of underground piping shall be determined by the following formula.

7. Allowable Limits for Leakage of Pressure Piping: The hydrostatic pressure tests shall be performed as hereinabove specified and no installation, or section thereof, will be acceptable until the leakage is less than the number of gallons per hour as determined by the formula:

$$L = \frac{SD(P)^{1/2}}{148{,}000}$$

in which,

L = Allowable leakage, in gallons per hour
S = Length of pipe being tested in feet
D = Nominal pipe diameter; in inches
P = Average test pressure during the test, in psi gauge

8. Water shall be supplied to the line during the test period as required to maintain the test pressure as specified. The quantity used, which shall be compared to the above allowable quantity, shall be measured by pumping from the calibrated container.

9. Where leakage exceeds the allowable limit, the defective pipe or joints shall be located and repaired. If the defective portions cannot be located, the CONTRACTOR shall remove and reconstruct as much of the work as is necessary in order to conform to the specified limits. No additional payment will be made for the correction of defective work, or to damage to other parts of the work resulting from such corrective work.

B. Balancing and Adjustment: The CONTRACTOR shall balance and adjust the various components of the sprinkler system so the overall operation of the system is most efficient. This includes a synchronization of the controllers, part circle sprinkler heads, and individual station adjustments on the controllers.

3.16 INSPECTION

A. The CONTRACTOR shall maintain proper facilities and provide safe access for inspection to all parts of the work.

B. Irrigation inspection shall consist of a minimum of:

1. Mainline pressure test;
2. Coverage test; and,
3. Final irrigation inspection.

C. If the laws, ordinances or any public authority require any work to be specifically tested or approved, the CONTRACTOR shall give the OWNER 3 days notice of its readiness for inspection.

D. The CONTRACTOR shall be solely responsible for notifying the OWNER where and when such work is in readiness for testing.

E. If any work should be covered up without approval of the OWNER it must be uncovered, if required, for examination at CONTRACTOR's expense.

F. No inspection will commence without 'Record' drawings and without completing previously noted corrections, or without preparing the system for inspection.

3.17 BACKFILL AND COMPACTING

A. After system is operating and required tests and inspections have been made, backfill excavations and trenches.

B. Backfill for all trenches, regardless of the type of pipe covered, shall be compacted to the requirements of Section 02221, Excavation and Backfilling for Utilities.

C. Within all planting and lawn areas the existing 4 inch layer of topsoil shall be restored to its original condition and finish grade. After backfilling, the CONTRACTOR shall dispose of surplus earth offsite.

3.18 RESPONSIBILITY PRIOR TO FINAL ACCEPTANCE

The CONTRACTOR shall be responsible for maintenance until the inspection for completion and final acceptance. The responsibilities include the following:

A. Repair of all damage to installed material and equipment as needed.

B. Adjustment of all sprinkler heads with regard to proper height after landscape installation, arc coverage, radius and operation at least once a week.

C. The system shall be operational at least one month prior to Substantial Completion. Once a week after Substantial Completion, the CONTRACTOR shall clean, repair and adjust all valves and other controls. Also, check to insure that they are opening and closing properly.

D. Once a week the controllers shall be checked to insure that the clocks have the right time, that the program is properly set and that it is properly operating all of the valves correctly. Following inspections, the pump enclosure is to be locked.

END OF SECTION 02810

SECTION 02900
LANDSCAPE WORK

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1-General Requirements shall govern the WORK under this section.

1.02 WORK INCLUDED

A. The work included in this section consists of furnishing all labor, supplies equipment and materials necessary to complete the installation of all landscaping as shown on the Plans as base bid including the installation of sod and seeding as shown, as well as all other related responsibilities as described in these Specifications and accompanying plans.

B. Installation: All plant materials included shall be of the specific size and quality indicated on the plans and in these specifications and shall be installed in strict accordance with sound nursery practices and shall include maintenance and watering for all work outlined on the plans and specifications until final acceptance.

C. Quantities and Locations: The OWNER reserves the right to adjust the number and locations of the designated types and species to be used at any of the locations shown in order to provide for any modifications which might become necessary.

1.03 RELATED WORK

A. Section 02210 - Site Grading

B. Section 02910 – Tree Relocation

B. Section 02920 - Sodding

1.04 QUALITY ASSURANCE

A. Responsibility for Assuring Quality Work: The CONTRACTOR'S Superintendent shall be well versed in Florida plant material, planting operations, blue print reading, and coordination with other performing contracts or services in the job area.

All employees shall be competent and highly skilled in their particular job in order to properly perform the work assigned to them. The CONTRACTOR shall be responsible for maintaining the quality of the material on the job throughout the duration of the CONTRACT.

B. Correct Grade of Plants: In the event that it becomes apparent that any nursery supplying plants for this work has knowingly and consistently represented the grade of plants as being higher than their actual grades as determined under these provisions, all plants already delivered from such sources shall be removed from the job at the CONTRACTOR'S expense, and no further plants will be accepted from such nursery until written evidence is submitted and confirmed that all material for delivery has been inspected and approved by inspectors of the State Plant Board as being of the grade as represented.

C. Authority for Nomenclature, Species, Etc.: All plant material shall conform to the names given in Hortus Third, 1976 edition. Names of varieties not included therein conform generally with names accepted in the nursery trade.

D. Grade Standards: All plant materials shall be nursery grown except where specified as collected material, and shall comply with all required inspections, grading standards and plant regulations as set forth by the Florida Department of Agriculture's "Grades and Standards for Nursery Plants" revised 1973, or with any superseding specifications that may be called for on the Plans or in the Specifications. ALL PLANTS NOT LISTED IN THE GRADES AND STANDARDS FOR NURSERY PLANTS, shall conform to a Florida No. 1 as to: (1) Health and Vitality, (2) Condition of Foliage, (3) Root System, (4) Freedom from Pest or Mechanical Damage, (5) Heavily Branched and Densely Foliated according to the accepted normal shape of the species, or sport, (6) Form and branching habit.

