



**Office of the Purchasing Agent
2100 Clarendon Blvd., Suite 500
Arlington, VA 22201**

**ITB-23-DPR-ITBPW-450
Project Manual**

Department of Parks and Recreation

**Arlington Junction Park
1051 South Eads Street
Arlington, Virginia 22202**

Project includes, but is not limited to, demolition of existing park and portion of 11th street, site work, stormwater management and metal bridge, walkways, a raised crosswalk across 11th Street, seating areas, a dog relief spot, custom site furnishing, signage/wayfinding pylons, mist emitting structures, boulder walls, bermed landscape beds and landscaping, irrigation and site lighting.

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DIVISION 01

GENERAL REQUIREMENTS

SECTION 011000 – GENERAL CONDITIONS

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Work covered by the Contract Documents.
 - 2. Use of premises.
 - 3. General requirements.

1.02 WORK COVERED BY CONTRACT DOCUMENTS

- A. Project Identification: Arlington Junction Park
- B. Project Location: 1051 S.Eads Street, Arlington, Virginia
- C. Owner: Arlington County, Virginia
Department of Parks and Recreation
2100 Clarendon Boulevard, Suite 414
Arlington, VA 22201
- D. The Work consists of but is not limited to, the following:
 - 1. Demolition of any existing site features and capping of any existing utilities; and the construction of new site work and site improvements including walkways and pavements, seating nook areas, pet/dog areas, stormwater management and bio-retention areas, water mist elements and irrigation, signage, pylon structures, site lighting, metal bridge, and landscape planting. Proposed site improvements as shown on the Plans and specified hereinafter, including:
 - a. Site preparation including construction fences, tree protection fencing, temporary erosion and sediment control measures, test pits and construction stake-out.
 - b. Protection and maintaining and all other existing park property, Arlington County right-of-way, and other existing improvements as required.
 - c. Site restoration of all facilities damaged by construction operations, or as directed by Department of Parks and Recreation (DPR), to the original condition and/or the satisfaction of DPR. Site restoration includes, but is not limited to, pavement restoration, site grading, topsoil placement, seeding and sodding.
 - d. Site Improvements:
 - 1. Construction of walkways and pavements, seating nook areas, pet/dog areas, bio-retention areas, water mist elements, pylon structures, metal bridge, lighting, irrigation, and landscape plantings as shown on the Plans and Specifications.

2. Coordination of public water mist element with the vendor.

E. Project will be constructed under a single prime contract.

1.03 USE OF PREMISES

A. General: Contractor shall have limited use of premises for construction operations as indicated in the Specifications and on the Drawings by the Contract limits.

Parking: The Contractor shall organize its work in such a manner so as to minimize the impact of its operations on the surrounding community. To the extent that the number of workers on the site is likely to have an adverse impact on neighborhood parking, as determined by the County, the Contractor shall develop a parking plan for those individuals working on the site that is reasonably acceptable to the County. The delays in approving the parking plan shall in no way absolve the Contractor from their obligation to maintain a safe site or adhere to the Baseline Schedule.

B. Use of Site: Do not disturb portions of Project site beyond areas in which the Limit of Disturbance (LOD) is shown. Specific limitations on use of the site include the following:

1. Construction activity shall not take place inside designated tree protection areas, except when necessary. Contractor shall provide Project Officer with 72 hours notice when work within a tree protection area is necessary, so that the County's urban forester can be notified.
2. Maintain public access to areas outside the limits of work whenever possible. Contractor shall request approval from Project Officer 72 hours in advance when closures outside the limits of work are necessary.

1.04 GENERAL REQUIREMENTS

A. Coordination: The Contractor shall be responsible for coordinating all construction operations included in the various Sections of the Specifications to ensure efficient and orderly installation of each part of the work.

B. Project Officer: The performance of the Contractor is subject to the review and approval of the County Project Officer who will be appointed by the Arlington County department or agency requesting the work under the Contract.

C. Contact Person: The Contractor shall establish a single contact person that will be responsible for all communication between the Contractor (including all subcontractors) and the Project Officer, Landscape Architect, and/or Engineer.

D. Submittals: Upon Contract award, the Contractor shall immediately prepare a list of required submittals, based on the specifications, and begin to gather the required submittals for submission to the Project Officer within 30 days for critical (long-lead items) submittals and 45 days for others.

- E. Site Access: Contractor shall ONLY access site per plans. Contractor shall be responsible for any damage to park property from access point to construction entrance at the project's limits of disturbance.
 - F. Tree Protection: See plans.
 - G. Permits:
 - 1. The County shall provide the Virginia Stormwater Management Permit (VSMP) and the building permit to the Contractor. The Contractor is responsible for obtaining all other required permits (including but not limited to ROW, electrical and/or any other work necessary for the completion of the project) from the Arlington County Department of Environmental Services (DES) and/or Inspection Services Division (ISD).
 - 2. The Contractor is required to submit designs, shop drawings, structural calculations, engineer certifications, or other items required for permit approval. In that case, the Contractor shall build in the required time for obtaining, submitting, and gaining approval of these items into the construction schedule.
 - 3. Permits: Contractor shall be required to obtain any necessary permits except the following that will be provided by the County:
 - a. Virginia Stormwater Management Permit (VSMP)
 - b. Building Permit for pre-engineered structure*
 - c. Civil Engineering Plan (CEP) Permit
 - d. Land Disturbance Activity (LDA) Permit. After award of contract, the contractor shall transfer the LDA permit to the contractor's name and notify the Project Officer.
- *If contractor elects to use an 'approved equal' for pre-engineered structure, the contractor shall be required to provide Building Permit.
- 4. The Contractor is responsible for obtaining all other required permits from the Arlington County Department of Environmental Services (DES) and/or Inspection Services Division (ISD). The permits shall include but not limited to Right of Way, electrical, plumbing, mechanical, Energy Assessment, Certificate of Occupancy, Dumpster permit, Trailer permit and/or any other work necessary for the completion of the project.
 - 5. The Contractor is responsible for obtaining final BMP certification upon completion of the project. The Contractor shall submit to the Project Officer all documentation verifying approval and acceptance by the Department of Environmental Services. The Contractor is responsible for obtaining the services of an approved and qualified licensed third-party testing agency to inspect, document and certify the BMP installation per the approved plans and checklist. Final certification and acceptance of the BMP shall be granted by the Department of Environmental Services.
 - a. The contractor shall submit all documentation including as-builts for the BMP within one week after final planting and mulching is complete.
 - b. The contractor shall maintain all BMPs to include weed removal, general cleaning, erosion control, plant maintenance, maintain mulch depth, as required till the BMPs are certified by DES.

6. The Contractor is required to submit designs, shop drawings, structural calculations, engineer certifications, or other items required for permit approval. In that case, the Contractor shall build in the required time for obtaining, submitting, and gaining approval of these items into the construction schedule.

H. Subcontractors:

1. A list of proposed subcontractors shall be submitted to the Project Officer. Proposed subcontractors shall be subject to the review and approval of the Project Officer, who will respond to the proposed list of subcontractors within ten (10) working days of receipt. Reasons for rejection of a proposed subcontractor may include, but are not limited to, the following:
 - a. Unsatisfactory work on previous County contracts.
 - b. Lack of experience in the type of work to be subcontracted.
2. The Contractor is fully responsible for the work of its subcontractors, and any unsatisfactory work on the part of a subcontractor shall be remedied at the Contractor's expense if necessary.
3. A competent person from the Prime Contractor shall be present on the site during the work of all subcontractors. If such a person is not present while a subcontractor is working on the site, the Project Officer reserves the right to stop work. No Claims for Delay will be allowed as a result of such stoppages.
4. All subcontractors must be furnished with a full set of the contract drawings and specifications at the Contractor's expense, and subcontractors shall be required to have these documents on site while the work is being performed. If the subcontractor does not have access to a full set of plans and specifications while working on the site, the Project Officer reserves the right to stop work. No Claims for Delay will be allowed as a result of such stoppages.

I. Construction Schedule:

1. The construction schedule shall indicate the dates and date ranges where major components of the Work will be performed.
2. The schedule shall indicate the dates that required submittals will be provided and shall also indicate time allotted for the review and approval of submittals.
3. The Contractor shall maintain and update the schedule as necessary when conditions change and shall resubmit the updated schedule to the Project Officer.
4. The Contract completion date cannot be changed by submission of a construction schedule indicating a different completion date. The Contract completion date can only be changed if specifically authorized by Change Order.

J. Preconstruction Meeting:

1. The Contractor shall attend a preconstruction meeting on-site with the Project Officer, Landscape Architect, their Consultants, the Contractor, major subcontractors, major suppliers, and other concerned parties.
2. At the meeting, the Contractor shall provide the following:
 - a. Construction schedule
 - b. List of required submittals
 - c. List of proposed subcontractors

3. Items of significance that could affect the progress of the work shall be discussed at the meeting.
4. Requirements for tree protection and erosion control shall be reviewed.
5. The Contractor shall record and distribute meeting minutes.

K. Notice to Proceed:

1. After the preconstruction meeting, the Project Officer will issue a written Notice to Proceed (NTP) to the Contractor.
2. The date of the NTP will be the first day of the timeframe in which the work is to be completed.
3. Generally, the NTP date is agreed-upon between the Project Officer and the Contractor. However, in the event of non-responsiveness or delay on the part of the Contractor, the Project Officer reserves the right to issue a NTP unilaterally without the agreement of the Contractor.

L. Contract Deliverables:

1. Construction Schedule
2. List of required submittals
3. List of proposed sub-contractors
4. See Specification 133000, Submittal Procedures
5. Safety Plan prior to NTP date.
6. SWPPP book prior to NTP date. SWPPP shall be approved by DES prior to construction start.
7. Existing Conditions Photograph. See Specification 133000, Submittal Procedures.

M. Progress Meetings:

1. The Contractor shall attend construction progress meetings on a bi-weekly basis, and at the request of the Project Officer.
2. The Contractor shall issue a meeting agenda min. 3 business days prior to the meeting.
3. An updated construction schedule shall be submitted at each progress meeting.
4. At the meeting, the following issues shall be discussed:
 - a. Work completed to date.
 - b. Work remaining to be completed and anticipated timeframes.
 - c. Issues affecting the progress of the work.
 - d. Items that require correction.
5. The Project Officer shall record and distribute meeting minutes.

N. Requests for Information (RFI):

1. The Contractor shall upload RFIs to a digital platform such as Procore, Proforma, Submittal Exchange, Oracle or approved equal. It is the contractor's responsibility to set-up this digital platform. The contractor shall grant access of this digital platform to applicable County staff so they can download and upload project materials.

2. The Contractor shall submit a written RFI in any of the following instances (not all-inclusive):
 - a. If the intent of any item in the drawings and specifications is unclear.
 - b. If existing conditions differ from those indicated on the drawings.
 - c. To document any verbal agreements or instructions.
 3. In instances (a) and (b), the Contractor shall stop work in the affected area, notify the Project Officer, and await instructions.
 4. The Contractor shall be responsible for any expenses incurred due to unexpected conditions if he fails to notify the Project Officer and wait for direction prior to continuing work in the affected area.
 5. The Contractor's failure to properly document any verbal agreements or instructions will result in the rejection of any claim for changes to the Contract amount or additional time for completion.
 6. The Contractor is responsible for making the necessary inquiries to determine the design intent of the drawings and specifications if anything is unclear, prior to submitting a bid. Claims for changes to the contract amount submitted after Contract award due to an RFI response may be approved or rejected at the sole discretion of the Project Officer.
- O. Documentation of Events: The Contractor shall document and immediately report any of the following events to the Project Officer:
1. Accidents.
 2. Stoppages, delays, shortages, and losses.
 3. Orders and requests of authorities having jurisdiction.
 4. Services connected and disconnected.
 5. Existing conditions that significantly differ from those indicated on the drawings.
- P. If the project site will not be worked on a particular work day or days, the Contractor shall notify the Project Officer that the site will not be worked on, and shall state the reason for such.
- Q. Documentation of Work Activity: The Contractor shall document and submit on a daily basis a daily report. The daily report shall contain the following information:
1. Contractor name.
 2. Date and time.
 3. Temperature and weather condition.
 4. Project number.
 5. Contract number.
 6. List of sub-contractors on site by trade.
 7. List of number of man-hours for contractor and subcontractor.
 8. Description of each activity performed by the contractor and sub-contractor(s).
 9. List of materials stored on site and delivered.
 10. List of equipment materials stored on site and delivered.
 11. Submit all tickets for verification for the following, but not limited to materials and equipment delivered, concrete pours and soil removal.

- R. Claims for Delay:
1. If the Contractor believes that the proposed time for completion in the Contract is unreasonable, the Contractor shall notify the Project Officer at least ten (10) working days prior to the bid opening date and suggest a more reasonable contract time frame. If the proposed new time frame is accepted, an amendment to the bid will be issued.
 2. The Contractor shall submit a written Claim for Delay within ten (10) working days of any event where the Contractor believes that an extension to the Contract time for completion is necessary or justified.
 3. The written Claim for Delay must include the following information:
 - a. Amount of days claimed
 - b. Justification for the delay
 - c. Supporting documentation
 4. Justifications for Claims for Delay include the following:
 - a. Inclement weather that prevents work on the site
 - b. Events beyond the control of the Contractor that result in a delay to the project, with the following exceptions:
 - 1) Delays in the delivery of materials.
 - 2) Failure of suppliers to provide required submittals in a timely manner.
 - 3) Any delays that result from the actions of a subcontractor.
 - 4) Disputes between the Contractor and subcontractors or suppliers
 - 5) Rejection of submittals.
 - 6) Re-work resulting from unsatisfactory work.
 - 7) Re-work resulting from failure to provide required submittals.
 - 8) Re-work resulting from failure to submit a Request for Information (RFI) if the design intent is unclear.
 - 9) Failure to obtain required permits in a timely fashion, as stated in Section 1.4. D. Permits.
 - 10) Failure to request required inspections from the Inspection Services Division (ISD) in a timely fashion, or rejection of work by an inspector.
 - 11) Stop work orders issued by authorities having jurisdiction that are due to items that are the Contractor's responsibility.
 5. A Claim for Delay may be denied if the Contractor fails to continue work on other aspects of the project that are not affected by the particular delayed item, or if, in the Project Officer's determination, the Contractor has failed to continuously work on the project or effectively manage the project.
 6. If planting installation is not feasible because it is not the proper season for planting, the Contractor shall notify the Project Officer. The Project Officer, at his sole discretion, may decide to treat planting as a Punch List item, thereby exempting it as a requirement for a Determination of Substantial Completion.
- S. Liquidated Damages (Damages for Delay): The Project Officer does NOT have the authority to waive Liquidated Damages unless the supporting documentation described

- above has been provided by the Contractor (within the aforementioned time limit) and approved by the Project Officer.
- T. Existing Conditions: Dimensions and/or locations of existing facilities and/or underground utilities shown on the plans are approximate. Contractor shall verify exact locations before commencing work.
 - U. Code Compliance: Comply with all applicable codes and regulations of authorities having jurisdiction.
 - V. Safety: Take all precautions necessary to protect the public during the construction period.
 - W. Protection of Existing Conditions: Take all precautions necessary to protect existing facilities to remain during the construction period. Repair any and all damage to existing facilities to remain caused by construction operations. Maintain existing utilities and protect them against damage during construction. Contact Miss Utility at (800) 552-7001 for utility locations prior to any excavation.
 - X. County Rights-of-Way: Work taking place within the right-of-way of County streets shall conform to the Arlington County DES Construction Standards and Specifications. The Contractor shall obtain a right-of-way permit from the County for work to take place within street rights-of-way.
 - Y. Differing or Conflicting Requirements: If a Specification section requires compliance with two or more standards, or if requirements conflict, the more stringent standard or requirement shall apply.
 - Z. Quality Control Testing and Laboratory Services: The Contractor shall provide necessary labor and supervision required to support field testing and inspection by the Project Officer. Defects disclosed by tests shall be rectified at no additional cost to the County.
 - AA. Operation and Maintenance Manuals: Contractor shall provide operations and maintenance manuals for all applicable products and systems used in the Work prior to substantial completion inspection. Record "As-Built" Drawings: The Contractor shall submit a digital set of marked-up plans in both PDF and AutoCAD format at the end of the construction period indicating any and all conditions that differ from the original Contract drawings. The As-built drawings shall be signed and stamped by a Professional Engineer or Licensed Land Surveyor. The As-built drawings shall comply with Arlington County Minimum Acceptance Criteria (MAC) Checklist (Link).
 - BB. Contractor Performance Evaluation Form: At the completion of the contract, after final completion, the Project Officer will complete an evaluation form per the terms and conditions of the agreement.

END OF SECTION 011000

SECTION 012000 – MOBILIZATION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Construction Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 1-33 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Mobilization shall include the following items:
1. Furnish and set up Contractor's necessary general plant and equipment required for operations on to the site.
 2. Field office:
 - a. The contractor shall furnish and maintain for the use of the Project Officer an approved field office containing not less than one hundred sixty (160) square feet of floor area, located at such a point as the Project Officer designates. The Office shall have an approved lockable entrance, glazed, screened and vandal protected windows on at least two (2) sides to insure good ventilation. The exterior shall come with a factory type of exterior finish such as aluminum.
 - b. The field office shall be furnished with a table and/or desk, two (2) chairs minimum, storage or filing cabinet with necessary locking equipment.
 - c. Electrical lights and heat (November through April) shall be supplied.
 - d. At the end of the work, when directed by the Project Officer, the field office and all furnishings shall become property of the Contractor and shall be removed and disposed of from the site of work as his own expense.
 - e. The contractor shall provide the field office from the notice-to-proceed date until the completion of the work.
 - f. Furnishing the field office is mandatory and no construction shall be permitted to be started at the site until the field office is made available to the Project Officer as herein specified. Any deviations from the above must be approved by the Project Officer.
 3. Providing on-site sanitary facilities
 4. Providing on-site all OSHA required notices and establishment of safety programs.
 5. Obtaining all required permits for completion of the project.
 6. Having the Contractor's superintendent at the jobsite full time.
 7. The cost of required insurance and bonds and/or any other similar significant initial expense required for the initiation of the contract work shall be included in this item.
 8. Submitting initial submittals and log.
 9. Provide approved SWPPP book.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

- 3.01 Such work as is done in providing the facilities and services under this item shall be done in safe and workmanlike manner and shall conform with any pertinent County, State or Federal law, regulation, or code. Good housekeeping consistent with safety shall be maintained.

PART 4 – MEASUREMENT AND PAYMENT

- 4.01 The Contractor's attention is directed to the condition that no payment for Mobilization, or any part thereof, will be approved for payment under the Contract Documents until all Mobilization items listed above have been completed as specified to the satisfaction of the Project Officer.
- 4.02 For MOBILIZATION in accordance with the specifications the Contractor shall receive the Schedule-of-Values amount, which is not to exceed three percent (3%) broken down as 60% for mobilization and 40% for demobilization of the total contract bid price excluding the bid for mobilization.

END OF SECTION 012000

SECTION 013300 - SUBMITTAL PROCEDURES

PART 1 – GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.02 DEFINITIONS

- A. Action Submittals: Written and graphic information that requires Landscape Architect or Project Officer's responsive action.
- B. Informational Submittals: Written information that does not require Landscape Architect or Project Officer's responsive action. Submittals may be rejected for not complying with requirements.

1.03 GENERAL REQUIREMENTS

- A. Upon Contract Award, the Contractor shall prepare a list of required submittals, and shall immediately begin working to compile all required submittals.
- B. The Contractor shall not begin work which requires the submission of other data, until said submittals are returned with the Project Officer's stamp indicating approval or "approved as noted."
- C. Deviations from Contract Documents: Approval of submittals does not relieve Contractor from responsibility for full compliance with the Contract Documents. Approval of a submittal does not indicate acceptance of any deviations from the Contract Documents included in the submittal. Such deviations must be approved specifically in writing by the Project Officer.

1.04 SUBMITTAL PROCEDURES

- A. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
 - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
- B. Project Officer: All submittals shall be submitted to the Project Officer, who will then distribute submittals to the Landscape Architect, as applicable. Landscape Architect shall return submittals with action taken to the Project Officer who will then notify the Contractor.
- C. Submittals Schedule: Include a list of submittals for review in the construction schedule.
- D. Processing Time: Allow enough time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Project Officer's receipt of submittal. No extension of the Contract Time will be authorized because of the Contractor's failure to incorporate this time into the construction schedule or transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow ten (10) business days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Project Officer will advise Contractor when a submittal being processed must be delayed for coordination.
 2. Resubmittal Review: Allow ten (10) business days for review of each resubmittal.
- E. Identification: Each submittal shall indicate the following:
1. Name of firm or entity that prepared each submittal.
 2. Project name.
 3. Date.
 4. Name and address of Contractor.
 5. Name and address of subcontractor.
 6. Name and address of supplier.
 7. Name and address of manufacturer.
 8. Applicable specification section.
 9. A unique identifier, such as a submittal number.
- F. Deviations: Highlight, encircle, or otherwise specifically identify deviations from the Contract Documents on submittals.
- G. Transmittal: Package each submittal individually and appropriately for transmittal and handling. Transmit each submittal using a transmittal form. Project Officer will discard submittals received from sources other than Contractor.
- H. Resubmittals: Make resubmittals in same form as initial submittal.
1. Note date and content of previous submittal.
 2. Note date and content of revision and clearly indicate extent of revision.
 3. Resubmit submittals until they are marked “approved” or “approved as noted.”
- I. Use for Construction: Use only final submittals with mark indicating “approved” or “approved as noted” by Project Officer.

PART 2 - PRODUCTS

2.01 ACTION SUBMITTALS

- A. General: Prepare and submit Action Submittals required by individual Specification Sections.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
1. If information must be specially prepared for submittal because standard printed data are not suitable for use, submit as Shop Drawings, not as Product Data.
 2. Mark each copy of each submittal to show which products and options are applicable.
 3. Include the following information, as applicable:
 - a. Manufacturer's written recommendations.
 - b. Manufacturer's product specifications.
 - c. Manufacturer's installation instructions.

- d. Manufacturer's catalog cuts.
 - e. Compliance with specified referenced standards.
 - f. Testing by recognized testing agency.
4. Number of Copies: One (1) electronic copy of Product Data, unless otherwise indicated. Project Officer will return one copy.
- C. Shop Drawings: Where required in the Specifications, prepare project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
 - a. Dimensions.
 - b. Identification of products.
 - c. Fabrication and installation drawings.
 - d. Schedules.
 - e. Notation of coordination requirements.
 - f. Notation of dimensions established by field measurement.
 - g. Relationship to adjoining construction clearly indicated.
 - h. Seal and signature of professional engineer if required.
 - i. Wiring Diagrams: Differentiate between manufacturer-installed and field-installed wiring.
 2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches but no larger than 24 by 36 inches.
 3. Number of Copies: One (1) electronic copy of each submittal. Project Officer will return one copy.
- D. Samples: When required by other specification sections, submit samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
1. Transmit samples that contain multiple, related components such as accessories together in one submittal package.
 2. Identification: Attach label on unexposed side of samples that includes the following:
 - a. Generic description of sample.
 - b. Product name and name of manufacturer.
 - c. Sample source.
 - d. Number and title of appropriate specification section.
 3. Samples for Initial Selection: If colors, textures, and/or patterns are not clearly indicated in the drawings and/or specifications, submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

- a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Project Officer will return submittal with options selected.
4. Samples for Verification: Submit full-size units or samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
 - a. Number of Samples: Submit one set of samples. Project Officer will retain the sample set and indicate acceptance or rejection in writing to the Contractor.

2.02 INFORMATIONAL SUBMITTALS

- A. General: Prepare and submit Informational Submittals required by other Specification Sections.
 1. Number of Copies: Submit One digital copy of each submittal, unless otherwise indicated. Project Officer will not return copies.
 2. Certificates and Certifications: Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

PART 3 - EXECUTION

3.01 CONTRACTOR'S REVIEW

- A. Prior to submittal to Project Officer, review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions.
- B. Contractor shall sign and verify that they have reviewed the submittal and that it complies with the contract documents and is complete.

3.02 LANDSCAPE ARCHITECT'S ACTION

- A. Action Submittals: Landscape Architect will review each submittal, make marks to indicate corrections or modifications required, and return it. Landscape Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action taken, as follows:
 1. No Exceptions Taken or Approved: A marking of "approved or "No Exceptions Taken" indicates approval of a submittal for general conformance with the design

- concept of the Project and with the drawings and specifications.
- a. The Contractor is still responsible for confirming and correlating dimensions at job site, for information which pertains to fabrication processes or construction techniques and for coordination of work of all trades.
 - b. Approval of submittals does not relieve Contractor from responsibility for full compliance with the Contract Documents.
2. Make Corrections, Approved as Noted or Approved as Noted: A marking of “Make Corrections, Approved as Noted” or “Approved as Noted” indicates conditional approval of a submittal.
- a. The Contractor is expected to comply with the revisions or notes indicated by the Landscape Architect in the document. These notes become an integral part of the approved submittal and their acceptance by the Contractor indicates an agreement to comply with the noted requirements.
 - b. The Contractor is still responsible for confirming and correlating dimensions at job site, for information which pertains to fabrication processes or construction techniques and for coordination of work of all trades.
 - c. Approval of submittals does not relieve Contractor from responsibility for full compliance with the Contract Documents.
3. Revise and Resubmit: Based on the notations provided by the Landscape Architect, make revisions required to comply with the requirements in the Contract Documents, and resubmit for approval.
4. Rejected: The product indicated does not comply with the requirements in the Contract Documents and shall not be used in the Project. Provide submittals for the correct product as indicated in the drawings and specifications.
- B. Informational Submittals: Landscape Architect will review each submittal and will not return it, or will return it if it does not comply with requirements.
- C. Partial submittals are not acceptable, will be considered nonresponsive, and will be returned without review.
- D. Submittals not required by the Contract Documents may not be reviewed and may be discarded.

END OF SECTION 013300

SECTION 015713 - TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes temporary measures throughout the life of the project to control erosion and siltation.
- B. Such measures shall include, but are not limited to:
 - 1. Stabilized Construction Entrance
 - 2. Silt Fence
 - 3. Super Silt Fence
 - 4. Inlet Protection
 - 5. Site Construction Fencing
 - 6. Culver Outlet Protection.
 - 7. Diversion Dike
 - 8. Sediment Trap
 - 9. Dewatering Bag
 - 10. Natural Coir Fabric Logs
- C. Temporary erosion and siltation control measures as described herein, shall be applied to erodible material exposed by any activity associated with construction, consistent with state and local control standards.

1.02 GENERAL REQUIREMENTS

- A. The Contractor is responsible for providing and maintaining facilities adequate to control erosion and sedimentation. The Project Officer reserves the right to order the performance of other temporary measures not specifically described herein to correct an adverse erosion or siltation condition.

1.03 APPLICABLE SPECIFICATIONS

- A. The following specifications are hereby incorporated into this specification section by reference.
 - 1. Arlington County Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code).
 - 2. Virginia Department of Environmental Quality Erosion and Sediment Control Handbook.
 - 3. See Division 2 Section "Tree Protection and Root Pruning" for requirements related to tree protection and root pruning.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Site construction fence
 - 1. Posts and rails: ASTM F 1043 for framework, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thicknesses according to ASTM F 1043 based on the following:
 - a. Fence Height: 72 inches.
 - b. Horizontal Framework Members: Top and bottom rails according to ASTM F 1043.
 - c. Brace Rails: ASTM F 1043.
 - d. Provide fittings according to ASTM F 626.
- B. All other materials shall be at the Contractor's Option, in accordance with the Virginia Erosion and Sediment Control Handbook, Removals Plan and all applicable standards listed above.

PART 3 - EXECUTION

3.01 TIMING OF INSTALLATION

- A. No grading operations will be allowed until temporary erosion and sediment control measures have been installed in accordance with the Erosion and Sediment Control Plan and all applicable standards listed above.
- B. No control measures may be removed without the approval of the Arlington County Erosion and Sediment Control Inspector.

3.02 MINIMIZE EXPOSED SOIL

- A. The Contractor shall limit the surface area of earth material exposed by grubbing and stripping of topsoil and excavation to that which is necessary to perform the next operation within a given area.
- B. Unless specifically authorized by the Project Officer, the grubbing of root mat and stumps shall be confined to the area over which excavation is to be actively executed within 30 days following the grubbing operations.
- C. The stripping of topsoil shall be confined to the area over which excavation is to be actively executed within 15 days following the stripping operations.
- D. Excavation shall be confined to the minimum area necessary to accommodate the Contractor's equipment and work force engaged in the earth moving work.
- E. No disturbed area, including stockpiles, is to remain denuded longer than 30 days without temporary seeding or otherwise stabilizing the area.

3.03 CLEANING AND MAINTENANCE

- A. Control measures shall be periodically cleaned of silt and maintained. Immediately after every rainstorm, all control measures shall be inspected, and any deficiencies corrected by the Contractor.

END OF SECTION 015000

SECTION 016000 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; product substitutions; and comparable products.
- B. See Division 1 Section "Closeout Procedures" for submitting warranties for Contract closeout.
- C. See Divisions 2 through 16 Sections for specific requirements for warranties on products and installations specified to be warranted.

1.02 SUBMITTALS

- A. Proposed Equivalent Item Requests during bidding process:

Refer to Section I. – Instructions to Bidders, Paragraph 16. – Use of Brand Names/Substitutes of the solicitation document for request procedures.

- B. Substitution Requests after Contract award:

- 1. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
 - a. Reasons why the specified product cannot be provided.
 - b. Coordination information, including a list of changes or modifications needed to other parts of the Work that will be necessary to accommodate proposed substitution.
 - c. Detailed comparison of significant qualities of proposed substitution with those of the product specified.
 - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
 - e. Samples, where applicable or requested.
 - f. List of similar installations for completed projects with project names and addresses and names and addresses of Architects and owners, if requested.
 - g. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
 - h. Statement of impact on the construction schedule. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating lack of availability or delays in delivery.
 - i. Cost information, including a proposal of change, if any, in the Contract Sum.
 - j. Contractor's certification that proposed substitution complies with requirements in the Contract Documents and is appropriate for applications indicated.

k. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

2. Project Officer's Action: If necessary, Project Officer will request additional information or documentation for evaluation within five (5) business days of receipt of a request for substitution. Project Officer will notify Contractor of acceptance or rejection of proposed substitution within ten (10) business days of receipt of request, or five (5) business days of receipt of additional information or documentation, whichever is later.

a. Use product specified if Project Officer cannot make a decision on use of a proposed substitution within time allocated.

1.03 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, product selected shall be compatible with products previously selected, even if previously selected products were also options.

1.04 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft. Comply with manufacturer's written instructions.

1.05 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Preprinted written warranty published by individual manufacturer for a particular product and specifically endorsed by manufacturer to Project Officer.

2. Special Warranty (if required by other specification sections): Written warranty required by or incorporated into the Contract Documents, either to extend time limit provided by manufacturer's warranty or to provide more rights for Project Officer.

B. Special Warranties (if required by other specification sections): Prepare a written document that contains appropriate terms and identification, ready for execution. Submit a draft for approval before final execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.

2. Specified Form: When specified forms are included with the Specifications, prepare a written document using appropriate form properly executed.

3. Refer to Divisions 2 through 16 Sections for specific content requirements and particular requirements for submitting special warranties.

- C. Submittal Time: Comply with requirements in Division 1 Section "Closeout Procedures."

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

- A. General Product Requirements: Provide products that comply with the Contract Documents, that are undamaged and that are new at time of installation.
1. Standard Products: Unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
- B. Product Selection Procedures:
1. Sole-Source: Where Specifications name a single product and manufacturer without the words "or approved equal," provide the named product that complies with requirements. No substitutions will be accepted.
2. Product or Approved Equal: Where Specifications name a single product and manufacturer accompanied by the words "or approved equal," the specification establishes a minimum standard for design and quality. This should not be construed as eliminating from competition other products of equal or better quality that also satisfy the design intent of the project (as determined by the Project Officer and Landscape Architect). In this case, either provide the named product that complies with requirements, or submit proposed equivalent items for consideration, as stated in the Invitation to Bid, by the Project Officer in accordance with process described in the solicitation documents.
3. Protocols for Approved Equal Request(s):
When the project is in construction and the specified product(s) cannot be procured due to the following:
- Product is no longer available.
 - The County and the Contractor agree that the lead time is too long.
 - If there is a "better" product.
- Contractor shall submit Approved Equal request to Construction Manager for approval.

Product List: Where Specifications include a list of manufacturers and products, provide the specified quantity of one of the named products that complies with requirements or an equivalent. Product selected shall be compatible with products previously selected, even if previously selected products were also options.

END OF SECTION 016000

SECTION 017700 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:
 - 1. Inspection procedures.
 - 2. Warranties.
 - 3. Final cleaning.
- B. See all other Sections for specific closeout and special cleaning requirements for the Work in those Sections.

1.02 FINAL COMPLETION

- A. Preliminary Procedures: See 'Final Completion' in ITB Terms and Conditions.
- B. Inspection: Submit a written request for inspection for Final Completion. On receipt of request, Project Officer will either proceed with inspection or notify Contractor of unfulfilled requirements. Project Officer will prepare the Certificate of Final Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by the Project Officer, that must be completed or corrected before certificate will be issued.
 - 1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.
 - 2. Results of completed inspection will form the basis of requirements for Final Acceptance.

1.03 FINAL ACCEPTANCE

- A. Preliminary Procedures: Before requesting final inspection for determining date of Final Completion, complete the following:
 - 1. Schedule a Pre Final inspection with Project Officer two weeks before contract completion date.
 - 2. Submit a final Application for Payment.
 - 3. Submit copy of Project Officer's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Project Officer. The copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
 - 4. Submit evidence of final, continuing insurance coverage complying with insurance requirements.
 - 5. Instruct Project Officer's personnel in operation, adjustment, and maintenance of products, equipment, and systems.

- B. Inspection: Submit a written request for final inspection for acceptance. On receipt of request, Project Officer will either proceed with inspection or notify Contractor of unfulfilled requirements. Project Officer will process final payment after inspection or will notify Contractor of construction that must be completed or corrected before payment will be issued.
 - 1. Re-inspection: Request re-inspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.04 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

- A. Preparation: Submit three (3) copies of list. Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1.05 WARRANTIES

- A. Organize warranty documents into an orderly sequence based on the table of contents of the Project Manual.
 - 1. Bind warranties and bonds in heavy-duty, 3-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
 - 2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
 - 3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
 - 4. Provide one digital copy of warranties organized in the same manor as above.
- B. Provide additional copies of each warranty to include in operation and maintenance manuals.

1.06 FINAL PAYMENT PROCEDURE

- A. Submit final pay application after the following:
 - 1. All punch list items have been corrected and verified by the Project Officer.
 - 2. As-Built Drawings and O/M manuals shall be submitted within 15 days from final completion date and have been submitted and accepted by the Project Officer.
 - 3. All final inspections (plumbing, electrical, final building etc.) have been completed and closed out by the County's Inspection Services Department.
 - 4. All BMP's (if any) shall be approved and certified by DES.
 - 5. LDA permit is close out the County.
 - 6. All sub-contractors have been paid.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

PART 3 - EXECUTION

3.01 FINAL CLEANING

- A. General: Provide final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.
- B. Cleaning: Clean each surface or unit to condition expected in an average cleaning and maintenance program. Comply with manufacturer's written instructions.
 - 1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a portion of Project:
 - a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
 - b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
 - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
 - d. Remove snow and ice to provide safe access to site.
 - e. Remove labels that are not permanent.
 - f. Touch up and otherwise repair and restore marred, exposed finishes and surfaces. Replace finishes and surfaces that cannot be satisfactorily repaired or restored or that already show evidence of repair or restoration.
 - 1) Do not paint over "UL" and similar labels, including mechanical and electrical nameplates.
 - g. Wipe surfaces of mechanical and electrical equipment and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
 - h. Replace parts subject to unusual operating conditions.
 - i. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency. Replace burned-out bulbs, and those noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.
 - j. Leave Project clean and ready for use.

- C. Comply with safety standards for cleaning. Do not burn waste materials. Do not bury debris or excess materials on Owner's property. Do not discharge volatile, harmful, or dangerous materials into drainage systems. Remove waste materials from Project site and dispose of lawfully.

END OF SECTION 017700

DIVISION 02

SITE WORK

SECTION 02100 - CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 Description of Work

- A. Provide all labor, material and equipment to perform all clearing and grubbing as called for on the approved plans and as specified herein, or as necessary to prosecute the Work.

1.02 Related Work Specified Elsewhere

- A. 01500 –Erosion and Sediment Control and Pollution Prevention
- B. 02200- Earthwork
- C. 311300- Tree Protection and Root Pruning

1.03 Applicable Standards and Specifications

- A. Underground Utility Protection Ordinance (Chapter 55 of the Arlington County Code)
- B. Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code)
- C. Trash, Recycling, and Care of Premises (Chapter 10 of the Arlington County Code)
- D. American Association of Nurserymen (A.A.N.)
- E. International Society of Arboriculture (I.S.A.) National Arborist Association (N.A.N.)

1.04 Protection of Vegetation

- A. Protect existing trees and shrubs outside the limits of clearing and grubbing and existing trees designated to be saved inside the limits of clearing and grubbing by methods approved by the Urban Forester (DPR) and outlined in Specification 311300 Tree Protection and Root Pruning.