E. Balled and Burlapped (B&B) and Wire Balled and Burlapped (WB&B) Plants: These plants shall be properly protected until they are planted. The plant shall be handled only by the earth ball and not be the plant itself.

Any (B&B) or (WB&B) plant which shows evidence of having handled by a method other than the method outlined above, and resulting in a cracked or broken ball or of the roots being loosened within the ball shall be rejected.

For plants grown in soil of loose texture, which does not readily adhere to the root system, (especially in the case of large plant material), WB&B plants may be specified. For WB&B plants, before plant is removed from the hole, sound hog wire shall be placed around the burlapped ball and looped and tensioned until the burlapped ball is substantially packaged by the tightened wire netting, such as to prevent disturbing of the loose soil around the roots during handling. Any wire, synthetic material or chemically treated material will be removed from the rootball at planting time, all ties shall be removed from the rootball and around the trunk at planting.

F. Container Grown Plants (CG): Any Container Grown (CG) plants, which have became "pot bound" or for which the top system is out of proportion (larger) to the size of the container, will not be acceptable.

With metal containers, unless the root-ball system slips easily and unbroken from the can, a nursery can-cutter shall be used to slit the can in such a way that the can may be opened fully.

CG plants shall not be removed from the can until immediately before planting, and with all due care to prevent damage to the root system.

G. Submit to the ENGINEER the names and locations of nurseries proposed as sources of acceptable plant material. The ENGINEER reserves the right to visit the nursery to inspect and/or select the specified material.

H. The OWNER reserves the option to disallow any vegetation that Staff determines may be a hazard or maintenance problem.

1.05 DELIVERY, STORAGE AND HANDLING

A. Inspection and Transporting: Movement of nursery stock shall comply with all Federal, State, and local laws and regulations. Therefore, required inspection certificates shall accompany each shipment, and shall be filed with the ENGINEER.

Wrap root balls with burlap. Wire wraps burlap if root ball is not sufficiently compacted. Palms will not require burlap wrapping if the following requirements are met:

1. Dug from marl or heavy soil that adheres to roots and retains shape without shattering.

2. Moistened material used to cover ball and roots not exposed to wind and sun.

3. Transport material on vehicles large enough to allow plants not to be crowded. Plants shall be covered to prevent wind damage during transit and shall be kept moist, fresh and protected at all times. Such protection shall encompass the entire period, which the plants are in transit, being handled, or are in temporary storage.

B. All plant material shall not remain on the work site longer than two (2) days prior to being installed.

1.06 SUBSTITUTIONS

A. Substitutions of plant types or change in the size of plant material will only be permitted upon submission of documented proof that the particular plant type and size specified is not obtainable.

B. Where B&B or WB&B plants are specified, CG plants of the same species, etc., will not be accepted. Where a B&B or WB&B is not specified on a particular plant material, B&B, WB&B or CG plants may be used provided they meet all specifications.

1.07 GUARANTEE

A. All plant material shall be guaranteed for a minimum of one (1) calendar year from the time of final acceptance.

1.08 REPLACEMENT

A. The guaranteeing of plant material shall be construed to mean the complete and immediate replacement of plant material if it is:

1. Not in a healthy growing condition.

2. There is a question to its survival ability at the end of the guarantee period.

3. It is dead.

1.09 SIZE, QUALITY AND GRADE OF REPLACEMENT

A. Replacement plant material shall be of the same species, quality and grade as that of the plant to be replaced. The size of the replacement shall not necessarily be the same size as the original specified plant at its initial planting but shall closely match specimens of the same species. Replacements shall be guaranteed for a period equal to the originally specified guarantee. This guarantee period shall begin at time of plant replacement.

1.10 GUARANTEE NULL AND VOID

A. The guarantee shall be null and void for plant material which is damaged or dies as a result of "Act of God" limited to hail, freeze, lightening, winds which exceed hurricane force, and lethal yellowing, providing the plant was in a healthy growing condition prior to these "Acts of God".

PART 2 - MATERIALS

2.01 PLANT MATERIAL

A. Florida No. 1: Except where another grade is specifically called for in the Plans, all plant material shall be no less than Florida No. 1 at the time of final inspection immediately prior to the acceptance by the OWNER.

B. Habit of Growth: All plant material shall have a habit of growth that is normal for that species and shall be sound, healthy, vigorous and free from insects, plant diseases, injuries, and dead limbs.

C. Branching, Leafing, Measurements and Ball Sizes:

1. Trees and Shrubs: Requirements for the measurement, branching character, ball diameter, depth and other standards shall follow the Code of Standards recommended by the American Association of Nursery Stock, Bulletin Z-60.1-1973 and as revised.

2. Palms: Requirements for the measurement of clear trunk, clear wood and graywood ball diameter and depth shall comply with requirements as set forth by the Florida department of Agriculture's "Grades and Standards for Nursery Plants, Part II for Palms and Trees".

D. Die-Back and Leaf-Drop: Plant material showing signs of die-back or leaf-drop will not be accepted and must be removed from the job immediately if so directed by the ENGINEER. Therefore, any plant material with tendencies toward leaf-drop or dieback must be root pruned early enough to provide a sound network of hair roots prior to relocation to the job site.

E. Mechanical Destruction of Foliage: Mechanical destruction of foliage resulting from root pruning shall not effect more than 10% of the total foliage prior to planting on the job site. Loss of foliage caused by seasonal change will be accepted.

F. Spanish Moss: If Spanish Moss (Tillandsia usneoides) exists on plant material, it shall be completely removed prior to planting on the job site.

G. Palms: Before transporting, see Delivery, Storage and Handling; for requirements related to wrapping of root balls.

1. Remove a minimum of fronds from the crown of the palms to facilitate transporting and handling.

2. Palms with burn marks, nail holes, and frond boots on trunk shall not be accepted.

3. Using untreated burlap strip or untreated cotton twine, tie Sabal Palmetto buds and leave in place until Palmetto is established. Tying shall be as set forth in Florida

Department of Agriculture's "Grades and Standards for Nursery Plants". Tying of other palms shall be at the option of the CONTRACTOR.

4. To reduce head volume, Palm fronds may be taper trimmed by not more than one-third (1/3).

5. Palm trees showing cable or chain marks and equipment scars shall be rejected.

H. Chlorosis: The allowable level of Chlorosis in foliage shall be as set forth in the Florida Department of Agriculture's "Grades and Standards for Nursery Plants".

2.02 PLANTING SOILS

A. General Type: All plant material with the exception of Sabal Palmetto shall be planted with planting soil mixed with 50% original soil, if the soil is of good quality, as determined by the ENGINEER. The planting soils shall be sandy loam (50% sand, and 50% muck) typical of the locality. The soil must be taken from ground that has never been stripped, with a slight acid reaction (5.5 to 6.5 ph) and without an excess of calcium or carbonate. Soil shall be delivered in a loose friable condition.

B. Special Type: Planting soil for palms shall be a good grade of salt free sand, which is free of all weeds.

2.03 WATER

A. Water shall be potable, from municipal water supplies or other sources, which are approved by a public health department.

2.04 MULCH

A. Mulch shall be Eucalyptus mulch or other approved non-native tree bark mulch. It must be uniformly shredded and be free from pieces of bark larger than 1 inch, foreign matter, weed seeds and any other organic or inorganic material. Submit sample for approval. CONTRACTOR shall apply one application at initial installation and a second application prior to final acceptance.

2.05 FERTILIZER

A. New Plant Material: Trees, palms and shrubs, fertilize with Agriform planting tablets, 20-20-5 formula, 21 gram or approved equal.

B. New Ground Covers: Fertilize with an approved fertilizer of fifty percent (50%) or greater organic 6-6-6 or 8-8-8 with minor elements including, but not limited to, iron zinc and manganese.

C. Composition of Quality: All fertilizer shall be uniform in composition and dry. Granular fertilizer shall be free flowing and delivered in manufacturers standard container with name of material, weight and guaranteed analysis printed on container. Tabletized fertilizer shall be delivered in unopened containers or boxes. All bags, containers or boxes shall be fully labeled with the manufacturer's analysis. Submit labels to ENGINEER for approval prior to placement of fertilizer.

D. All shall comply with the State of Florida fertilizer laws.

2.06 PRUNING PAINT

A. Pruning paint shall be commercial tree paint, which is waterproof, antiseptic, adhesive, elastic and free of kerosene, water, cresol and any other substances harmful to plant material.

2.07 VEGETATIVE ROOT INHIBITOR

A. A vegetative root inhibitor shall consist of a polypropylene fabric with root control time-release modules of Trifluralin with an effective life of 100 years or approved equal.

B. Vegetative root inhibitor shall be Bio-Barrier as manufactured by Reemay, Inc. or approved equal.

PART 3 - EXECUTION

3.01 INSPECTION

A. Utilities: The location and existence of utilities (overhead and underground) shall be thoroughly investigated and verified by the CONTRACTOR before the work begins in the area of said utilities. The CONTRACTOR shall exercise care in digging and work so as not to damage existing utilities in said areas, such as underground pipes, cables, wires, etc. Should such overhead or underground obstructions be encountered which interfere with planting, the ENGINEER shall be consulted immediately in order for a decision to be made on the relocations of plant material to clear such obstruction. The CONTRACTOR shall be responsible for the immediate repair of any damage to utilities caused by CONTRACTOR's work.

3.02 PREPARATION

A. Staking Plant Locations: Plant locations must be staked or marked prior to plant hole excavation or placing on deck, by scaling the plants from existing features found on-site and shown on the plans or by given dimensions if shown.

B. Spacing of Shrubs: Shrub beds located next to another bed, walkway, structure, etc., shall have the plants along the perimeter spaced so that the plants can mature properly without growing into the other bed, walkway, structure, etc.

C. Excavation of Plant Holes: Excavation of plant holes shall be roughly cylindrical in shape with the sides approximately vertical. The ENGINEER reserves the right to adjust the size and shape of the plant hole and the location of the plant in the hole to compensate for unanticipated structures or unanticipated factors. All plant holes shall be sufficiently deep to allow the rootball to set on existing soil and have root collar at grade level. Plants shall be centered in the holes with the tree trunk locations scaled from existing permanent structures as shown on the drawings. Plants shall be set straight or plumb in locations. All plant holes to accommodate plants with ball sizes less than 24 inches in diameter shall be at least 18 inch greater than the diameter of the ball. All plants holes to accommodate plants with ball sizes two feet (2') and larger in diameter shall be at least twice the diameter of the ball. The excavated material from the plant holes may not be used to back-fill around the plant material. Such material shall be disposed of either on the project site or off the site as directed by the ENGINEER. Plant holes for shrub material planted in mass shall meet all requirements listed

above for plant holes. However, they shall not be individual holes but one continuous hole or excavation. Plant holes for hedge material shall also meet all requirements listed above for plant holes, however, a continuous trench shall be used in lieu of individual holes.