1.05 Protection of Property

- A. Protect property pipes, stones and monuments from damage. The Contractor shall be responsible for replacing disturbed markers by a registered surveyor at no expense to the County as approved by the Project Officer.
- B. Protect street, roads, historical objects, adjacent property, vegetation and other works to remain throughout the contract.
- C. The location of existing utilities has been indicated on the drawings based on the best information available. The completeness or accuracy of the information is not guaranteed. Contractor shall notify “Miss Utility” in accordance with the provisions stipulated in the Underground Utility Protection Ordinance (Chapter 55), of the Arlington County Code.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.01 Clearing

- A. The area of clearing (limits of disturbance) shall be maintained within the limits shown on the approved plans. The Contractor shall ensure the specifications in the County's Tree Protection and Planting Standards are followed throughout the duration of the work. Clearing shall include removal of trees as designated on the construction drawings. Trees and other vegetation that shall not be removed shall be properly protected to avoid damage and limit adverse impacts. Contractor shall refer to Specification 311300, "Tree Protection and Root Pruning".

3.02 Grubbing

- A. The area of grubbing shall be maintained within the limits of disturbance shown on the approved plans. Remove stumps and matted roots to a depth of 24 inches below existing ground surface. Refill excavations made by removal of stumps or roots as specified for backfill in Section 02200.

3.03 Trimming of Tree Branches and Roots

- A. Trees may be trimmed to remove branches or roots which interfere with construction when so approved by the Project Officer and as authorized by the County Urban Forester. Contractor shall refer to Specification 311300, "Tree Protection and Root Pruning".

3.04 Salvage

- A. Unless otherwise indicated on the plans, remove only those trees which directly interfere with the construction of the project. Trees designated by the Project Officer to be salvaged shall be either mechanically dug with a tree spade or hand dug, balled and burlapped with root ball sizes as specified by the American Association of Nurserymen.
- B. Material, which is to be salvaged, as a result of clearing operations, shall include live plants suitable for replanting. Shrubbery is to be transplanted as trees using A.A.N. Standards. If required, temporarily replant the shrub and at the completion of construction replace according to A.A.N. Standards.
- C. Place any desirable topsoil in well-drained stockpiles, not to exceed 7 feet in height, and protect per Section 01500.

3.05 Disposal

- A. Dispose of trees and shrubs in accordance with the Trash, Recycling, and Care of Premises Ordinance of the Arlington County Code. When approved by the Project Officer, material may be dumped within the Contract area where directed. Trees can be retained as snags as approved by the Project Officer and authorized by the County Urban Forester.
- B. Do not burn materials on the site. The County Fire Marshal may consider granting a waiver from open burning restrictions in cases where the State Air Pollution Control Board has granted a waiver to the Contractor or permit holder. The responsibility for obtaining all waivers shall be the Contractor's or permit holders.
- C. Remove material from the site as it accumulates. Do not allow waste material to accumulate for more than 48 hours.

END OF SECTION 02100

SECTION 02400 – PROTECTION OF EXCAVATION

PART 1 - GENERAL

1.01 Description of Work

- A. Provide all labor, material, equipment, and incidentals for the protection of excavation during the Work. The protection of excavation system shall provide for the protection of public or private property, and for the safety of personnel as called for on the approved plans, as specified herein, or as required by field conditions and/or regulations.

1.02 Related Work Specified Elsewhere

- A. Section 02100 - Clearing and Grubbing
- B. Section 02200 – Earthwork
- C. Section 02202 – Rock Excavation
- D. Section 03100 – Concrete, Formwork, Reinforcement, and Materials

1.03 Applicable Standards and Specifications

- A. American Association of State Highways and Transportation Officials (AASHTO)
- B. American Society for Testing and Materials (ASTM)
- C. Occupational Safety and Health Act (OSHA)
- D. Virginia Department of Transportation, Road and Bridge Specifications (VDOT)
- E. Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code) stipulated in the Underground Utility Protection Ordinance (Chapter 55), of the Arlington County Code.

PART 2 - PRODUCTS

- 2.01 Materials shall be of metal, wood or other material acceptable to the Project Officer. Sheet steel piling shall conform to ASTM A-328. Structural timber and timber piles shall conform to AASHTO M-168.

PART 3 - EXECUTION

3.01 General

- A. Be fully responsible for the design and supervision of installation and removal of all sheeting, shoring, bracing, or other systems required to support the excavation. Submit the design and proposed installation procedure to the Project Officer for approval prior to any excavation. Approval by the Project Officer shall not relieve the Contractor of the responsibility for the adequacy of the protection system, and if at any time during the progress of the work it is determined by the Project Officer that such design and installation is inadequate, the Contractor shall at his expense, furnish, install or make such changes in the plan or installation as may be necessary to perform the work in a manner satisfactory to the Project Officer and in conformance with all applicable Local, State, and Federal regulations.

- B. The installation of the protection system shall provide for the depth and width of the excavation and the characteristics and water content of the soil. Also, weather conditions, the proximity of other structures, the vibration from construction equipment and/or vehicular traffic and spoil placement or other surcharge loads shall all be taken into account.
- C. For trenches 20 feet deep or greater, the Contractor shall submit to the Project Officer for approval, design of the support of excavation system signed and sealed by a professional engineer licensed to practice in the Commonwealth of Virginia as per 29 CFR 1926.652. No excavation requiring such support system may proceed in advance of the Project Officer's written approval of the support system design.

3.02 Installation

- A. Furnish, put in place, and maintain such sheeting, bracing, shoring, or other systems required to support the sides of the excavation and to prevent any movement of earth which could in any way injure persons, endanger adjacent structures and utilities, or delay the work.
- B. Whenever possible, drive sheeting ahead of the excavation to avoid loss of material from behind the sheeting. If it is necessary to excavate below the sheeting, care shall be taken to avoid trimming behind the face along which the sheeting shall be driven. Prevent voids outside of the sheeting. If voids are formed, fill immediately with appropriate material and compact.
- C. In areas not shown on the approved plans, where it is required to leave sheeting, shoring and bracing in place to prevent injury to proximate structures, utilities and property, or the installation, the approval of the Project Officer, in writing, shall be required for payment. Cut off sheeting and bracing at the elevations approved by the Project Officer.

3.03 Removal

- A. Remove sheeting, shoring, bracing, or other systems during the backfill operations. Provide additional backfill compaction around the area of the pipe or structure to fill voids left behind the sheeting and shoring as it is removed. Avoid the production of loads which shall increase the safe backfill load on the pipe or structure.

END OF SECTION 02400

SECTION 02500 - GRAVITY SEWERS AND APPURTENANCES

PART 1 - GENERAL

1.01 Description of Work

- A. Provide all labor, materials, and equipment to furnish and install gravity sewer pipe, structures, and appurtenances as specified herein and in related specifications.

1.02 Related Work Specified Elsewhere

- A. Section 02200 – Earthwork
- B. Section 02202 – Rock Excavation
- C. Section 02400 - Protection of Excavation
- D. Section 02505 – Storm Sewers and Appurtenances
- E. Section 02510 - Sanitary Sewers and Appurtenances
- F. Section 02515 – Televised Inspection of Sewers
- G. Section 02650 – Restoration of Roadways
- H. Section 2952 – Trenchless Crossing
- I. Section 03100 – Concrete, Formwork, Reinforcement, and Materials
- J. Section 03400 - Precast Concrete
- K. Section 04200 - Masonry Units
- L. Section 05500 – Structural Steel

1.03 Applicable Standards and Specifications

- A. American Society for Testing and Materials (ASTM)
- B. American National Standards Institute (ANSI)
- C. Virginia Department of Transportation, Road and Bridge Specifications (VDOT)
- D. Arlington County Plumbing Code (Chapter 18 of the Arlington County Code)
- E. Arlington County Utilities Code (Chapter 26 of the Arlington County Code)
- F. Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code)
- G. Virginia Department of Environmental Quality Erosion and Sediment Control Handbook
- H. Virginia Department of Health (VDH) and State Water Control Board Sewerage Regulations (VR355-17-000) [Section 62.1-44.19(8) of the Virginia Code].

1.04 Submittals

- A. Submit full descriptions and details of all pipe, valves, hydrants, and other appurtenances proposed for the project Per Section 01330 Submittal Procedures.

1.05 Quality Assurance

- A. The Contractor shall be responsible for providing evidence that all materials used in the work meet all applicable standards and certifications. Such evidence shall comply with the requirements of Section 01400 Quality Requirements.
- B. The Contractor shall provide ample space and other accommodations to enable the Project Officer to inspect all pipe, structures, and other materials upon delivery to the site and prior to utilizing the pipe, structures and materials in the Work. The Contractor shall

ensure that materials are stockpiled or otherwise stored such that the Project Officer has access to all aspects and components.

- C. The Contractor shall conduct a television inspection of all installed sewer installations in accordance with Section 02515 Televised Inspection of Sewers prior to final acceptance.

1.06 Easements

- A. Sewers shall be installed within the ROW whenever possible.
- B. Where the following clearances cannot be maintained within the ROW, permanent easements shall be secured to allow for the clearances required to facilitate maintenance and operations.
 - 1. 10 feet each side of the centerline (20 feet total) for sewers 15 inches and smaller and less than 10 feet in depth.
 - 2. 10 feet from the outside edge of the pipe for sewers greater than 15 inches or deeper than 10 feet in depth

PART 2 - PRODUCTS

2.01 Reinforced Concrete Pipe (RCP)

- A. RCP shall conform to ASTM C-76, Class III or greater. Asbestos containing pipe or appurtenances shall not be accepted.
- B. RCP pipe shall be in lengths of at least 8 feet and shall be manufactured with bell and spigot ends with rubber gasket joints conforming to ASTM C443.

2.02 Polyvinyl Chloride Pipe (PVC)

- A. PVC pipe and fittings 15" and less shall comply with ASTM D3034.
- B. PVC pipe and fittings larger than 15" shall comply with ASTM F679, T-1.
- C. PVC pipe shall be in lengths of at least 12 feet and be manufactured with integrated bell gasket joints. Joints shall comply with ASTM D3212 and gaskets shall comply with ASTM F477.
- D. PVC pipe shall be less than 6 months old at the time of installation.

2.03 Polypropylene Pipe (PPP)

- A. PPP shall conform to ASTM F2881 and AASHTO M330
- B. Joint performance shall meet or exceed ASTM D3212

2.04 Polypropylene Pipe HP (High Performance Pipes)

- A. In addition to A and B in 2.3 above, HP pipes shall have a smooth interior and annular exterior corrugations. Manning's "n" value for use in design shall be 0.012
- B. Pipe shall be joined using bell & spigot joint meetings the requirements of ASTM F2881 or AASHTO M330
- C. Gaskets shall meet the requirements of ASTM F477 Fittings shall conform to ASTM F2881 or AASHTO M330. Bell and spigot connections shall utilize a welded or integral bell and valley or inline gaskets meeting the watertight joint performance requirements of ASTM D3212.

2.05 Precast Concrete Manholes

- A. Precast manhole bases, risers, and cones shall conform to the requirements of ASTM C-478. Cones shall be eccentric. Manholes shall have a minimum internal diameter of 48 inches.
- B. All sections shall be of male and female end type with a preformed groove provided in the male end for a round rubber gasket ring complying with ASTM C361 or C443. The gasket assembly alone shall provide adequate sealing to meet internal and/or external pressure requirements.
- C. Precast manhole sections shall be clearly marked with the following information as applicable: ASTM designation, standard detail or drawing number, station location and designation, date of manufacture and name of manufacturer.
- D. Concrete used in precast manholes or structures shall be VDOT Class A4.
- E. Precast manholes shall be manufactured by Americast, Smith-Midland Corporation, Old Castle Infrastructure or approved equivalent.

2.06 Concrete

- A. Concrete used in manhole or structure construction shall be VDOT Class A3 and conform to the requirements of Section 03100 – Concrete, Formwork, Reinforcement, and Materials.

2.07 Brick

- A. Brick used in manhole bench and collar construction shall conform to the requirements of Section 04200 - Masonry Units.

2.08 Mortar

- A. Mortar used in manhole construction shall be one part of Portland cement conforming to ASTM C150, Type II, and two parts of sand conforming to ASTM C144, with enough water added to produce mortar of the proper consistency for the type of joint.

2.09 Manhole Frames and Covers

- A. Manhole frames and covers shall be constructed of gray or ductile iron conforming to ASTM A48 and A536.
- B. Frames and covers shall have machined bearing surfaces to prevent rocking and rattling under traffic.
- C. Manhole covers shall be as shown on the Construction Standards and as indicated on the Contract Drawings. Frames and covers shall be manufactured by Dewey Brothers Inc., or equivalent.

2.010 Manhole Steps

- A. Manhole steps shall be a composite of a No. 3 grade 60 deformed steel bar encased in a copolymer polypropylene plastic of the “press-fit” design or rubber.
- B. Steps shall be PSI-PF as manufactured by M.A. Industries or Wedge-Lok as manufactured by Delta Pipe Products, or approved equivalent.

2.011 Manhole Neck Adjustments

- A. Adjustments to manhole necks shall be limited to 2 inches of concrete.
- B. Concrete adjustment rings shall be used for adjustments in excess of 2 inches, but not to exceed 12 inches. Non-shrink grout shall be used between adjustment rings.

2.012 Quick-Setting Grout

- A. Quick-setting non-shrink grout shall conform to the requirements of VDOT Road and Bridge Specification, Section 218.

2.013 Miscellaneous Metals

- A. Structural steel, grating and miscellaneous metal shall conform to the requirements of Section 05500 - Structural Steel and Miscellaneous Metal.

2.014 Bedding

- A. Bedding for pipe shall be compacted granular bedding crushed stone, VDOT Size #57, Specification 203.

PART 3 - EXECUTION

3.01 General

- A. No sewer facilities shall be constructed without approved plans, shop drawings, and construction cut sheets.
- B. Sewer size, material, direction, and grade shall remain constant between manholes or structures.
- C. Bring any conflicts during the installation of piping to the attention of the Project Officer.
- D. If any active sewers must be removed from service for any period of time, the Contractor shall submit to the Project Officer for approval per Section 01330, Submittal Procedures, a plan for diverting flow or otherwise maintaining service and capacity of the existing pipe(s) while out of service.
- E. In the event of a water or sewer emergency, the Contractor shall immediately notify the County's Water Control Center at 703-228-5555 and the Project Officer.

3.02 Depth and Cover of Pipe

- A. PVC sewer shall not be installed with less than 3 feet of cover from the top of pipe to finished grade.
- B. PVC pipe installed with less than 14 feet of cover shall be SDR 35 (pipe stiffness of 46 psi) or stronger. PVC installed with 14 or more feet of cover shall be SDR 26 (pipe stiffness of 115 psi) or stronger. PVC shall not be installed at depths greater than 20 feet without special design analysis.
- C. RCP sewer shall not be installed with less than 18 inches of cover from the top of the pipe to finished grade. Refer to the table below for minimum Class requirements based upon height of cover from the top of the pipe to finished grade and pipe diameter:

	12"	15"	18"	24"	30"	36"	42"	48"	60"	72"	84"
2'	IV	III	III	III	III	III	III	III	III	III	III
3'	III	III	III	III	III	III	III	III	III	III	III

4'	III	III	III	III	III	III	III	III	III	III	III
5'	III	III	III	III	III	III	III	III	III	III	III
6'	III	III	III	III	III	III	III	III	III	III	III
7'	III	III	III	III	III	III	III	III	III	III	III
8'	IV	III	III	III	III	III	III	III	III	III	III
9'	IV	IV	III	III	III	III	III	III	III	III	III
10'	IV	IV	IV	III	III	III	III	III	III	III	III
11'	IV	IV	IV	III	III	III	III	III	III	III	III
12'	IV	IV	IV	IV	III	III	III	III	III	III	III
13'	IV	IV	IV	IV	IV	III	III	III	III	III	III
14'	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
15'	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
16'	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
17'	V	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
18'	V	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
19'	V	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV
20'	V	IV	IV	IV	IV	IV	IV	IV	IV	IV	IV

- D. PPP and PPP HP sewer shall not be installed with less than 2 feet of cover from the top of the pipe to finished grade
- E. PPP shall not be installed at depths greater than 20' without special design analysis

3.03 Laying Pipe

- A. Install PVC pipe in accordance with ASTM D2321. Install RCP pipe in accordance with ASTM C1479.
- B. Use the proper tools for the safe handling and laying of pipe. Unload pipe by hand, skidways or hoists in such a manner so that material is not dropped or damaged. Distribute pipe at site of installation near area where it is to be laid. Protect machined ends of pipe from damage and keep pipe free from dirt and debris.
- C. Lay pipe to a true uniform line and grade from elevations indicated on the drawings with continuous bearing of barrel and bells on cradle or bedding material. Excavate bedding material at bells to ensure continuous and direct bearing of all portions of the pipe and bell on bedding materials.
- D. Utilize adequate bedding material to provide a continuous and firm bearing profile for the pipe. Pay particular attention to sufficient compaction of the bedding and haunches area below the pipe springline.
- E. Lay pipe upgrade whenever possible and with the bell end pointing in the direction of work progress.
- F. Use full manufactured lengths of pipe whenever possible. Do not use short lengths of pipe with couplings unless approved by the Project Officer.
- G. Plug or grout lift holes left in the pipe prior to backfilling operations.
- H. As the work progresses, clear the interior of the pipe of all dirt and superfluous materials of every description.
- I. Keep trenches and excavations free of water during construction and until final inspection. Do not lay pipe in water or in a frozen bedding condition. Prevent flotation and re-lay pipe that has floated.
- J. Install PPP and PPP HP in accordance with ASTM D2321

3.04 Manholes, Catch Basins, and Other Structures

- A. All structures shall be constructed to be watertight under the anticipated loads and site conditions.
- B. Structures shall be centered along the axis of the pipes intersecting the structure, unless otherwise specified. Structures shall not be placed overtop of any other utilities.
- C. Precast manholes and catch basins shall be placed on a 6-inch minimum gravel bedding extending 6 inches all around outside of the structured footprint and resting on undisturbed earth. Cast-inplace concrete bases may be poured directly onto undisturbed soil that has been compacted to a minimum of 95% density compaction and determined to be adequate subgrade by the Project Officer.
- D. Manholes in fill areas shall have a foundation extending a minimum depth of 18 inches into undisturbed earth.
- E. Cast-in-place concrete for structures shall be placed monolithically, or as shown on the plans. Concrete may be allowed to drop freely up to five feet in height; where greater drops are required, a tremie or other device approved by the Project Officer shall be used.
- F. Construct flow channels in the bottom of structures. Cast in place channels shall be a minimum of 4 inches thick 3000 psi concrete. Provide a positive means of bonding the channel to the manhole base of the structure. Flow channels shall provide a smooth transition from inlet pipe(s) to outlet pipe(s) to minimize turbulence. Benches shall be sloped towards the channel to prevent the accumulation of debris.
- G. The minimum invert drop from inlet to outlet of a manhole shall be 0.10 foot.
- H. Steps shall be provided in any structure greater than 4' in depth. Steps shall be installed in accordance with Standard Drawing M-2.0.
- I. The crown of inlet pipes shall not be lower than the crown of outlet pipes.
- J. Special design may be required for pipe sizes greater than 36 inches.
- K. Cut all pipes flush with the inside walls of the structures. Sanitary structures shall use a flexible rubber gasket designed specifically for the materials and the anticipated service conditions to ensure a watertight and flexible joint.
- L. Adjust frame and cover to match finished grade using concrete adjusting ring(s).
- M. For repair of existing manholes, joints for brickwork and precast concrete block work shall be completely filled and shall be smooth and free from surplus mortar on the inside of the manhole. Brick shall be laid radially with every sixth course laid as a stretcher course. Brick and concrete block manholes shall be plastered with mortar over the entire outside surface of the walls.

3.05 Abandonment of Sewers

- A. Structures to be abandoned in place shall be excavated and removed to a minimum depth of 2' below finished grade. The remainder of the structure shall be filled with flowable fill, 21A aggregate, or sand. #57 aggregate may be used if all openings of the structure are completely covered with filter fabric to prevent migration of adjacent fines.
- B. Sewers to be abandoned in place shall be capped at all open ends and completely filled with flowable fill.

3.06 As Built Plans

- A. Prior to Final Release & Payment, the Contractor shall submit one set of As-Built drawings per Section 01720 of these specifications and meeting industry standards for clarity, detail, and precision. As-Built shall include a certification from a Licensed Surveyor or Licensed Engineer that the plans as drawn indicate actual construction.

- B. The As-Builts shall include, at a minimum Surveyed:
1. Invert Elevations
 2. Manhole top elevations
 3. Percent of grade between manholes
 4. Horizontal distance between manholes
 5. Any material changes
 6. Location of connection to existing system measured from nearest structure
 7. Location of pipe connections, including service lines, measured from nearest manhole
 8. Actual location, depth or elevation, and type and size of all utility crossing.

3.07 Bypass Pumping, Temporary Flow Diversion and Dewatering

- A. The Contractor shall utilize temporary pumps to divert storm, and sanitary sewer flows during construction as required. All equipment used for these purposes shall comply with the requirements of the Arlington County Noise Ordinance. The Contractor shall be responsible for the installation, operation, and removal of the temporary pumps. The Contractor shall be responsible for utilizing pumps sufficient to bypass the normal flow and dewater the work area.
- B. The Contractor shall furnish, install, operate and maintain all sumps, pumps, casings, wellpoints, dewatering device, portable dams/barriers and other equipment needed to perform the temporary flow diversion and dewatering of the construction site as needed for proper execution of the construction Work.
- C. The Contractor shall furnish to the County in writing, a plan for diverting flows and removal of water from the work area before beginning the construction work. Acceptance of this plan will not relieve the Contractor of responsibility for completing the work as specified.

END OF SECTION 02500

SECTION 02505 - STORM SEWERS AND APPURTENANCES

PART 1- GENERAL

1.01 Description of Work

- A. Provide all plant, labor, supervision, materials and equipment to furnish and lay all storm sewer pipe and appurtenances to the lines and depths called for on the approved plans and as specified in Section 02500 Gravity Sewers and Appurtenances.

1.02 Related Work Specified Elsewhere

- A. Section 02200 – Earthwork
- B. Section 02500 – Gravity Sewers and Appurtenances
- C. Section 02510 - Sanitary Sewers
- D. Section 02515 – Televised Inspection of Sewers
- E. Section 02650 – Restoration of Roadways
- F. Section 02952 – Trenchless Crossing
- G. Section 03400 - Precast Concrete
- H. Section 04200 - Masonry Units
- I. Section 05500 – Structural Steel

1.03 Applicable Standards and Specifications

- A. American Society for Testing and Materials (ASTM)
- B. American National Standards Institute (ANSI)
- C. Virginia Department of Transportation, Road and Bridge Standards and Specifications (VDOT)
- D. Arlington County Plumbing Code (Chapter 18 of the Arlington County Code)
- E. Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code)
- F. Virginia Department of Environmental Quality Erosion and Sediment Control Handbook

1.04 Submittals

- A. Submit full descriptions and details of structures, and other appurtenances proposed for the project Per Section 01330 Submittals.

PART 2 - PRODUCTS

2.01 Storm sewers pipes shall be RCP as specified in Section 02500 Gravity Sewers. Other materials may be approved on a case by case basis.

2.02 Precast Concrete Blocks

- A. Precast concrete blocks shall conform to ASTM C-139.

PART 3 - EXECUTION

3.01 General

- A. Maintain a minimum 5-foot horizontal distance between storm sewer and all other utilities.
- B. The minimum vertical clearance between storm sewer and other utilities shall be 1.0 foot, unless provisions to prevent damage to the underlying utility are detailed for approval by the Project Officer.

3.03 Catch Basins and Structures

- A. Joints for masonry structures shall be completely filled and shall be smooth and free of surplus mortar on the inside of the structure.
- B. Structures shall be pargecast on the inside using Portland cement mortar 1/2" thick.
- C. Concrete blocks shall be 12" in length. For structures less than 6' in depth, 6" thick concrete blocks may be used. For depths from 6' to 12', 8" thick blocks shall be used. For depths greater than 12', 12" thick blocks shall be used.
- D. When possible on storm drainage inlets, manhole covers shall be positioned over the outgoing pipe.
- E. Whenever grate inlets are used, they shall be bicycle friendly such that the inlet openings run perpendicular to any anticipated traffic flow.
- F. Inverts are to be paved to the shape of the pipe and to the spring line except where inlet and outlet pipes make an angle with each other in which case paving shall be to the crown of the outlet pipe. Then from the spring line or the invert, whichever is the case, the paving is to be extended upward at a 45 degree angle to meet the structure wall. Refer to Standard Detail D-2.1.
- G. Angle iron and frame and cover shall be painted with black asphaltic paint.
- H. A construction joint shall be provided in the gutter at the outside edges of each catch basin. The gutter between the outside edges of a catch basin shall be considered part of the catch basin and this work shall be included in the payment for catch basins.
- I. Place three 3-inch drain pipe weep holes under the gutter and in other locations as required by the Contract Drawings. All drain pipes shall be placed within two feet below the top of curb.

3.04 Design Requirements

- A. Storm sewers shall be designed as described in the VDOT Drainage manual, with the exceptions defined below:
 - 1. The 10-year storm shall be the basis of design except for conditions in which severe threat to property or life would result from system failure, in which case the 100-year storm should be the design basis.
 - 2. Storm sewer inlets on residential streets shall be located to prevent stormwater from overtopping the curb during the design storm. The design shall account for a 1" freeboard between the top of curb and gutter flow depth. Gutter flow spread shall not be permitted to overtop the crown of the roadway. On streets other than residential, storm sewer inlets shall be placed in accordance with the requirements of the VDOT Drainage Manual.

3.05 Valley Gutters

- A. Concrete valley gutters may be utilized where placement of drainage inlets would not be feasible due to lack of drainage infrastructure and/or conflicts with other infrastructure.

- B. Valley gutters should be used only on residential streets. For streets with greater than 1500 vehicles per day, valley gutters shall only cross stop controlled legs of an intersection.
- C. Valley gutters shall be constructed of Class A3 concrete, 9" thick, placed on a 6" base of crushed aggregate, with welded wire fabric as shown in VDOT Road and Bridge Standard PR-2, and per detail R-2.9.
- D. Valley gutters shall be capable of carrying the design storm runoff entirely within the concrete conveyance area.

3.06 Private Connections

- A. Storm Sewer Connections are privately owned and maintained from the storm sewer main up to and including the property served. Pipe and fitting for storm sewer service connections shall conform to the requirements of the Arlington County Plumbing Code and Plumbing Code adopted by the State of Virginia.
- B. Connections to existing storm sewer mains shall be at manholes or inlets. The connection shall be made by core-drilling the structure and using a manhole adaptor appropriate for the pipe and structure materials. Connections at brick or masonry structures shall be made by carefully chiseling or removing single bricks or blocks such that the clearance between the connection pipe and any portion of the manhole is minimized.
- C. Connections directly to pipes shall not be allowed without specific approval by the DES Engineering Bureau and issuance of appropriate permits. Where specifically permitted by DES, connections to existing pipes shall be made using saddles or fittings designed specifically for use on the pipe material which it is proposed to be used upon. When manholes or inlets are not accessible for connections, a hole can be core-drilled into the main line and the use of a threepiece service connection that consists of a PVC hub, a compression rubber sleeve, and a stainless steel band can be used in conformance with ASTM F2946. When anchors are set into concrete pipes, expansion anchors shall not be permitted. Such fittings or saddles shall eliminate any encroachment of the incoming pipe into the flow line of the existing pipe when flowing full. Saddles shall provide flexural relief for the incoming line without transmitting any stress onto the storm sewer pipe. All field connections must be approved by the Project Officer.
- D. No mechanical discharge of groundwater, stormwater, or other collected water onto the public right of way shall be permitted. Gravity drainage from roofs or area drains through the curb shall be permitted.

END OF SECTION 02505

SECTION 02550 – WATER MAINS AND APPURTENANCES

PART 1 - GENERAL

1.01 Description of Work

- A. Provide all plant, labor, supervision, materials and equipment to install all water pipe and appurtenances to the lines and depths as called for on the approved plans and as described herein for a complete and operable water distribution system.

1.02 Related Work Specified Elsewhere

- A. Section 02200 – Earthwork
- B. Section 02202 – Rock Excavation
- C. Section 02400 – Protection of Excavation
- D. Section 02650 – Restoration of Roadways
- E. Section 02952 – Trenchless Crossing
- F. Section 03100 – Concrete, Formwork, Reinforcement, and Materials

1.03 Applicable Standards, and Specifications

- A. American National Standards Institute (ANSI)
- B. American Society for Testing and Materials (ASTM).
- C. American Water Works Association (AWWA).
- D. National Fire Protection Association (NFPA)
- E. Arlington County Fire Protection Code (Chapter 8.1 of the Arlington County Code)
- F. Arlington County Plumbing Code (Chapter 18 of the Arlington County Code).
- G. Arlington County Utilities Code (Chapter 26 of the Arlington County Code).
- H. Plumbing Code adopted by the State of Virginia
- I. Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code).
- J. Virginia Department of Health (VDH) Waterworks Regulations (12 VAC 5-590)
- K. Arlington County Dechlorination Policy Acknowledgement form
- L. Arlington County Dechlorination Plan form
- M. Arlington County Dechlorination and Disposal Procedures

1.04 Submittals

- A. Submit full descriptions and details of all pipe, valves, hydrants, and other appurtenances proposed for the project Per Section 01330 Submittal Procedures.

1.05 Quality Assurance

- A. The manufacturer shall provide facilities or a certified laboratory for conducting load bearing and other tests required by the referenced specifications such as the ASTM.
- B. The Contractor shall provide ample space and other accommodations to enable the Project Officer to inspect all pipe, fittings, and joint materials upon delivery to the site and prior to utilizing the pipe, fittings, and joint materials in the Work. The Contractor shall ensure that materials are stockpiled or otherwise stored such that the Project Officer has access to all aspects and components.

1.06 Acceptance

- A. No portion of new installation shall be considered for acceptance without a submittal. That includes a minimum of a passing hydrostatic test, passing bacteriological tests, and as-built drawing (Section 3.3).

PART 2 - PRODUCTS

2.01 General

- A. All materials shall be suitable for 150 pounds per square inch (psi) working pressure unless otherwise indicated.
- B. Pipe of the same size and material shall be furnished by the same manufacturer. Each pipe length and fitting shall be clearly marked with the manufacturer's name, trademark and class of pipe.
- C. Materials shall be recently manufactured and unused. Only previously approved manufacturers items may be furnished.

2.02 Pipe

- A. Pipe shall be ductile iron conforming to AWWA C151 (ANSI A21.51), class 53 minimum for 6-inch and smaller pipe and class 52 minimum for 8-inch and larger pipe. Pipe shall be single cement lined conforming to AWWA C104 (ANSI A21.4) with a minimum 1.0 mil. Thick bituminous coating and shall have mechanical or push-on joints utilizing rubber gasket rings, conforming to AWWA C111 (ANSI A21.11).
- B. Fittings shall be mechanical joint ductile iron conforming to AWWA C110 (ANSI A21.10), with a minimum pressure rating of 250 psi, or ductile iron compact grade conforming to AWWA C-153 (ANSI 21.53) with a minimum pressure rating of 350 psi. Fittings shall be cement lined conforming to AWWA C104 (ANSI A21.4) with a minimum 1.0 mil. thick bituminous coating.
- C. Polyethylene encasement with a minimum thickness of 8-mils shall be applied to all underground ductile pipe installations and shall comply with the installation and material requirements of AWWA C-105 and ANSI A21.5. All pipes, fittings, valves, hydrants and branch connections shall be encased as shown on approved plans. All holes and openings of any size shall be repaired in accordance with the manufacturer's recommendations.

2.03 Tie Rods and Accessories for Anchorage and Mechanical Joint Restraints

- A. Tie rods, tie bolts and accessories shall be manufactured of corrosion resistant steel, ASTM-A242, Super Star series of Star National Products, Romac Industries, Smith Blair, or approved equivalent.
- B. Mechanical joint restraints shall be used with all water main appurtenances as directed or as approved by the Project Officer. 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. Restraining devices shall be manufactured of ductile iron. Torque limiting twist off nuts shall be used to ensure proper installation of the restraining device. The minimum working pressure shall be at least 250 psi. and shall be manufactured by EBAA iron, inc., Romac Industries, Smith Blair, or approved equivalent.

2.04 Gate Valves

- A. Gate valves, 4-inch through 12-inch, for buried installation shall be ductile or grey cast iron, resilient wedge type, O-ring sealed, non-rising stem, fitted with a 2-inch operating nut opening left, with mechanical joint and/or flanged ends, as indicated on the drawings. Valves shall conform to AWWA C-509 (grey iron) or C-515 (ductile iron) requirements. Provide buried valves with valve boxes. Provide extension stems extended within two feet of finished grade if required for valve depth. Valves shall be American Flow Control Series 2500-1, Mueller A- 22360, U.S. Pipe USPO valve, Kennedy KS, or approved equivalent.
- B. Gate valves 14" and larger shall be iron body with fusion epoxy coating conforming to AWWA C 550 bronze mounted, double disc, resilient wedge, O-ring sealed, non-rising stem, fitted with a 2" operating nut opening left, with mechanical joint and/or flanged ends as indicated on the drawings. 14" gate valves may be installed in vaults or buried with valve boxes and extension stems placed within two feet of finished grade if required for valve depth. Gate valves 16" and larger shall be installed in vaults with or without NRS bypass valve as indicated on the drawings. Valves shall conform to AWWA C-500 requirements and shall be Mueller Co. 2360 series or from US Pipe USPO, or American Flow Series, or approved equivalent.
- C. Gate valves 3" to 8" for water meter and/or fire line vault or interior installation shall be iron body, bronze mounted, resilient wedge , bolted bonnet, 250 psig maximum working pressure class 125 psi, outside screw and yoke, rising stem with hand wheel, opening left, with flanged ends. Valves shall be Mueller Co. 2360 series or from US Pipe USPO, or American Flow Series, or approved equivalent.
- D. Gate valves 2" and smaller shall be bronze body, solid disc, union bonnet, class 150 psi minimum, non-rising stem with hand wheel, opening left, with inside threaded ends. Valves shall be Stockham Model B-128 , Crane Model No. 426, or from Mueller Co or US Pipe USPO. Or approved equivalent.

2.05 Butterfly Valves, Check Valves and Insert Valves

- A. Butterfly, check, and insert valves shall be as directed by the Project Officer on a special project basis.

2.06 Fire Hydrants

- A. Fire hydrants shall be dry top, dry barrel compression type, with a valve opening of 5-1/4inches, double O-ring seals and safety flange, and shall conform to AWWA C502 requirements.
- B. Hydrants shall be provided with two 2-1/2 inch hose outlets and one 4-inch pumper outlet with threading conforming to NFPA No. Standard 1963, Standard for Fire Hose Connections, requirements for American National Fire Hose Connection Screw Threads (NH), 6-inch mechanical joint inlet connection, National Standard 1-1/2 inch pentagon operating nut and outlet cap nuts, chains on outlet caps, and harnessed lugs. Hydrants shall open left and counterclockwise. Fire hydrants shall be painted with an exterior type industrial coating enamel. The upper barrel including bonnet and hose nozzle caps shall be painted "National Standard Yellow". Hydrants shall be Mueller Super Centurion 250, Kennedy "Guardian", Clow "Medallion", or approved equivalent.

2.07 Valve Boxes

- A. Valve boxes shall be of the two-piece, sliding type 5-1/4-inch shaft, cast iron kind. Valve box lid shall read "Water" Valve boxes shall be as manufactured by Bingham and Taylor Company, Capitol Foundry, or Tyler Company and conform to their standard dimensions.

2.08 Copper Pipe

- A. Copper pipe shall be seamless water tube, AWWA type K conforming to ASTM designation B88 requirements. Fittings shall be underground copper service flared type.

2.09 Water Meters and Services 2-inch and smaller by Arlington County

- A. Water meters, including taps, pipe fittings, meter box and accessories from the water main through the meter, shall normally be furnished and installed by the Arlington County Department of Environmental Services (DES) after payment of the appropriate fee. The connection from the back side of the meter installation to the building shall be installed by the owner's plumber.

2.010 Water Meters and Services 2-inch and smaller by Contractor

- A. The Department of Environmental Services shall approve all water meter locations. Water meters shall be located in the utility strip or just behind the curb within public right-of-way or recorded easements and a minimum of 5 feet horizontally clear from other utilities, structures, or trees.
- B. The Contractor shall assume complete responsibility for the installation, adjustments and any damage that may occur until final acceptance of the project.
- C. The Contractor shall furnish all water service materials except the water meter. The water meter is always supplied and installed by Arlington County.
- D. New water mains shall pass all acceptance testing procedures before the installation of water service connections.
- E. All services shall be installed by wet tap only. Service taps shall be located at the 10:00 and 2:00 position on the water main. Maintain a minimum of 12 inches between taps. Direct taps are allowed for 1-inch connections. Use approved saddles for 1 ½ inch and 2-inch connections.
- F. Water service lines shall have a minimum of three feet of cover and shall be approved by the Project Officer, from the main to the meter prior to backfilling. Meter settings for 1-inch to 2-inch services shall be a minimum of 18-inches and a maximum of 24-inches below the meter box cover. Meter box covers shall be painted black with an exterior type of rust resistant enamel.
- G. Meter boxes, meter box covers, corporation stops, angle valves, yoke ells, yoke bars and all other appurtenances (except the water meter) necessary for a complete installation shall be provided in accordance with the approved plans, specifications and requirements of DES. Meter box covers shall be furnished by Bingham and Taylor, Capitol Foundry, Ford Meter Box Co., or approved equivalent.