3.03 INSTALLATION

A. Setting of Plants:

1. When lowered into the hole the plant shall rest on the prepared hole bottom such that the roots after settlement are level, or slightly above the level of its previous growth condition and the final level of the ground around the plant shall conform to the surrounding grade. The plants shall be set straight or plumb or normal to the relationship of their growth prior to transplanting. The ENGINEER reserves the right to realign any plant material after it has been set.

2. Palms of the Sabal species may be set deeper than the depth of their original growth condition in order to lessen the necessity for support or bracing. For such deeper planting however, it will be required that the underlying soil be friable and that the clear trunk requirements set forth in the plant list be maintained from the finished grade and NOT from the previous grade of the palm trees before it was transplanted.

3. Plant material of the shrub category and smaller must be handled by the ball only. Plant material too large for hand handling, if moved by winch or crane, must be thoroughly protected from chain, rope or cable marks, girdling, bark slippage, limb breakage and any other damage that might occur by improper handling or negligence.

4. All palm trees handled by the trunks must be wrapped with burlap and wood battens, held in place by banding strips as called for in the details.

B. Backfilling:

1. Use planting soils specified in Article 2.02, Planting Soil. Backfill to the bottom two thirds of the planting hole and firmly tamp and settle by watering as backfilling progresses. After having tamped and settled the bottom two thirds (2/3) of the hole, thoroughly puddle with water and fill remaining one third (1/3) of the hole with planting soil, tamping and watering to eliminate air pockets.

C. Application of Fertilizer:

1. Fertilize New Planting (Trees, Palms and Shrubs) as follows:

a.

Specified Container Size	Application Rate
1 gallon container	1 tablet
3 gallon container	2 tablets
5 gallon container	3 tablets
7 gallon container	5 tablets

b. Large tubs or boxes and B&B material shall receive one (1) tablet for each one-half (1/2) inch of trunk diameter (measured three (3) feet from ground). For large shrubs, one (1) tablet for each one (1) foot of height or spread.

D. Mulch: Within 24 hours after planting, planting areas must be mulched as called for in these specifications. The mulch shall be uniformly applied to a depth of two (2) inches over all shrub, tree and groundcover areas and any areas indicated on the plans.

E. Staking and Guying shall be installed within 24 hours; in accordance with details.

F. Initial Watering: Initially, water the plant material to develop uniform coverage and deep-water penetration of at least six inches (6"). Avoid erosion, puddling, and washing soil away from plant roots.

G. Hand Watering: Provide hand watering of plant material as necessary subject to weather conditions, to maintain healthy growing conditions until final acceptance. This shall be in addition to water received from irrigation system, if any.

H. Pruning:

1. The amount of general pruning shall be limited to the minimum necessary to remove dead or injured twigs and branches and to compensate for the loss of roots as a result of transplanting operations. Pruning shall be done in such a manner as not to change the natural habit of shape of a plant, and in accordance with National Arborist Association standards for pruning.

2. All broken or damaged roots shall be cut off smoothly. The tops of all trees shall be pruned in a manner complying with standard horticultural practices. All cut surfaces of one-half inch (1/2") or more in diameter above ground level shall be treated with approved commercial tree paint.

I. Weeding: In the event that weeds or undesirable vegetation becomes prevalent to such an extent that they threaten plant material, they shall be removed as directed by the ENGINEER. If necessary, the plant material and/or planting soil shall be replaced as needed to eliminate the weeds at the expense of the CONTRACTOR.

3.04 CLEANING AND PROTECTION

A. Disposal of Trash: All debris and other objectionable material created through planting operations and landscape construction shall be removed completely on a daily basis from the job or as directed by the ENGINEER. Excess soil shall be disposed of as directed by the ENGINEER.

B. Responsibility for Protection and Restoration of Property: The CONTRACTOR shall be responsible for all damage to property whether it is accidental or necessary for the completion of the contract.

C. Protection Against Mechanical Damage: The CONTRACTOR's responsibility for protection against mechanical damage shall include providing protection from vehicles and providing warning signs and barricades as might be necessary and CONTRACTOR shall repair, restore and replace any planting areas which become damaged as a result of any negligence of the CONTRACTOR or CONTRACTOR’s employees in complying with these requirements. Coordination shall be with the OWNER and the ENGINEER.

D. Responsibility Prior to Final Acceptance:

1. Maintenance shall begin immediately after each plant is planted and continue until final acceptance.

2. Plants shall be watered by hose, soaking thoroughly each day for the first two weeks (14 calendar days) and every other day for the following two week period. Soaking then shall continue on a twice weekly basis for another period of three (3) weeks for material over five feet (5') height, amounting to a total of 28 days after installation of planting under five feet (5') and a total of 45 days for plants over five feet (5'). All watering is required without regard to an irrigation system.

3. Plant maintenance shall include watering, pruning, weeding, cultivating, mulching, tightening and repairing of guys, stakes, braces, etc., replacement of sick or dead plants, resetting plants to proper grades or upright position and maintenance of the watering saucer, and all other care needed for proper growth of the plants. Plant material rejected during the course of the construction shall be removed within five (5) working days and replaced before the inspection for completion will be scheduled.

4. During the maintenance period and up to the issuance of Certificate of Final Acceptance, the CONTRACTOR shall do all seasonal spraying and/or dusting of all planting. The materials and methods shall be in accordance with the highest standard nursery practices and as recommended by the City Agent, or Horticultural ENGINEER and approved by the ENGINEER, prior to implementation.

5. Planting areas and plants shall be protected against trespassing and damage. If any plants become damaged or injured they shall be treated or replaced, as directed and in compliance with this specification. No work shall be done within or over planting areas or adjacent to plants without proper safeguards and protection.

3.05 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on actual quantities installed as more specifically discussed and described in SECTION 01025 of MEASUREMENT AND PAYMENT.

END OF SECTION 02900

SECTION 02910
TREE RELOCATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1-General Requirements shall govern the WORK under this section.

1.02 WORK INCLUDED

A. The work included in this section consists of furnishing all labor, supplies equipment and materials necessary to complete the removal and relocation of existing trees as shown on the Plans, as well as all other related responsibilities as described in these Specifications and accompanying plans.

B. Before tree excavation, pruning, removal, or relocation of existing trees, contractor shall notify:

1. The OWNER of schedule of operation.

2. Appropriate utility companies and the Owner for flagging and coordination of service disconnection as necessary to complete work.

3. Coordinate work with other trades.

4. Coordinate with OWNER for location of relocated tree to be relocated within the Eastern Shores neighborhood.

1.03 RELATED WORK

A. Section 02900 – Landscape Work

1.04 REFERENCES

A. American National Standards Institute (ANSI): Z60.1 American Standard for Nursery Stock.

B. Florida Department of Agriculture and Consumer Services: "Grades and Standards for Nursery Plants".

C. National Arborist Association (NAA): Ref.1 Transplanting of Trees and Shrubs in the Southeastern United States.

1.05 DESCRIPTION

A. Protect existing trees to remain during construction phases. Provide tree protection barriers for those existing trees adjacent to tree transplantation operations. Any trees scarred or destroyed, designated to remain, will be replaced at the Contractor's expense, with similar species, size, and quality.

B. Remove other vegetation as necessary and as directed by the A/E to accommodate new plantings. Prepare areas to be planted according to Section 02900.

C. Resulting tree pits of relocated material shall be backfilled with clean fill and brought back flush with surrounding grade, unless the pits are to be immediately replanted. Stabilize grade if required. Correct problems caused by erosion, wind, etc., in the reclaimed area. Pits to be quickly replanted shall be surrounded by safety barricades to prevent accidental falls into pits.

1. In areas where new plant material will replace relocated plant material, appropriate planting soil mix shall be used as backfill.

1.05 SUBMITTALS

A. Submit a list of equipment, procedure, and labor force anticipated for use for tree relocation for approval by the OWNER.

B. Submit a schedule by day indicating units to be dug and relocated. Note materials requiring root pruning, and that the relocation schedule is to begin at the end of the specified root pruning period.

C. Obtain permits required by authority having jurisdiction.

D. Submit written certification that trees indicated to remain have been protected during the course of construction according to recognized standards of the industry. Certify that where damage did occur:

1. Trees were promptly and properly treated.

2. Indicate which damaged trees (if any) are incapable of retaining full growth potential and are recommended to be replaced.

E. Obtain permits required by authority having jurisdiction.

1.06 QUALITY ASSURANCE

A. The Contractor's crew used for the relocation of existing trees shall have minimum five (5) years experience in relocation of existing plant materials and be recognized by the American Association of Nurserymen.

B. Unless otherwise specified, tree transplanting shall comply with NAA Ref.1.

C. Comply with NAA standards for pruning and remove branches from trees to remain to clear new construction.

D. Recommend procedures to compensate for loss of roots (if any) and perform initial pruning of branches and stimulation of root growth where removed to accommodate new construction.

E. Perform tree repair work for damage incurred by new construction.

F. Provide routine progress evaluation reports on relocated trees until the end of the maintenance period.

G. Evaluate existing trees and verify trees are free of disease and ready to survive relocation from the site to their new location on-site or off-site.

SECTION 02910
TREE RELOCATION

1.07 DELIVERY, STORAGE, AND HANDLING

A. Properly handle trees and palms during moving so trunks will not be scarred or damaged and to avoid broken limbs. Broken limbs not causing the tree to be rejected shall be repaired as follows:

1, Properly prune dead, dying, or damaged branches with clean, sharp equipment.

2. Remove injured bark and wood of a tree would with a clean, sharp knife to a point where healthy bark and wood make contact at their margins.

3. Inspect and treat wound for insect and disease.

4. Seal wounds with bituminous base wound paint for all oak limbs greater than 3 inch diameter.

B. Transport trees on vehicles of adequate size to prevent overcrowding, broken limbs, foliage damage, or root ball damage.

C. Keep root balls moist during relocation.

D. Protect tree crowns with shade cloth to prevent desiccation and wind burn. Crowns shall be periodically sprayed with water to help ensure against desiccation.

E. Handle plant material only in ways and means accepted by the landscaping industry and accepted by the OWNER.

F. Plant material shall be planted the same day it is dug. Coordinate preparation of planting pits or beds to ensure this schedule.

1.08 WARRANTY

A. Relocated plant material does not fall under the standard 12 month guarantee.

B. For relocated trees or palms that die, replace their canopy area with new trees as specified.

1. Canopy spread for all palms and trees shall be listed on proposal when submitted for relocation work.

2. Replacements (mitigation plantings) shall be provided at no additional cost to the OWNER.

3. Proposed replacement canopy tree species shall be OWNER accepted trees and palms.

4. The specification requirements for these trees and palms are according to Section 02900.

C. Repair damage to other plants and lawn or construction work within the relocation area during tree transplantation at no cost to the OWNER. This includes, but is not limited to, damage to curbs, walks, roads, fences, site furnishings, etc. Replacing and replanting of damaged trees, shrubs or turf shall be according to Section 02900.

1.09 MAINTENANCE

A. Maintain relocated plant materials immediately after each item is planted and continued until the 90 day watering period is completed, upon which time the OWNER will take over maintenance of materials following procedures and recommendations of contractor and specifications.