2.011 Water Meters and Services by Contractor 3-inch and Larger

- A. The Department of Environmental Services shall approve all water meter and service locations. Water meters shall be within a specified permanently provided clear space located just behind the curb in public right-of-way or just behind the curb in recorded easements.

- B. All materials necessary for a complete water service installation (except the water meter) shall be provided and installed by the Contractor in accordance with the approved plans.
- C. The Contractor shall assume complete responsibility for the installation, adjustments, and any damage that may occur until final acceptance of the project.
- D. New water service piping and appurtenances shall pass all acceptance testing procedures and inspections before the installation of the water meter by Arlington County.

2.012 Air Release Valves

- A. Air release valves shall be constructed of cast iron body and cover conforming to ASTM A126.GR.B requirements. The float shall be stainless steel conforming to ASTM A240 requirements. Air release valves shall be manufactured by Apco, Crispin, Cla-val, Flomatic, or approved equivalent.

2.013 Tapping Sleeves and Valves

- A. Tapping sleeves and valves shall conform to the applicable requirements specified herein for installation on the existing type of pipe described below.
 - 1. Iron Pipe: Tapping sleeves shall be iron or stainless steel. The iron tapping sleeve shall have an iron body, mechanical joint, with gaskets, suitable for installation on the existing iron pipe. The tapping sleeve shall be as manufactured by Mueller Company No. H-615 or approved equal. Tapping valves shall conform to the applicable requirements specified herein for gate valves. All stainless steel tapping sleeves shall be type 304 stainless steel with stainless steel flange and full circumferential seal as manufactured by JCM style 432, Ford style FAST, Smith Blair #663, or approved equivalent.
 - 2. Concrete Pipe: The tapping sleeve shall be in accordance with AWWA Manual M9. The sleeves shall have a separate gland which permits installation of the sleeve prior to the cutting of the prestress wires. The gland shall have a fusion epoxy coated (per AWWA C- 213-79) waterway, and a broad gasket set in a retaining groove of a draw flange to eliminate flexing. The gland shall be equipped with load bearing set screws to protect the cylinder. Sleeves shall be furnished with grouting seals and grout horns to facilitate filling the space between the sleeve and the pipe.

2.014 Service Clamps

- A. Service clamps shall have cadmium zinc plated be double steel straps and ductile iron body with corporation stop thread of appropriate size, neoprene gasket cemented in place, and cadmium zinc plated nuts. and straps and shall be the diameter required. Clamps shall be as manufactured by Ford, Mueller, Romac Industries, Smith Blair, JCM Industries or approved equivalent.

2.015 Manhole Frames and Covers

- A. Manhole frames and covers shall conform to the requirements of Section 02500 Gravity Sewers, or as specified on the plans. Refer to W-9.7, W-9,8, and W-9.9.

2.016 Manhole Steps

- A. Manhole steps shall conform to the requirements of Section 02500 Gravity Sewers.

2.017 Concrete

- A. Concrete used for concrete thrust blocks and valve collars shall be in conformance with Section 03100 of these Specifications.

PART 3 - EXECUTION

3.01 Water Main Design Criteria

- A. Water mains shall be designed and installed to conform to Arlington County Standards and Specifications, the Virginia Department of Health Waterworks Regulations, American Water Works Association Standards and the following design criteria:
 - 1. If required by DES, detailed design calculations shall be submitted to substantiate line sizes and to demonstrate that the minimum pressure of 20 psi, as stated in 12VAC5-90 of the Virginia Administrative Code, shall be met for average daily demands, peak hourly demands, and maximum daily demand plus fire flow. The final size of all water mains and appurtenances shall be determined by DES.
 - 2. The hydraulic conditions at the points of proposed connection of the existing Arlington County water system shall be defined. DES shall provide the hydraulic conditions at the node closest to the point of connection (i.e., fire flow test results). The designer of the proposed water system shall model the water system network starting from the node of the water system for which Arlington County has supplied the starting hydraulic conditions. Requests for computer modeling or fire flow test information shall be addressed to DES. The request for computer modeling shall include a sketch plan indicating the location of proposed development, size of building, type of occupancy, number of occupants, estimated average daily demand, maximum daily demand, peak hourly demand and fire flow demand based on the Arlington County Fire Prevention Code requirements for all buildings within the proposed development. Required fire flow calculations shall be provided on the cover sheet of the approved plans.
 - 3. Water mains shall be 8-inch diameter minimum (unless otherwise approved by DES) and shall be looped wherever possible. Dead end mains shall not exceed 600 feet without approval from DES and shall have blow-offs or fire hydrants for flushing. No flushing device shall be directly connected to any sewer.
 - 4. Water mains shall be located in street right of way and 7 feet off of face of curb wherever possible. The water main shall extend the full frontage of the property being served unless directed otherwise by DES. Water mains shall not be located longitudinally under walks. Water mains, water meters, fire hydrants and blow offs shall be publicly maintained and as such shall be installed within recorded easements on private property when locations in public right of way are not possible. Such easements, measuring 20 feet in width, shall be recorded prior to final approval and issuance of building permits.
 - 5. Water mains shall have a minimum cover of 4 feet measured from the top of pipe to the proposed finished grade directly above the waterline; however, 3 feet minimum cover may be used for short distances to avoid utility conflicts and

- excessive depth of water main. Mains shall be laid on continuous grades to avoid sags or crests in the line.
6. The minimum clear horizontal separation between water mains and sewer mains or sewer manholes shall be 10 feet (conforms to VDH Waterworks Regulation 12 VAC 5-590-1150). When local conditions prevent a minimum horizontal separation of 10 feet between water mains and sewer mains or sewer manholes, a closer separation may be allowed provided that:
 - a. Sewer manholes shall be of watertight construction and tested in place.
 - b. The bottom (invert) of the water main shall be a minimum of 18 inches above the top (crown) of the sewer. The water main and sewer pipes shall be kept in separate trenches. Where minimum vertical separation cannot be obtained, the sewer shall be constructed of ductile iron pipe and pressure tested in place without leakage prior to backfilling.
 7. No water mains shall pass through or come in contact with any part of a sewer manhole.
 8. Water mains crossing over sewers shall be laid to provide a minimum vertical separation of 18 inches between the top of the sewer and the bottom of the water main. If local conditions prevent this, the water main shall be relocated to provide the separation directed by the Project Officer, or the sewer shall be constructed of ductile iron pipe pressure tested in place without leakage before backfilling and with no joint of the sewer closer than 8 feet of the water main.
 9. Water mains crossing under sanitary sewers shall be protected by the following provisions:
 - a. A minimum vertical separation of 18 inches between the top of the water main and the bottom of the sewer.
 - b. Sewer shall be constructed of ductile iron pipe, pressure tested in place without leakage before backfilling.
 - c. Adequate structural support for the sewer to prevent excessive joint deflection and the settling on and breakage of the water main. Refer to Standard Drawing M-7.0.
 - d. One length of the water pipe shall be centered at the point of crossing so that the joints are equidistant and as far as possible from the sewer.
 10. Water mains crossing over surface waters shall be adequately supported, protected from freeze damage, accessible for repair or replacement, and above the 100-year flood elevation.
 11. Water mains crossing under surface waters shall be protected by the following provisions:
 - a. The pipe shall be of special construction, having flexible watertight joints.
 - b. Valves shall be provided at both ends of the water crossing so that the section can be isolated for tests or repair; the valves shall be easily accessible and not subject to flooding.
 - c. Sample taps shall be available at each end of the crossing at a reasonable distance from each side of the crossing and not subject to flooding.
 - d. Permanent taps shall be made for testing and locating leaks.

12. The minimum clear horizontal separation between water main and utilities other than sanitary sewer shall be 5 feet (see 3.1.A.6 for separation between water main and sanitary sewer).
13. The minimum vertical clearance between water main and utilities other than sanitary sewer shall be 1.0 foot, unless provisions to prevent damage to the underlying utility are detailed for approval by DES.
14. The minimum horizontal separation between water main and buildings or other structures shall be provided as follows:
 - a. Ten feet for water mains less than 16 inches and 10 feet or less in depth.
 - b. Fifteen feet for water mains 16 inches and larger or all mains in excess of 10 feet in depth.
15. Valves shall be provided on all mains at major intersections and on branch mains at minor intersections. Four valves are required at crosses and three at tees unless otherwise approved by DES. Line valve spacing shall be 500 feet maximum for water mains 12 inches and smaller and as determined by DES for mains larger than 12 inches. Valve boxes shall be set and adjusted flush with the roadway surface. Where valves boxes are located in off street areas they shall be set flush in a 2' x 2' x 6" concrete pad.
16. Automatic air release valves shall be installed on water mains according to the following provisions (conforming to VDH Waterworks Regulation 12-VAC 5-590-1160):
 - a. Air release valves shall be located at "strategic" high points as directed or approved by DES.
 - b. Refer to the standard drawings for air release valve settings.
 - c. Air release valve and piping shall be two inches unless directed or approved otherwise by DES.
 - d. Air release valves shall not be located in areas subject to flooding or high water table. In cases where such locations cannot be avoided, sump pumps and special vent piping shall be required as directed by DES.
 - e. Tapping saddles shall be used.
 - f. Chambers containing air release valves shall not be connected directly to any storm drain or sanitary sewer, nor shall air release valves be connected directly to any sewer. Chambers shall be drained to the surface of the ground where they are not subject to flooding by surface water or to absorption pits located above the seasonal groundwater table elevation. Sump pumps may be used where other means are not practical.
17. Water meters shall be located in the utility strip or just behind the curb and a minimum of 5 feet clear of driveways and other vehicular traffic areas. A clear space 5 feet by 5 feet shall be permanently provided for 2 inch and smaller water meters. A clear space 20 feet by 15 feet and 10 feet deep shall be permanently provided behind the curb for 3- and 4- inch water meter vault installations. A clear space 25 feet by 20 feet and 10 feet deep shall be provided for 6- and 8-inch meter vault installations. Water meters sizes greater than 8- inches shall be approved by DES.
18. No water service taps shall be made without special approval from DES in transmission mains 16 inches and larger.

19. Backflow prevention devices shall be installed at each service connection to a consumer's water system when specified by the Arlington County Department of Community Planning, Housing & Development (DCPHD) - Inspection Services Division that a potential health, pollution or system hazard to the waterworks exists. Refer to the Arlington County Cross Connection and Backflow Prevention Control Ordinance for more information.
20. All plans and specifications for construction of proposed water distribution facilities must be approved by DES. No water distribution facility shall be constructed without approved plans, shop drawings and construction cut sheets.
21. All existing segments of water main to be cut and capped shall be strapped or thrust blocked as directed by DES.
22. Blow offs for water mains shall be provided at all “strategic” low points and all terminal points. Fire hydrants may be used in lieu of blow offs as directed by DES. Blow offs shall be installed in meter boxes and located behind the curb line and clear of driveways and other vehicular traffic areas (refer to Standard Drawing W4.0).

3.02 Fire Protection Requirements

A. Waterworks systems shall be designed to deliver a minimum residual pressure of 20 psi with fire flow requirements and maximum daily demands applied to the system. Applicable fire flow shall be selected based on the requirements of Appendix B of the Arlington County Fire Prevention Code. The required fire flow may be reduced by up to 75% for buildings protected throughout with automatic sprinkler systems complying with the requirements of the Virginia Uniform Statewide Building Code, but in no case shall the flow be less than:

1. One and Two-family dwellings - minimum exposure distances of:

Less than 10'	1,500 – 2,000 gallons per minute (gpm)
10' – 30'	1,000 – 1,500 gpm
Greater than 30'	1,000 gpm

2. Other than One and Two-family dwellings: 1,500 gpm

B. Fire Hydrants

1. Fire hydrants shall be located behind the curb line in accessible areas. Maximum spacing shall be 500 feet in residential areas and 300 feet in commercial and high-density areas.
2. Building siamese fire line connections shall be located within 75 feet of fire hydrants or as approved by the Arlington County DCPHD - Inspection Services Division.
3. Actual fire hydrant locations are subject to approval by the Arlington County Fire Marshal and DES.
4. Fire hydrants shall not be installed on lines less than 8 inches in diameter or on lines not adequately sized to carry fire flows. Installation of fire hydrants on 6-inch water mains may be approved in special cases as determined by DES.
5. Connect hydrants to the water main with a minimum 6-inch ductile iron branch controlled by an independent gate valve. Hydrants shall stand vertically plumb with the center of the 4-inch pumper nozzle a minimum of 18 inches above the

top of curb on streets with curb and gutter or a minimum of 18 inches above the elevation of the edge of the shoulder on streets without curb and gutter. Provide vertical offsets or bends as required to set hydrants at proper grade. The maximum bury depth shall be 6 feet.

6. No plantings or erection of other obstructions shall be made within 5 feet of any fire hydrant.
7. All hydrants, fire line valves and fittings shall be strapped or thrust blocked as approved by DES (refer to Standard Drawing W-7.0).
8. Drainage fill shall be provided to prevent the ponding of water around hydrants.
9. Fire hydrants shall be installed five feet from the point of curvature of curb returns or at the property line between properties in subdivisions or other areas where fire hydrants are installed between intersections.
10. Fire hydrants shall be drained to dry wells provided exclusively for this purpose.
11. Fire hydrants shall not be located in areas subject to high groundwater, flooding, contaminant or pollutant spills, or in areas where surface water ponds. If there exist no alternative location, weep holes on the hydrant shall be plugged and the hydrant shall be marked for seasonal dewatering or the weep hole drainage shall be piped to daylight with the pipe end screened.
12. Fire hydrants shall be placed so that the top operating nut is a minimum of 18 inches and a maximum of 2 feet back from the face of curb unless otherwise directed by the Arlington County Fire Marshal or DES.
13. Fire hydrants shall be installed within recorded easements on private property when locations in public right of way are not possible.

3.03 Minimum Requirement for As-Built Plan

- A. Prior to acceptance of water mains and appurtenances, the Contractor shall submit to the Project Officer all As-Built Drawings as required in Section 01720 of these specifications. Such submittals shall be made prior to Request for Final Payment. As-Built drawings shall include a certification from a Licensed Surveyor or Licensed Engineer that the plans as drawn indicate actual construction. The As-Built Drawings shall include, but are not limited to, the following:
 1. Changes in valve and fire hydrant locations.
 2. Horizontal line changes and/or location of water main appurtenances changes.
 3. Any changes in water main profiles greater than 6-inches.
 4. Actual materials, limits of mechanical joint restraints and location of reaction blocking used on the project.
 5. Water main to meter distances and locations of all water service meters and water service lines.
 6. Show actual location, depth or elevation, type and size of all utility crossings.
 7. Provide a minimum of two (2) swing ties to all valve boxes and permanent blow offs from fixed permanent objects visible above snow cover such as fire hydrants, utility poles or building corners. Swing ties shall cross as near to ninety degrees as practical for each valve box and blow off located.

3.04 Construction Standards

- A. Laying Pipe

1. Use proper and suitable tools for the safe handling and laying of pipes and fittings. Prevent fitting linings and coatings from being damaged; damaged pipe shall be replaced or repaired to the satisfaction of the Project Officer.
2. Unless indicated otherwise, the depth of trench shall be sufficient to provide a minimum cover over the top of the pipe of 4.0 feet from the existing or proposed ground surface and to avoid interference of the pipeline with other utilities. Install pipe on continuous grades, as indicated on plans, to avoid sags or crests in the line.
3. The cutting of pipe for inserting valves, fittings, or closure pieces shall be done in a neat and workmanlike manner, without damage to the pipe, so as to leave a smooth end at right angles to the axis of the pipe. Outside edge of cut pipe shall be beveled and smoothed to avoid damage to the gasket. Avoid damage to the lining. Do not flame cut cast iron pipe with oxyacetylene torch.
4. Thoroughly clean pipes and fittings before they are laid.
5. Carefully lower pipe fittings into trench. Butt ends of pipe against each other in such a manner that there shall be no shoulder or unevenness on the inside of the pipe.
6. Ensure that pipe is well bedded on a solid foundation as shown in the standard details. Correct any defects due to settlement. Excavate bell holes sufficiently large to ensure making proper joints. Exercise precautions to include the furnishing and placing of aggregate to prevent any pipe from resting directly on rock. Rock found in trench shall be removed to provide a clearance of at least six inches below and on each side of all pipe, valves and fittings and shall be replaced with select fill.
7. Iron pipe shall be jointed in full accordance with AWWA Standard C600, the manufacturer's recommendations and the following requirements:
 - a. Push-on joints shall be thoroughly cleaned. Brush-coat gasket retaining groove with approved gasket lubricant and insert the rubber gasket in the bell socket. Apply a thin film of approved gasket lubricant to the exposed gasket surface. Clean and center the spigot end of the pipe into the socket complete the joint by forcing the spigot end to the bottom of the socket.
 - b. Mechanical joints shall be thoroughly cleaned. Lubricate the gasket and spigot. Place the gland on the spigot end, followed by the gasket, and the pipe end seated and centered in the socket. The gasket shall then be seated in the sockets, gland moved into position and bolts and nuts loosely assembled by hand. Tighten with a wrench.
8. At the close of work each day, close end of the pipeline with an expansion stopper so that no dirt or other foreign substance may enter the line. Keep this stopper in place until pipe laying is resumed.
9. Remove and replace all defective materials at no additional cost to the County.

B. Connections to Existing Mains

1. Notify the Project Officer two (2) working days prior to scheduling work on existing water mains (notify Project Officer on Thursday before proposed Monday work). No connections shall be scheduled for the day before weekends and holidays. Connect new water mains to the existing mains as shown on the drawings. Verify the location, type of pipe and size of the existing main well in advance of any work on the connection. The Contractor shall give DES at least

five (5) days' notice of the need to shut down existing water mains so that DES may give advanced notice to the affected customers. Shutdowns in service, where permitted, and operation of any valves on the existing system shall be done only by DES. To minimize shutdown time, connections to water lines shall be made by the Contractor only after complete preparations for such work have been done to the satisfaction of the Project Officer.

2. Reaction backing at connections to existing mains shall be made with high early strength concrete. In the event that line pressure must be restored less than 48 hours after the placement of reaction backing at these connections, provide temporary deadman and/or similar devices as required to maintain stability of the water mains.

C. Installing Valves and Fittings

1. Install valves, fittings, and caps to pipe in the manner herein before specified for laying pipe. Provide valve boxes for each buried gate valve. Boxes shall not transmit shock or stress to the valve. Center and plumb boxes over the operating nut of the valve, with the box cover flush. Valves shall be strapped to adjacent fittings unless directed otherwise.
2. Inserting valves and tapping sleeves and valves shall be installed in accordance with the valve manufacturer's recommendations. Test pits shall be dug by the Contractor to determine type and size of existing pipe and suitability of tapping location on the pipe.

D. Thrust Restraint

1. Provide caps, tees, bends and inserting valves in water mains with reaction backing and mechanical joint restraints except where tie rods are specified or indicated. Reaction backing shall consist of concrete thrust blocks as shown on the Standard Details. Valves for connections to future lines, fire hydrants and related valves, and other fittings or valves so indicated shall be anchored by steel rods protected by two coats of acid-resisting asphalt paint.
2. The use of reaction backing may be waived in the sole discretion of DES if the designer provides calculations to indicate an adequate number of joints are restrained in proximity to caps, tees, bends and inserting valves. The limits of restraints shall be indicated clearly on the approved plans.
3. Concrete thrust blocks shall be installed per the requirements for cast-in-place concrete in Section 03100 of these Specifications and DES Standard Details.

E. Water Service Connections

1. Water meters, including taps, pipe fittings, meter box, and accessories from the water main through the meter, shall normally be furnished by, and installed by, Arlington County after payment of the appropriate fee. Connections from the meter installation to the building shall be installed by the Contractor.
2. For water meters installed as part of a contract, the taps, pipe fittings, meter box and accessories from the water main to the existing building service line, shall be furnished and installed by the Contractor. Water meters will be provided by the County.
3. For water meters relocated as part of a contract, the taps, pipe fittings, meter box and accessories from the water main to the existing building service line, shall be

furnished and installed by the Contractor. The existing meters shall be re-installed in the new housing location. The Contractor shall clearly photograph the existing meter reading prior to and immediately after the relocation and submit the photographs to the Project Officer.

4. The Department of Environmental Services shall approve all water meter locations. Water meters shall be located in the utility strip or just behind the curb within public right-of-way or recorded easements and a minimum of 5 feet horizontally clear from other utilities, structures, or trees.
5. The Contractor shall assume complete responsibility for the installation, adjustments and any damage that may occur until final acceptance of the project.
6. New water mains shall pass all acceptance testing procedures before the installation of water service connections.
7. All services shall be installed by wet tap only. Service taps shall be located at the 10:00 and 2:00 position on the water main. Maintain a minimum of 12 inches between taps. Direct taps are allowed for 1-inch connections. Use approved saddles for 1 ½-inch and 2-inch connections.
8. Water service lines shall have a minimum of three feet of cover and shall be approved by the Project Officer, from the main to the meter prior to backfilling. Meter settings for 1- inch to 2-inch services shall be a minimum of 18-inches and a maximum of 24-inches below the meter box cover. Meter box covers shall be painted black with an exterior type of rust resistant enamel.
9. Where specified that Contractor shall install the water service, meter boxes, meter box covers, corporation stops, angle valves, yoke ells, yoke bars and all other appurtenances (except the water meter) necessary for a complete installation shall be provided in accordance with the approved plans, specifications, and requirements of DES.

F. Abandoning Existing Water Mains

1. Drain and abandon existing water mains not required in the completed system. Abandoned mains and appurtenances that conflict with proposed construction shall be removed as required. Abandoned mains not removed shall be capped or bulk headed at all open ends.
2. Valves to be abandoned shall be removed along with the valve box, or if abandoned in place, the valve box shall be removed, and the resulting void shall be stabilized via use of flowable fill or other approved means to avoid any future settlement.
3. Cut and cap the existing water mains to remain in service at the locations indicated on the drawings and provide with thrust block. Keep the length of pipe removed to the minimum necessary for installing the cap and concrete blocking. A cap shall be placed over the end of the pipe to be abandoned. The concrete thrust block shall be placed to bear against undisturbed ground. After this work has been completed, the capped line shall not be recharged unless so directed by the Project Officer.
4. Existing fire hydrants not required in the completed system shall be carefully removed, cleaned and transported to the County storage yard. Cap and anchor hydrant lead as close as possible to its control valve with concrete thrust block and tie rods if main is to remain in service.
5. Existing water services shall be discontinued by DES unless a written request is provided to DES for the temporary use of the service during construction. Water meter boxes and vaults shall be removed by the Contractor. Water meters shall be

removed by DES as required. No credit or allowance shall be given for discontinued water services.

G. Disinfection of Water Mains

1. When each pipe length has been placed and shut off, disinfect each section of the water main. Provide all labor, materials and equipment to perform the disinfection operations in compliance with all state and local regulations. Disinfection shall conform to AWWA C601 and C51 requirements.
2. Water for disinfection, flushing and testing shall be furnished to the Contractor from the existing water system at no charge to the Contractor. Schedule water usage with the Project Officer to result in a minimum interference to water service throughout the existing water system. Temporary connections to the existing water system shall be provided and removed by the Contractor and shall include approved means to prevent backflow and possible contamination of the existing water system. Temporary taps for removing air and flushing the main shall be provided by the Contractor as necessary.
3. Disinfection of the water main shall be accomplished in the following manner:
 - a. Preliminary Flushing of Mains: All mains shall be flushed prior to disinfection except when the tablet method of disinfection is used. The mains shall be flushed at a minimum velocity of 3 feet per second and all points in the main shall receive a minimum of five (5) consecutive minutes of flushing at this velocity, until the water runs clear.
 - b. Form of Chlorine to be Used: Liquid chlorine, calcium hypochlorite or sodium hypochlorite may be used for disinfection. Liquid chlorine shall be used only when approved by the Project Officer. Calcium hypochlorite and sodium hypochlorite shall be added to water to form a chlorine water solution before being used.
 - c. Methods of Application: The chlorine shall be applied by continuous feed method or by the tablet method only (slug method shall not be used). The application shall be performed as follows:
 - 1) Continuous Feed Method: Potable water shall be introduced into the pipe line at a constant flow rate. Chlorine shall be added at a constant rate to this flow so that the chlorine concentration in the water in the pipe is at least 50 mg/L. The chlorinated water shall remain in the pipe at least 24 hours, after which, the chlorine concentration in the water shall be at least 10 mg/L.
 - 2) Tablet Method: Tablet method shall not be used if trench water or foreign material has entered the main or if the water is below 50C (41oF). Tablets are placed in each section of pipe and also in hydrant branches and other appurtenances. A sufficient number of tablets shall be used to ensure that a chlorine concentration in the water in the pipe is at least 25 mg/L. The tablets shall be attached by an adhesive to the top of the pipe sections and crushed or rubbed in all appurtenances. The adhesive shall be acceptable to the Virginia Department of Health (VDH). When installation has been completed, the main shall be filled with water at a velocity of less than one foot per

second. The water shall then remain in contact with the pipe for at least 24 hours.

4. Contact Period: The chlorinated water shall be retained in the main for at least 24 hours during which time all valves and hydrants, in the section treated, shall be operated in order to disinfect the appurtenances. The tests for chlorine residual shall be made by the Contractor in the presence of the Project Officer. The Contractor shall install corporation cocks and copper tubing for the tests at the locations indicated by the Project Officer.
5. Flushing and Discharge: The Contractor shall be solely responsible for the disposal of all chlorinated water in accordance with these Specifications and with all applicable Local, State, and Federal regulations and permits.

H. Hydrostatic Testing

1. Pressure tests shall conform with Section 4 of AWWA Standard C600.
2. The water mains shall be tested for leakage by the Contractor at his own expense in the presence of the Project Officer. All tests shall be conducted in a manner to minimize any interference with the Contractor's work or progress. A maximum of 2,000 linear feet of water main may be tested at one time.
3. The Contractor shall notify the Project Officer when the work is ready for hydrostatic testing and tests shall be taken soon thereafter as practicable under the direction of the Project Officer. Personnel for reading meters, gauges or other measuring devices shall be furnished by the Project Officer, but all other labor, equipment, water and materials, excluding meters and gauges, shall be furnished by the Contractor.
4. The water mains, including all appurtenances, shall be tested as a whole or in sections, valved or bulkhead at the ends. Test piping under a hydrostatic pressure of 200 psig unless shown otherwise on the approved plans. Testing shall not be conducted against existing valves. Apply pressure to the piping after it has been purged of air. Maintain water pressure for a minimum of two hours. The test pressure shall not vary by more than 5 psi during the test. Testing procedures shall be in accordance with AWWA Standard C600 with the exception that in no case shall the measured leakage exceed 10 gallons/ inch of diameter/mile/day.

I. Final Flushing

1. All water mains shall be flushed after the acceptance of the hydrostatic test and before bacteriologic testing. The water mains shall be flushed at the highest flow possible through hydrants and/or blow-offs. The operation of any valves on the existing water system shall be done only by DES. Water discharged to the environment, storm, or sanitary sewer system shall be done in accordance with these specifications and all applicable regulations.

J. Bacteriologic Test

1. After chlorination, hydrostatic testing and final flushing, and before the water main is placed in service, samples shall be collected from the main and tested for enteric bacterial contamination and shall show the absence of coliform organisms. At least two (2) sets of consecutive satisfactory bacteriological

samples shall be obtained from the distribution system before the system can be placed into service.

2. Samples shall be collected in one of the following manners:
 - a. At all accessible locations not exceeding 1,200 feet apart in the line downstream from where the pipe was filled with water. After the initial samples are taken, resample after 16 hours.
- OR-
- b. At all accessible locations not exceeding 1,200 feet apart in the line downstream from where the pipe was filled with water. Allow main sit for 16 hours without water movement, then take first set of samples with a second set of samples after a 15- minute waiting period.
3. Samples shall be taken through the use of sample tap consisting of a corporation cock and copper tube or through other accessible appurtenances on the main. Samples shall be collected by a representative of the testing laboratory.
 - a. All bacteriological sampling and testing shall be conducted by a state certified laboratory. If the initial disinfection fails to produce satisfactory samples, disinfection shall be repeated until satisfactory samples have been obtained. After each group of samples is taken, the Contractor shall submit in writing to the Project Officer a copy of the report stating the results of the tests.

K. Repairs: Cleaning, disinfecting, flushing, testing, or similar operational actions shall be in accordance with the most current standards issued by AWWA (AWWA C-601).

L. Discharge of chlorinated water

1. The contractor shall be responsible to handle, discharge, and dispose chlorinated water in compliance with all regulations, including the County's Municipal Separate Storm and Sanitary Sewer (MS4) Permit.
2. No potable water shall be discharged to the environment or the storm sewer system until complete dichlorination has been achieved.
3. Contractor shall be responsible to identify, implement, and monitor appropriate dichlorination methods which comply with all applicable regulations.
4. Contractor shall conduct testing on-site to confirm that chlorine has been removed from any water discharged to the environment or storm sewer.
5. Contractor shall take care to ensure that any discharge of dechlorinated water to the storm sewer or environment does not create any adverse impacts to the environment or infrastructure, such as erosion, or water volumes, temperatures, or velocities which adversely affect existing aquatic or terrestrial life in the receiving bodies.
6. Super chlorinated water which has been used to disinfect the system, or any water which exceeds the generally prevailing chlorine concentration in the system (measured as less than 4 mg/L), shall be discharged to the sanitary sewer system after submittal and approval of a discharge plan. The discharge plan shall be submitted in accordance with Section 01300, and shall document at a minimum:

- a. the receiving sanitary sewer manhole,
 - b. the anticipated rate and duration of discharge,
 - c. plans to prevent any hydraulic connection between wastewater and the water distribution system (backflow prevention or an adequate air-gap),
 - d. listing of methods and equipment to be used,
 - e. accommodations to maintain vehicular and pedestrian traffic during the operation.
7. Discharge of water to the sanitary sewer shall not exceed 200 gallons per minute.
 8. Discharge of water to the sanitary sewer shall not occur without the Project Officer present and shall be conducted only after careful disinfection of all components connected to the water system.
 9. At all times during discharge of water to the sanitary sewer system, the Contractor shall have personnel monitoring the discharge into the sewer to ensure there is no cross connection and that there are no adverse impacts upon the water or sanitary sewer system.
 10. If an adequate sanitary sewer facility is not available, the discharge plan may require use of a tanker truck to collect and dispose of the water in a sanitary sewer.
- M. Unless otherwise directed, Contractors are expressly prohibited from operating any water valves or appurtenances. Contractors shall submit all requests for valve operations to the Project Officer at least 3 working days in advance of the required operation.
- N. In the event of a water or sewer emergency, the Contractor shall immediately notify the County's Water Control Center at 703-228-5555 and the Project Officer

END OF SECTION 02550

SECTION 02611 - CONCRETE WALKS AND CONCRETE DRIVEWAY ENTRANCE

PART 1 - GENERAL

1.01 Description of Work

- A. Provide all labor, plant materials, and equipment to lay all concrete walks and driveway entrance as detailed in the Construction Standards and as called for on the approved plans.

1.02 Related Work Specified Elsewhere

- A. Section 02200 – Earthwork
- B. Section 02600 – Bituminous Roadway Pavements
- C. Section 03100 - Concrete Formwork, Reinforcement and Materials

1.03 Applicable Standards and Specifications

- A. American Society for Testing and Materials (ASTM)
- B. Virginia Department of Transportation, Road and Bridge Specifications (VDOT)
- C. Arlington County, VA Materials Specification Testing Reference

PART 2 - PRODUCTS

2.01 Aggregate Base

- A. The aggregate base shall be aggregate having CBR-30 and conforming to VDOT Section 205 gradation 25 or 26 or coarse aggregate of size 68 in conformance with Section 203 of the VDOT Specifications.

2.02 Concrete

- A. Concrete shall be Portland Cement air-entrained Class A3 in conformance with Section 03100.

2.03 Joint Filler

- A. Joint filler shall be 1/2-inch preformed asphalt expansion joint material conforming to ASTM D994 or ASTM D1751.

PART 3 - EXECUTION

- 3.01 Concrete testing shall be conducted in conformance with Section 03100 of these specifications. All testing must be in compliance with the Arlington County, VA Materials Specification Testing Reference.
- 3.02 Thoroughly prepare and compact the sub grade as specified in Section 305 of VDOT Specifications.
- 3.03 Place the aggregate base in conformance with Section 309 of the VDOT Specifications.
- 3.04 Joints shall be constructed at intervals of 40 feet, except for closures, but a slab shall not be less than 6 feet in length. Separate slabs by transverse pre-molded expansion joint filler for the full

- width of the slab, extending from the bottom of the slab to within one-quarter (1/4) inch of its top surface. Divide the slab between expansion joints into blocks 5-feet in length by scoring transversely. Where slabs are more than 7-feet in width, they shall be scored longitudinally to secure uniform blocks approximately square. Extend traverse and longitudinal scoring to at least 1/3 of the depth of the concrete slab. Scoring of transverse and longitudinal joints may be done with trowels, finishing and edging tools or by other means approved by the Project Officer.
- 3.05 Where sidewalks are constructed adjacent to permanent structures or other rigid construction on one side and curb on the other, extend an expansion joint of pre-molded material only along back at curb and place for the full depth of the slab. Place a pre-molded expansion joint between the sidewalk and adjacent curb at all crosswalks both public and private. Fasten pre-molded expansion joint filler to prevent displacement.
- 3.06 Where sidewalk is constructed in conjunction with adjacent curb, the expansion joints in the curb and sidewalk shall coincide. Where such construction is adjacent to existing curb, the expansion joints shall, if practicable, coincide. Prior to placing concrete around any permanent structure, place pre-molded expansion joint material around such structure for the full depth of the sidewalk.
- 3.07 Where existing structures, such as light standards, poles, fire hydrants, etc., are within the limits of the sidewalk area, place pre-molded expansion joint around the structure for the full depth of the concrete.
- 3.08 Place sidewalk stress columns 6 inches in diameter and a minimum depth of 12 inches below the bottom of the sidewalk at locations shown in Construction Standards unless otherwise specified by the Project Officer. The holes for the columns may be dug with a post hole digger or other approved means. The concrete must be the same type used in the sidewalk and placed at the same time.
- 3.09 Provide concrete forms and pour the concrete in conformance with Sections 316 and 504 of the VDOT Specifications.
- 3.10 Finish concrete walks and driveways as specified in Section 316.04 of the VDOT Specifications.
- 3.11 The surface tolerance of the completed work shall be as specified in Section 316 of the VDOT Specifications.

END OF SECTION 02611

SECTION 02619 – PERMANENT SIGNS

PART 1 - GENERAL

1.01 Description of the Work

- A. Provide all necessary labor, materials and equipment to provide, fabricate, and install the permanent signs, posts, and connections as shown on plans, details, and these specifications. All work under this section is subject to the Special and General Conditions and Instruction to Bidders which form a part of these specifications and to the current editions of the Arlington County Construction Standards and Specifications Manual and Virginia Department of Transportation Road and Bridge Specifications (VDOT). The Contractor shall be responsible for and governed by all the requirements thereunder.

1.02 Related Work Specified Elsewhere

- A. Section 03100 – Concrete, Formwork, Reinforcement and Materials
- B. Section 13180 – Maintenance and Control of Traffic.

1.03 Applicable Standards and Specifications

- A. Virginia Department of Transportation Road and Bridge Specifications (VDOT)
- B. Virginia Department of Transportation Road and Bridge Standards (VDOT)
- C. Manual on Uniform Traffic Control Devices (MUTCD)
- D. Virginia Department of Transportation Supplement to the Manual on Uniform Traffic Control Devices
- E. Virginia Standard Highway Signs Manual
- F. American Association of State Highway and Transportation Officials (AASHTO)
- G. American Society for Testing and Materials (ASTM)
- H. Federal Highway Administration (FHWA)

1.04 Submittals

- A. The Contractor shall submit colors and shop drawings of the signs to the Project Officer for approval prior to fabrication.
- B. The Contractor shall submit, with the sign shipment, copies of the sheeting manufacturer certifications noting that the sheeting material on the sign supplied meets all of the sheeting federal specifications.

PART 2 - PRODUCTS

2.01 All signs shall conform to the latest editions of the Manual on Uniform Traffic Control Devices (MUTCD) and the VDOT supplement to the MUTCD.

2.02 All signs shall be in compliance with the latest version of the Virginia Standard Highway Signs Manual.

2.03 Sign anchors, bases, or sleeve bases shall meet current AASHTO, FHWA, and VDOT requirements for breakaway and yielding and shall be galvanized or stainless steel.

- 2.04 Sign posts shall be 2-inch square black powdered coated 14 gauge steel tube posts with full length punching on all four sides of 7/16-inch diameter holes spaced 1 inch on center starting 1 inch from each end. Posts shall conform to the standard specification for Hot-Rolled Carbon Sheet Steel, structural quality ASTM designation A570, Grade 50.
- 2.05 Anchor sleeves set in concrete shall be 30-inch long, 2.5-inch square 7 gauge galvanized steel posts with full length punching on all four sides of 7/16-inch diameter holes spaced 1 inch on center. Installation hardware shall include a 5/16 corner bolt with flanged nut.
- 2.06 Sign attachments will be made with 3/8-inch driver rivets with washers.
- 2.07 Sign bracing products, if needed, shall conform to VDOT Road & Bridge Standards (Details 1321.19, 1321.20, 1321.21).
- 2.08 Sign surface image shall conform to applicable portions of Sections 247 and 701 of the VDOT Road and Bridge Specifications.
- 2.09 Signs shall be drilled for bolts prior to painting.
- 2.010 Post footings shall be Class A-3 concrete per Section 03100 of the Arlington County Construction Standards and Specifications Manual.