B. During the maintenance period, maintain relocated plant materials according to procedures described in Section 02900.

PART 2 PRODUCTS

2.01 MATERIALS

A. Bone meal shall be readily available steamed bone meal, useable as a natural organic nitrogen fertilizer.

B. Peat moss, topsoil, planting soil, mulch, staking, and guying, shall be as specified in section 02900.

C. Fill materials shall be as specified in Section 02900.

PART 3 EXECUTION

3.01 TRANSPLANTATION

A. Transplanting shall consist of on-site or off-site transplanting of existing trees or palms from proposed construction areas to permanent positions as directed by the OWNER within the Eastern Shores neighborhood as noted on the drawings.

B. Digging, Wrapping, and Handling: Plants shall be dug and prepared for moving in a manner that will not cause damage to branches, shape, root system, and development.

C. Balled and Burlapped Plants:

1. Balls shall be firmly wrapped with burlap or accepted cloth substitute.

2. No balled plant will be acceptable if the ball is cracked and broken or if the stem or trunk is loose in the ball, either before or during transplanting.

3. Balled plants shall be lifted and handled from the bottom of the ball.

4. Protect ball and deliver to the site, plant immediately, and water thoroughly.

5. Ball sizes shall be as recommended in ANSI Z60.1

3.02 PLANTING

A. Relocated Material:

1. Relocated trees/palms shall be planted according to procedures described for new material, Section 02900. Verify final grades have been established before planting

operations. Ensure proposed planting pits drain by test-filling with water before transplantation.

2. Continue watering and caring for relocated material as specified.

3. Mulch tree pit areas to reduce weeds, discourage foot traffic, conserve moisture, and minimize temperature fluctuations.

4. Brace trunk and leave in place for approximately one year until trees are wind firm.

5. Wrap trunks and structural branches of thin-barked trees to protect against sun scald and dehydration. Retain through at least one growing season, and through cold season.

6. Feed with a diluted solution of N-P-K in solution form with a soil needle, providing water, air, and nutrients.

7. Where foliage is retarded, spray with one of the soluble types of foliage feeders.

8. At time of planting, fill air pockets and keep roots, especially feeder roots, moist, live, and healthy. Use soil needles for watering new transplants. Direct fine spray at foliage to help harden-off new leaves.

3.03 STAKING AND GUYING

A. Stake and guy designated material according to procedures described for new plant materials, Section 02900.

3.04 WATERING

A. Following transplantation, water trees daily for the first two weeks, every other day for the next three weeks, and every third day for the balance of the three month watering/maintenance period. Such watering shall thoroughly saturate the root ball to its full depth.

B. Following relocation, trees designated for transplanting shall be watered as specified in this section. Such watering shall thoroughly saturate the root ball to its full depth.

C. Provide manual watering of relocated plant materials for 90 days. If used, after watering period, Contractor shall be responsible for the complete removal of all temporary watering systems.

3.05 TAGGING

A. Trees within the designated areas for relocation shall be clearly marked by means of yellow plastic surveyor's ribbons and coordinated with, inspected, and accepted by the OWNER before root pruning and digging.

3.06 ROOT PREPARATION

A. Trees to be relocated shall be root pruned at least eight (8) weeks before digging with clean, sharp equipment.

1. Maintain root pruned materials by watering, weeding, mowing, spraying, fertilizing, and other horticulture practices.

2. After root pruning, backfill with good rooting medium, fertilize with organic fertilizer to promote root growth.

3. Mulch to reduce weeds, discourage foot traffic, conserve moisture, and minimize temperature fluctuation.

B. Root Ball Size Chart: Root ball sizes shall be according to minimum standards set forth in Grades and Standards for Nursery Plants Part II, Palms and Trees, Florida Department of Agriculture.

1. Trees-Minimum Ball Sizes:

Caliper	Minimum Ball Diameter
3-1/2" to 4"	28"
4" to 4-1/2"	30"
4-1/2" to 5"	32"
5" to 5-1/2"	34"

Larger sizes increase proportionally.

2. Minimum Ball Depth:

Ball Diameter	Depth
Less than 20"	Not less than 75 percent of diameter.
20" to 30"	Not less than 65 percent of diameter.
30" to 48"	Not less than 60 percent of diameter.

3.07 CROWN PREPARATION

A. Shade and Flowering Trees:

1. Shade Trees: Selectively prune and thin crown to remove approximately one third of the branches. Preserve the basic shape and form of the tree, eliminate cross-branching and dead or diseased branches.

2. Hand strip selected species of all leaves following pruning and before moving.

B. Palms: Follow standard procedure for transplantation of palms.

3.08 HAND DIGGING

A. Burlapping is required. Trees that are burlapped for relocation shall comply and be handled in same manner as new plant material specified in Section 02900.

3.09 SPECIAL CONDITIONS

A. Multi-Trunk Trees: Relocate multi-trunk tree as one unit. Measure unit by taking the aggregate total of all DBH measurements.

B. Multi-Trunk Palms: Relocate multi-trunk palms as one unit. Unit shall be measured as follows:

1. 50 percent of the value in dollars of the largest trunk in the grouping times the number of trunks in the clump.

C. On-site relocation:

1. On-site relocation shall include root pruning, canopy pruning, on-site transportation, hauling and dumping of debris, and 90- day maintenance.

2. If the tree or palm should die within the 90 day maintenance period, remove the tree, replace the material, and restore the site at no additional cost to the OWNER.

3.10 CLEANING

A. Site Clean-up:

1. Upon completion of the work, thoroughly clean up the project site.

2. Remove equipment, unused materials, deleterious material, and surplus excavated material.

3. Fine grade all disturbed areas and the areas adjacent to the transplanted material to provide a neat and uniform site.

4. All damaged or altered existing structures, as a result of the landscape work, shall be corrected.

END OF SECTION 02910

SECTION 02920
SODDING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. All applicable provisions of the Bidding and Contract Requirements, and Division 1-General Requirements shall govern the WORK under this section.

1.02 WORK INCLUDED

A. The work included in this section consists of furnishing all labor, supplies, equipment and materials necessary to complete the installation of sod and associated materials herein after listed and as shown on the plans.

1.03 RELATED WORK

A. Section 02200 - Earthwork.

B. Section 02210 - Site Grading

C. Section 02900 - Landscape Work.

1.04 QUALITY ASSURANCE

A. Sodding work shall be performed by a firm specializing in sodding.

B. Source Quality Control: Ship sod with certificates of inspection as required by governing authorities.

Do not make substitutions. If specified sod is not obtainable, submit proof of non-availability to ENGINEER, together with proposal for use of equivalent material.

C. Analysis and Standards: Package standard products with manufacturer have certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

1.05 SUBMITTALS

A. Submit the following in accordance with Conditions of Contract and Division 1 Specification Sections.

B. Plant and Material Certifications:

1. Certificate of inspection as required by governmental authorities.

2. Manufacturer's or vendor's certified analysis for soil amendments or fertilizer materials.

1.06 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis, and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

B. Sod: Time delivery so that sod will be placed within 24 hours after stripping. Protect sod against drying.

C. Transporting:

1. Sod transported to the project in open vehicles shall be covered with tarpaulin or other suitable covers securely fastened to the body of the vehicle to prevent injury to the sod material. Closed vehicles shall be adequately ventilated to prevent overheating of the sod. Evidence of inadequate protection against drying out in transit shall be cause for rejection.

2. Sod shall be kept moist, fresh and protected at all times. Such protection shall encompass the entire period during which the sod is in transit, being handled, or in temporary storage.

3. Upon arrival at the temporary storage location or the site of work, sod shall be inspected for proper shipping procedures. Should the roots be dried out, the ENGINEER will reject the sod. When sod has been rejected, the CONTRACTOR shall remove it at once from the area of the work and replace it.

4. Unless otherwise authorized by the ENGINEER, the CONTRACTOR shall notify the ENGINEER at least 48 hours in advance of the anticipated delivery date of sod material. A legible copy of the invoice, showing species and variety of sod included for each shipment shall be submitted to the ENGINEER. Certificate of Inspection must accompany each sod shipment.

1.07 JOB CONDITIONS

A. Begin installation of sod after preceding related work is accepted.

B. Environmental Requirements:

1. Install sod during months acceptable to the ENGINEER.

2. Do not install sod on saturated soil.

C. Protection: Erect signs and barriers to control vehicular traffic.

D. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Maintain grade stakes set by others until parties concerned mutually agree upon removal.

1.08 SEQUENCING AND SCHEDULING

A. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.

B. Coordination with sodding: Plant trees, palms and shrubs after final grades are established and prior to planting of sod, unless otherwise acceptable to ENGINEER. If planting of trees, palms and shrubs occurs after sod work, protect sod areas and promptly repair damage to lawns resulting from planting operations.

1.09 SPECIAL PROJECT WARRANTY

A. Warranty sod through specified lawn maintenance period, and until final acceptance.

PART 2 - PRODUCTS

2.01 PLANTING SOIL

A. Provide new planting soil that is fertile, friable, natural loam, surface soil, reasonably free of subsoil, clay lumps, brush, weeds and other litter, and free of roots, stumps, stones larger than 1 inch in any dimension, and other extraneous or toxic matter harmful to plant growth.

B. Obtain planting soil from local sources or from areas having similar soil characteristics to that found at project site.

C. Refer to Section 162 of the "FDOT Standard Specifications for Road and Bridge Construction" latest edition for Topsoil Specifications.

2.02 COMMERCIAL FERTILIZER

A. For sod, provide fertilizer with percentage of nitrogen required to provide not less than 1 pound of actual nitrogen per 1,000 square foot of lawn area and not less than 4 percent phosphoric acid and 2 percent potassium. Provide nitrogen in a form that will be available to sod during initial period of growth; at least 50 percent of nitrogen to be organic form.

2.03 SOD

A. Provide strongly rooted sod, not less than 2 years old, free of weeds and undesirable native grasses, and machine cut to pad thickness of 1-1/2 inch (plus or minus 1/4 inch), excluding top growth and thatch. Provide only sod capable of vigorous growth and development when planted (viable, not dormant).

B. Provide sod uniform pad sizes with maximum 5 percent deviation in either length or width. Broken pads with uneven ends will not be acceptable. Sod pads incapable of supporting their own weight when suspended vertically with a firm grasp on upper 10 percent of pad will be rejected.

C. Provide sod composed of the type specified on the project plans.

D. Sod shall be nursery grown on cultivated mineral agricultural soils. Sod shall have been mowed regularly and carefully maintained from planting to harvest.

E. American Sod Producers Association (ASPA) Grade: Nursery Grown or Approved. Field grown sod is not acceptable.

F. Furnished in pads:

1. Size:

a. Length: 24 inches plus or minus 5%.
b. Width: 18 inches plus or minus 5%

c. Thickness: 1-1/2 inches excluding top growth and thatch.

2. Not stretched, broken or torn.

G. Uniformly mowed height when harvested: 2 inches.

H. Thatch: Maximum 1/2 inch uncompressed.

I. Inspected and found free of disease, nematodes, pests, and pest larvae, by entomologist of State Department of Agriculture.