PART 3 - EXECUTION

- 3.01 The signs shall be installed in locations as shown on the plans.
- 3.02 Posts located in earth shall be anchored or driven to a minimum depth of 36 inches.
- 3.03 Driving caps shall be used when driving posts following the manufacturer's instructions.
- 3.04 Posts located in concrete sidewalk or concrete medians shall be installed per VDOT Detail 1321.13 Square Tube Sign Post Foundation Type A for 2-inch square tube post, except that the post shall extend 36" (thirty-six inches) minimum below finished grade.
- 3.05 Posts located outside of concrete surfaces shall be installed per VDOT Detail 1321.17 Square Tube Sign Post Foundation Type D for 2-inch square tube post.
- 3.06 Concrete for footings shall be poured in accordance with the requirements outlined in the Section 03100 of the Arlington County Construction Standards and Specifications Manual.
- 3.07 The sign shall be centered on the post and fastened with the specified bolts.
- 3.08 The lower edge of signs shall be in accordance with VDOT Detail 1321.10 Square Post Sign Detail.

END OF SECTION 02619

SECTION 02650 - RESTORATION OF ROADWAY

PART 1 - GENERAL

1.01 Description of Work

- A. Provide the necessary plant, labor, materials, and equipment to restore and maintain the various street and driveway surfaces of all types, pavement and driveway bases, curbs, curb and gutter, and sidewalks disturbed, damaged or demolished during the performance of the work.

1.02 Related Work Specified Elsewhere

- A. Section 02200 – Earthwork
- B. Section 02600 - Bituminous Roadway Pavements
- C. Section 02601 - Bituminous Hiking, Biking and Jogging Trails
- D. Section 02611 - Concrete Walks and Concrete Driveway Entrance
- E. Section 02612 - Interlocking Concrete and Brick Pavers
- F. Section 02750 - Curb and Gutters
- G. Section 03100 - Concrete Formwork, Reinforcement and Materials

1.03 Applicable Standards and Specifications

- A. American Society for Testing and Materials (ASTM)
- B. Virginia Department of Transportation, Road and Bridge Specifications (VDOT)
- C. American Association of State Highway and Transportation Officials (AASHTO)

1.04 Permits

- A. Before performing any work, secure the necessary permits to work within the County or State right of way and easements when surface materials shall be disturbed or demolished.

PART 2 - PRODUCTS

- 2.01 The quality of materials used in the restoration of existing pavements and driveways shall produce a street surface equal to or better than the condition before the work began.
- 2.02 Concrete shall be Class A3 air-entrained Portland cement type as specified in Section 03100.
- 2.03 The base and surface courses shall be BM-25.0A and SM-9.5A respectively as specified in Section 02600.
- 2.04 Crusher run aggregate shall be size 25 in conformance with Section 206 of the VDOT Specifications.
- 2.05 Joint filler shall be 1/2-inch preformed asphalt expansion joint material conforming at ASTM 1751.
- 2.06 Asphalt for a temporary patch shall be BM-25.0A as specified in Section 02600.

2.07 Prime Coat shall conform to VDOT Section 310 for Asphalt Binders.

PART 3 - EXECUTION

- 3.01 At the end of each work day, the road surface shall be brought flush with the adjacent surface using hot mix asphalt. A minimum of 4" of hot mix asphalt shall be installed. All lanes shall be open for traffic during non-work hours unless otherwise directed in writing by the Project Officer. The Contractor shall maintain all road surfaces within the work area to provide a smooth drivable surface with no significant potholes, dips, or bumps of any kind.
- 3.02 Where trenches have been opened in any roadway or street that is a part of the VDOT highway system, restore surfaces in accordance with the requirements of VDOT. All other restoration shall be done in accordance with the Contract Drawings, these specifications, and the Arlington County Construction Standards.
- 3.03 Contractor shall submit the extent of the pavement restoration to the County for approval, prior to any saw cuts and/or milling and paving to the existing pavement.
- 3.04 Existing manhole frames, covers, valve boxes and other appurtenances shall be adjusted to the final grade or replaced, as necessary.
- 3.05 Removal of concrete pavement, if encountered, will be to the next joint. In some cases, and when approved by the County Project Officer, the Contractor may be allowed to saw cut a neat joint mid-span of the existing concrete pavement. The limits of concrete pavement restoration shall be determined by the County Project Officer.
- 3.06 Excavation in the pavement area shall require that pavement surfaces be saw-cut to provide a straight and smooth edge. Cut out pavement 24-inches wider than the trench width or excavation opening as shown on Construction Standard M-6.0.
- 3.07 Upon completion of installation of utility and backfill, fill the top 18-inches of the trench with crusher run and temporary asphalt patch until such time that the permanent pavement patch shall be constructed.
- 3.08 Complete the pavement restoration for the various types of streets in conformance with Construction Standard M-6.0 and Section 02600 of these specifications.
- 3.09 Concrete curb and gutter, and sidewalks, shall be restored as required to match existing construction. Replace damaged sections with complete new sections or squares; patching of damaged sections shall not be permitted.
- 3.010 Maintain restored sections and surfaces as part of the Contract requirements for a period of one year following the date of final acceptance.
- 3.011 When a manhole top requires adjustment to an elevation one inch or more above the existing pavement grade and is exposed to traffic before final paving is completed, a temporary ramp shall be constructed by feathering bituminous concrete for 360 degrees around the manhole. A taper slope of not less than two feet per one inch shall be used. During the paving operation, but prior to the placement of the topping course, the bituminous concrete taper shall be removed from around the manhole to a minimum depth of one inch below the top of manhole.

END OF SECTION 02650

SECTION 02750 - CURB AND GUTTERS

PART 1 - GENERAL

1.01 Description of Work

- A. Provide all plant, labor, materials and equipment to install the concrete curbs and combination concrete curb and gutters as called for on the approved plans, as detailed on the Construction Standards, and as specified herein.

1.02 Related Work Specified Elsewhere

- A. Section 02200 – Earthwork
- B. Section 02600 – Bituminous Roadway Pavements
- C. Section 02611 - Concrete Walks and Concrete Driveway Entrance
- D. Section 03100 - Concrete Formwork, Reinforcement and Materials

1.03 Applicable Standards and Specifications

- A. American Association of State Highway and Transportation Officials (AASHTO)
- B. American Society for Testing and Materials (ASTM)
- C. Virginia Department of Transportation, Road and Bridge Specifications (VDOT)

PART 2 - PRODUCTS

2.01 Concrete

- A. Concrete shall be air entrained Portland cement class A3 in conformance with Section 03100.

2.02 Joint Filler

- A. Joint filler shall be 1/2-inch preformed asphalt expansion joint material conforming to ASTM D994 or ASTM D1751.

2.03 Subbase

- A. The aggregate base shall be aggregate having CBR-30 and conforming to VDOT Section 208, gradation size 21A.

PART 3 - EXECUTION

- 3.01 Construct the sub grade to the required elevation below the finished surface of the gutter in accordance with dimensions and design as shown on Construction Standards. Remove all soft and unsuitable material and replace with subbase material, which shall be compacted to 95% density in accordance with AASHTO T-99 and finished to a smooth surface. Moisten the subbase prior to placing the concrete.

- 3.02 When curb and gutter or structures along the curb are being replaced adjacent to an existing roadway surface, the roadway surface must be excavated and restored as per VDOT detail WP-2 to allow for formwork.
- 3.03 Construct forms of wood or metal conforming to VDOT Section 316.
- 3.04 Prior to placing concrete, check the line and grade for accuracy and fasten the face forms of the curb to the gutter forms. Spade the concrete and tamp sufficiently to bring the mortar to the surface, after which finish with a magnesium float. Construction shall be in sections of uniform lengths, providing transverse joints at approximately 10-foot intervals and when the time elapsing between placements exceeds 45 minutes. No section shall be less than 6 feet in length. Separate sections by plate steel templates set perpendicular to the grade and center line of the unit specified. The templates shall be 1/8-inch in thickness and shall have a width and depth equal to the unit cross-section. Leave these templates in place until the concrete has set sufficiently to hold its shape.
- 3.05 Form expansion joints at intervals of 100 feet or less. When the curb and gutter is constructed adjacent to rigid pavements, the location and width of expansion joints shall coincide with those in the pavement, where practicable. Where stationary structures, such as catch basins and drop inlets, are within the limits of the curb and gutter, place an expansion joint between the structure and the curb and gutter. Place expansion joints at all returns.
- 3.06 Screed the face and top of curb and surface of gutter smooth and round the edges to a radius as shown on the Construction Standards.
- 3.07 As soon as the concrete has attained sufficient set, remove the face forms of the curb. The exposed surfaces shall be screeded with a straight edge and finished with a steel trowel. Remove all trowel marks with a brush wet with clear water. Do not use mortar in finishing.
- 3.08 The finished surface of curb and gutter shall be true to line and grade with an allowable tolerance as specified in Section 316.05 of the VDOT Specifications.
- 3.09 After the concrete has set in conformance with Section 03100, fill the spaces on both sides of gutter or the back side of curb to the required elevation with suitable material and compact to 95 percent density in accordance with AASHTO T-99 in layers of not more than 6-inches.

END OF SECTION 02750

SECTION 02910 – SOIL PROFILE REBUILDING

PART 1 – GENERAL

1.01 PURPOSE

- A. Soil Profile Rebuilding is an appropriate soil restoration technique for sites where topsoil has been completely or partially removed and subsoil layers have been compacted (graded and/or trafficked by equipment). It may also be used with some modifications if topsoil is present. This is not an appropriate technique in sites with surface compaction only (6 inches or less), although this situation is rare on construction sites. This technique is not appropriate within the root zones of trees that are to be protected. Soil Profile Rebuilding can improve physical and biological characteristics of soil to allow for revegetation. Soil chemical problems, soil contamination from heavy metals, pathogens, or excessive debris or gravel shall be addressed separately.

1.02 DESCRIPTION OF PROCEDURE

- A. The procedure includes a subsoiling procedure, addition of organic matter in the form of compost, replacement or addition of topsoil, and subsequent planting with woody plants. The soil preparation portion of Soil Profile Rebuilding puts the components in place for restoration to characteristics similar to undisturbed soils, however, the complete restoration process requires root activity and occurs over many years. This technique may be appropriate for restoration of disturbed soils as defined by SITES™.

1.03 EXPECTED OUTCOMES

- A. Soil Profile Rebuilding may improve vegetation establishment, increase tree growth rates, increase soil permeability, enhance formation of aggregates in the subsoil, and enhance long-term soil carbon storage.

PART 2 – PROCEDURE

2.01 LOCATION

- A. Profile Rebuilding shall occur on all soil areas that are to be vegetated that have been disturbed by trafficking or grading during construction or prior to construction. Soil areas that are not to be treated should be protected by permanent fencing during the construction period and all access to these areas prohibited. A soil map delineating protected areas and areas to be treated shall be approved by the owner, arborist, or landscape architect before grading or construction begins.

2.02 SEQUENCING

- A. Profile Rebuilding shall occur after site disturbance is complete, including all vehicle and equipment trafficking, but before replacement of topsoil. Once profile rebuilding is complete, all traffic and equipment or materials storage on treated areas is prohibited with the exception of foot traffic for the purposes of planting or mulching.

- B. If topsoil is already present and is 4 inches or greater in depth, use the “modifications for pre-existing topsoil.”

2.03 REMOVE FOREIGN MATERIALS

- A. Remove all foreign materials resulting from construction operations, including oil drippings, stone, gravel, and other construction materials from the existing soil surface.

2.04 APPLICATION OF COMPOST

- A. Spread mature, stable compost (see Section 3. Definitions for definition of compost) to a 4 inch depth over compacted subsoil.

2.05 REMOVE FOREIGN MATERIALS

- A. Subsoiling may be performed when soil is neither wet nor dry. If a shovel cannot be forced into the soil, it is too dry. If the surface is sticky or muddy, it is too wet. Use a backhoe rearbucket or similar equipment with a tined bucket to break up the compacted soil and incorporate the compost. Work backwards away from excavated soils so that treated soil is not trafficked by the equipment. Insert the bucket through the compost layer and into the subsoil to a depth of 24 inches and raise a bucket of soil at least 24 inches above the soil surface. Tip the bucket and allow soil to fall. Repeat this procedure until no clumps of compacted soil larger than 12 inches in diameter remain. The tines of the bucket can be used to break apart larger clumps if necessary. 50% of the soil shall be in clumps 6 inches or smaller. No clumps shall be greater than 18” in diameter. The subsoiling is not intended to homogenize the compost and soil, but rather loosen the soil to a 24-inch depth and create veins of compost down to that depth as well. To ensure that subsoiling reached the appropriate depth, a push tube soil sampler shall be used to verify compost is present at 24 inch depth.

2.06 REPLACEMENT OF TOPSOIL

- A. Stockpiled topsoil, or additional topsoil if none is available from the site, shall be returned to the site to a 4 inch minimum depth (see *Section 3.3 Definitions* for definition of topsoil). If soil was severely disturbed (see definitions), a 6-8 inch minimum shall be replaced.
- B. *Modification if significant topsoil is already present before Profile Rebuilding is initiated*
 - Case 1:*

At least four inches of topsoil is present on the site after construction activities are completed AND soil is **not** severely disturbed (see *Section 3.3 Definitions* for description of severely disturbed).
 - Case 2:*

Less than 4 inches of topsoil is present on site after construction activities were completed but before Profile Rebuilding is initiated, OR soil is severely disturbed (see *Section 3.3 Definitions* for description of severely disturbed).

For Case 1: A minimum of 3 inches additional topsoil shall be placed over the subsoiled layer before tilling.

For Case 2: Follow *Section 2.6.1 Standard procedure*, as if no topsoil had been present.

2.07 TILLING

- A. Rototill topsoil to a depth of 6-8 inches when soil is neither dry nor very moist. Rototilling depth should cross the interface with the subsoiled layer by a minimum of 1 inch and can be verified with a random sampling with a push tube soil sampler.

2.08 PLANTING

- A. Plant the site with woody plants, trees or shrubs, at a density that insure a minimum of 50% of the site will be occupied with roots within 10 years. Planting of at least one large stature tree (e.g., one that will mature at approximately 60-70 feet in height) or 20 medium stature shrubs per 5,000 sq. ft. shall be considered to achieve this.

PART 3 – DEFINITIONS

3.01 TOPSOIL - Soil can be considered topsoil if it originates from an A horizon of a natural soil or is a mineral soil with 3% or greater organic matter content and a NRCS textural class similar to pre-development A horizon soils for the site or as specified by the owner, arborist, or landscape architect. Blended soils shall not be used unless specified by the owner, arborist, or landscape architect. In addition topsoil shall:

- A. Be friable and well drained;
- B. Have a pH between 5.2 and 7.5 (a narrower range may be specified for particular plant material);
- C. Have an organic matter content not less than 3%;
- D. Have low salinity as indicated by an electrical conductivity of less than 4.0 mmhos/cm
- E. Be free of debris, stones, gravel, trash, large sticks, heavy metals, and other deleterious contaminants, (if screening is used to remove debris, screen size must be ¾ inch or larger);
- F. Have a nutrient profile such that it is able to support plant growth;
- G. Be free of noxious weed seeds.

3.02 COMPOST- Compost feedstock shall be leaves, yardwaste, or foodwaste. Biosolid-based composts shall not be used. A compost sample with analysis shall be submitted for approval to the client before application. Stability refers to the rate of biological breakdown, measured by carbon dioxide release. Maturity refers to completeness of the aerobic composting process and suitability (lack of plant toxicity) as a plant growth media, often measured by ammonia release and by plant growth tests. Compost manufacturers that subscribe to the US Composting Council's testing program may document stability as compost testing 7 or below in accordance with TMECC 05.08-B, "Carbon Dioxide Evolution Rate". Maturity (suitability for plant growth) may be documented as compost testing greater than 80% in accordance with TMECC 05.05-A, "Germination and Vigor". Compost is considered mature and stable if it tests at 6.0 or higher on the Solvita Compost Maturity Index Rating, which is a combination of Carbon Dioxide and Ammonia Maturity Tests (test information and equipment available at www.solvita.com). Compost shall also:

1. Free of weed seeds
2. Free of heavy metals or other deleterious contaminants
3. Have an EC of less than 4.0 mmhos/cm

3.03 SEVERELY DISTURBED SOIL - Soil shall be considered *severely disturbed* if grade was lowered more than 14 inches OR soil was compacted in lifts regardless of the final grade.

PART 4 – SUBMITTALS

4.01 Soil Map

- A. A soil map indicating soil areas to be protected and those to be restored via Soil Profile Rebuilding shall be submitted by the contractor for approval by the owner, arborist, or landscape architect before construction begins.

4.02 COMPOST

- B. A compost sample with analysis certifying it is stable, mature, from acceptable feedstocks and free of contaminants and weed seeds shall be submitted for approval to the landscape architect or owner before compost is applied to the soil.

4.03 TOPSOIL

- C. A topsoil sample with analysis from a certified testing laboratory and verification of source shall be submitted for approval to the landscape architect or owner before application. Separate documentation is required for each 100 cubic yards of topsoil unless otherwise approved by the landscape architect or owner.

END OF SECTION 02910

SECTION 03100 - CONCRETE, FORMWORK, REINFORCEMENT AND MATERIALS

PART 1 - GENERAL

1.01 Description of Work

- A. Provide all plant, labor, materials and equipment necessary for the completion of the plain and reinforced concrete called for on the approved plans.

1.02 Related Work Specified Elsewhere

- A. Section 03400 - Precast Concrete

1.03 Applicable Standards and Specifications

- A. American Concrete Institute (ACI)
- B. American Society for Testing and Materials (ASTM)
- C. United States Product Standards PS I-66
- D. Virginia Department of Transportation, Road and Bridge Specifications (VDOT)
- E. Wire Reinforcement Institute (WRI)

1.04 Quality Assurance, The following codes and standards are hereby made a part of this specification and concrete work performed shall conform with the applicable references except as specified otherwise in this section.

- A. ACI Standard 318-71 - Building Code Requirements Reinforced Concrete (Working Stress Design) ACI Standard 318 - Building Code Requirements for Reinforced Concrete ACI Standard 315 - Manual of Standard Practice for Detailing Reinforced Concrete Structures ACI Committee Report - Concrete Sanitary Engineering Structures, ACI Committee 350 ACI Standard 301 - Specifications for Structural Concrete for Buildings Wire Reinforcement Institute, Inc., WRI - Manual of Standard Practice, Virginia Department of Transportation, Road and Bridge Specifications (VDOT)

1.05 Submittals

- A. Shop drawings shall include bar tabulations, placement drawings and details.
- B. The Concrete Plant shall provide the concrete mix design and certified test reports on the aggregate, admixture, cement, and curing materials to be incorporated in the concrete for the project.
- C. The steel fabricator shall provide certified mill test reports for the reinforcing steel and accessories to be incorporated in the work.
- D. The Contractor shall provide delivery tickets for concrete and shall include the date, time, truck identification, concrete plant, plant inspector, ticket and load number, concrete class and design mix, moisture content of aggregates, quantity and location of placement.

PART 2 - PRODUCTS

2.01 General

- A. Concrete materials, methods of mixing, conveying, curing, placing, and reinforcement shall conform to the latest requirements of Section 217 of the VDOT Specifications.
- B. The making and removal of forms shall conform to the latest requirements of Sections 316 and 404 of the VDOT Specifications.

2.02 Class of Concrete

- A. Cast-in-place concrete shall be Class A4 (4,000 psi) for Precast structures and bridge deck, Class A3 General Use (3,000 psi) or Class B2 (2,200 psi) unless stated otherwise on the approved plans.

2.03 Earth Forms

- A. Except for the bearing surface of thrust blocks, concrete cradle, concrete encasements, and the second pours of drop manholes, do not place concrete directly against vertical surfaces of the soil.

2.04 Plywood

- A. Except where noted otherwise on the approved plans, use plywood forms for all concrete which shall be exposed in the finished work, and for all exterior walls below grade which are to receive membrane waterproofing. Plywood shall be a minimum of 5/8-inch thick. Each panel shall carry the grade trademark of the American Plywood Association along with the DFPA (Douglas Fir Plywood Association) Quality stamp.

2.05 Form Coating

- A. Use non-grain raising and non-staining type that shall not leave residual matter on surface of concrete or adversely affect proper bonding of subsequent application of other material applied to concrete surface, such as “Nox-Crete Form Coating” as manufactured by the Nox-Crete Company, “Arcal-80” as manufactured by Arcal Chemical Corporation, “Synthex” as manufactured by Industrial Synthetics Company, or approved equivalent. Do not use coatings containing mineral oils or other non-drying ingredients.

PART 3 - EXECUTION

3.01 General

- A. Employ a competent and acceptable crew leader for concrete work. This crew leader shall be thoroughly familiar with all phases of concrete construction, including forms.
- B. Be responsible for the capacity of all form work, shoring and bracing to carry all superimposed live and dead loads before, during and after concrete is poured.
- C. Provide form work with adequate cleanout openings to permit inspection and easy cleaning after reinforcement has been placed. Where possible, place these openings in the side of the unexposed surfaces.

3.02 Construction of Forms

- A. General: Construct wood forms of sound material, and of the correct shape and dimensions, constructed tightly and of sufficient strength. Brace and tie the forms together so that the movement of men, equipment, materials, or placing and vibrating the

concrete shall not throw them out of line or position. Forms shall be strong enough to maintain their exact shape under all imposed loads. Camber where necessary to assure level finished soffits. Construct forms that may be easily removed without damage to the concrete. Before concrete is placed in any form, the horizontal and vertical position of the form shall be carefully verified, and all inaccuracies corrected. Complete all wedging and bracing in advance of placing concrete.

- B. Chamfered Corners: Unless otherwise indicated, provide chamfered corners on all exposed corners. Provide 3/4 inch moldings in forms for all chamfering required.
- C. Embedded Items: Make provision for sleeves, anchors, inserts, water stops, and other features.
- D. Form Ties: Use form ties of sufficient strength and in sufficient quantities to prevent spreading of the forms. Place ties at least 1-inch away from the finished surface of the concrete. Do not use ties consisting of twisted wire loops. Leave inner rods in concrete when forms are stripped. Space all form ties equidistant, and symmetrical, and line up both vertically and horizontally.
- E. Cleanouts and Access Panels: Provide removable cleanout sections or access panels at the bottom of all forms to permit inspection and effective cleaning of loose dirt, debris, and waste material. Clean all forms and surfaces to receive concrete of all chips, sawdust, and other debris and thoroughly blow out with compressed air just before concrete is placed.
- F. Arrangement: Arrange formwork to allow proper erection sequence and to permit form removal without damage to concrete.

3.03 Preparation for Placing

- A. Remove water from excavations before concrete is deposited. Divert any flow of water through proper side drains and remove water without washing over freshly-deposited concrete. Remove hardened concrete, debris, ice, and other foreign materials from the interior of the forms, and from the inner surfaces of mixing and conveying equipment. Do not place on frozen ground. Secure reinforcing in position and place vapor barrier and have inspected and approved before the concrete is poured. Do not wheel equipment used to deposit concrete over reinforcement.
- B. Prior to placing of any concrete, and after placement of reinforcing steel in the forms, notify the Project Officer so that proper inspection may be made. Such notification shall be made at least 48 hours in advance of placing concrete to permit proper arrangements for inspection.

3.04 Delivery

- A. Submit a delivery ticket indicating the mix and design strength of the concrete, design slump, and time of leaving the truck mixer with each batch at the time of delivery. Record on the back of the delivery ticket: (a) the time of arrival of the truck mixer on the site; (b) the time of deposit of the concrete from the truck; and (c) the place of deposit of the concrete. The completed delivery ticket shall be delivered to the Project Officer. Failure to deliver such completed ticket to the Project Officer shall be cause for the Project Officer to reject the deposited concrete at any time and cause it to be removed and replaced at no additional expense to the County.
- B. Do not use concrete on the job site when it has exceeded the allotted mixing time as specified in Section of the 217.09 of the VDOT Specifications.

3.05 Placing Concrete

- A. Before placing concrete, remove all construction debris, water and ice from the places to be occupied by the concrete. Give particular attention to the removal of dirt and debris from all formed construction joints.
- B. Concrete, when deposited, shall have a temperature ranging between a minimum of 50 degrees Fahrenheit and a maximum of 90 degrees Fahrenheit. When the temperature of the surrounding air is below 50 degrees or above 90 degrees Fahrenheit, concreting shall be done in accordance with the recommendations noted in ACI-306 and ACI-305 respectively.
- C. Mix concrete in such quantities as required for immediate use and place prior to loss of slump. Do not retemper concrete.
- D. Spade, work and vibrate concrete as it is being poured, to secure its maximum density, free from voids and completely filling the forms. Thoroughly work concrete to secure the complete envelopment of all parts of the reinforcing steel and completely fill the corners of the forms. Maintain not less than 2 approved vibrators on the work at all times. Use tremies or chutes for drops of more than 5-feet.
- E. Fill under Slabs on Grade: Clean sand, or aggregate, evenly spread and compacted to the full depth, unless otherwise shown on the Contract Drawings.

3.06 Removal of Forms

- A. After concrete has been placed, all forms, bracing and supports shall remain undisturbed long enough to allow the concrete to reach the strength necessary to support with safety its own weight plus any live load and earth pressure that might be placed upon it without causing excessive settlement or deflection or any temporary or permanent damage to the structure. Prevent the breaking of edges and corners of concrete in the stripping of forms. Upon removal of formwork, immediately patch honeycombed areas and other voids to the satisfaction of the Project Officer.
- B. Thoroughly clean forms and recoat with specified form coating before each reuse. Do not reuse any form for exposed work which cannot be reconditioned to "like new" condition. Discard forms considered unsatisfactory by the Project Officer. Apply form coating to all forms in accordance with the manufacturer's specifications. Apply form coatings before placing reinforcing steel.

3.07 Protection of New Work

- A. Protect all freshly placed concrete from mechanical injury or action of the elements until such time as the concrete is thoroughly set.
- B. Protect projecting inserts, anchor bolts and other embedded items from disturbances until the concrete has sufficiently set to hold such items.

3.08 Preformed Joints

- A. Furnish and install preformed expansion joint material at locations shown on the Contract Drawings. Cut preformed expansion joint material slightly less than the full width of the cross section of the concrete to allow for a liquid joint sealant with any backup material.
- B. Tool the concrete edges at expansion or contraction joints to a one-eighth (1/8) inch radius.

3.09 Finishing

- A. All areas of exposed concrete walls and appendages from the top of the wall to 1'-6-inch below the finished grade or water level of the structure shall receive a rubbed finish applied in the following manner:
 - 1. After removal of forms, point cavities, stone pockets, and tie holes in exposed surfaces with mortar by thoroughly wetting the repair area. Cut out honeycombs down to dense concrete, and then patch and point as described above. The mortar mix for patching shall be determined by trial to obtain a good color match with the concrete when both patch and concrete are cured and dry. The amount of mixing water shall be as little as consistent with the requirements of handling and placing the mortar.
 - 2. Ground off form joint marks and fins to a smooth surface, dense and free of prominent grain markings and bulges or depressions more than 1/8-inch in 4 feet.
 - 3. When the mortar pointing has set, the entire exposed concrete surface shall be thoroughly covered with water by means of brush and rubbed with carborundum brick to remove all blemishes and leave the entire exposed surface uniform in color and texture.
- B. All areas of walls not covered above shall have all fins and projections removed. Patch all voids and depressions exceeding 3/8-inch in any dimensions.
- C. Unless otherwise noted or specified, all slabs shall be finished monolithically. Exposed concrete slabs shall have a tolerance of 1/8-inch in 10 feet with maximum high and low variance not occurring in less than 20 feet, and with 1/16-inch tolerance in any one running foot with no abrupt variations.
- D. After screeding and floating, give concrete steps and slabs a light steel toweling to seal the surface and remove any irregularities left by the float. Just before the concrete becomes non-plastic, the surface of the concrete shall be given a fine broom finish perpendicular to the line of traffic and so executed that the corrugations thus produced shall be uniform in character and width. The broomed surface shall be free from porous spots, irregularities, depressions, and small pockets or rough spots such as may be caused by accidentally disturbing particles of coarse aggregate embedded near the surface. Use a coarse broom to provide a non-slip surface for ramps.

3.010 Curing

- A. Curing shall be started as soon as it is possible to apply the curing medium without damaging the surface, preferably immediately upon completion of the finishing operation.
- B. Curing shall continue uninterrupted for a minimum period of 14 days. Rapid drying upon completion of the curing period shall be prevented. At no time during the curing period shall the temperature of the concrete be permitted to drop below 40 degrees Fahrenheit.

3.011 Sampling, Testing and Enforcement

- A. The Contractor shall furnish such facilities as the Project Officer may require for on site testing and for collecting and forwarding concrete samples for testing to an approved independent laboratory selected by the Project Officer. The laboratory shall establish the mix proportions and test the concrete. One test shall be performed for each 10 cu. yds. of concrete. The laboratory shall maintain records showing brand of cement, brand and quantity of admixtures, time and location of the batch from which the test was made, air content, slump, and compressive strength. The laboratory shall supply the test cylinders,

- slump cones, field technicians, and all equipment necessary for performance of field and laboratory testing specified herein.
- B. One strength test shall consist of four field specimens. One (1) specimen for testing at seven (7) days, one (1) specimen for testing at fourteen (14) days, and two (2) specimens for testing at twenty-eight (28) days. The samples for strength tests shall be taken in accordance with –“Method of Sampling Fresh Concrete” (ASTM C-172). Cylinders for acceptance tests shall be molded and laboratory-cured in accordance with “Method of Making and Curing Concrete Compression and Flexure Test Specimens in the Field” (ASTM C-31) and tested in accordance with “Method of Test for Compressive Strength of Molded Concrete Cylinders” (ASTM C-39). Each strength test result shall be the average of two cylinders from the same sample tested at seven (7), fourteen (14) and twenty-eight (28) days.
 - C. When the frequency of testing shall provide less than five strength tests for a given class of concrete, make tests from at least five randomly selected batches or from each batch if fewer than five are used. When the total quantity of a given class of concrete is less than 30 cu. yds., the strength tests may be waived by the Project Officer if, in his judgment, adequate evidence of satisfactory strength is provided.
 - D. Should individual tests of laboratory-cured specimens produce results more than 500 psi below specified strength (f_c), or tests of field-cured cylinders indicate deficiencies in protection and curing, take steps to assure that load carrying capacity may have been significantly reduced, tests of cores taken from the area in questions shall be required in accordance with “Standard Method of Obtaining and Testing Drilled Cores and Sawed Beams of Concrete” (ASTM C-42). Three cores shall be taken for each cylinder test more than 500 psi below specified strength (f_c). If the concrete in the structure shall be more than superficially wet under service conditions, the cores shall be immersed in water for at least 48 hours and tested wet.
 - E. Concrete represented by the above core tests shall be considered structurally adequate if the average of the three cores is equal to at least 85 percent of specified strength (f_c) and if no single core is less than 75 percent of f_c . To check testing accuracy, locations represented by erratic core strengths may be retested. If these strength acceptance criteria are not met by the core tests, and if structural adequacy remains in doubt, the Project Officer shall order load tests for the questionable portion of the structure or declare the section to be defective.

3.012 Defective Concrete

- A. Defective concrete is defined as concrete in place which does not conform to strength, shapes, alignments, appearance, and/or elevations as shown on the drawings; areas which contain faulty surface areas and/or concrete surfaces not finished in accordance with these specifications.
- B. Remove all defective concrete and replace in a manner meeting with the Project Officer’s approval. Should only surface imperfections occur, patch at the discretion of, and in a manner satisfactory to, the Project Officer. Permission to patch the work shall not be considered as a waiver of the County's right to require complete removal and replacement of such defective work should the patching fail to satisfactorily restore the required quality and appearance of the work.

END OF SECTION 03100

DIVISION 03

CONCRETE

SECTION 033000 - CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Section includes cast-in-place concrete, including formwork, reinforcement, concrete materials, mixture design, placement procedures, and finishes, for the following:
 - 1. Concrete Footings for Site Furnishings (no footer for receptacles)
 - 2. Concrete Footings for Signage (as shown on the plans)
 - 3. Concrete Curbing
- B. Related Sections:
 - 1. Section 129300 – Site furnishings

1.03 DEFINITIONS

- A. Cementitious Materials: Portland cement alone or in combination with one or more of the following: blended hydraulic cement; subject to compliance with requirements.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For each concrete mixture. Submit alternate design mixtures when characteristics of materials, Project conditions, weather, test results, or other circumstances warrant adjustments.
 - 1. Indicate amounts of mixing water to be withheld for later addition at Project site.
- C. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.
- D. Formwork Shop Drawings: Prepared by or under the supervision of a qualified professional engineer detailing fabrication, finishes, assembly, and support of formwork.
 - 1. Plywood form layout and tie hole locations.
 - 2. Construction joint and control joint locations.
- E. Material Certificates: For each of the following, signed by manufacturers:
 - 1. Cementitious materials.
 - 2. Admixtures.

3. Form materials and form-release agents.
 4. Steel reinforcement and accessories.
 5. Curing compounds.
 6. Bonding agents.
 7. Repair materials.
 8. Sealant
- F. Material Test Reports: For the following, from a qualified testing agency, indicating compliance with requirements:
1. Concrete materials and mix designs.
- G. Certified mill test reports provided by the steel fabricator for the reinforcing steel and accessories to be incorporated in the work.
- H. Delivery tickets for concrete including the date, time, truck identification, concrete plant, plant inspector, ticket and load number, concrete class and design mix, moisture content of aggregates, quantity and location of placement.
- I. Field quality-control reports.

1.05 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified installer who employs only Project personnel qualified as ACI-certified Flatwork Technician and Finisher and a supervisor who is an ACI-certified Concrete Flatwork Technician.
- B. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.
1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."
- C. Concrete Testing Service: County shall be responsible to engage a qualified independent testing agency to perform material evaluation tests and to design concrete mixtures.
- D. Source Limitations: Obtain each type or class of cementitious material of the same brand from the same manufacturer's plant, obtain aggregate from single source, and obtain admixtures from single source from single manufacturer.
- E. ACI Publications: Comply with the following unless modified by requirements in the Contract Documents:
1. ACI 301, "Specifications for Structural Concrete," Sections 1 through 5.
 2. ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 - PRODUCTS

2.01 CONCRETE MATERIALS

- A. Cementitious Material: Use the following cementitious materials, of the same type, brand, and source, throughout Project:

1. Portland Cement: ASTM C 150, Type I/II. Supplement with the following:
 - a. Ground Granulated Blast-Furnace Slag: ASTM C 989, Grade 100 or 120.
 2. Blended Hydraulic Cement: ASTM C 595, Type IS, portland blast-furnace slag cement.
- B. Normal-Weight Aggregates: ASTM C 33, coarse aggregate or better, graded. Provide aggregates from a single source.
1. Maximum Coarse-Aggregate Size: 1 inch (25 mm) nominal.
 2. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.
- C. Water: ASTM C 94/C 94M and potable.

2.02 CONCRETE MIXTURES

- A. Exposed footings such as Curbing: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 4,000 PSI
 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.
- B. Buried footings such as Athletic Equipment/ Court Equipment footings, Chain Link Fence Footings/ Shade Structure and Dugout footings/ Metal handrail footings: Proportion normal-weight concrete mixture as follows:
1. Minimum Compressive Strength: 3,000 PSI
 2. Maximum Water-Cementitious Materials Ratio: 0.50.
 3. Slump Limit: 8 inches (200 mm) for concrete with verified slump of 2 to 4 inches (50 to 100 mm) before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch (25 mm).
 4. Air Content: 6 percent, plus or minus 1.5 percent at point of delivery for 1-inch (25-mm) nominal maximum aggregate size.

2.03 CONCRETE MIXTURES, GENERAL

- A. Prepare design mixtures for each type and strength of concrete, proportioned on the basis of laboratory trial mixture or field test data, or both, according to ACI 301.
1. Use a qualified independent testing agency for preparing and reporting proposed mixture designs based on laboratory trial mixtures.
- B. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
1. Limit use of fly ash to not exceed: 25 percent of cement content by weight.

- C. Limit water-soluble, chloride-ion content in hardened concrete to 0.15 percent by weight of cement.
- D. Admixtures: Use admixtures according to manufacturer's written instructions.
 - 1. Use water-reducing, high-range water-reducing or plasticizing admixture in concrete, as required, for placement and workability.
 - 2. Use water-reducing and retarding admixture when required by high temperatures, low humidity, or other adverse placement conditions.
 - 3. Use water-reducing admixture in pumped concrete, concrete for heavy-use industrial slabs and parking structure slabs, concrete required to be watertight, and concrete with a water-cementitious materials ratio below 0.50.
 - 4. Use corrosion-inhibiting admixture in concrete mixtures where indicated.

2.04 STEEL REINFORCEMENT

- A. Reinforcing Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), deformed.
- B. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.
- C. Deformed-Steel Wire: ASTM A 496/A 496M.
- D. Plain-Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain, fabricated from as-drawn steel wire into flat sheets.
- E. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.05 REINFORCEMENT ACCESSORIES

- A. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
- B. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
 - 1. For concrete surfaces exposed to view where legs of wire bar support contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.06 ADMIXTURES

- A. Air-Entraining Admixture: ASTM C 260.
- B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.
 - 1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
 - 2. Retarding Admixture: ASTM C 494/C 494M, Type B.
 - 3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
 - 4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
 - 5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
 - 6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.07 CURING MATERIALS (non-stained concrete)

- A. Evaporation Retarder: Waterborne, monomolecular film forming, manufactured for application to fresh concrete.
- B. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth made from jute or kenaf, weighing approximately 9 oz./sq. yd. (305 g/sq. m) when dry.
- C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- D. Water: Potable.
- E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.

2.08 RELATED MATERIALS

- A. Expansion- and Isolation-Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber or ASTM D 1752, cork or self-expanding cork.
- B. Bonding Agent: ASTM C 1059/C 1059M, Type II, non-redispersible, acrylic emulsion or styrene butadiene.
- C. Expansion Joint Sealant: Sealant shall be one-component polyurethane-base elastomeric sealant. Asphalt cement will not be approved as a substitution. Sealant color shall match color of adjacent pavement. Where joints fall between pavement sections of different colors, color shall be selected by Project Officer/ Landscape Architect to match one of the pavement colors.
 - 1. Products: Subject to compliance with requirements, provide one of the following or an approved equal:
 - a. SikaFlex-1a by Sika Corporation.
 - b. Sonoclastic NP-1 by Sonneborn and Chem Rex Inc.

2.09 FABRICATING REINFORCEMENT

- A. Fabricate steel reinforcement according to CRSI's "Manual of Standard Practice."

2.010 CONCRETE MIXING

- A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M, and furnish batch ticket information.
 - 1. When air temperature is between 85 and 90 deg F (30 and 32 deg C), reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F (32 deg C), reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.01 SAMPLING, TESTING AND ENFORCEMENT

- A. County performed sampling and testing shall be implemented in accordance with Section 03100- Concrete Formwork Reinforcement and Materials, *Arlington County Department of Environmental Services Construction Standards and Specifications*.

3.02 PREPARING THE SUBGRADE

- A. Thoroughly prepare and compact the subgrade. Subgrade shall be excavated to the required elevation below the finished surface of the pavement in accordance with grades and lines shown on the Drawings.

3.03 LAYOUT

- A. Cast in place concrete shall have true curves to the radii indicated on the Drawings. No straight segments or tangents shall be approved. A digital CADD file containing the project layout is available from the Project Officer to aid in the installation of cast in place concrete elements.

3.04 DEWATERING

- A. Remove water from excavations before concrete is deposited. Divert any flow of water through proper side drains and remove water without washing over freshly-deposited concrete. Remove hardened concrete, debris, ice, and other foreign materials from the interior of the forms, and from the inner surfaces of mixing and conveying equipment. Secure reinforcing in position and place vapor barrier and have inspected and approved before the concrete is poured. Do not wheel equipment used to deposit concrete over reinforcement.

3.05 FORMWORK

- A. Design, erect, shore, brace, and maintain formwork, according to ACI 301, to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.
- B. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.
- C. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:
 - 1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.
 - 2. Class B, 1/4 inch (6 mm) for rough-formed finished surfaces.
- D. Construct forms tight enough to prevent loss of concrete mortar.
- E. Fabricate forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.
- F. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
- G. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.
- H. Chamfer exterior corners and edges of permanently exposed concrete as indicated in drawings.
- I. Form openings, chases, offsets, sinkages, keyways, reglets, blocking, screeds, and bulkheads required in the Work. Determine sizes and locations from trades providing such items.
- J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.
- K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

- L. Coat contact surfaces of forms with form-release agent, according to manufacturer's written instructions, before placing reinforcement.

3.06 EMBEDDED ITEMS

- A. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
 - 1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC's "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. Install reglets to receive waterproofing and to receive through-wall flashings in outer face of concrete frame at exterior walls, where flashing is shown at lintels, shelf angles, and other conditions.
 - 3. Install dovetail anchor slots in concrete structures as indicated.

3.07 REMOVING AND REUSING FORMS

- A. General: Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F (10 deg C) for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations and curing and protection operations need to be maintained.
- B. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.
- C. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the Project Officer.

3.08 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for placing reinforcement.
 - 1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.
- B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that would reduce bond to concrete.
- C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars. Concrete cover: Protect reinforcing by thickness of concrete indicated on drawings. Where not otherwise shown thickness over reinforcement shall be as follows:
Provide clear distance to outermost reinforcing as follows:
Concrete Cast Against Earth..... 3 inches
Concrete Exposed to Earth or Weather:
#5 or smaller1-1/2 inches
#6 or Larger..... 2 inches
- D. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

1. Install welded wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.
- E. Inspection: After placement of reinforcing steel in the forms, and prior to placing concrete, notify the Project Officer so that proper inspection may be made. Such notification shall be made at least 48 hours in advance of placing concrete to permit proper arrangements for inspection.

3.09 JOINTS

- A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.
- B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Project Officer.
 1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated.
 2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
 3. Space vertical joints in walls as indicated.
 4. Use a bonding agent at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.010 CONCRETE PLACEMENT

- A. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections have been performed.
- B. Do not add water to concrete during delivery, at Project site, or during placement unless approved by Project Officer.
- C. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.
 1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.
- D. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete will be placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.
 1. Deposit concrete in horizontal layers of depth to not exceed formwork design pressures and in a manner to avoid inclined construction joints.
 2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.
 3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches (150 mm) into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

- E. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.
1. When average high and low temperature is expected to fall below 40 deg F (4.4 deg C) for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.
 2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.
 3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.
- F. Hot-Weather Placement: Comply with ACI 301 and as follows:
1. Maintain concrete temperature below 90 deg F (32 deg C) at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.
 2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

3.011 FINISHING FORMED SURFACES

- A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces not exposed to public view.
- B. Smooth-Formed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch defects. Do not patch tie holes. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
1. Apply to concrete surfaces exposed to public view or to be covered with a coating or covering material applied directly to concrete.
- C. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.012 MISCELLANEOUS CONCRETE ITEMS

- A. Filling In: Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

- B. Curbs: Provide monolithic finish to interior curbs by stripping forms while concrete is still green and by steel-troweling surfaces to a hard, dense finish with corners, intersections, and terminations slightly rounded.

3.013 CONCRETE PROTECTING AND CURING

- A. General: Immediately protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and ACI 301 for hot-weather protection during curing.
- B. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h (1 kg/sq. m x h) before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.
- C. Formed Surfaces: Cure formed concrete surfaces, including underside of beams, supported slabs, and other similar surfaces. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for the remainder of the curing period.
- D. Unformed Surfaces: Begin curing immediately after finishing concrete. Cure unformed surfaces, including slabs, and other surfaces.
- E. Cure concrete according to ACI 308.1, by one or a combination of the following methods:
 - 1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:
 - a. Water.
 - b. Continuous water-fog spray.
 - c. Absorptive cover, water saturated, and kept continuously wet. Cover concrete surfaces and edges with 12-inch (300-mm) lap over adjacent absorptive covers.
 - 2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches (300 mm), and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
 - a. Moisture cure or use moisture retaining covers to cure concrete surfaces to receive floor coverings.
 - b. Moisture cure or use moisture retaining covers to cure concrete surfaces to receive penetrating liquid floor treatments.
 - 3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.
 - a. Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound will not interfere with bonding of floor coating used on Project.

3.014 CONCRETE SURFACE REPAIRS

- A. Defective Concrete: Repair and patch defective areas when approved by Project Officer. Remove and replace concrete that cannot be repaired and patched to Project Officer's approval.
- B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 (1.18-mm) sieve, using only enough water for handling and placing.
- C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
 - 1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch (13 mm) in any dimension to solid concrete. Limit cut depth to 3/4 inch (19 mm). Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent except at architectural finish for retaining walls.
 - 2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
 - 3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Project Officer.
- D. Repairing Unformed Surfaces: Test unformed surfaces for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
 - 1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch (0.25 mm) wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
 - 2. After concrete has cured at least 14 days, correct high areas by grinding.
 - 3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
 - 4. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch (6 mm) to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.
 - 5. Repair defective areas, except random cracks and single holes 1 inch (25 mm) or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch (19-mm) clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.

6. Repair random cracks and single holes 1 inch (25 mm) or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.
- E. Perform structural repairs of concrete, subject to Project Officer's approval, using epoxy adhesive and patching mortar.
- F. Repair materials and installation not specified above may be used, subject to Project Officer's approval.

3.015 PROTECTION OF NEW WORK

- A. Protect all freshly placed concrete from mechanical injury or action of the elements until such time as the concrete is thoroughly set.
- B. Protect sleeves, projecting inserts, anchor bolts and other embedded items from disturbances until the concrete has sufficiently set to hold such items.

3.016 FIELD QUALITY CONTROL

- A. Testing and Inspecting: County shall engage a qualified testing and inspecting agency to perform tests and inspections and to submit reports.
- B. Inspections:
 1. Steel reinforcement placement.
 2. Steel reinforcement welding.
 3. Verification of use of required design mixture.
 4. Concrete placement, including conveying and depositing.
 5. Curing procedures and maintenance of curing temperature.
- C. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172 shall be performed according to the following requirements:
 1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd. (4 cu. m), but less than 25 cu. yd. (19 cu. m), plus one set for each additional 50 cu. yd. (38 cu. m) or fraction thereof.
 2. Testing Frequency: Obtain at least one composite sample for each 100 cu. yd. (76 cu. m) or fraction thereof of each concrete mixture placed each day.
 - a. When frequency of testing will provide fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
 3. Slump: ASTM C 143/C 143M: one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
 4. Air Content: ASTM C 231, pressure method, for normal-weight concrete, one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.

5. Concrete Temperature: ASTM C 1064/C 1064M: one test hourly when air temperature is 40 deg F (4.4 deg C) and below and when 80 deg F (27 deg C) and above, and one test for each composite sample.
6. Compression Test Specimens: ASTM C 31/C 31M.
 - a. Cast and laboratory cure two sets of two standard cylinder specimens for each composite sample.
7. Compressive-Strength Tests: ASTM C 39/C 39M; test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
 - a. Test one set of two field-cured specimens at 7 days and one set of two specimens at 28 days.
 - b. A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
8. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.
9. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi (3.4 MPa).
10. Test results shall be reported in writing to the Project Officer and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.
11. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Project Officer but will not be used as sole basis for approval or rejection of concrete.
12. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Project Officer. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Project Officer.
13. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
14. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

END OF SECTION 033000

DIVISION 05

METALS

SECTION 051210 - STRUCTURAL STEEL

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 DESCRIPTION

- A. Extent of structural steel work as shown on drawings, including schedules, notes, and details to show size and location of members, typical connections, and type of steel required.
- B. Products furnished but not installed under this section:
 - 1. Steel anchorages cast in concrete.
- C. General: Unless otherwise specifically approved in writing, furnish exact section, weights, and kinds of material specified, using details and dimensions shown.
- D. Details shown are typical; similar details apply to similar conditions, unless otherwise indicated.

1.03 QUALITY ASSURANCE

- A. Welding Procedures: Establish that joint welding procedures are prequalified or test in accordance with AWS D1.1 qualification procedures.
- B. Welder Qualifications: Welders must be currently certified under American Welding Society qualification procedures. If recertification is required, retesting will be the Contractor's responsibility.
- C. Regulatory Requirements: Unless other requirements of governing authorities or particular requirements of this specification are more stringent, comply with provisions of the following:
 - 1. AISC "Code of Standard Practice for Steel Buildings and Bridges."
 - 2. AISC "Specification for Structural Steel Buildings--Allowable Stress Design and Plastic Design," with Commentary and Supplements.
 - 3. ANSI/AWS D1.1 -- Structural Welding Code - Steel; American Welding Society.
 - 4. ASTM A 123 -- Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
- D. Specification for Structural Joints Using ASTM A325 or A490 Bolts; Research Council on Structural Connections; American Institute of Steel Construction, Inc. (AISC).
- E. Specification for Structural Steel Buildings -- Allowable Stress Design and Plastic Design; American Institute of Steel Construction, Inc. (AISC).

1.04 SUBMITTALS

- A. Product Data: Upon request, submit producer's or manufacturer's data for products as follows, including sufficient data to show compliance with specified requirements:

1. Shop Drawings: Submit complete shop drawings at 1/8 scale minimum for structural steel, including information on location, type, and size of all bolts, and welds, distinguishing between those made in the shop and those made in the field. (Reproduced contract drawings are not acceptable for use as erection plans.)
2. The Contractor shall verify all existing conditions and dimensions prior to submitting of shop drawings. Shop drawings shall not be submitted until all field checking of dimensions have been shown on the shop drawings.
3. Welder Qualifications: Submit evidence that welders employed in the work are currently certified under AWS qualification procedures.

PART 2 - PRODUCTS

2.01 STEEL MATERIALS

- A. Structural Steel Angles, Channels, Tees, Plates, and Bars: ASTM A 36.
- B. Hollow Structural Sections (HSS): ASTM A500, Grade C.
- C. Anchor Bolts: ASTM A 36
- D. High-strength Threaded Fasteners: Heavy hexagon structural bolts, heavy hexagon nuts, and hardened washers, quenched and tempered medium-carbon steel, complying with ASTM A 325.
- E. Electrodes for Welding: Comply with AWS Code, use E70XX Series.
- F. Standard Primer Paint: High solids, low VOC, rust inhibitive, all-purpose shop primer which is free of lead, chromates, and other heavy metals. Acceptable products, or equivalent:
 1. Structural Steel Primer (B5ONV12 Red, B5OAV11 Gray) by Sherwin Williams Company, Cleveland, OH.
 2. Duraclad High Solids Shop Coat Metal Primer (33-082 Red, 33-083 Gray) by Duron Paints and Wall Coverings, Beltsville, MD
 3. Devoe Rustgard 4140 Quick Drying Shop Primer (4140-7100 Red, 4140-6120 Gray) by ICI Dulux Paints, Louisville, KY.
- G. Non-shrink Grout: Premixed, nonmetallic, noncorrosive, nonstaining product containing selected silica sands, portland cement, shrinkage compensating agents, plasticizing and water reducing agents, complying with CRD-C621.

2.02 FABRICATION

- A. Shop Fabrication and Assembly: Fabricate and assemble structural assemblies in the shop to greatest extent possible. Fabricate items of structural steel in accordance with AISC Specifications and as indicated on final shop drawings. Provide camber in structural members where indicated.
- B. Properly mark and match-mark materials for field assembly. Fabricate for delivery sequence which will expedite erection and minimize field handling of materials.
- C. Connections: Weld or bolt shop connections, as indicated.
- D. Bolts need only to be tightened to a snug tight condition in accordance with the RCSC specification for shear/bearing bolts except for those identified as slip critical bolts.

- E. Welded Construction: Comply with AWS Code for procedures, appearance, and quality of welds, and methods used in correcting welding work.
- F. Galvanizing: Provide a zinc coating for those items indicated or specified to be galvanized, as follows: ASTM A 153 for galvanizing iron and steel hardware. ASTM A 123 for galvanizing rolled, pressed and forged steel shapes, plates, bars and strip 1/8: thick and heavier. ASTM A 386 for galvanizing assembled steel products.

2.03 SHOP PAINTING

- A. General: Shop paint structural steel, except those members or portions of members to be embedded in concrete or mortar. Paint embedded steel which is partially exposed on exposed portions and initial 2" of embedded areas only.
- B. Apply two coats of paint to those surfaces which are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.
- C. Surface Preparation: After inspection and before galvanizing or shipping, clean steelwork to be painted. Remove loose rust, loose mill scale, and spatter, slag or flux deposits. Clean steel in accordance with Steel Structures Painting Council (SSPC) as follows: SSPC - SP-3 "Power Tool Clean" for concealed steel.
- D. Painting: Immediately after surface preparation, apply structural steel primer paint in accordance with manufacturer's instructions and at a rate to provide dry film thickness of not less than 1.5 mils. Use painting method which results in full coverage of joints, corners, edges, and exposed surfaces.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Erector must examine the areas and conditions under which structural steel work is to be installed and notify the Contractor, in writing, of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected in a manner acceptable to the Erector.
- B. Erector must survey as-built anchor bolt, bearing plate and embedded plates used for beam connection layouts prior to setting structural steel. If structural steel is set prior to surveying, erector is responsible for all modifications necessitated by improperly located bolts or plates.
- C. Erector must inform the Architect when the erection of steel deviates from the approved shop drawings due to fabrication errors, misalignment of embeds and any additional type of deviation. The erector must submit, for review, a report of the deviation condition in writing, including cause and possible solution. A written acceptance of all deviates must be maintained at the jobsite for review by the Owner's testing laboratory.
- D. Temporary Support: Provide temporary guys, braces, falsework, cribbing, or other elements required to secure the steel framing against loads equal in intensity to design loads. Remove such temporary support only when permanent connections have been made and the steel framing is fully capable of supporting design loads, including any temporary constructions loads.

3.02 DELIVERY, STORAGE, AND HANDLING

- A. Shipping: Deliver steel in timely fashion, to permit the most efficient and economical flow of work. Deliver steel members properly marked for field assembly and erection.

- B. Deliver anchor bolts, washers, and other anchorage devices to be built into other work in time to avoid delays and permit their proper installation.
- C. Storage: Protect steel and other materials of this section from damage and corrosion. If temporary storage at the project site is required, keep steel members off the ground, using platforms or pallets, in location easily accessible for inspection.

3.03 ERECTION

- A. General: Erect structural steel in compliance with AISC Code and Specifications.
- B. Set structural frames accurately to the lines and elevations indicated. Align and adjust the various members forming a part of a complete frame or structure before permanently fastening. Clean bearing surfaces and other surfaces which will be in permanent contact before assembly. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.
- C. Level and plumb individual members of the structure within specified AISC tolerances.
- D. Pack grout solidly between bearing surfaces and bases or plates to ensure that no voids remain. Finish exposed surfaces, protect installed materials, and allow to cure. For proprietary grout materials, comply with manufacturer's instructions.
- E. Splice members only where indicated and accepted on final shop drawings.
- F. Do not enlarge unfair holes in members by burning or by the use of drift pins. Ream holes that must be enlarged to admit bolts.
- G. Gas Cutting: Do not use gas cutting torches in the field for correcting fabrication errors in primary structural framing.
- H. Touch-up Painting: After erection, wire brush clean and paint scarred areas, welds, rust spots on steel, using same type of shop paint used on adjacent surfaces.

3.04 FIELD QUALITY CONTROL

- A. Owner will engage an independent testing and inspection agency.
- B. The testing agency shall visit the fabricator's plant and verify that the fabricator's detailed fabrication and quality control procedures are in place and conform to industry standards. If the fabricator can demonstrate that they currently comply with the AISC quality certification program category I, the testing agency's plant inspection may be omitted.
- C. The testing agency will conduct tests in accordance with industry standards and interpret the tests and state in each report whether the test specimens comply with the requirements and specifically state any deviations therefrom.

END OF SECTION 05121

SECTION 055000 - METAL FABRICATIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Electrical drawings that contain lighting products and schedules.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Custom Pylon Structures
 - 2. Bar Grating Bridge
 - 3. Mist Elements
- B. Products furnished, but not installed, under this Section include the following:
 - 1. Anchor bolts, steel pipe sleeves, and wedge-type inserts indicated to be cast into concrete or built into unit masonry.

1.03 PERFORMANCE REQUIREMENTS

- A. Thermal Movements: Provide exterior metal fabrications that allow for thermal movements resulting from the following maximum change (range) in ambient and surface temperatures by preventing buckling, opening of joints, overstressing of components, failure of connections, and other detrimental effects. Base engineering calculation on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.
 - 1. Temperature Change (Range): 120 deg F (67 deg C), ambient; 180 deg F (100 deg C), material surfaces.
- B. Control of Corrosion: Prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.04 SUBMITTALS

- A. The Contractor acknowledges its responsibility to submit complete submittals in a timely fashion. Failure to do so may result in automatic rejection of work and/or materials. Incomplete submittals will be returned to the Contractor unreviewed. No time extensions or cost increases will be allowed for delays or costs caused by un-submitted or late submittals or the return of incomplete or incorrect submittals.
- B. Product Data: For the following:
 - 1. Metal trim.

2. Finishes.
 3. Grout.
- C. Shop Drawings: Show fabrication and installation details for metal fabrications.
1. Include plans, elevations, sections, and details of metal fabrications and their connections. Show anchorage and accessory items.
 2. For installed products indicated to comply with design loads, include structural analysis data signed and sealed by the qualified professional engineer responsible for their preparation.
- D. Samples for Verification:
1. For each type and finish of metal trim.
 2. For each type and finish of color coating.
- E. Mill Certificates: Signed by manufacturers of stainless-steel sheet certifying that products furnished comply with requirements.
- F. Welding certificates.
- G. Qualification Data: For professional engineer.

1.05 QUALITY ASSURANCE

- A. Welding: Qualify procedures and personnel according to the following:
1. AWS D1.1, "Structural Welding Code--Steel."
 2. AWS D1.2, "Structural Welding Code--Aluminum."
 3. AWS D1.3, "Structural Welding Code--Sheet Steel."
 4. AWS D1.6, "Structural Welding Code--Stainless Steel."

1.06 PROJECT CONDITIONS

- A. Field Measurements: Verify actual locations of walls and other construction contiguous with metal fabrications by field measurements before fabrication and indicate measurements on Shop Drawings.
1. Provide allowance for trimming and fitting at site.

1.07 COORDINATION

- A. Coordinate installation of anchorages for metal fabrications. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.
- B. Coordinate installation of steel weld plates and angles for casting into concrete that are specified in this Section but required for work of another Section. Deliver such items to Project site in time for installation.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Light Pylon Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:
 - a. Miscellaneous Metals, Inc, 21793, 301-695-8820
 - b. Baltimore Fabrication, 410-522-0030
 - c. Steven Jones, 443-690-7738
 - d. Streetlife Furniture, 215-247-0148
 2. Mister Manufacturers: Subject to compliance with requirements, provide products by one of the following or an approved equal:
 - a. Rodney Carroll, 410-752-2481
 - b. Steve Jones, 443-690-7738

2.02 METALS, GENERAL

- A. Metal Surfaces, General: Provide materials with smooth, flat surfaces, unless otherwise indicated. For metal fabrications exposed to view in the completed Work, provide materials without seam marks, roller marks, rolled trade names, or blemishes.

2.03 FERROUS METALS

- A. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.
B. Stainless-Steel Sheet, Strip, Plate, and Flat Bars: ASTM A 666, Type 304.
C. Stainless-Steel Bars and Shapes: ASTM A 276, Type 304.
D. Steel Tubing: ASTM A 500, cold-formed steel tubing.

2.04 NONFERROUS METALS

- A. Aluminum Plate and Sheet: ASTM B 209 (ASTM B 209M), Alloy 6061-T6.
B. Aluminium Extrusions: ASTM B 221 (ASTM B 221M), Alloy 6063-T6.

2.05 FASTENERS

- A. General: Unless otherwise indicated, provide Type 304 stainless-steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, at exterior walls. Provide stainless-steel fasteners for fastening aluminum. Select fasteners for type, grade, and class required.
- B. Steel Bolts and Nuts: Regular hexagon-head bolts, ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6); with hex nuts, ASTM A 563 (ASTM A 563M); and, where indicated, flat washers.
- C. Stainless-Steel Bolts and Nuts: Regular hexagon-head annealed stainless-steel bolts, nuts and, where indicated, flat washers; ASTM F 593 (ASTM F 738M) for bolts and ASTM F 594 (ASTM F 836M) for nuts, Alloy Group 1 (A1).
- D. Anchor Bolts: ASTM F 1554, Grade 36.

1. Provide hot-dip or mechanically deposited, zinc-coated anchor bolts where item being fastened is indicated to be galvanized.
- E. Machine Screws: ASME B18.6.3 (ASME B18.6.7M).
- F. Lag Bolts: ASME B18.2.1 (ASME B18.2.3.8M).
- G. Wood Screws: Flat head, ASME B18.6.1.
- H. Plain Washers: Round, ASME B18.22.1 (ASME B18.22M).
- I. Lock Washers: Helical, spring type, ASME B18.21.1 (ASME B18.21.2M).
- J. Cast-in-Place Anchors in Concrete: Anchors capable of sustaining, without failure, a load equal to four times the load imposed, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 1. Threaded or wedge type; galvanized ferrous castings, either ASTM A 47/A 47M malleable iron or ASTM A 27/A 27M cast steel. Provide bolts, washers, and shims as needed, hot-dip galvanized per ASTM A 153/A 153M.
- K. Expansion Anchors: Anchor bolt and sleeve assembly with capability to sustain, without failure, a load equal to six times the load imposed when installed in unit masonry and four times the load imposed when installed in concrete, as determined by testing according to ASTM E 488, conducted by a qualified independent testing agency.
 1. Material for Anchors in Exterior Locations: Alloy Group 1 (A1) stainless-steel bolts complying with ASTM F 593 (ASTM F 738M) and nuts complying with ASTM F 594 (ASTM F 836M).

2.06 MISCELLANEOUS MATERIALS

- A. Welding Rods and Bare Electrodes: Select according to AWS specifications for metal alloy welded.
- B. Zinc-Rich Primer: Complying with SSPC-Paint 20 or SSPC-Paint 29 and compatible with topcoat.
 1. Use primer with a VOC content of 420 g/L (3.5 lb/gal.) or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
 2. Available Products:
 - a. Benjamin Moore & Co.; Epoxy Zinc-Rich Primer CM18/19.
 - b. Carboline Company; Carbozinc 621.
 - c. ICI Devoe Coatings; Catha-Coat 313.
 - d. International Coatings Limited; Interzinc 315 Epoxy Zinc-Rich Primer.
 - e. PPG Architectural Finishes, Inc.; Aquapon Zinc-Rich Primer 97-670.
 - f. Sherwin-Williams Company (The); Corothane I GalvaPac Zinc Primer.
 - g. Tnemec Company, Inc.; Tneme-Zinc 90-97.
- C. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.
- D. Bituminous Paint: Cold-applied asphalt emulsion complying with ASTM D 1187.

- E. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for interior and exterior applications.
- F. Concrete Materials and Properties: Comply with requirements in Division 3 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mix concrete with a minimum 28-day compressive strength of 3000 psi (20 MPa), unless otherwise indicated.

2.07 FABRICATION, GENERAL

- A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Disassemble units only as necessary for shipping and handling limitations. Use connections that maintain structural value of joined pieces. Clearly mark units for reassembly and coordinated installation.
- B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges to a radius of approximately 1/32 inch (1 mm), unless otherwise indicated. Remove sharp or rough areas on exposed surfaces.
- C. Form bent-metal corners to smallest radius possible without causing grain separation or otherwise impairing work.
- D. Form exposed work true to line and level with accurate angles and surfaces and straight edges.
- E. Weld corners and seams continuously to comply with the following:
 - 1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
 - 2. Obtain fusion without undercut or overlap.
 - 3. Remove welding flux immediately.
 - 4. At exposed connections, finish exposed welds and surfaces smooth and blended so no roughness shows after finishing and contour of welded surface matches that of adjacent surface.
- F. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners where possible. Where exposed fasteners are required, use Phillips flat-head (countersunk) screws or bolts, unless otherwise indicated. Locate joints where least conspicuous.
- G. Fabricate seams and other connections that will be exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate.
- H. Cut, reinforce, drill, and tap metal fabrications as indicated to receive finish hardware, screws, and similar items.
- I. Provide for anchorage of type indicated; coordinate with supporting structure. Space anchoring devices to secure metal fabrications rigidly in place and to support indicated loads.

2.08 MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Provide steel framing and supports not specified in other Sections as needed to complete the Work.
- B. Fabricate units from steel shapes, plates, and bars of welded construction, unless otherwise indicated. Fabricate to sizes, shapes, and profiles indicated and as necessary to receive adjacent construction retained by framing and supports. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Furnish inserts if units are installed after concrete is placed.
- C. Galvanize miscellaneous framing and supports where indicated.
- 2.09 LOOSE BEARING AND LEVELING PLATES
- A. Provide loose bearing and leveling plates for steel items bearing on masonry or concrete construction. Drill plates to receive anchor bolts and for grouting.
 - B. Galvanize plates after fabrication.
- 2.010 STEEL WELD PLATES AND ANGLES
- A. Provide steel weld plates and angles not specified in other Sections, for items supported from concrete construction as needed to complete the Work. Provide each unit with not less than two integrally welded steel strap anchors for embedding in concrete.
- 2.011 MISCELLANEOUS STEEL TRIM
- A. Unless otherwise indicated, fabricate units from steel shapes, plates, and bars of profiles shown with continuously welded joints and smooth exposed edges. Miter corners and use concealed field splices where possible.
 - B. Provide cutouts, fittings, and anchorages as needed to coordinate assembly and installation with other work.
 1. Provide with integrally welded steel strap anchors for embedding in concrete or masonry construction.
 - C. Galvanize exterior miscellaneous steel trim.
- 2.012 FINISHES, GENERAL
- A. Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.
 - B. Finish metal fabrications after assembly.
- 2.013 STEEL AND IRON FINISHES
- A. Galvanizing: Hot-dip galvanize items as indicated to comply with applicable standard listed below:
 1. ASTM A 123/A 123M, for galvanizing steel and iron products.
 2. ASTM A 153/A 153M, for galvanizing steel and iron hardware.
 - B. Powder-Coat Finish Over Galvanized Substrate: Prepare, treat, and coat galvanized metal to comply with resin manufacturer's written instructions and as follows:
 1. Prepare galvanized metal by aging, profiling surface, and cleaning to provide optimum bonding & uniform, smooth finish coat. Remove grease, dirt, oil, flux, and other foreign matter.
 2. Treat prepared metal with zinc-phosphate pretreatment, rinse, and seal surfaces.
 3. Apply thermosetting polyester or acrylic urethane powder coating with cured-film thickness not less than 1.5 mils (0.04 mm).

4. Color: As indicated.

2.014 STAINLESS-STEEL FINISHES

- A. Remove tool and die marks and stretch lines or blend into finish.
- B. Grind and polish surfaces to produce uniform, directionally textured, polished finish indicated, free of cross scratches. Run grain with long dimension of each piece.
- C. Bright, Directional Satin Finish: No. 4.
- D. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.

2.015 ALUMINUM FINISHES

- A. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
- B. Class I, Clear Anodic Finish: AA-M12C22A41 (Mechanical Finish: nonspecular as fabricated; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

- A. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing metal fabrications. Set metal fabrications accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.
- B. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints but cannot be shop welded because of shipping size limitations. Do not weld, cut, or abrade surfaces of exterior units that have been hot-dip galvanized and/or color coated after fabrication. Join with bolted or screwed field connections.
- C. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction. Provide threaded fasteners for use with concrete and masonry inserts, toggle bolts, through bolts, lag bolts, wood screws, and other connectors.
- D. Provide temporary bracing or anchors in formwork for items that are to be built into concrete, masonry, or similar construction.
- E. Corrosion Protection: Coat concealed surfaces of aluminum that will come into contact with grout, concrete, masonry, wood, or dissimilar metals with a heavy coat of bituminous paint.

3.02 INSTALLING MISCELLANEOUS FRAMING AND SUPPORTS

- A. General: Install framing and supports to comply with requirements of items being supported, including manufacturers' written instructions and requirements indicated on Shop Drawings.
 1. Where grout space under bearing plates is indicated for girders supported on concrete or masonry, install as specified in "Installing Bearing and Leveling Plates" Article.

3.03 INSTALLING BEARING AND LEVELING PLATES

- A. Clean concrete and masonry bearing surfaces of bond-reducing materials and roughen to improve bond to surfaces. Clean bottom surface of plates.
- B. Set bearing and leveling plates on wedges, shims, or leveling nuts. After bearing members have been positioned and plumbed, tighten anchor bolts. Do not remove wedges or shims but, if protruding, cut off flush with edge of bearing plate before packing with grout.
 - 1. Use non-shrink, nonmetallic grout in exterior locations, unless otherwise indicated.
 - 2. Pack grout solidly between bearing surfaces and plates to ensure that no voids remain.

3.04 ADJUSTING AND CLEANING

- A. Touchup Painting: Immediately after erection, clean bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.
 - 1. Apply by brush or spray to provide a minimum 2.0-mil (0.05-mm) dry film thickness.
- B. Galvanized Surfaces: Clean field welds, bolted connections, and abraded areas and repair galvanizing to comply with ASTM A 780.

END OF SECTION 05 50 00

DIVISION 09

FINISHES

SECTION 09 96 00 - HIGH PERFORMANCE COATINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Coating systems for site metals.

1.02 RELATED SECTIONS

- A. Division 05 Section "Metal Fabrications."

1.03 REFERENCES

- A. ASTM D 16 - Terminology Relating to Paint, Varnish, Lacquer, and Related Products.
- B. ASTM F 1869 - Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride.

1.04 DEFINITIONS

- A. Definitions of Painting Terms: In accordance with ASTM D 16, unless otherwise specified.
- B. Dry Film Thickness (DFT): Thickness of a coat of paint in fully cured state measured in mils (1/1000 inch).

1.05 SUBMITTALS

- A. The Contractor acknowledges its responsibility to submit complete submittals in a timely fashion. Failure to do so may result in automatic rejection of work and/or materials. Incomplete submittals will be returned to the Contractor unreviewed. No time extensions or cost increases will be allowed for delays or costs caused by un-submitted or late submittals or the return of incomplete or incorrect submittals.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
 - 4. Operation and maintenance data.
- C. Samples for Initial Selection: For each product specified, complete set of color chips representing Manufacturer's full range of standard colors, finishes, and patterns.
- D. Samples for Verification: For each product specified, two samples, minimum size 4 inches (100 mm) square, demonstrating actual product, color, and patterns, prepared on actual substrate.
- E. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

- A. Manufacturer's Qualifications: Submit Manufacturer's certification that coatings comply with specified requirements and are suitable for intended application.

- B. Applicator's Qualifications: Submit list of a minimum of 3 completed projects of similar size and complexity to this Work. Include for each project:
1. Project name and location.
 2. Name of owner.
 3. Name of contractor.
 4. Name of architect.
 5. Name of coating Manufacturer.
 6. Approximate area of coatings applied.
 7. Date of completion.
- C. Mock-Up: Provide a mock-up for evaluation of surface preparation techniques and application workmanship.
1. Prepare a mock-up for each coating system specified using same materials, tools, equipment, and procedures intended for actual surface preparation and application.
 2. Do not proceed with remaining work until workmanship, color, and sheen are approved by Architect.
 3. Refinish mock-up area as required to produce acceptable work.
 4. Retain mock-ups to establish intended standards by which coating systems will be judged.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Delivery: Deliver materials to site in Manufacturer's original, unopened containers and packaging, with labels clearly identifying:
1. Coating or material name.
 2. Manufacturer.
 3. Color name and number.
 4. Batch or lot number.
 5. Date of manufacture.
 6. Mixing and thinning instructions.
- B. Storage:
1. Store materials in a clean dry area and within temperature range in accordance with Manufacturer's instructions.
 2. Keep containers sealed until ready for use.
 3. Do not use materials beyond Manufacturer's shelf life limits.
- C. Handling: Protect materials during handling and application to prevent damage or contamination.
- D. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.08 PROJECT CONDITIONS

- A. Maintain environmental conditions within limits recommended by Manufacturer for optimum results. Do not install products under environmental conditions outside Manufacturer's absolute limits.
- B. Weather:

1. Air and Surface Temperatures: Prepare surfaces and apply and cure coatings within air and surface temperature range in accordance with Manufacturer's instructions.
 2. Surface Temperature: Minimum of 5 degrees F (3 degrees C) above dew point.
 3. Relative Humidity: Prepare surfaces and apply and cure coatings within relative humidity range in accordance with Manufacturer's instructions.
 4. Precipitation: Do not prepare surfaces or apply coatings in rain, snow, fog, or mist.
 5. Wind: Do not spray coatings if wind velocity is above Manufacturer's recommended limit.
- C. Ventilation: Provide ventilation during coating evaporation stage in confined or enclosed areas in accordance with Manufacturer's instructions.
- D. Dust and Contaminants:
1. Schedule coating work to avoid excessive dust and airborne contaminants.
 2. Protect work areas from excessive dust and airborne contaminants during coating application and curing.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Manufacturer: Coating Manufacturers must be approved by Master Painters Institutes Approved Product Listing. Basis of Design Manufacturer is Sherwin-Williams. Other Approved Manufacturers include:
1. AkzoNobel/Devo,
 2. Benjamin Moore/Corotech
 3. PPG/Pitthane.

2.02 COATING SYSTEMS FOR STEEL FRAMING – ARCHITECTURAL EXPOSE STEEL

- A. Primer: MPI #108; S-W Marcopoxy 646 Fast Cure Epoxy B58-600 Series (applied at 5 – 10 mils DFT).
- B. Top Coats: MPI # 7; S-W Acrolon 218 HS Polyurethane Coating, Semi-Gloss B65-650 Series (or Gloss B65-600 Series), (applied at 3 – 6 mils DFT).
- C. Finish Color:
1. As selected by Architect from Manufacturer's standard colors and finishes.

2.03 ACCESSORIES

- A. Coating Application Accessories:
1. Accessories required for application of specified coatings: Provide in accordance with coating Manufacturer's instructions, including thinners.
 2. Products of coating Manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Do not begin installation until substrates have been properly prepared.