J. Weeds:

1. Free of Bermuda grass, nut grass or other objectionable weeds.

K. Uniform in color, leaf texture, and density.

2.04 WATER

A. Water shall be potable, from municipal water supplies or other sources which are approved by a public health department.

2.05 FERTILIZER

A. FS O-F-241c (1), Grade A or B.

B. The chemical designation shall be 1-8-8, with at least 50 percent of the nitrogen from a non-water-soluble organic source.

2.06 HERBICIDES

A. As recommended by the State Department of Agriculture.

2.07 STAKES

A. Softwood, 3/4-inch diameter, 8-inch length.

PART 3 - EXECUTION

3.01 PREPARATION OF GROUND SURFACE

A. Before mixing, clean planting soil of roots, plants, sods, stones, clay lumps, and other extraneous material harmful or toxic to plant growth.

B. Mix specified fertilizers with planting soil as necessary at rates specified. Delay mixing fertilizer if planting will not allow placing of planting soil within a few days.

C. For sod, mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly before planting.

SECTION 02920
SODDING

3.02 PREPARATION OF PLANTING BEDS

A. Loosen subgrade of lawn areas to a minimum depth of 4 inches. Remove stones measuring over 1 1/2 inches in any dimension. Remove sticks, stones, rubbish, and other extraneous matter. Limit preparation to areas, which will be planted promptly after preparation.

B. Spread planting soil to minimum depth of 2 inches or as required meeting lines, grades, and elevations shown, after light rolling and natural settlement. Add specified fertilizer and mix thoroughly into upper 4 inches of topsoil.

C. Place approximately 1/2 of total amount of topsoil required. Work into top of loosened subgrade to create a transition layer and then place remainder of planting soil. Add specified soil amendments and mix thoroughly into upper 4 inches.

D. Where sod is to be planted in areas that have not been altered or disturbed by excavating, grading, or stripping operations, prepare soil for lawn planting as follows: Till to a depth of not less than 6 inches. Apply fertilizers as specified. Remove high areas and fill in depressions. Till soil to a homogenous mixture of fine texture, free of lumps, clods, stones, roots and other extraneous matter.

E. Prior to preparation of unchanged areas, remove existing grass, vegetation and turf. Dispose of such material outside of OWNER's property. Do not turn existing vegetation over into soil being prepared for lawns.

F. Allow for sod thickness in areas to be sodded.

G. Apply specified commercial fertilizer at rates specified and thoroughly mix into upper 2 inches of topsoil. Delay application of fertilizer if lawn planting will not follow within a few days.

H. Fine grade sod areas to smooth, even surface with loose, uniformly fine texture. Roll, rake, and drag lawn areas, remove ridges and fill depressions, as required to meet finish grades. Limit fine grading to areas, which can be planted immediately after grading.

I. Moisten prepared sod areas before planting if soil is dry. Water thoroughly and allow surface to dry before planting lawns. Do not create a muddy soil condition.

J. Restore sod areas to specified condition, if eroded or otherwise disturbed, after fine grading and prior to planting.

3.03 SODDING NEW LAWNS

A. Lay sod within 24 hours from time of stripping.

B. Lay sod to form solid mass with tightly fitted joints. Butt ends and sides of sod strips; do not overlap. Stagger strips to offset joints in adjacent courses. Work from boards to avoid damage to subgrade or sod. Tamp or roll lightly to ensure contact with subgrade. Work sifted soil into minor cracks between pieces of sod; remove excess to avoid smothering of adjacent grass.

C. Anchor sod on slopes with wood pegs to prevent slippage.

D. Water sod thoroughly with a fine spray immediately after planting.

3.04 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Maintain lawns for not less than 30 days after substantial completion, and longer as required to establish an acceptable lawn.

C. Maintain sod by watering, fertilizing, weeding, mowing, trimming, and other operations such as rolling, regrading and replanting as required to establish a smooth, acceptable lawn, free of eroded or bare areas.

D. Mowing:

1. Whenever grass reaches a height of 3 inches, it shall be cut back to 2 inches with all clippings removed.

2. After two mowings, CONTRACTOR shall topdress the sod with an application of fertilizer at the rate of 1 pound of actual nitrogen per 1,000 square feet.

3.05 CLEANUP AND PROTECTION

A. During sodding work, keep pavements clean and work area in an orderly condition.

B. Protect sodding work and materials from damage due to landscape operations, operations by other CONTRACTORs and trades, and trespassers. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged sod work as directed.

3.06 INSPECTION AND ACCEPTANCE

A. Sod areas will be accepted when in compliance with all the following conditions:

1. The roots are thoroughly attached to the soil.
2. Absence of visible joints.
3. All areas show a uniform stand of specified grass in healthy condition.
4. At least 60 days have elapsed since the completion of the work in this section.

B. When inspected sod work does not comply with requirements, replace rejected work and continue specified maintenance until reinspected by ENGINEER and found to be acceptable. Remove rejected plants and materials promptly from project site.

C. Procedure:

1. The CONTRACTOR shall submit a request for acceptance in writing to the ENGINEER. Request must be received not less than 10 days before the anticipated date for final inspection.

2. Upon completion of all repairs and/or renewals required by ENGINEER at the inspection, the ENGINEER will verify the completeness of the work and then notify the OWNER in writing that the work is accepted.

3. Upon completeness, the OWNER will assume maintenance of all sod areas.

SECTION 02920
SODDING

3.07 MEASUREMENT AND PAYMENT

A. Measurement and payment will be based on actual quantities installed as more specifically discussed and described in SECTION 01025 of MEASUREMENT AND PAYMENT.

END OF SECTION 02920