- B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.02 PROTECTION OF SURFACES NOT SCHEDULED TO BE COATED

- A. Protect surrounding areas and surfaces not scheduled to be coated from damage during surface preparation and application of coatings.
- B. Immediately remove coatings that fall on surrounding areas and surfaces not scheduled to be coated.

3.03 SURFACE PREPARATION, GENERAL

- A. Surface Preparation: Iron & Steel, Atmospheric Conditions, SSPC-SP2/3. Surface must be clean, dry, and in sound condition. Remove all oil, dust, grease, dirt, loose rust, mill glaze and other foreign material to ensure adequate adhesion. See product data sheet for complete information.

3.04 SURFACE PREPARATION OF STEEL

- A. Prepare steel surfaces in accordance with Manufacturer's instructions. Correct all defects and otherwise deleterious conditions in substrate prior to commencing Work.
- B. Fabrication Defects include, but are not limited to, the following:
 1. Correct steel and fabrication defects revealed by surface preparation.
 2. Remove weld spatter and slag.
 3. Round sharp edges and corners of welds to a smooth contour.
 4. Smooth weld undercuts and recesses.
 5. Grind down porous welds to pinhole-free metal.
 6. Remove weld flux from surface.
- C. Ensure surfaces are dry.
- D. Remove visible oil, grease, dirt, dust, mill scale, rust, paint, oxides, corrosion products, and other foreign matter in accordance with SSPC-SP 6/NACE 3, unless otherwise specified.
- E. Abrasive Blast-Cleaned Surfaces: Coat abrasive blast-cleaned surfaces with primer before visible rust forms on surface. Do not leave blast-cleaned surfaces uncoated for more than 8 hours.
- F. Shop Primer: Prepare shop primer to receive field coat in accordance with Manufacturer's instructions.

3.05 SURFACE PREPARATION OF GALVANIZED STEEL AND NONFERROUS METAL

- A. Prepare galvanized steel and nonferrous metal surfaces in accordance with Manufacturer's written specifications. Surface preparation recommendations will vary depending on substrate and exposure conditions.

3.06 APPLICATION

- A. Apply coatings in accordance with Manufacturer's written specifications.
- B. Do not proceed with application when actual and/or potential environmental and adjacent conditions may deleteriously affect the coating.

- C. Mix and thin coatings, including multi-component materials, in accordance with Manufacturer's instructions.
- D. Keep containers closed when not in use to avoid contamination.
- E. Do not use mixed coatings beyond pot life limits.
- F. Use application equipment, tools, pressure settings, and techniques in accordance with Manufacturer's instructions.
- G. Uniformly apply coatings at spreading rate required to achieve specified DFT.
- H. Apply coatings to be free of film characteristics or defects that would adversely affect performance or appearance of coating systems.
- I. Stripe paint with brush critical locations on steel such as welds, corners, and edges using specified primer.

3.07 REPAIR

- A. Materials and Surfaces Not Scheduled To Be Coated: Repair or replace damaged materials and surfaces not scheduled to be coated.
- B. Damaged Coatings: Touch-up or repair damaged coatings. Touch-up of minor damage shall be acceptable where result is not visibly different from adjacent surfaces. Recoat entire surface where touch-up result is visibly different, either in sheen, texture, or color.
- C. Coating Defects: Repair in accordance with Manufacturer's instructions coatings that exhibit film characteristics or defects that would adversely affect performance or appearance of coating systems.

3.08 CLEANING

- A. Remove temporary coverings and protection of surrounding areas and surfaces.

3.09 PROTECTION OF COATING SYSTEMS

- A. Protect surfaces of coating systems from damage during construction.
- B. Touch-up, or repair damaged products before Substantial Completion.

3.010 ONE-YEAR INSPECTION

- A. Owner will set date for one-year inspection of coating systems.
- B. Inspection shall be attended by Owner, Contractor, Architect, and Manufacturer's representative.
- C. Repair deficiencies in coating systems, as determined by Architect, in accordance with Manufacturer's instructions.

END OF SECTION 099600

DIVISION 10

SPECIALTIES

SECTION 101400 – SIGNAGE

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Park Rules Sign
 - 2. Interpretive Signs

1.02 SUBMITTALS

- A. Product Data: For each product indicated.
- B. Shop Drawings for all signs: Include plans, elevations, sections of components, and installation details.

1.03 WARRANTY

- A. Warranty Period: Minimum of one year from date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Available Manufacturers: Subject to compliance with requirements, provide the signs by the following or approved equal:
 - 1. Engraphix Architectural Signage, Inc., 132 Hanley Industrial Court, St. Louis, MO 63144 (314) 781-7878.
- B. Manufacturers NOT listed above must meet the following requirements:
 - 1. The vendor(s) shall have a long and established history (no less than five (5) years) of producing high quality, easily maintained, and cost conscious sign fabrications.
 - 2. The vendor shall a long-term relationship with municipalities and public entities in the region, such as Arlington County.
 - 3. Vendor shall be prepared to fabricate sign(s) on time and within acceptable budget provisions while providing the expected quality of craftsmanship.

2.02 MATERIALS

- A. Aluminum Sheet and Plate: ASTM B 209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated, and with at least the strength and durability properties of alloy 5005-H15.
- B. Vinyl Film: Opaque, nonreflective vinyl film, 0.0035-inch minimum thickness, with pressure-sensitive adhesive backing, suitable for exterior applications.
- C. Colored Coatings for Plastic Sheet: Nonfading coatings, including inks and paints for copy and background colors. Use coatings that are recommended by manufacturers for optimum adherence to type of plastic used.
- D. Steel Plate: ASTM A36.
- E. Steel Tubing: ASTM A500, Grade B.

- F. Concrete for Postholes: Comply with requirements in Division 3 Section "Cast-in-Place Concrete."
- G. Hardware: Hot-dipped galvanized or stainless steel.

2.03 POSTS

- A. General: Fabricate posts to lengths required for mounting method indicated.
 - 1. Direct-Burial Method: All posts are assumed to use direct-burial method. Provide posts 36 inches longer than height of sign to permit direct embedment in concrete foundations.
 - 2. Surface-Mount Method: If on-site conditions prevent use of direct burial method, contractor to notify landscape architect immediately. Sign contractor to provide details for surface mount option for landscape architect review and approval.
 - 3. Size: As indicated on the drawings.
 - 4. Color: As shown on the drawings.

2.04 TEXT

- A. All sign text shall read as shown on the drawings.

2.05 GRAPHICS

- A. Graphic Content and Style: Provide sign copy that complies with requirements indicated in Drawings for size, style, spacing, content, mounting height and location, material, finishes, and colors of signage.

2.06 GRAPHIC PANELS

- A. Custom High Pressure Laminate (CHPL) composed of several layers of phenolic resin impregnated kraft filler paper, a digitally imaged graphic, a layer of melamine resin, surfaced by a layer of translucent UV/graffiti overlay protection with 12-color high definition printing warranted against fading, delamination, and weather deterioration for a minimum of ten years.
- B. Basis of Design Product: Engraphix Architectural Signage, Inc., 132 Hanley Industrial Court, St. Louis, MO 63144 (314) 781-7878.2.8

2.07 ACCESSORIES

- A. Mounting Methods: Use fasteners fabricated from materials that are not corrosive to sign material and mounting surface.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. For Interpretive signs and park rules signs, as indicated.
- B. Install signs level, plumb, and at height indicated, with surfaces free from distortion.

END OF SECTION 101400

DIVISION 12

FURNISHINGS

SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Trash and Recycling Receptacles
 - 1. Bicycle Rack
 - 2. Bench
 - 3. Bench (Backless)
 - 4. Lounge Seat
 - 5. Café table
 - 6. Café Chair
 - 7. Custom benches 1 and 2 – Not in Base Bid. Add Alt #2A and 2B
 - 8. Removable Bollard

1.02 RELATED SECTIONS:

- A. Construction Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 1-33 Specification Sections, apply to this Section.
- B. Section 310000 – Earthwork
- C. Section 033010 - Cast in Place Concrete

1.03 SUBMITTALS

- A. Shop Drawings: Provide fabricator's shop drawings for each type of product indicated for approval prior to any fabrication.
- B. Product Data: For each type of product indicated.
- C. Fastener Data: For each type of fastener used.
- D. Material Certificates: For site furnishings, signed by manufacturers.
- E. Maintenance Data.

PART 2 - PRODUCTS

2.01 TRASH RECEPTACLE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Victor Stanley, Inc., P.O. Drawer 330, Dunkirk, Maryland 20754. Phone: (800) 368-2573.
- B. Style: Ironsites Model SD-42 with Dome Lid and Side Door.
- C. Support Frames: Steel; welded.
- D. Trash Receptacles:
 - 1. Receptacle Shape and Form: Round cylinder with optional S-2 formed dome lid; with opening for depositing trash in top.
 - 2. Inner Container: High density plastic liner designed to be removable and reusable.

3. Capacity: Not less than 36-gallon.

E. Steel Finish: Powdercoated.

1. Color: Silver.

2.02 RECYCLING RECEPTACLE

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Victor Stanley, Inc., P.O. Drawer 330, Dunkirk, Maryland 20754. Phone: 800- 368-2573.

B. Style: Ironsites Model S-42 with recycle lid, custom decal band with “Arlington County name and logo” and side door.

C. Support Frames: Steel; welded.

D. Recycling Receptacles:

1. Receptacle Shape and Form: Round cylinder with optional recycling package with lid, plaque, and decals; with opening for depositing recyclables in top.

2. Inner Container: High density plastic liner designed to be removable and reusable.

3. Capacity: Not less than 36-gallon.

E. Steel Finish: Powdercoated.

1. Color: VS Blue

2.03 BICYCLE RACK

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Victor Stanley, Inc., P.O. Drawer 330, Dunkirk, Maryland 20754. Phone: 800- 368-2573.

B. Style: BRHS-101, Cycle Sentry Collection

C. Bicycle Rack Construction:

1. Frame: 2.375 inch OD tubular steel

2. Installation Method: Surface mounted.

D. Steel Finish: Powdercoated over galvanized finish.

1. Color: Silver.

2.04 BENCH (BACKED)

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Landscape Forms, 800-430-6209.

B. Style: Generation 50 Bench, backed, looped end arms, standard surface mount.

C. Materials:

1. Frames: Aluminum

2. Slats: Domestically Sourced Thermally Modified Ash.

D. Finishes:

1. Frames: Thermosetting TGIC polyester powder coat. UV, chip, and flake resistant. Color To be selected by landscape architect from manufacturer's full range of colors.
2. Slats, wood: Unfinished

E. Installation: Surface mounted

2.05 BENCH (BACKLESS)

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Landscape Forms, 800-430-6209.

B. Style: Generation 50 Bench, backless, looped end arms, standard surface mount

C. Materials:

1. Frames: Aluminum
2. Slats: Domestically Sourced Thermally Modified Ash

D. Finishes:

1. Frames: Thermosetting TGIC polyester powder coat. UV, chip, and flake resistant. Color To be selected by landscape architect from manufacturer's full range of colors.
2. Slats, wood: Unfinished

E. Installation: Surface mounted

2.06 LOUNGE SEAT

A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Vestre Furnishing, 617-780-4134.

B. Style: Bloc Sun Bench

C. Materials:

1. Frames: Hot Dip Galvanized Powdercoated Steel
2. Slats: Kebony Clear

D. Finishes:

1. Frames: polyester powdercoat. Color To be selected by landscape architect from manufacturer's full range of colors.
2. Slats, wood: Unfinished

E. Installation: Freestanding

2.07 CAFÉ TABLE

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Vestre Furnishing, 617-780-4134.
- B. Style: Munch table
- C. Materials:
 - 1. Frames: Hot Dip Galvanized Powdercoated Steel
- D. Finishes:
 - 1. Frames: Polyester powder coat. Color To be selected by landscape architect from manufacturer's full range of colors.
- E. Installation: Freestanding

2.08 CAFÉ CHAIR

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Vestre Furnishing, 617-780-4134.
- B. Style: April Go Chair
- C. Materials:
 - 1. Frames: Hot Dip Galvanized Powdercoated Steel
- D. Finishes:
 - 1. Frames: Polyester powder coat. Color To be selected by landscape architect from manufacturer's full range of colors.
- E. Installation: Freestanding.

2.09 CUSTOM BENCHES 1 AND 2 – Not in Base Bid. Add Alt #2A and 2B

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Vestre Furnishing, 617-780-4134.
- B. Style: Custom Via bench
- C. Materials:
 - 1. Frames: Hot dip galvanized and powdercoated steel
 - 2. Kebony slats
- D. Finishes:
 - 1. Frames: Polyester powder coat. Color To be selected by landscape architect from manufacturer's full range of colors. Include under-bench linear LED lighting.
- E. Installation: Surface mount

2.010 REMOVABLE BOLLARD

- A. Manufacturers: Subject to compliance with requirements, provide products by the following or approved equal: Reliance Foundry Co., 877-789-3245
- B. Style: R-8907 Stainless Steel Bollard.
- C. Materials:

1. Frames: Stainless steel

D. Installation: Removable embedded receiver with lid-4”.

2.011 FOOTING MATERIAL

- A. Concrete Footings. Shall be Portland Cement, Class A3, air entrained in conformance with VDOT, Section 217. Minimum 28-day compressive strength of 3000 psi.
- B. Nonshrink, Nonmetallic Grout: Factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107. Provide grout specifically recommended by manufacturer for exterior applications.
- C. Epoxy Sealer. After the grout has hardened, the remaining space shall be filled with an epoxy sealer fillet, equivalent to Sonneborn Epo-Grip and Epo-Gel Epoxy system, as manufactured by Sonneborn, Shakopee, Mn.

PART 3 - EXECUTION

3.01 GENERAL

- A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.
- B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.
- C. Field locate and mark all site furnishings at the location indicated on the drawings for approval by the Landscape Architect before installing footers or drilling for surface mounted site furnishing in hardscape
- D. Install site furnishings level, plumb, true, and **anchored**, as shown on drawings.
- E. Post Setting: Set cast-in support posts in concrete footing with smooth top. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

3.02 CLEANING AND PROTECTION

- A. After installation, clean soiled surfaces according to manufacturer’s written instructions. Protect site furnishings from damage until acceptance by Project Officer.

END OF SECTION 129300

DIVISION 22

PLUMBING

SECTION 224700 – DRINKING FOUNTAIN & ASSOCIATED EQUIPMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes water-distribution piping and related components outside the for water service.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.03 QUALITY ASSURANCE

- A. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
- B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
- C. NSF Compliance:
 - 1. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.04 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.01 Outdoor Drinking Fountains –

- A. Pedestal, Powder Coated Stainless Steel:
Manufacturer: Item: Dog Water Fountain
Model No: 300 SMSS
Manufacturer: Most Dependable Fountains (800-552-6331)
Install per manufacturer's instructions and recommendations. Color to be silver. Include hose bib.
- B. Type: Vandal resistant and freeze resistant.

- C. Maximum Water Flow: 0.15 gpm (0.0095 L/s).
- D. Controls: Push button.
- E. Access to Internal Components: Panel in pedestal.
- F. Bury Depth, Grade to Valve Components: 36 inches (915 mm).

2.02 NONFREEZE GROUND HYDRANTS:

- A. Manufacturer: Jay R. Smith Model 5810.
- B. Standard: ASME A112.21.3M.
- C. Type: Nonfreeze, concealed-outlet ground hydrant with box.
- D. Operation: Loose key.
- E. Casing and Operating Rod: Of at least length required for burial of valve below frost line.
- F. Inlet: NPS 3/4 (DN 20).
- G. Outlet: Garden-hose thread complying with ASME B1.20.7.
- H. Drain: Designed with hole to drain into ground when shut off.
- I. Box: Standard pattern with cover.
- J. Operating Key(s): Two with each ground hydrant.
- K. 11. Install with 1 cu. yd. (0.75 cu. m) of crushed gravel around drain hole. Set ground hydrants with box flush with grade

2.03 BACKFLOW PREVENTION

- A. Reduced-Pressure-Principle Backflow Preventers: Zurn Model 975XL2 or Watts Model LF009.
- B. Standard: ASSE 1013.
- C. Pressure Loss: 12 psig (83 kPa) maximum, through middle third of flow range.
- D. Size: 3/4".
- E. Body: Bronze.
- F. End Connections: Threaded.
- G. Configuration: Designed for horizontal, straight-through.
- H. Accessories:

1. Ball type with threaded ends on inlet and outlet.
2. Air-Gap Fitting: ASME A112.1.2, matching backflow-preventer connection.

2.04 BACKFLOW PREVENTER VAULT

A. Aboveground:

1. Manufacturer: Safe-T-Cover Model 75SN-AL.
2. Color: Hartford Green or Sierra Tan.
3. Inside dimensions shall be 9"W x 26"L x 25"H.
4. Material shall be 5052-H32 marine grade aluminum (.050/18 gauge), mill finish and shall meet ASTM B209.
5. Insulation shall be 1.5" minimum thickness polyisocyanurate foam laminated to a glass fiber reinforced facer (each side).
6. The roof and walls of the enclosure shall be constructed of 5052-H32 (.050/18 gauge) marine grade aluminum, mill finish, ASTM B209 outside with insulation 1-1/2" thick in the walls and roof.
7. The enclosure shall have a hinged roof and hinged drop down access panel in the front of the enclosure for testing and maintenance.
8. Clear opening drain panel area shall be 17 1/4"W x 4"H.
9. Drain flap shall be constructed of the same materials that is used in the walls and roof of the enclosure and shall have a stainless steel hinge and a stainless steel light strength spring as a positive means of closure so that it will not be activated by wind.
10. Heater shall be Safe-T-Cover HCHS1000-120, 1 kW at 120 volts.
11. Enclosure shall be mounted on a concrete pad 16"W x 33"L x 4"D.

2.05 PIPE AND FITTINGS

A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

B. Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper.

1. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

2.06 JOINING MATERIALS

A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

B. Brazing Filler Metals: AWS A5.8, BCuP Series.

2.07 PIPING SPECIALTIES

A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.

B. Tubular-Sleeve Pipe Couplings:

1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
 - a. Standard: AWWA C219.

2.08 DOUBLE CHECK VALVES

A. Double-Check Valves Assemblies:

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Ames Fire & Waterworks; a division of Watts Regulator Co.
 - b. Conbraco Industries, Inc.
 - c. FEBCO; SPX Valves & Controls.
 - d. Flomatic Corporation.
 - e. Watts Water Technologies, Inc.
 - f. Zurn Plumbing Products Group; Wilkins Water Control Products Div.
2. Standard: ASSE 1015 or AWWA C510.
3. Operation: Continuous-pressure applications, unless otherwise indicated.
4. Pressure Loss: As required by the work and approved by Arlington County Code.
5. Size: As required by the work and approved by Arlington County Code.
6. Design Flow Rate: As required by the work and approved by Arlington County Code.
7. Selected Unit Flow Range Limits: As required by the work and approved by Arlington County Code.
8. Pressure Loss at Design Flow Rate: As required by the work and approved by Arlington County Code.
9. Body: Bronze for NPS 2 and smaller; stainless steel for NPS 2-1/2 and larger.
10. End Connections: Threaded for NPS 2 and smaller; flanged for NPS 2-1/2 and larger.
11. Configuration: Designed for horizontal, straight through flow.
12. Accessories: Ball valves with threaded ends on inlet and outlet of NPS 2 and smaller; OS&Y gate valves with flanged ends on inlet and outlet of NPS 2-1/2 and larger.

2.09 CONCRETE VAULTS

- A. Description: Utility Vault Model 444-CUS by Smith-Midland PCC or approved equal.
 1. Manhole:
 - a. Gasket Seal Cover #1480 by East Jordan Iron Works or approved equal.
 - b. Watertite Base Flange #1480 by East Jordan Iron Works or approved equal.
 2. Drain: 4" Typ. Drain line with strainer connected to drainage system.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Refer to Section 310000, "Earthwork," for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping NPS 3/4 to NPS 3 shall be soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- F. Underground water-service piping NPS 4 and NPS 6 shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- G. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 shall be same as underground water-service piping.

3.03 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply:
 - 1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, metal seated gate valves with valve box.
 - 2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
 - 3. Use the following for valves in vaults and aboveground:
 - a. Gate Valves, NPS 2 and Smaller: Bronze.
 - b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.

3.04 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.
- B. Make connections NPS 2 and smaller with drilling machine according to the following:
 - 1. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.

2. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
 3. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
 4. Install corporation valves into service-saddle assemblies.
 5. Install manifold for multiple taps in water main.
 6. Install curb valve in water-service piping with head pointing up and with service box.
- C. Comply with NFPA 24 for fire-service-main piping materials and installation.
1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."
- D. Install PVC, AWWA pipe according to ASTM F 645 and AWWA M23.
- E. Bury piping with depth of cover over top at least 42 inches, with top at least 12 inches below level of maximum frost penetration.
- F. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.

3.05 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
1. PE Piping Insert-Fitting Joints: Use plastic insert fittings and fasteners according to fitting manufacturer's written instructions.
 2. PVC Piping Gasketed Joints: Use joining materials according to AWWA C900. Construct joints with elastomeric seals and lubricant according to ASTM D 2774 or ASTM D 3139 and pipe manufacturer's written instructions.
 3. Dissimilar Materials Piping Joints: Use adapters compatible with both piping materials, with OD, and with system working pressure. Refer to Division 2 Section "Piped Utilities - Basic Materials and Methods" for joining piping of dissimilar metals.

3.06 ANCHORAGE INSTALLATION

- A. Anchorage, General: Install water-distribution piping with restrained joints. Anchorages and restrained-joint types that may be used include the following:
1. Concrete thrust blocks.
 2. Locking mechanical joints.
 3. Set-screw mechanical retainer glands.
 4. Bolted flanged joints.
 5. Heat-fused joints.
 6. Pipe clamps and tie rods.
- B. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600.
 2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23.
 3. Fire-Service-Main Piping: According to NFPA 24.

- C. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.07 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- C. MSS Valves: Install as component of connected piping system.
- D. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.08 CONNECTIONS

- A. Piping installation requirements are specified in other Division 2 Sections. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect water-distribution piping to utility water main. Use tapping sleeve and tapping valve.

3.09 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

3.010 IDENTIFICATION

- A. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 02 Section "Earthwork."
- B. Permanently attach equipment nameplate or marker indicating plastic water-service piping, on main electrical meter panel.

3.011 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use

- procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.
- B. Prepare reports of purging and disinfecting activities.

END OF SECTION 112800

DIVISION 26

ELECTRICAL

SECTION 260010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Basic Electrical Requirements specifically applicable to Division 26 Sections, in addition to Division 1 - General Requirements.

1.02 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Submit shop drawings and product data grouped to include complete submittals of related systems, products, and accessories in a single submittal.
- C. Mark dimensions and values in units to match those specified.

1.04 REGULATORY REQUIREMENTS

- A. Conform to all codes required by the local jurisdiction including, but not limited to, the following: IBC; NFPA 70.
- B. Obtain permits, and request inspections from authority having jurisdiction.

1.05 PROJECT/SITE CONDITIONS

- A. Install Work in locations shown on Drawings, unless prevented by Project conditions.
- B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect/Engineer before proceeding.

PART 2 - PRODUCTS

2.01 MANUFACTURER

- A. Furnish products listed and classified by Underwriter's Laboratories, Inc. as suitable for purpose specified and shown.

PART 3 - EXECUTION

3.01 COORDINATION

- A. Prior to system rough-in of all equipment, coordinate the power connections with the controls requirements. The circuiting shown on the drawings is schematic only. It is this contractor's responsibility to ensure that all equipment is connected properly.

3.02 TEMPORARY POWER

- A. Install and maintain the temporary power and lighting for all construction, existing facilities and trades during the construction period. Refer to Division 1 for further requirements.

END OF SECTION 260010

SECTION 260111 - CONDUIT

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Metal conduit.
- B. Nonmetal conduit.
- C. Fittings and conduit bodies.

1.02 RELATED SECTIONS

- A. Section 260195 - Electrical Identification.

1.03 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.
- B. NECA "Standard of Installation."
- C. NEMA TC 2 - Electrical Plastic Tubing (EPT) and Conduit (EPC-40 and EPC-80).
- D. NEMA TC 3 - PVC Fittings for Use with Rigid PVC Conduit and Tubing.

1.04 REGULATORY REQUIREMENTS

- A. Conform to requirements of ANSI/NFPA 70
- B. Furnish products listed and classified by Underwriters Laboratories Inc. as suitable for purpose specified and shown.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Accurately record actual routing of conduits larger than 2 inches.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Deliver, store, protect, and handle Products to site under provisions of Division 1.
- B. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.
- C. Protect PVC conduit from sunlight.

1.07 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Verify routing and termination locations of conduit prior to rough-in.
- C. Conduit routing is shown on Drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

PART 2 - PRODUCTS

2.01 CONDUIT REQUIREMENTS

- A. Minimum Size: 3/4" inch unless otherwise specified.
- B. Underground Installations:
 - 1. Use, thickwall nonmetallic conduit.
 - 2. Above grade installations: Galvanized rigid steel conduit.
 - 3. In or Under Slab on Grade: Use thickwall nonmetallic conduit.

2.02 METAL CONDUIT

- A. Manufacturers:
 - 1. Allied Tube and Conduit.
 - 2. Killard Electric Manufacturing Co.
 - 3. Raco, Inc.
 - 4. Or approved equivalent.
- B. Galvanized Rigid Steel Conduit: ANSI C80.1.
- C. Fittings and Conduit Bodies: ANSI/NEMA FB 1; material to match conduit.

2.03 NONMETALLIC CONDUIT

- A. Manufacturers:
 - 1. Carlon.
 - 2. Raco, Inc.
 - 3. Thomas & Betts Corp.
 - 4. Or approved equivalent.
- B. Description: NEMA TC 2; Schedule 40 PVC.
- C. Fittings and Conduit Bodies: NEMA TC 3.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install conduit in accordance with NECA "Standard of Installation."
- B. Install nonmetallic conduit in accordance with manufacturer's instructions.
- C. Arrange supports to prevent misalignment during wiring installation.
- D. Cut conduit square using saw or pipecutter; de-burr cut ends.
- E. Bring conduit to shoulder of fittings; fasten securely.
- F. Join nonmetallic conduit using cement as recommended by manufacturer. Wipe nonmetallic conduit dry and clean before joining. Apply full even coat of cement to entire area inserted in fitting. Allow joint to cure for 20 minutes, minimum.
- G. Use conduit hubs or sealing locknuts to fasten conduit to sheet metal boxes in damp and wet locations and to cast boxes.
- H. Install no more than equivalent of three 90-degree bends between boxes. Use conduit bodies to make sharp changes in direction, as around beams. Use hydraulic one-shot

- I. bender to fabricate factory elbows for bends in metal conduit larger than 2-inch size.
Avoid moisture traps; provide junction box with drain fitting at low points in conduit system.
- J. Provide suitable fittings to accommodate expansion and deflection where conduit crosses seismic and expansion joints.
- K. Use suitable caps to protect installed conduit against entrance of dirt and moisture.

END OF SECTION 260111

SECTION 260123 - WIRE AND CABLE

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Building wire and cable.
- B. Wiring connectors and connections.

1.02 RELATED SECTIONS

- A. Section 260111 - Conduit.
- B. Section 260195 – Electrical Identification.

1.03 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide manufacturer's catalog information on building wire and cable and wiring connectors.

1.05 PROJECT CONDITIONS

- A. Verify that field measurements are as shown on Drawings.
- B. Conductor sizes are based on copper unless noted otherwise. Refer to the riser diagram for alternate Stabiloy aluminum alloy feeder sizes.
- C. Wire and cable routing shown on Drawings is approximate unless dimensioned. Route wire and cable as required to meet Project Conditions.
- D. Where wire and cable routing is not shown, and destination only is indicated, determine exact routing and lengths required.

1.06 COORDINATION

- A. Coordinate Work under provisions of Division 1.
- B. Determine required separation between cable and other work.
- C. Determine cable routing to avoid interference with other work.

PART 2 - PRODUCTS

2.01 MANUFACTURERS - BUILDING WIRE AND CABLE

- A. American Insulated Wire Corp.
- B. Carol Cable Co. Inc.
- C. Southwire Co.
- D. Alcan Cable
- E. Or equivalent

2.02 WIRE AND CABLE

A. Single conductor insulated wire.

1. Conductor: Copper.
2. Insulation Voltage Rating: 600 volts.
3. Insulation: ANSI/NFPA 70; Type XHHW-2 insulation for feeders and branch circuits.

B. UF-B Cable

1. Standards and References: ASTM - B3 and B-8; UL Standard 83; UL Standard 493; Federal Specification A-A-59544; National Electrical Code, NFPA 70, 2011 Edition; and RoHS/REACH
2. Conductor: Copper.
3. Insulation Voltage Rating: 600 volts.
4. Insulation: Phase conductors are polyvinyl chloride (PVC) insulated, nylon jacketed, color coded for identification purposes. Jacketed with sunlight, moisture, and fungus resistant gray PVC.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.
- B. Verify that mechanical work likely to damage wire and cable has been completed.

3.02 PREPARATION

- A. Completely and thoroughly swab raceway before installing wire.

3.03 WIRING METHODS

- A. Exterior Locations: Use building wire in raceway.

3.04 INSTALLATION

- A. Install products in accordance with manufacturers instructions.
- B. Use solid conductor for feeders and branch circuits 10 AWG and smaller.
- C. Use conductor not smaller than 12 AWG.
- D. Pull all conductors into raceway at same time.
- E. Use suitable wire pulling lubricant for building wire 6 AWG and larger.
- F. Neatly train and lace wiring inside boxes, equipment, and panelboards.
- G. Clean conductor surfaces before installing lugs and connectors.
- H. Make splices, taps, and terminations to carry full ampacity of conductors with no perceptible temperature rise.
- I. Use split bolt connectors for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connector with electrical tape to 150 percent of insulation rating of conductor.
- J. Use solderless pressure connectors with insulating covers for conductor splices and taps, 8 AWG and smaller.
- K. Use insulated spring wire connectors with plastic caps for conductor splices and taps, 10 AWG

and smaller.

- L. Protect exposed cable from damage.
- M. Use #6 AWG wire for all underground lighting branch circuits.
- N. Use #12/2 solid copper UF-B with ground wire inside light poles. This type of cable shall be used between the terminal block of the luminaire and the splice at the pole base.

3.05 INTERFACE WITH OTHER PRODUCTS

- A. Identify wire and cable under provisions of Section 26 0195.
- B. Identify each conductor with its circuit number or other designation indicated on Drawings.

3.06 FIELD QUALITY CONTROL

- A. Perform field inspection and testing under provisions of Division 1.
- B. Inspect wire and cable for physical damage and proper connection.
- C. Measure tightness of bolted connections and compare torque measurements with manufacturer's recommended values.
- D. Verify continuity of each branch circuit and feeder conductor.

END OF SECTION 260123

SECTION 260130 - BOXES

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:

1. Handholes and boxes for exterior underground cabling.

PART 2 - PRODUCTS

2.01 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

A. General Requirements for Handholes and Boxes:

1. Boxes and handholes for use in underground systems shall be designed and identified as defined in NFPA 70, for intended location and application.
2. Boxes installed in wet areas shall be listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

B. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel, fiberglass, or a combination of the two.

1. Standard: Comply with SCTE 77.
2. Configuration: Designed for flush burial with closed bottom unless otherwise indicated.
3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure and handhole location.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC".
6. Conduit Entrance Provisions: Conduit-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.

PART 3 - EXECUTION

3.01 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.

- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch (12.5-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch (25 mm) above finished grade.
- D. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.02 PROTECTION

- A. Protect coatings, finishes, and cabinets from damage and deterioration.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC coatings or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION 260130

SECTION 260141 - WIRING DEVICES

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Receptacles, receptacles with integral GFCI, and associated device plates.

1.02 REFERENCES

- A. NEMA WD 1 - General Purpose Wiring Devices.
- B. NEMA WD 6 - Wiring Device Configurations.

1.03 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

PART 2 – PRODUCTS

2.01 RECEPTACLES

- A. Manufacturers:
 - 1. Leviton.
 - 2. Hubbell Inc.
 - 3. Pass and Seymour, Inc.
 - 4. or approved equal
- B. Description: NEMA WD 1; heavy-duty, specification grade general-use receptacle.
- C. Device Body: Black plastic.
- D. Configuration: NEMA WD 6; type as specified and indicated.
- E. GFCI Receptacle: Convenience receptacle with integral ground fault circuit interrupter to meet regulatory requirements.

2.01 USB CHARGER OUTLETS

- A. Manufacturers:
 - 1. Leviton.
 - 2. Hubbell Inc.
 - 3. Pass and Seymour, Inc.
 - 4. or approved equal

- B. Description: 5 Amp, 5 Volt DC
- C. Device Body: Black plastic.
- D. Configuration: Four USB type A ports or Two USB type A ports and two USB type C ports or as specified and indicated.

2.03 PLATES

- A. Weatherproof Cover Plate: Gasketed cast metal with hinged gasketed device cover.
 - 1. Hubbell.
 - 2. Pass & Seymour.
 - 3. Slater.
 - 4. or approved equal

PART 3 – EXECUTION

3.01 EXAMINATION

- A. Verify conditions under provisions of Division 1.
- B. Verify outlet boxes are installed at proper height.
- C. Verify branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

3.02 PREPARATION

- A. Clean debris from outlet boxes.

3.03 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install devices plumb and level. All devices shall be installed in vertical position unless noted otherwise on contract drawings.
- C. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

3.04 FIELD QUALITY CONTROL

- A. Inspect each wiring device for defects.
- B. Verify that each receptacle device is energized.
- C. Test each receptacle device for proper polarity.
- D. Test each GFCI receptacle device for proper operation.

END OF SECTION 260141

SECTION 260195 - ELECTRICAL IDENTIFICATION

PART 1 – GENERAL

1.01 SECTION INCLUDES

- A. Nameplates and tape labels.
- B. Wire and cable markers.

1.02 REFERENCES

- A. ANSI/NFPA 70 - National Electrical Code.

PART 2 – PRODUCTS

2.01 PRODUCT REQUIREMENTS

- A. Nameplates: Engraved three-layer laminated plastic, black letters on a white background.
- B. Locations:
 - 1. Disconnect switches.
 - 2. Panelboards.
- C. Letter Size:
 - 1. Use 1/4 inch letters for identifying individual equipment and loads.
 - 2. Use 3/8 inch letters for identifying grouped equipment loads.
 - 3. Use 3/4 inch letters for identifying electrical equipment cabinet.

2.02 WIRE MARKERS

- A. Description: Tape type wire markers.
- B. Locations: Each conductor at pull boxes, outlet and junction boxes, and each load connection.
- C. Legend:
 - 1. Power and Lighting Circuits: Branch circuit or feeder number indicated on drawings.

2.03 UNDERGROUND WARNING TAPE

- A. Description: 6 inch wide plastic tape, colored yellow, with suitable warning legend describing buried electrical lines.

PART 3 – EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive nameplates.

3.02 APPLICATION

- A. Install nameplate parallel to equipment lines.
- B. Secure nameplates to equipment fronts using screws, rivets.
- C. Secure nameplate to outside surface of cover on panelboard that is recessed in finished locations.
- D. Identify underground conduits using underground warning tape. Install one tape per trench at 3 inches below finished grade.

END OF SECTION 260195

SECTION 260470 - PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. Branch circuit panelboards.

1.02 RELATED WORK

- A. Section 260195 - Electrical Identification: Engraved Nameplates.

1.03 REFERENCES

- A. NECA (National Electrical Contractors Association)
"Standard of Installation".
- B. NEMA AB 1 - Molded Case Circuit Breakers.
- C. NEMA KS 1 - Enclosed Switches
- D. NEMA PB 1 - Panelboards.
- E. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less.
- F. NFPA 70 - National Electrical Code.

1.04 SUBMITTALS

- A. Submit under provisions of Division 1.
- B. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, and circuit breaker arrangement and sizes.

1.05 PROJECT RECORD DOCUMENTS

- A. Submit under provisions of Division 1.
- B. Record actual locations of Products; indicate actual branch circuit arrangement.

1.06 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of Division 1.
- B. Maintenance data: Include spare parts data listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.07 QUALITY ASSURANCE

- A. Perform work in accordance with NECA Standard of Installation.

1.08 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.09 MAINTENANCE MATERIALS

- A. Provide maintenance materials under provisions of Division 1.
- B. Provide two of each panelboard key.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. Square D.
- B. General Electric.
- C. Eaton's Cutler Hammer.
- D. Siemens/ITE.
- E. Or approved equal.
- F. All panelboards listed in Section 260470 shall be supplied by a single manufacturer.

2.02 BRANCH CIRCUIT PANELBOARDS

- A. Lighting and Appliance Branch Circuit Panelboards: NEMA PB1; circuit breaker type.
- B. Panelboard Bus: Copper, ratings as indicated. Provide copper ground bus in each panelboard.
- C. Minimum integrated short circuit rating: Verify available fault current with Dominion Virginia Power and provide breakers with appropriate fault current ratings.
- D. Molded Case Circuit Breakers: NEMA AB 1, bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled. Do not use tandem circuit breakers.
- E. Enclosure: NEMA PB 1, Type 3R.
- F. Cabinet Front: Door in Door; surface cabinet front with concealed trip clamps, concealed hinge, and flush lock all keyed alike. Finish in manufacturer's standard gray enamel.
- G. Surge Protective Device (SPD)

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Install panelboards in accordance with NEBA PE 1.1.
- B. Install panelboards plumb. Reuse existing supports.
- C. Mounting Height: Align bottom of panel with transocket meter.

- D. Provide typed circuit directory for each branch circuit panelboard. Revise directory to reflect circuiting changes required to balance phase loads.
- E. Provide engraved plastic nameplates under the provisions of Section 260195.

3.02 FIELD QUALITY CONTROL

- A. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION 260470

DIVISION 31

EARTHWORK

SECTION 310000 - EARTHWORK

PART 1 - GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide all labor, material and equipment to perform all work pertaining to earthwork as called for on the approved plans and as specified herein.

1.02 RELATED DOCUMENTS

- A. Construction Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Virginia Erosion and Sedimentation Control Handbook, Latest Edition
- C. Underground Utility Protection Ordinance – Chapter 55 Arlington County Code
- D. Local Governing Authority and Code Requirements – Chapter 57 Arlington County Code
- E. Arlington County DES Construction Standards and Specifications
- F. Virginia Department of Transportation Road and Bridge Specifications
- G. Tree Protection Standards and Specifications – as indicated in Construction Drawings
- H. SECTION 02910 Soil Profile Rebuilding

1.03 SUMMARY

- A. This Section includes the following:
 - 1. Excavation for footings, steps, subgrades for slabs-on-grade, walks, pavements, lawns and grasses.
 - 2. Subsurface drainage backfill for trenches.
 - 3. Excavating and backfilling for utility trenches (vault, water hydrant and water pump).
 - 4. Related Sections include the following: 311100 Site Clearing, Demolition and Removals
 - 5. 033000 – Cast in Place Concrete
 - 6. 321313 – Concrete Pavement
 - 7. 329200 – Seeding and Sodding

1.05 DEFINITIONS

- A. Backfill: Soil material or controlled low-strength material used to fill an excavation.
 - 1. Final Backfill: Backfill placed over initial backfill to fill a trench.
- B. Base Course: Course placed between the subbase course and hot-mix asphalt paving.

- C. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.
- D. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.
- E. Drainage Course: Course supporting the slab-on-grade that also minimizes upward capillary flow of pore water.
- F. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.
 - 1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by Project Officer. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
 - 2. Bulk Excavation: Excavation more than 10 feet in width and more than 30 feet in length.
 - 3. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by Project Officer. Unauthorized excavation, as well as remedial work directed by Project Officer, shall be without additional compensation.
- G. Fill: Soil materials used to raise existing grades.
- H. Rock: Rock material in beds, ledges, unstratified masses, conglomerate deposits, and boulders of rock material that exceed 1 cu. yd. for bulk excavation or 3/4 cu. yd. for footing, trench, and pit excavation that cannot be removed by rock excavating equipment equivalent to the following in size and performance ratings, without systematic drilling, ram hammering, ripping, or blasting, when permitted:
 - 1. Excavation of Footings, Trenches, and Pits: Late-model, track-mounted hydraulic excavator; equipped with a 42-inch- wide, maximum, short-tip-radius rock bucket; rated at not less than 138-hp flywheel power with bucket-curling force of not less than 28,090 lbf and stick-crowd force of not less than 18,650 lbf; measured according to SAE J-1179.
 - 2. Bulk Excavation: Late-model, track-mounted loader; rated at not less than 210-hp flywheel power and developing a minimum of 48,510-lbf breakout force with a general-purpose bare bucket; measured according to SAE J-732.
- I. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.
- J. Subbase Course: Course placed between the subgrade and base course for hot-mix asphalt pavement, or course placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.
- K. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.
- L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.06 SUBMITTALS

- A. Product Data: For the following:
 - 1. Geotextile.
 - 2. Controlled low-strength material, including design mixture.
 - 3. Geofoam.
- B. Samples: 12-by-12-inch Sample of subdrainage geotextile.
- C. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of the following with requirements indicated:
 - 1. Classification according to ASTM D 2487 of each on-site and borrow soil material proposed for fill and backfill.
 - 2. Laboratory compaction curve according to ASTM D 698 for each on-site and borrow soil material proposed for fill and backfill.
- D. Pre-excavation Photographs or Videotape: Show existing conditions of adjoining construction and site improvements, including finish surfaces, that might be misconstrued as damage caused by earthwork operations. Submit before earthwork begins.

1.07 QUALITY ASSURANCE

- A. Geotechnical Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct soil materials and rock-definition testing, as documented according to ASTM D 3740 and ASTM E 548.
- B. Pre-excavation Conference: Conduct conference at Project site to comply with requirements in Division 1 Section "Coordination, Field Engineering, Cutting and Patching, and Regulatory Requirements."

1.08 PROJECT CONDITIONS

- A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated.
 - 1. Notify Project Officer not less than two days in advance of proposed utility interruptions.
 - 2. Do not proceed with utility interruptions without Project Officer's written permission.
 - 3. Contact utility-locator service for area where Project is located before excavating.
- B. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.
- C. Protect all existing pipes, poles, wires, fences, trees, and landscape plant materials, and other structures that are to remain in place. In case of damage, notify the appropriate agency to affect repair in a manner resulting in a condition at least equal to the condition prior to damage.

- D. Excavations near existing structures shall not be closer than the distance from finished grade to the bottom of the foundation without sheeting and shoring to protect the existing structure.
- E. On paved surfaces, do not use or operate tractors, bulldozers, or other power-operated equipment, the treads or wheels of which are so shaped as to cut or otherwise damage such surfaces. Placing mats or using other methods of protection may be allowed subject to the approval of the Project Officer. Promptly restore all surfaces that have been damaged to a condition at least equal to that in which they were found immediately prior to the beginning of operations. Suitable materials and methods shall be used for such restoration.
- F. The Contractor shall be solely responsible for the stability of excavations and meeting of all State and Federal OSHA requirements. Provide all sheathing, lagging, bracing, and other support required to retain the stability of excavations.

PART 2 - PRODUCTS

2.01 SOIL MATERIALS

- A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.
- B. Satisfactory Soils: ASTM D 2487 Soil Classification Groups CL, ML, SC, GC, GW, GP, GM, SW, SP, and SM, or a combination of these groups; free of rock or gravel larger than 4 inches in any dimension, debris, waste, frozen materials, vegetation, and other deleterious matter.
- C. Unsatisfactory Soils: Soil Classification Groups OL, CH, MH, OH, and PT according to ASTM D 2487, or a combination of these groups.
 - 1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.
- D. Subbase Material: Naturally or crushed stone, slag, and natural or crushed sand: with or without soil motor.
- E. Base Course: designated as Type I or Type II as follows: Type I shall consist of crushed stone, crushed slag, or crushed gravel with or without soil mortar or other admixtures. Crushed gravel shall consist of particles of which at least 90 percent by weight of the material retained on the No. 10 sieve shall have at least one face fractured by artificial crushing. Type II shall consist of gravel, stone or slag screenings; fine aggregate and crushed coarse aggregate; sand-clay-soil mortar or other admixtures.
- F. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.
- G. Bedding Course: Crushed stone Virginia Department of Transportation (VDOT) size 57, 68, or 78 in accordance with VDOT specification section 203 Table II-5

- H. Drainage Course: Narrowly graded mixture of crushed stone or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.
- I. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.
- J. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.
- K. Impervious Fill: Clayey gravel and sand mixture capable of compacting to a dense state.

2.02 GEOTEXTILES

- A. Subsurface Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 157 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 142 lbf; ASTM D 4632.
 - 4. Tear Strength: 56 lbf; ASTM D 4533.
 - 5. Puncture Strength: 56 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: Equal to or smaller than 0.300mm.
 - 7. Permittivity: 0.8 second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.
- B. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 - 1. Survivability: Class 2; AASHTO M 288.
 - 2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
 - 3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
 - 4. Tear Strength: 90 lbf; ASTM D 4533.
 - 5. Puncture Strength: 90 lbf; ASTM D 4833.
 - 6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
 - 7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
 - 8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.03 ACCESSORIES

- A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; colored as follows:
 - 1. Red: Electric.
 - 2. Yellow: Gas, oil, steam, and dangerous materials.
 - 3. Orange: Telephone and other communications.
 - 4. Blue: Water systems.
 - 5. Green: Sewer systems.

- B. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
1. Red: Electric.
 2. Yellow: Gas, oil, steam, and dangerous materials.
 3. Orange: Telephone and other communications.
 4. Blue: Water systems.
 5. Green: Sewer systems.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.
- B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface as specified in section 311100 Site Clearing, Demolition, and Removals.
- C. Protect and maintain erosion and sedimentation controls, which are specified in section 015700 Temporary Erosion and Sediment Control, during earthwork operations.
- D. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.02 DEWATERING

- A. Prevent surface water and ground water from entering excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.
- B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
 2. Install a dewatering system to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXPLOSIVES

- A. Explosives: Use of explosives is prohibited.

3.04 EXCAVATION, GENERAL

- A. Classified Excavation: Excavate to subgrade elevations. Material to be excavated will be classified as earth and rock. Do not excavate rock until it has been classified and cross

sectioned by the Geotech. The Contract Sum will be adjusted for rock excavation in the Contract Documents. Changes in the Contract time may be authorized for rock excavation.

1. Earth excavation includes excavating pavements and obstructions visible on surface; underground structures, utilities, and other items indicated to be removed; together with soil, boulders, and other materials not classified as rock or unauthorized excavation.
 - a. Intermittent drilling; blasting, if permitted; ram hammering; or ripping of material not classified as rock excavation is earth excavation.
2. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction without exceeding the following dimensions:
 - a. 24 inches outside of concrete forms other than at footings.
 - b. 12 inches outside of concrete forms at footings.
 - c. 6 inches outside of minimum required dimensions of concrete cast against grade.
 - d. Outside dimensions of concrete walls indicated to be cast against rock without forms or exterior waterproofing treatments.
 - e. 6 inches beneath bottom of concrete slabs on grade.
 - f. 6 inches beneath pipe in trenches, and the greater of 24 inches wider than pipe or 42 inches wide.

3.05 EXCAVATION FOR STRUCTURES

- A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.
 1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.
 2. Pile Foundations: Stop excavations 6 to 12 inches above bottom of pile cap before piles are placed. After piles have been driven, remove loose and displaced material. Excavate to final grade, leaving solid base to receive concrete pile caps.
 3. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Utility Structures: Excavate to elevations and dimensions indicated within a tolerance of plus or minus 1 inch. Do not disturb bottom of excavations intended as bearing surfaces.

3.06 EXCAVATION FOR WALKS AND PAVEMENTS

- A. Excavate surfaces under walks and pavements to indicated lines, cross sections, elevations, and subgrades.

3.07 EXCAVATION FOR UTILITY TRENCHES

- A. Excavate trenches to indicated gradients, lines, depths, and elevations.
- B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit.

1. Clearance: As indicated on details.
- C. Trench Bottoms: Excavate trenches deeper than bottom of pipe elevation to allow for bedding course.
1. Width and Depth: As indicated on details.

3.08 SUBGRADE INSPECTION

- A. Notify Project Officer when excavations have reached required subgrade.
- B. If Project Officer determines that unsatisfactory soil is present, continue excavation and replace with compacted backfill or fill material as directed.
- C. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.
 1. Completely proof-roll subgrade in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph.
 2. Proof-roll with a loaded 10-wheel, tandem-axle dump truck weighing not less than 15 tons.
 3. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Project Officer, and replace with compacted backfill or fill as directed.
- D. Authorized additional excavation and replacement material will be paid for according to Contract provisions for changes in the Work.
- E. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Project Officer, without additional compensation.

3.09 UNAUTHORIZED EXCAVATION

- A. Fill unauthorized excavation under foundations or wall footings by extending bottom elevation of concrete foundation or footing to excavation bottom, without altering top elevation. Lean concrete fill, with 28-day compressive strength of 2500 psi, may be used when approved by Project Officer.
 1. Fill unauthorized excavations under other construction or utility pipe as directed by Project Officer.

3.10 STORAGE OF SOIL MATERIALS

- A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.
 1. Stockpile soil materials away from edge of excavations. Do not store within tree protection areas and drip line of remaining trees.

3.11 BACKFILL

- A. Place and compact backfill in excavations promptly, but not before completing the following:
 - 1. Construction below finish grade including, where applicable, subdrainage, dampproofing, waterproofing, and perimeter insulation.
 - 2. Surveying locations of underground utilities for Record Documents.
 - 3. Testing and inspecting underground utilities.
 - 4. Removing concrete formwork.
 - 5. Removing trash and debris.
 - 6. Removing temporary shoring and bracing, and sheeting.
 - 7. Installing permanent or temporary horizontal bracing on horizontally supported walls.
- B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.12 UTILITY TRENCH BACKFILL

- A. Place backfill on subgrades free of mud, frost, snow, or ice.
- B. Place and compact bedding course on trench bottoms. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.
- C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section "Cast-in-Place Concrete."
- D. Backfill voids with satisfactory soil while installing and removing shoring and bracing.
- E. Place and compact final backfill of satisfactory soil to final subgrade elevation.
- F. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

- A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.
- B. Place and compact fill material in layers to required elevations as follows:
 - 1. Under grass and planted areas, use satisfactory soil material.
 - 2. Under walks and pavements, use satisfactory soil material.
 - 3. Under steps and ramps, use engineered fill.
 - 4. Under building slabs, use engineered fill.
 - 5. Under footings and foundations, use engineered fill.
- B. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.14 SOIL MOISTURE CONTROL

- A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
 - 1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
 - 2. Remove and replace or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

- A. Place backfill and fill soil materials in layers not more than 6 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.
- B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.
- C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 698:
 - 1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
 - 2. Under walkways, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 - 3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
 - 4. For utility trenches, compact each layer of final backfill soil material at 95 percent.

3.16 GRADING

- A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
 - 1. Provide a smooth transition between adjacent existing grades and new grades.
 - 2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.
- B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:
 - 1. Lawn or Unpaved Areas: Plus or minus 1 inch.
 - 2. Walks: Plus or minus 1 inch.
 - 3. Pavements: Plus or minus 1/2 inch.
- C. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.17 SUBSURFACE DRAINAGE

- A. Subdrainage Pipe: Specified in Division 2 Section "Subdrainage."
- B. Subsurface Drain: Place subsurface drainage geotextile around perimeter of subdrainage trench. Place a 6-inch course of filter material on subsurface drainage geotextile to support subdrainage pipe. Encase subdrainage pipe in a minimum of 12 inches of filter material, placed in compacted layers 6 inches thick, and wrap in subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
- C. Drainage Backfill: Place and compact filter material over subsurface drain, in width indicated, to within 12 inches of final subgrade, in compacted layers 6 inches thick. Overlay drainage backfill with 1 layer of subsurface drainage geotextile, overlapping sides and ends at least 6 inches.
 - 1. Compact each filter material layer to 85 percent of maximum dry unit weight according to ASTM D 698.
 - 2. Place and compact impervious fill over drainage backfill in 6-inch- thick compacted layers to final subgrade.

3.18 SUBBASE AND BASE COURSES

- A. Place subbase and base course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place subbase and base course under pavements and walks as follows:
 - 1. Install separation geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
 - 2. Place base course material over subbase course under hot-mix asphalt pavement.
 - 3. Shape subbase and base course to required crown elevations and cross-slope grades.
 - 4. Place subbase and base course 6 inches or less in compacted thickness in a single layer.
 - 5. Place subbase and base course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
 - 6. Compact subbase and base course at optimum moisture content to required grades, lines, cross sections, and thickness to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.19 DRAINAGE COURSE

- A. Place drainage course on subgrades free of mud, frost, snow, or ice.
- B. On prepared subgrade, place and compact drainage course under cast-in-place concrete slabs-on-grade as follows:

1. Install subdrainage geotextile on prepared subgrade according to manufacturer's written instructions, overlapping sides and ends.
2. Place drainage course 6 inches or less in compacted thickness in a single layer.
3. Place drainage course that exceeds 6 inches in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches thick or less than 3 inches thick.
4. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.

3.20 FIELD QUALITY CONTROL

- A. Testing Agency: Contractor shall engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing for site work. The Project Officer may engage a qualified independent geotechnical engineering testing agency to perform testing for critical structures and building foundations.
- B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
- C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Project Officer.
- D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable. Tests will be performed at the following locations and frequencies:
 1. Paved and Building Slab Areas: At subgrade and at each compacted fill and backfill layer, at least 1 test for every 5,000 sf or less of building slab, but in no case fewer than 3 tests for building slabs and at least 1 test every 500 linear feet of paved roadway, but in no case fewer than 2 tests for pavements.
 2. Foundation Wall Backfill: At each compacted backfill layer, at least 1 test for each 100 feet or less of wall length, but no fewer than 2 tests.
 3. Trench Backfill: At each compacted bedding and final backfill layer, at least 1 test for each 300' or less of trench length, but no fewer than 2 tests.
- E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.21 PROTECTION

- A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.
- B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

1. Scarify or remove and replace soil material to depth as directed by Project Officer; reshape and recompact.
- C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.
1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.
- 3.22 DISPOSAL OF SURPLUS AND WASTE MATERIALS
- A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 310000

SECTION 311100 - SITE CLEARING, DEMOLITION AND REMOVALS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
1. Protecting existing trees and landscaping to remain.
 2. Removing above-grade site items, including concrete curbs, sidewalks, trails, and gravel pavements.
 3. Disconnecting and capping or sealing site utilities.
- B. Related Sections:
1. Section 310000 Earthwork
 2. Section 311300 Tree Protection and Root Pruning
 3. Section 015713 Temporary Erosion and Sediment Control
 4. Section 329100 Planting Preparation
 5. Section 329200 Seeding and Sodding
 6. Section 329300 Exterior Plants
- C. In addition to the specifications contained herein, Work shall be performed in accordance with the:
1. Drawings and general provisions of the contract, including general and supplementary conditions
 2. Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code)
 3. Virginia Erosion and Sedimentation Control Handbook, Latest Edition
 4. Local Governing Authority and Code Requirements – Chapt.57 Arlington County Code
 5. Arlington County Department of Parks & Recreation Design Standards as shown on the plans and available online at:
 6. Design Standards – Official Website of Arlington County Virginia Government (arlingtonva.us)
 7. Underground Utility Protection Ordinance – Chapt. 55 Arlington County Code
 8. Tree Protection Standards and Fencing Requirements – as contained in Arlington County Landscape Standards Design Standards – Official Website of Arlington County Virginia Government (arlingtonva.us) and in Section 311300.

1.02 MATERIAL OWNERSHIP

- A. Except for stripped topsoil, items identified by the Project Officer as salvage, or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.
- B. Salvable Items: Carefully remove items indicated by the Project Officer to be salvaged and store on Owner's premises where indicated in the Demolition Plans.

- C. Temporary storage of removed items or materials on-site will not be allowed without prior approval from DPR. Carefully remove items indicated by the Project Officer to be salvaged and store on Owner's premises as determined at Pre-Construction meeting.
- D. Materials shall be at the Contractor's option in accordance with the plans and specifications and with Arlington County Code, Erosion and Sediment Control Ordinance (Chapter 57.)
- E. Materials resulting from demolition activities shall be subject to County retention and delivered to the location selected by the County, at no additional expense to the County.

1.03 ENVIRONMENTAL REQUIREMENTS

- A. Construct temporary erosion control systems as shown on Construction Drawings and in accordance with applicable County requirements to protect adjacent properties and water resources from erosion and sedimentation.
- B. Contractor shall not begin construction without "Virginia Stormwater Management Permit" (VSMP) permit governing discharge of storm water from site for entire construction period. VSMP permit requires Erosion Control Plan to be in place during construction. County shall apply for the VSMP permit. County shall provide Contractor with a Stormwater Pollution Protection Plan (SWPPP) as required by the VSMP permit.
- C. Contractor shall be totally responsible for conducting storm water management practices in accordance with VSMP permit and for enforcement action taken or imposed by Federal or State agencies, including cost of fines, construction delays, and remedial actions resulting from Contractor's failure to comply with provisions of VSMP permit.

1.04 SUBMITTALS

- A. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining construction and site improvements that might be misconstrued as damage caused by demolition operations.

1.05 QUALITY ASSURANCE

- A. Regulatory Requirements: Comply with governing EPA notification regulations before starting demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

1.06 PROJECT CONDITIONS

- A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 - 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Project Officer and authorities having jurisdiction.
 - 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction. Accessible routes are required to be provided.
- B. Utility Locator Service: Notify Miss Utility at (800) 552-7001 for utility location services 72 hours prior to site clearing.

- C. Do not commence site clearing operations until temporary erosion and sedimentation control measures are in place.
- D. Conditions existing at time of inspection for bidding purposes will be maintained by the County in so far as practical.
- E. Variations to conditions or discrepancy in actual conditions as they apply to site preparation operations are to be brought to attention of the County prior to commencement of site work.

PART 2 - MATERIALS

2.01 EQUIPMENT

- A. Off site materials and on-site materials shall be transported to project using well-maintained and operating vehicles. Once on site, transporting vehicles shall stay on designated haul roads and shall at no time endanger improvements.

2.02 SOIL MATERIALS

- A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Section 310000 Earthwork
 - 1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

2.03 CONSTRUCTION FENCE

- A. Fabric: Fabric shall be 9 Ga., galvanized steel wire woven into 2-inch diamond mesh, knuckled at the bottom and barbed at the top.
- B. Line Posts: Line posts shall be 2 ½ inch O.D. galvanized steel, standard weight pipe conforming to F 1083, schedule 40, weighing 3.65 pounds per linear foot.
- C. Terminal Posts: Terminal posts shall be 3 inch O.D. galvanized steel, standard weight pipe conforming to ASTM F1083 schedule 40, weighing 5.79 pounds per linear foot.
- D. Braces: Braces shall be 1 5/8" inch O.D. galvanized steel, standard weight pipe conforming to ASTM F 1083, schedule 40, weighing 2.27 pounds per linear foot. Trusses shall be 5/16" diameter adjustable truss rods.
- E. Top and Bottom Tension Wire: Wire shall be No. 6-gauge galvanized wire.
- F. Fittings and Hardware: Hardware, fittings and post caps shall be ductile iron, cast steel or pressed steel, all hot dipped galvanized.
- G. Gates: A gate of similar construction as the fence shall be provided with locks. Gates shall be placed at locations as shown on the plans or as required by the Contractor / Owner and approved by the Project Officer. The Project Officer shall be supplied with a set of keys, one (1) key for every lock.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Protect and maintain benchmarks and survey control points from disturbance during construction.
- B. Protect existing site items to remain from damage during construction.

1. Restore damaged existing site items to their original condition, as acceptable to Project officer.
- C. Identify existing plant life that is to remain and verify clearing limits are clearly tagged, identified, and marked in such manner as to ensure their safety throughout construction operations. Limits of clearing and grading shall be staked and approved by Project Officer before commencing work. Install Tree Protection Fence (TPF) according to Arlington County Specifications around trees to be preserved and as shown on the construction drawings.
- D. No grading operations will be allowed until temporary sediment and erosion control measures have been installed in accordance with the approved plan conforming to the requirements of Arlington County Erosion and Sediment Control Ordinance. No work, storage of materials or parking of vehicles/ equipment shall occur within designated tree protection areas.
- E. Control measures shall be periodically cleaned of silt and maintained. Immediately after every rain storm, all control measures shall be inspected and any deficiencies corrected by the Contractor.
- F. No measurement will be made for temporary erosion control required to correct conditions created due to the Contractor's negligence, carelessness, or failure to install controls in accordance with the approved plan and sequence for the performance of such work.
- G. In the event the Contractor repeatedly fails to satisfactorily control erosion and siltation, the Owner reserves the right to employ outside assistance or to use its own forces to provide the corrective measures indicated; the cost of such work, plus engineering costs, will be deducted from the monies due to the Contractor for other work.
- H. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
 1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Project Officer and authorities having jurisdiction.
 2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

3.02 EXISTING UTILITIES

- A. Utility Locator Service: Notify Miss Utility for utility location services 72 hours prior to site clearing.
- B. Locate, identify, disconnect, and seal or cap utilities indicated to be removed or abandoned in place.
 1. Arrange with utility companies to shut off indicated utilities.
- C. Interrupting Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others, unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 1. Notify Project Officer not less than two days in advance of proposed utility interruptions.
 2. Do not proceed with utility interruptions without Project Officer's written permission.

3.03 EXISTING SITE ITEMS

- A. Remove existing above-grade items as indicated and as necessary to facilitate new construction.
- B. All concrete and asphalt items to be removed shall be saw cut from concrete or asphalt to remain at the location indicated.

3.04 DISPOSAL

- A. Disposal: Remove surplus soil material, unsuitable topsoil, obstructions, demolished materials, concrete, and waste materials including trash and debris, and legally dispose of them off Owner's property.

3.05 PROTECTION

- A. Locate and identify existing utilities that are to remain and protect these from damage.
- B. Following Arlington County Specifications/ Guidelines for Tree Protection Fencing, protect trees, plant growth, and features designated to remain as part of final landscaping. Refer to actual bid drawings for tree protection fencing and signage and drawing references as contained in Arlington County Landscape Standards.
- C. Trees damaged by construction operations shall be evaluated by the Urban Forester and replaced or pruned and treated as needed by an International Society of Arboriculture (I.S.A.) Certified Arborist.
- D. According to Arlington County's Tree Replacement Guidelines, replace trees damaged beyond repair by the construction process with nursery grown stock meeting American Nursery and Landscape Association (ANLA).
- E. Conduct operations with minimum interference to public or private accesses and facilities. Maintain ingress and egress at all times and clean or sweep roadways daily as required by Erosion Control Plan or governing authority. Dust control shall be provided with sprinkling systems or equipment provided by Contractor.
- F. Demolition operations and remove debris to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from County.
- G. Demolition operations to prevent injury to people and damage to facilities to remain. Ensure safe passage of people around demolition area. Protect existing site improvements, appurtenances, and landscaping to remain.
- H. Protect benchmarks, property corners, and other survey monuments from damage or displacement. If marker needs to be removed it shall be referenced by licensed land surveyor and replaced, as necessary, by same.
- I. Provide traffic control as required, in accordance with the US Department of Transportation's "Manual on Uniform Traffic Control Devices" and applicable state highway department requirements.

3.06 CLEARING AND GRUBBING

- A. Clear areas required for access to site and execution of work.
- B. Unless otherwise indicated on Construction Drawings, remove trees, shrubs, grass, other vegetation, improvements, or obstructions interfering with installation of new construction. Removal includes digging out stumps and roots. Depressions caused by

clearing and grubbing operations are to be filled to subgrade elevation to avoid ponding of water.

- C. The area of grubbing shall be maintained within the clearing limits shown on the plans. Remove stumps and matter roots to a depth of 24inches below existing ground surface. Refill excavations made by removal of stumps or roots with materials specified for structural backfill in Section 31000.
- D. Remove grass, trees, plant life, stumps, and other construction debris from site to dump site that is suitable for handling such material according to state laws and regulations.

3.07 TOPSOIL EXCAVATION

- A. Topsoil shall consist of organic surficial soil found in depth of not more than 6-inches. Satisfactory topsoil shall be reasonably free of subsoil, clay lumps, stones and other objects over 1 inch in diameter, weeds, roots, and other objectionable material.
- B. Cut heavy growths of grass from areas before stripping and remove cuttings with remainder of cleared vegetative material.
- C. Strip topsoil from areas that are to be filled, excavated, landscaped, or re-graded to such depth that it prevents intermingling with underlying subsoil or questionable material.
- D. Stockpile topsoil in storage piles in areas shown on Construction Drawings or where directed by Project Officer. Construct storage piles to freely drain surface water. Cover storage piles as required to prevent windblown dust. Dispose of unsuitable topsoil as specified for waste material, unless otherwise specified by Project Officer. Excess topsoil shall be removed from site by Contractor unless specifically noted otherwise on Construction Drawings or as acceptable to Project Officer.
- E. Refer to SECTION 02910 Soil Profile Rebuilding before performing this work.

3.08 DEMOLITION

- A. Bituminous and Portland cement concrete pavement designated for demolition shall be broken into pieces and disposed of at a location selected by the Contractor.
- B. The Contractor shall be solely responsible for making the arrangements for the disconnection and abandonment of gas, water, sewer, electricity, cable, telephone, and other public or service utilities.

3.09 DISPOSAL

- A. Dispose of trees and shrubs in accordance with the Garbage, Refuse and Weeds Ordinance of the Arlington County Code. When approved by the Project Officer, material to be dumped within the Contract area where directed.
- B. Do not burn materials on the site.
- C. Remove material from the site as it accumulates. Do not allow waste material to accumulate for more than 72 hours and should be removed before non work days.
- D. Transport demolition materials off County property and legally dispose of them.

PART 4 - MEASUREMENT AND PAYMENT

- 4.01 For performing the work of SITE CLEARING, DEMOLITION AND REMOVALS in accordance with the plans, specifications and directions of the Project Officer, the Contractor shall receive the LUMP SUM price bid.

- A. The price bid shall be a LUMP SUM of Site Clearing, Demolition, and Removals and shall include storage and re-installation of relocated items the cost of all labor, materials, equipment and incidental expenses necessary to complete the work in accordance with the plans and specifications, to the satisfaction of the Project Officer.

END OF SECTION 022300

SECTION 311300 - TREE PROTECTION AND ROOT PRUNING

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Protection of existing trees to remain:
 - a. Pruning of existing trees roots that are affected by execution of the Work, whether temporary or permanent construction.
 - b. Aeration and Root Protection Matting
 - c. Tree Protection Fencing
- A. Provide all labor, materials, tool and equipment as required to have tree protection applied on all areas called for on plans.
- B. Coordinate with streetscape project details for tree branch removal location and tree protection fencing measurements.
- C. In addition to the specifications contained herein, Work shall be performed in accordance with the Arlington County Department of Parks & Recreation Design Standards for Tree Protection and Trimming as shown on plans and available online at:

[Design Standards – Official Website of Arlington County Virginia Government \(arlingtonva.us\)](http://arlingtonva.us)

Related Sections:

- 1. 310000 Earthwork
- 2. 311000 Site Clearing, Preparation, Demolition and Removals
- 3. 015713 Temporary Erosion and Sediment Control
- 4. 329100 Planting Preparation
- 5. 329200 Seeding and Sodding
- 6. 329300 Exterior Plants

1.02 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Imported Topsoil: Soil obtained off-site that meets the specifications herein for topsoil and is suitable for use in planting soil/backfill soil mixture when existing soil quantities are insufficient. Refer to Section 329100 “Planting Preparation.
- C. Planting Soil/Backfill Soil Mixture: Existing soil modified as specified to be suitable for planting. Refer to Section 329100 “Planting Preparation.”
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.
- E. ISA: International Society of Arboriculture
- F. CBAY: Chesapeake Bay, typically referring to CBAY watershed.

- G. Urban Forester/County Urban Forester: Refers to the Arlington County Urban Forester
- H. Landscape Architect: Refers to an Arlington County Landscape Architect or their designee.

1.02 SUBMITTALS

- A. Product Data: For each type of product indicated in Section 2.0
- B. Certification: From Contractor's arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.
- C. Maintenance Requirements: From Contractor's arborist, for care and protection of trees affected by construction during and after completing the Work.
- D. Contract arborist Qualifications: Contractor shall submit a copy of valid ISA certification to the Project Officer for approval with confirmation by Urban Forester.
- E. List products to be used and firms, including qualifications to perform work.
- F. Provide schedules for performance of work.

1.03 QUALITY ASSURANCE

- A. Contractor shall ensure that tree and plant protection methods are implemented by an arborist Certified by the International Society of Arboriculture (ISA) to provide for the care of the trees and plants impacted by construction activities. Provide ISA certification verification to Project Officer per section 1.03 "Submittals" prior to beginning work.
- B. The Contractor shall identify to the Project Officer at least one authorized on-site Point of Contact(POC) who is, by training or experience, familiar with the policies, regulations and standards applicable to the work being performed. The POC and the certified arborist may be the same individual.
- C. Crews shall be directly supervised by an ISA certified arborist.
- D. All workers, through related training and on the job experience, shall be familiar with the technical aspects of arboricultural work and equipment used in such operations.
- E. Trucks and mechanized equipment shall not enter tree protection areas.
- F. Stump grinding shall be with small machines specifically designed for that purposes. No stumps shall be excavated except as described herein. Stumps shall be ground not more than 8" below grade and care must be taken to minimize damage to root of the trees to remain.
- G. No stump grinding within tree protection areas.
- H. All work in or near tree protection areas shall be carefully performed by Contractor in order to avoid damage to tree trunks, branches, root system, and other existing plant materials and soils that are to remain.
- I. Silt shall not be allowed to collect in preservation or reforestation areas. Silt accumulating in preservation areas shall constitute damage and will require remedial activity. All silt shall be removed from preservation areas within 24 hours of siltation. The methods and procedures for silt removal within tree preservation and reforested areas shall be approved by the Project Officer with confirmation by the Urban Forester.
- J. Tree Pruning Standard: Comply with ANSI A300 (Part 1), "Tree, Shrub, and Other Woody Plant Maintenance--Standard Practices (Pruning)."
 - 1. Pruning shall remove only dead, dying, damaged or broken limbs greater than 1" – 1.5" in diameter.
 - 2. Pruning for clearance shall be reviewed and approved by Project Officer with confirmation by the Urban Forester.

- K. Urban Forester Notification: The Contractor shall notify the Project Officer 72 hours prior to the following events, so that the County's Urban Forester can be notified and present at a pre-construction site meeting (refer to Section 3) and to observe work:
1. Tree protection fencing installation
 2. Tree or root-pruning operations.
 3. Work within tree protection zones.
 4. Tree planting.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. Temporary Tree Protection Fence: Unless otherwise indicated in approved plans, tree protection fence shall be two-inch wire mesh fabric measuring 72 inches in height mounted on 1.9" O.D. steel pipes driven 24 inches into the ground, placed 120 inches on-center maximum. Refer to Arlington County DPR standard detail on approved plans.
- B. Tree Protection Signs: Shall be of heavy-duty sheet aluminum or weatherproof plastic material measuring 12 inches by 18 inches. Signs shall state "NO ENTRY, TREE PROTECTION AREA, CALL 703-228-6557 TO REPORT VIOLATIONS" in both English and Spanish. Signs shall be mounted on fence every 50 feet maximum.
- C. Topsoil: Refer to Section 329100 – Plant Preparation.
- D. Bark Mulch: Refer to Section 329100 –Plant Preparation
- E. Temporary Root Protection Matting: If required in approved plans, temporary root protection matting shall be a double-sided geocomposite, geonet core, non-wove covering such as Tendrain 770-2, as manufactured by Tenax Corporation, Baltimore, MD or approved equal. Six (6) inches of wood chip mulch shall be applied to area to receive root protection matting prior to installation. Matting shall be installed in a single layer.
- F. Landscape nails: When required, spikes shall be 12" as indicated on the drawings.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Prior to the construction activities, the Contractor shall meet on-site with the Project Officer and Urban Forester to review trees to remain and protective measures required.
- B. Temporary Tree Protection Fencing: Install temporary tree protection fencing and signs around tree protection zones to protect remaining trees and vegetation from construction damage. Maintain temporary fence and remove when construction is complete after approval by Project Officer with confirmation by the County Urban Forester.
- C. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.
- D. No personnel, vehicles, equipment, construction materials, or construction debris shall be allowed inside the tree protection areas at any time during construction without the written consent of the Project Officer with confirmation by the Urban Forester. If a violation is observed, the Contractor will be notified by the Project Officer and shall immediately rectify the situation. Continued and subsequent violations will result in a fine of \$500 per day of violation.
- E. Special Demolition Procedures:

1. Demolition of walks and hardscape within tree protection areas shall be directly supervised by an ISA certified arborist.
2. Mechanized equipment shall not enter tree protection areas (TPAs) or reforestation areas.
3. Backfill of voids created by demolition within the TPAs and reforestation areas shall be loosely placed topsoil. Only the amount of topsoil necessary to fill the void without spreading over existing grades shall be allowed.

3.02 EXCAVATION

- B. Install shoring or other protective support systems to minimize sloping or benching of excavations if indicated in the approved plans.
- C. Do not excavate within tree protection zones, unless otherwise indicated.
- D. Where utility trenches are required within tree protection zones, Contractor shall perform root pruning prior to trenching.
- E. Where excavation is proposed within the critical root zone of trees to remain, Contractor shall perform root pruning as indicated in approved plans prior to excavation.
- F. Where new finish grade is indicated below existing grade around trees, Contractor shall slope grade outside of tree protection zones. Maintain existing grades within tree protection zones.

3.03 ROOT PRUNING:

- G. When required, root pruning locations will be indicated on the approved plans. Exact location and depth shall be determined on site with Project Officer and Urban Forester during the pre-construction meeting.
- H. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots with clean, sharp pruning instruments; do not break or chop. All root pruning shall be performed by an ISA certified arborist. Refer to Arlington County Department of Parks & Recreation Design Standards “Tree Protection and Trimming” as shown on plans and available online at:

[Design Standards – Official Website of Arlington County Virginia Government \(arlingtonva.us\)](http://arlingtonva.us)

3.04 TREE REPAIR AND REPLACEMENT

- I. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to Arlington County Urban Forester or contract arborist's written instructions.
- J. The Contractor shall be responsible for any damage to trees within the Tree Protection Area caused by the Contractor's personnel, vehicles, or equipment at the site. Any damage to a tree to remain shall result in a payment by the Contractor to the Project Officer for the amount of damage based on the latest edition of the Council of Tree and Landscape Appraisers Guide for Plant Appraisal published by the International Society of Arboriculture (ISA). All trees are to be valued as landscape trees.

3.05 DISPOSAL OF WASTE MATERIALS

- K. Burning is not permitted.
- L. Disposal: Remove excess excavated material and displaced trees from Owner's property and legally dispose.

END OF SECTION 311300

DIVISION 32

EXTERIOR IMPROVEMENTS

SECTION 321216 – ASPHALT PAVEMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes hot-mix VEHICULAR asphalt paving.

1.02 REFERENCES

- B. Virginia Department of Transportation Construction Standards and Specifications (VDOT)

1.03 SUBMITTALS

- C. Product Data: For each type of product indicated. Include technical data and tested physical and performance properties.
- D. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
- E. Material certificates.

1.04 QUALITY ASSURANCE

- F. Manufacturer Qualifications: Manufacturer shall be registered with and approved by authorities having jurisdiction or the DOT of the state in which Project is located.
- G. Regulatory Requirements: Comply with the Arlington County DPW Construction Standards and Specifications for asphalt paving work.
- H. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.

1.05 PROJECT CONDITIONS

- I. Environmental Limitations: Do not apply asphalt materials if subgrade is wet or excessively damp or if the following conditions are not met:
 - 1. Tack Coat: Minimum surface temperature of 60 deg F.
 - 2. Asphalt Base Course: Minimum surface temperature of 40 deg F and rising at time of placement.
 - 3. Asphalt Surface Course: Minimum surface temperature of 60 deg F at time of placement.

PART 2 - PRODUCTS

2.01 AGGREGATES

- A. Subbase: VDOT 208, gradation 21-A.

2.02 ASPHALT MATERIALS

- B. Base Course: Bituminous concrete consisting of coarse and fine aggregate combined with asphalt cement, resulting in a mixture of type BM-2 in conformance with VDOT 211.
- C. Tack Coat: Asphalt cement of viscosity grade CMS-2 or CRS-2 in conformance with VDOT 310.
- D. Surface Course: Bituminous concrete consisting of crushed stone, crushed slag, or crushed gravel in fine aggregate, slag or stone screenings, or combination thereof, combined with asphalt cement, resulting in a mixture of type SM-2A in conformance with VDOT 211.

2.03 AUXILIARY MATERIALS

- E. Herbicide: Commercial chemical for weed control, registered by the EPA. Provide in granular, liquid, or wettable powder form.

PART 3 - EXECUTION

3.01 PATCHING

- A. Hot-Mix Asphalt Pavement: Saw cut perimeter of patch and excavate existing pavement section to sound base. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically. Remove excavated material. Recompact existing unbound-aggregate base course to form new subgrade.
- B. Tack Coat: Apply uniformly to vertical surfaces abutting or projecting into new, hot-mix asphalt paving at a rate of 0.05 to 0.15 gal./sq. yd..
- C. Patching: Fill excavated pavements with hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

3.02 SURFACE PREPARATION

- D. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction.

- E. Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.
 - 1. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.
- F. Herbicide Treatment: Apply herbicide according to manufacturer's recommended rates and written application instructions. Apply to dry, prepared subgrade or surface of compacted-aggregate base before applying paving materials.

3.03 HOT-MIX ASPHALT PLACING

- G. Machine place hot-mix asphalt on prepared surface, spread uniformly, and strike off. Place asphalt mix by hand to areas inaccessible to equipment in a manner that prevents segregation of mix. Place each course to required grade, cross section, and thickness when compacted.
 - 1. Spread mix at minimum temperature of 250 deg F.
 - 2. Regulate paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat.
- H. Place paving in a strip of the full width of the walkway being constructed, or in strips of not less than 10 feet for larger areas.
- I. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.

3.04 COMPACTION

- J. General: Begin compaction as soon as placed hot-mix paving will bear roller weight without excessive displacement. Compact hot-mix paving with hot, hand tampers or vibratory-plate compactors in areas inaccessible to rollers.
 - 1. Complete compaction before mix temperature cools to 185 deg F.
- K. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- L. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling while hot-mix asphalt is still hot enough to achieve specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:
 - 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent nor greater than 96 percent.

- M. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.
- N. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.
- O. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.05 INSTALLATION TOLERANCES

- P. Thickness: Compact each course to produce the thickness indicated within the following tolerances:
 - 1. Base Course: Plus or minus 1/2 inch.
 - 2. Surface Course: Plus 1/4 inch, no minus.
- Q. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot straightedge applied transversely or longitudinally to paved areas:
 - 1. Base Course: 1/4 inch.
 - 2. Surface Course: 1/8 inch.
 - 3. Cross Slope: Ensure cross slope of 1.5% perpendicular to the direction of travel, in the direction of site drainage.

3.06 FIELD QUALITY CONTROL

- R. Testing Agency: If deemed necessary by the Project Officer, Owner may engage a qualified independent testing and inspecting agency to perform field tests and inspections and to prepare test reports.
- S. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.
- T. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with specified requirements.

3.07 DISPOSAL

- U. Except for material indicated to be recycled, remove excavated materials from Project site and legally dispose of them in an EPA-approved landfill.

END OF SECTION 321216

SECTION 321313 – CONCRETE PAVEMENT

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes exterior concrete pavement for, but not limited to, the following:
 - 1. Pedestrian walkways
 - 2. Concrete pads for irrigation, drinking fountains, etc.
 - 3. Curb and Gutters
 - 4. Curb ramps

1.02 RELATED SECTIONS

- A. Construction Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 1-33 Specification Sections, apply to this Section.
- B. Section 321373 – Pavement Joint Sealant

1.03 RELATED DOCUMENTS

- A. Arlington County DES Construction Standards and Specifications – 02611 Concrete Walks.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Design Mixtures: For concrete pavement mixture.
- C. Delivery tickets for concrete including the date, time, truck identification, concrete plant, plant inspector, ticket and load number concrete class and design mix, moisture content of aggregates, quantity and location of placement.
- D. Color of expansion joint sealant.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Manufacturer of ready-mixed concrete products who complies with ASTM C 94/C 94M requirements for production facilities and equipment.
- B. ACI Publications: Comply with ACI 301, "Specification for Structural Concrete," unless modified by requirements in the Contract Documents.

PART 2 - PRODUCTS

2.01 STEEL REINFORCEMENT

- A. Plain-Steel Welded Wire Reinforcement: ASTM A 185, fabricated from as-drawn steel wire into flat sheets.
- B. Deformed-Steel Welded Wire Reinforcement: ASTM A 497, flat sheet.
- C. Reinforcing Bars: ASTM A 615/A 615M, Grade 60; deformed, sizes as shown on the drawings.

- D. Plain Steel Wire: ASTM A 82, as drawn.
- E. Deformed-Steel Wire: ASTM A 496.
- F. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars, welded wire reinforcement, and dowels in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice."

2.02 CONCRETE MATERIALS

- A. The design of the concrete mix, equipment, workmanship, and materials shall conform to the applicable requirements of Division 3 sections, except as hereinafter specified. Minimum compressive strength after 28 days shall be 3000 psi. Maximum size of aggregate shall be 1-01/2 inches, but not less than 3/4 inch. Air content by volume shall be 4-1/2 per-cent, plus or minus 1-1/2 percent.
 - 1. Provide Class A3 General Use (3,000 psi) concrete for walkways.
 - 2. Provide 3,500 psi concrete for driveway aprons or dumpster pads.
- B. Portland Cement air-entrained, ASTM C 150, Class A3 General Use (3,000 psi) per VDOT 217.

2.03 CURING MATERIALS

- A. Absorptive Cover: AASHTO M 182, Class 2, burlap cloth.
- B. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.
- C. Water: Potable.
- D. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.
- E. Clear Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B, dissipating.
- F. White Waterborne Membrane-Forming Curing Compound: ASTM C 309, Type 2, Class B.

2.04 EXPANSION JOINT FILLER

- A. See section 312373 – Pavement Joint Sealant

2.05 EXPANSION JOINT SEALANT

- A. See section 312373 – Pavement Joint Sealant

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces to receive concrete with Project Officer present for compliance with requirements for installation tolerances and other conditions which might affect the performance of the concrete. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 EDGE FORMS AND SCREED CONSTRUCTION

- A. Set, brace, and secure edge forms, bulkheads, and intermediate screed guides for pavement to required lines, grades, and elevations. Install forms to allow continuous progress of work and so forms can remain in place at least 24 hours after concrete placement.
- B. Forms shall be set to alignment and grade and to conform smoothly to the shapes and dimensions indicated on the Drawings. All curves, where shown on the drawings or as require, shall be smooth. No tangents or broken segments shall be accepted.
- C. Clean forms after each use and coat with form-release agent to ensure separation from concrete without damage.

3.03 STEEL REINFORCEMENT

- A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

3.04 JOINTS

- A. Construct expansion and contraction joints at right angles to the lines of the sidewalks and pads.
- B. Control joints in sidewalks and pads shall be formed 1/4 depth of the slab with a tool designated for that purpose, and shall be spaced as indicated on Drawings, or if not shown, as directed by Project Officer. Saw-cut joints are not acceptable under any circumstances.
- C. Where structures, such as light standards, poles, fire hydrants, etc., are within the limits of the sidewalk area, place premolded expansion joint around the structure for the full depth of the concrete.
- D. Form expansion joints using 1/2 inch thick pre-molded expansion joint fillers, full depth of the concrete, conforming to the shape of the sidewalks and curb and gutters. Place expansion joints where walks or exterior concrete slabs abut other vertical surfaces, including but not limited to building perimeter, curbs, columns, retaining or cheek walls, etc. Place expansion joints elsewhere as indicated on Drawings or as directed by Architect.
- E. Installation of Sealants: Install sealants by proven techniques that result in sealants directly contacting and fully wetting joint substrates, completely filling recesses provided for each joint configuration, and providing uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability. Install sealants at the same time sealant backings are installed.

3.05 CONCRETE PLACEMENT

- A. Moisten subbase to provide a uniform dampened condition at time concrete is placed.
- B. Comply with ACI 301 requirements for measuring, mixing, transporting, and placing concrete.
- C. Deposit and spread concrete in a continuous operation between transverse joints. Do not push or drag concrete into place or use vibrators to move concrete into place.
- D. Screed pavement surfaces with a straightedge and strike off.

- E. Commence initial floating using bull floats or darbies to impart an open textured and uniform surface plane before excess moisture or bleed water appears on the surface. Do not further disturb concrete surfaces before beginning finishing operations or spreading surface treatments.

3.06 FINISHING

- A. General: Do not add water to concrete surfaces during finishing operations.
- B. Broom Finish: Provide a coarse finish by striating float-finished concrete surface 1/16 to 1/8 inch deep with a stiff-bristled broom, perpendicular to line of traffic.

3.07 CONCRETE PROTECTION AND CURING

- A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures.
- B. Comply with ACI 306.1 for cold-weather protection.
- C. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screening, and bull floating or darbying concrete, but before float finishing.
- D. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.
- E. Curing shall be stated as soon as it is possible to apply the curing medium without damaging the surface. Curing shall continue uninterrupted for a minimum period of 14 days. Rapid drying upon completion of the curing period shall be prevented. At no time during the curing period shall the temperature of the concrete be permitted to drop below 40° F.
- F. Curing Methods: Cure concrete by moisture curing, moisture-retaining-cover curing, curing compound, or a combination of these methods.

3.08 REPAIRS AND PROTECTION

- A. Remove and replace concrete pavement that is broken, damaged, or defective or that does not comply with requirements in this Section.
- B. Protect concrete from damage. Exclude traffic from pavement for at least 14 days after placement.
- C. Maintain concrete pavement free of stains, discoloration, dirt, and other foreign material. Sweep concrete pavement not more than two days before date scheduled for Substantial Completion inspections.

END OF SECTION 321313

SECTION 32 13 15 – FLEXIBLE PERVIOUS PAVING – NOT IN BASE BID ADD ALT #1

PART 1 - GENERAL

1.01 SCOPE

- A. This specification provides requirements for the construction of flexible pervious paving.
- B. In case the requirements of this specification conflict with the contract documents, this document shall govern.

1.02 RELATED SECTIONS

- A. Division 32 Section "Concrete Pavement."

1.03 DEFINITIONS

- A. Exposure Condition, Moderate: Exposure to a climate where the paving will not be in a saturated condition when exposed to freezing and will not be exposed to deicing agents or other aggressive chemicals.
- B. Exposure Condition, Severe: Exposure to deicing chemicals or other aggressive agents or where the paving can become saturated by continual contact with moisture or free water before freezing.
- C. Base Reinforcement: The use of a geosynthetic within the aggregate base course to enhance the performance of a paving.
- D. Geogrid: Biaxial or triaxial woven polypropylene material for base course reinforcement and confinement, and subgrade stabilization and increased subgrade load capacity
- E. Panel: An individual paving slab bordered by joints or slab edges.
- F. Pervious Paving: A paving comprising material with sufficient continuous voids to allow water to pass from the surface to the underlying layers.
- G. Pervious: The property of a material which permits movement of water through it under ordinary hydrostatic pressure.
- H. Flexible Pervious Paving: Paving system comprised of three components: recycled passenger car tires, aggregate, and urethane binder that provides a strong, pervious, yet flexible paving.
- I. Subbase: A layer in a paving system between the subgrade and the base course, or between the subgrade and a Portland-cement concrete paving.
- J. Subgrade: The soil prepared and compacted to support a structure or paving system.

1.04 REFERENCED STANDARDS

- A. ASTM standards:
 - 1. C29/C29M-97 (2003) Test Method for Bulk Density (Unit Weight) and Voids in Aggregate.
 - 2. Accessibility of Surfacing Systems: ASTM F1951-99: To ensure wheelchair access.
 - 3. Coefficient of friction: ASTM D2047-82: Meet a minimum standard for coefficient of friction of 0.9-wet, 1.0 dry.
 - 4. Tensile Strength: ASTM D412-87: Test results for wear course must be a minimum tensile strength of 60 PSI and minimum percent elongation @ break of 140%.

5. C 138/C138M-01a Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
6. D 3665-06 Standard Practice for Random Sampling of Construction Materials E 329-06a Specification for Agencies Engaged in Construction Inspection and/or Testing.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:

1. Flexible Pervious Paving installer shall be currently certified by the Manufacturer and have successfully installed a minimum of 100,000 square feet within the mid-Atlantic region within the last five years.
2. Flexible Pervious Paving installer shall employ no less than three Manufacturer-certified Flexible Pervious Paving technicians who must be on site working as members of each placement crew during all Flexible Pervious Paving placement, unless otherwise specified.

B. Liquid Infiltration Rate Testing Device: ERIK device.

C. Testing Agencies:

1. Engage a qualified independent testing agency to perform material evaluation tests.

1.06 SUBMITTALS

A. The Contractor acknowledges its responsibility to submit complete submittals in a timely fashion. Failure to do so may result in automatic rejection of work and/or materials. Incomplete submittals will be returned to the Contractor unreviewed. No time extensions or cost increases will be allowed for delays or costs caused by un-submitted or late submittals or the return of incomplete or incorrect submittals.

B. Qualification Data

1. For Pervious Paving Installer:

- a. Provide a list of successfully installed Flexible Pervious Paving projects, as required herein, including the address, square footage, and photographs for each project.
- b. Manufacturer's Certifications.

2. For Testing Agency.

C. Proposed Mix Design.

D. Samples for Verification:

1. Provide two 6-inch diameter x 2 inch thickness Flexible Pervious Paving samples.
2. Provide 6-inch length of edging material and one anchor.

1.07 PROJECT CONDITIONS

- A. Traffic Control: Maintain access for pedestrian traffic as required for other construction activities.
- B. Schedule placements to minimize exposure to wind and heat before curing materials are applied.
- C. Avoid placing concrete if rain, snow, or frost is forecast within 24 hours. Protect fresh paving from moisture and freezing.
- D. Comply with professional practices described in ACI 305# and ACI 306R.

PART 2 - PRODUCTS

2.01 SUBBASE

- A. Coarse aggregates shall meet the durability requirements of ASTM C 33.

2.02 FLEXIBLE PERVIOUS PAVING

- A. System:
 - 1. Manufacturer to be Capitol Flexipave or approved equal
 - 2. Bonding: Have the capacity to bond with: wood; steel; concrete; aluminum; compacted aggregate; enamel tile, or; fiberglass
 - 3. Resistance to degradation: Resistant to: chlorine; ozone; bromine; muriatic acid; salt water; oil; transmission oil, and; hydraulic oil.
 - 4. Ability to withstand Severe Exposure Conditions.
- B. Aggregate:
 - 1. Stone: Triple-washed coarse aggregate, No. 8 coarse aggregate (3/8 to 1/2 inch) per ASTM C 33. Bagged and labeled as tested and certified by Flexible Pervious Paving Manufacturer.
 - a. Nominal maximum aggregate size shall not exceed 1/3 of the specified paving thickness.
 - b. Color TBD by Landscape Architect
 - 2. Rubber Granules: Per Manufacturer's written specifications.
 - a. Color TBD by Landscape Architect
- C. Binding agent: urethane liquid prepolymer based upon Diphenylmethane-Diisocyanate.
- D. Air Entraining Agents: Prohibited.
- E. Mix Design: Using materials acceptable to the Architect, design a tentative mix and test for the consistency intended for use on the work and specified.
 - 1. The volume of aggregate per cu. yd. shall be 50% of the total dry mix.
 - 2. The volume of the rubber product per cu. yd. shall be 50% of the total dry mix.
 - 3. Permeability: Pervious infiltration rate of 2,000 gallons/square foot/hour

2.03 FORMS

- A. Make forms with steel, wood, or other material that is sufficiently rigid to maintain specified tolerances, and capable of supporting concrete and mechanical concrete placing equipment.
- B. Forms shall be clean and free of debris of any kind, rust, and hardened concrete.

- C. Form release: Bio-diesel or vegetable oil coating.

2.04 ACCESSORIES

- A. Job-Built Concrete Edge Restraints: Comply with requirements in Division 03 Section "Cast-in-Place Concrete" for normal-weight, air-entrained, ready-mixed concrete with minimum 28-day compressive strength of 3000 psi (20 MPa).

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

- A. Prepare subgrade as specified in the contract documents.
- B. Construct subgrade to ensure that the required paving thickness is obtained in all locations.
- C. Keep all traffic off of the subgrade during construction to the maximum extent practical. Regrade subgrade disturbed by delivery vehicles or other construction traffic, as needed.
- D. Compact the material added to obtain final subgrade elevation.
- E. Determine subgrade permeability in accordance with ASTM D3385 before concrete placement. Confirm that subgrade permeability meets requirements of Contract Documents.

3.02 SUBBASE

- A. Prepare subbase in accordance with contract documents.

3.03 SETTING FORMWORK

- A. Set, align, and brace forms so that the hardened paving meets the tolerances specified herein.
- B. Apply form release agent to the form face which will be in contact with pervious paving, immediately before placing paving.
- C. The vertical face of previously placed concrete may be used as a form.
 - 1. Protect previously placed paving from damage.
 - 2. Do not apply form release agent to previously placed concrete.
 - 3. Apply liquid urethane bonding agent to face for proper adhesion.
- D. Placement width shall be as specified in Contract Documents. Concrete placement width shall not exceed 20 feet (6 M).

3.04 BATCHING, MIXING, AND DELIVERY

- A. Batch and mix on site in compliance with Manufacturer's written specifications, except that discharge shall be completed within 5 minutes of the introduction of urethane to the dry products.

3.05 PLACING AND FINISHING PAVING

- A. Do not place pervious paving on frozen or wet subgrade or subbase.

- B. Deposit pervious paving either directly onto the subgrade or subbase or by conveyor onto the subgrade or subbase, unless otherwise specified.
- C. Deposit pervious paving between the forms to an approximately uniform height.
- D. Spread the pervious paving using a come-along, short-handle, square-ended shovel or rake.
- E. Use steel trowels to finish to the elevations and thickness specified in Contract Documents.

3.06 COMPACTION

- A. General: Begin compaction as soon as placed paving will bear equipment without excessive displacement.
- B. Promptly correct surface irregularities in paving course behind paver. Use suitable hand tools to remove excess material forming high spots. Fill depressions with hot-mix asphalt to prevent segregation of mix; use suitable hand tools to smooth surface.
- C. Breakdown Rolling: Complete breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Correct laydown and rolling operations to comply with requirements.
- D. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling. Continue rolling until paving course has been uniformly compacted to the following density:
 - 1. Average Density: 92 percent of reference maximum theoretical density according to ASTM D 2041, but not less than 90 percent or greater than 96 percent.
- E. Finish Rolling: Finish roll paved surfaces to remove roller marks while paving is still workable.
- F. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while paving is still workable; compact thoroughly.
- G. Repairs: Remove paved areas that are defective or contaminated with foreign materials and replace with fresh paving. Compact by rolling to specified density and surface smoothness.
- H. Protection: After final rolling, do not permit vehicular traffic on pavement until it has hardened.

3.07 TOLERANCES

- A. Construct paving to comply with the following tolerances:
 - 1. Elevation: 1/4 inch (6 mm).
 - 2. Thickness: Plus 3/8 inch (10 mm), minus 1/4 inch (6 mm).
 - 3. Surface: Gap below 10-foot- (3-m-) long, unleveled straightedge not to exceed 1/4 inch (6 mm).

3.08 HOT- AND COLD-WEATHER CONSTRUCTION

- A. When hot weather is anticipated, submit detailed procedures for the production, transportation, placement, protection, curing, and temperature monitoring of paving during hot weather. Temperature of paving prior to curing shall be 95 degrees or less.

- B. In cold weather, comply with ACI 306.1, recording concrete temperature no less than twice per 24-hour period.

3.09 OPENING TO TRAFFIC

- A. Do not open the paving to traffic until it has cured for at least 24 hours, and not until the paving is accepted by the Architect for opening to traffic.

END OF SECTION 32 13 15

SECTION 321373 - PAVING JOINT SEALANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

- A. This Section includes the following:
 - 1. Expansion and isolation joints within cement concrete pavement.
 - 2. Expansion, isolation, and sealant joints in Unit Paving.
- B. Related Sections include the following:
 - 1. Section 321313 - Concrete Paving: for constructing joints in concrete pavement.

1.3 SUBMITTALS

- A. The Contractor acknowledges its responsibility to submit complete submittals in a timely fashion. Failure to do so may result in automatic rejection of work and/or materials. Incomplete submittals will be returned to the Contractor unreviewed. No time extensions or cost increases will be allowed for delays or costs caused by un-submitted or late submittals or the return of incomplete or incorrect submittals.
- B. Product Data: For each joint-sealant product indicated.
- C. Product Test Reports: For each joint-sealant product indicated.
- D. Samples for initial selections: For each type of joint sealant required, as selected by Architect from manufacturer's full range.
- E. Samples for Verification: For each type and color of joint sealant required. Install joint-sealant samples in 1/2-inch- (13-mm-) wide joints formed between two 6-inch- (150-mm-) long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.
- F. Product Certificates: For each type of joint sealant and accessory, signed by product manufacturer.
- G. Qualification Data:
 - 1. For Installer.
 - 2. For Testing Agency.

- H. Compatibility and Adhesion Test Reports: From sealant manufacturer, indicating the following:
 - 1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
 - 2. Interpretation of test results and written recommendations for primers and substrate preparation needed for adhesion.

1.4 QUALITY ASSURANCE

- A. Installer Qualifications: An employer of workers trained and approved by manufacturer.
- B. Source Limitations: Obtain each type of joint sealant through one source from a single manufacturer.
- C. Preconstruction Compatibility and Adhesion Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.
 - 1. Use manufacturer's standard test methods to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
 - 2. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
 - 3. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures including use of specially formulated primers.
- D. Product Testing: Obtain test results for "Product Test Reports" Paragraph in "Submittals" Article from a qualified testing agency based on testing of current sealant products within a 36-month period preceding the commencement of the Work.
 - 1. Testing Agency Qualifications: An independent testing agency qualified according to ASTM C 1021 for testing indicated, as documented according to ASTM E 548.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials to Project site in original unopened containers or bundles with labels indicating manufacturer, product name and designation, color, expiration date, pot life, curing time, and mixing instructions for multi-component materials.
- B. Store and handle materials to comply with manufacturer's written instructions to prevent their deterioration or damage due to moisture, high or low temperatures, contaminants, or other causes.

1.6 PROJECT CONDITIONS

- A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F (4.4 deg C).
2. When joint substrates are wet or covered with frost.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

- A. Available Products: Subject to compliance with requirements, products that may be incorporated into the Work include, but are not limited to, products listed in other Part 2 articles.

2.2 MATERIALS, GENERAL

- A. Compatibility: Provide joint sealants, backing materials, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer based on testing and field experience.
- B. Colors of Exposed Joint Sealants: match adjacent pavement color.

2.3 COLD-APPLIED JOINT SEALANTS

- A. Type NS Silicone Sealant for Concrete: Single-component, low-modulus, neutral-curing, nonsag silicone sealant complying with ASTM D 5893 for Type NS.
 1. Available Products:
 - a. Crafcoc Inc.; RoadSaver Silicone.
 - b. Dow Corning Corporation; 888.
- B. Single-Component, Self-Leveling, Silicone Joint Sealant for Concrete: ASTM D 5893, Type SL.
 1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Crafcoc Inc., an ERGON company; RoadSaver Silicone SL.
 - b. Dow Corning Corporation; 890-SL.
 - c. Pecora Corporation; 300 SL.
- C. Multi-component, Non-sag, Traffic-grade, Urethane Joint Sealant: ASTM C 920, Type M, Grade NS, Class 25, for Use T.

1. Available Products:
 - a. BASF Building Systems; Sonolastic NP 2.
 - b. LymTal International, Inc.; Iso-Flex 885 SG.
 - c. May national Associates, Inc.; Elasto-Thane 227 High Shore Type II.
 - d. Pecora Corporation; Dynatred.
 - e. Tremco, Inc.; Vulkem 227.

2.4 JOINT-SEALANT BACKER MATERIALS

- A. General: Provide joint-sealant backer materials that are non-staining; are compatible with joint substrates, sealants, primers, and other joint fillers; and are approved for applications indicated by joint-sealant manufacturer based on field experience and laboratory testing.
- B. Round Backer Rods for Cold-Applied Sealants: ASTM D 5249, Type 3, closed cell polyethylene, of diameter and density required to control sealant depth and prevent bottom-side adhesion of sealant.
 1. Minimum diameter: 25% greater than joint width.
- C. Cork or self-expanding cork: ASTM D 1752, Type 2.
- D. Sponge rubber: ASTM D 1752, Type I, closed cell sponge rubber.
- E. Contractor option: Provide ½ inch deep snap caps with any of the above to hold space for sealant during concrete installation. Match joint width.
 1. For applications where snap cap is to remain as surface joint filler, color shall be as selected by Architect from Manufacturer's full range of standard colors.
- F. Pre-fabricated PVC Expansion Joint. Above snap cap required.

2.5 PRIMERS

- A. Primers: Product recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting joint-sealant performance.

1. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

- A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions.
- B. Joint Priming: Prime joint substrates where indicated or where recommended in writing by joint-sealant manufacturer, based on preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

3.3 INSTALLATION OF JOINT SEALANTS

- A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.
- B. Sealant Installation Standard: Comply with recommendations in ASTM C 1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.
- C. Install backer materials of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.
 1. Do not leave gaps between ends of backer materials.
 2. Do not stretch, twist, puncture, or tear backer materials.
 3. Remove absorbent backer materials that have become wet before sealant application and replace them with dry materials.
- D. Install sealants using proven techniques that comply with the following and at the same time backings are installed:
 1. Place sealants so they directly contact and fully wet joint substrates.
 2. Completely fill recesses provided for each joint configuration.
 3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.
- E. Tooling of Non-sag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants according to requirements specified below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.
 1. Remove excess sealants from surfaces adjacent to joint.
 2. Use tooling agents that are approved in writing by joint-sealant manufacturer and that do not discolor sealants or adjacent surfaces.

- F. Provide joint configuration to comply with joint-sealant manufacturer's written instructions, unless otherwise indicated.
- G. Provide recessed joint configuration for silicone sealants of recess depth and at locations indicated.

3.4 CLEANING

- A. Clean off excess sealants or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved by manufacturers of joint sealants and of products in which joints occur.

3.5 PROTECTION

- A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out and remove damaged or deteriorated joint sealants immediately and replace with joint sealant so installations with repaired areas are indistinguishable from the original work.

END OF SECTION 32 13 73

SECTION 321443 - POROUS UNIT PAVING

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.
- B. Arlington County DES specifications and design standards, section 2780 – Permeable Unit Paver: [DES-Construction-Standards-and-Specifications.pdf](https://arlingtonva.s3.amazonaws.com/DES-Construction-Standards-and-Specifications.pdf) (arlingtonva.s3.amazonaws.com)

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Porous paving consisting of concrete pavers set in aggregate setting beds.
 - 2. Cast-in-place concrete edge restraints.
- B. Related Sections include the following:
 - 1. Division 31 Section "Earth Moving" for excavation and compacted subgrade.
 - 2. Division 32 Section "Concrete Paving" for cast-in-place concrete curbs that serve as edge restraints for porous paving.

1.03 SUBMITTALS

- A. The Contractor acknowledges its responsibility to submit complete submittals in a timely fashion. Failure to do so may result in automatic rejection of work and/or materials. Incomplete submittals will be returned to the Contractor unreviewed. No time extensions or cost increases will be allowed for delays or costs caused by un-submitted or late submittals or the return of incomplete or incorrect submittals.
- B. Product Data: For the following:
 - 1. Pavers.
 - 2. Edge restraints.
 - 3. Geotextiles.
- C. Sieve Analyses: For aggregate materials, according to ASTM C 136.
- D. Samples for Initial Selection:
 - 1. Each type of unit paver indicated.
 - 2. Aggregate fill.
- E. Samples for Verification:
 - 1. Full-size units of each type of unit paver indicated.
 - 2. Aggregate fill.
- F. Shop Drawings: Provide a plan drawing indicating point(s) of beginning for paver layout. Note cut unit locations and recommended adjustments to limit cut units for review and approval by Architect.

- G. Material Certificates: For unit pavers. Include statements of material properties indicating compliance with requirements, including compliance with standards. Provide for each type and size of unit.

1.04 QUALITY ASSURANCE

- A. Source Limitations: Obtain each type of porous paver from one source that has resources to provide materials and products of consistent quality in appearance and physical properties.
- B. Mockups: Build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
 - 1. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
- C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination."

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Store pavers on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied.
- B. Store aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

PART 2 - PRODUCTS

2.01 GENERAL

- A. Products: Manufacturer: Hanover Architectural Products. Model: Permeable, 4.5x9x9. Finish: Heavy Tudor. Color(s): Limestone Gray, Charcoal, Glacier White.

2.02 POROUS PAVERS

- A. Solid Concrete Pavers for Porous Paving: Solid interlocking paving units of shapes that provide openings between units, complying with ASTM C 936, resistant to freezing and thawing when tested according to ASTM C 67, and made from normal-weight aggregates.
 - 1. Thickness: 3 inches (80 mm).
 - 2. Face Size and Shape: As indicated.
 - 3. Color: 3 colors as selected by Architect from manufacturer's full range.

2.03 AGGREGATE SETTING-BED MATERIALS

- A. Graded Aggregate for Subbase: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 2.
- B. Graded Aggregate for Base Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 57.
- C. Graded Aggregate for Leveling Course: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 8.
- D. Graded Aggregate for Porous Paver Fill: Sound crushed stone or gravel complying with ASTM D 448 for Size No. 9

1. Provide stone of color indicated.
- E. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:
 1. Survivability: Class 2; AASHTO M 288.
 2. Apparent Opening Size: No. 40 (0.425-mm) sieve, maximum; ASTM D 4751.
 3. Permittivity: 0.5 per second, minimum; ASTM D 4491.
 4. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

PART 3 - EXECUTION

3.01 PREPARATION

- A. Verify as-built lines and elevations with plans. Make minor adjustments, as approved by Architect, to meet the design intent.

3.02 INSTALLATION, GENERAL

- A. Do not use unit pavers with chips, cracks, voids, discolorations, and other defects that might be structurally unsound or visible in finished work.
- B. Cut unit pavers with motor-driven masonry saw equipment to provide clean, sharp, unchipped edges. Cut units to provide pattern indicated and to fit adjoining work neatly. Use full units without cutting where possible. Hammer cutting is not acceptable.
- C. Tolerances:
 1. Variation in Plane between Adjacent Units (Lipping): Do not exceed 1/16-inch (1.5-mm) unit-to-unit offset from flush.
 2. Variation from Level or Indicated Slope: Do not exceed 1/8 inch in 24 inches (3 mm in 600 mm) and 1/4 inch in 10 feet (6 mm in 3 m) or a maximum of 1/2 inch (13 mm).
- D. Provide edge restraints as indicated. Install edge restraints before placing unit pavers.
 1. Install job-built concrete edge restraints to comply with requirements in Division 32 Section "Concrete Paving."

3.03 SETTING-BED INSTALLATION

- A. Proof-roll prepared subgrade to identify soft pockets and areas of excess yielding. Excavate soft spots, unsatisfactory soils, and areas of excessive pumping or rutting, as determined by Architect, and replace with compacted backfill or fill as directed.
- B. Place drainage geotextile over prepared subgrade, overlapping ends and edges at least 12 inches.
- C. Place aggregate courses in maximum 6 inch lifts. Compact each lift with 2 passes of a 10-ton vibratory or static roller. Place and compact additional material as needed to reach depth indicated.

- D. Place drainage geotextile over compacted subbase, overlapping ends and edges at least 12 inches (300 mm).
- E. Place leveling course and screed to a thickness of 2 inches, taking care that moisture content remains constant, and density is loose and constant until pavers are set and compacted.

3.04 PAVER INSTALLATION

- A. Set unit pavers on bedding layer, being careful not to disturb bedding layer. Place pavers hand tight against lugs or spacer bars, oriented per Manufacturer's written specifications. Use string lines to keep straight lines. Fill gaps between units that exceed 3/4 inch with pieces cut to fit from full-size pavers.
 - 1. When installation is performed with mechanical equipment, use only unit pavers with lugs or spacer bars on sides of each unit.
- B. Compact pavers into leveling course with a low-amplitude plate vibrator capable of a 3500- to 5000-lbf (16- to 22-kN) compaction force at 80 to 90 Hz. Use vibrator with neoprene mat on face of plate or other means as needed to prevent cracking and chipping of pavers. Perform at least three passes across paving with vibrator.
 - 1. Compact pavers when there is sufficient surface to accommodate operation of vibrator, leaving at least 36 inches (900 mm) of uncompacted pavers adjacent to temporary edges.
 - 2. Before ending each day's work, compact installed concrete pavers except for 36-inch (900 mm) width of uncompacted pavers adjacent to temporary edges (laying faces).
 - 3. As work progresses to perimeter of installation, compact installed pavers that are adjacent to permanent edges unless they are within 36 inches (90 mm) of laying face.
 - 4. Before ending each day's work and when rain interrupts work, cover pavers that have not been compacted and leveling course on which pavers have not been placed with nonstaining plastic sheets to protect them from rain.
- C. Place graded aggregate fill immediately after vibrating pavers into leveling course. Spread and screed aggregate fill level with tops of pavers.
 - 1. Before ending each day's work, place aggregate fill in installed porous paving except for 42-inch (1067-mm) width of unfilled paving adjacent to temporary edges (laying faces).
 - 2. As work progresses to perimeter of installation, place aggregate fill in installed paving that is adjacent to permanent edges unless it is within 42 inches (1067 mm) of laying face.
 - 3. Before ending each day's work and when rain interrupts work, cover paving that has not been filled with nonstaining plastic sheets to protect it from rain.
- D. Remove and replace pavers that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Provide new units to match adjoining units and install in same manner as original units, with same joint treatment and with no evidence of replacement.

END OF SECTION 321443

SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

- A. The Contractor shall provide all labor, materials, services, and equipment necessary to paint the pavement marking as specified herein.
 - 1. 11th St. painted markings applied to asphalt paving.

1.02 RELATED DOCUMENTS

- A. Construction Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
- B. Refer to civil drawings and details.
- C. Virginia Department of Transportation Road and Bridge Standards
- D. Virginia Department of Transportation Road and Bridge Specifications
- E. Arlington County DES Construction Standards and Specifications, section 2900 – Pavement Markings
- F. Section 321216 – Asphalt Pavement

1.03 QUALITY ASSURANCE

- A. Product Manufacturer: Company specializing in manufacturing quality paints and finish products with five years experience.
- B. Applicator: Company specializing in commercial painting and finishing with five years documented experience.

1.04 SUBMITTALS

- A. Provide product data on all finishing products for approval to Project Officer.
- B. Submit two samples 12” long in size illustrating each of the colors selected for the work described within the construction drawings.
- C. Installer qualifications and applicable experience.
- D. Provide a written list of paint manufacturer, product name, color, number, sheen, and the area in which the paint was used.

- E. Provide Material Safety Data Sheet (MSDS) for all products used on site.

1.05 FIELD SAMPLES

- A. Provide field samples where directed by County Project Officer.

1.06 DELIVERY HANDLING AND STORAGE

- A. The preformed thermoplastic markings shall be placed in protective plastic film with cardboard stiffeners where necessary to prevent damage in transit. Legends and symbols must also be supplied in flat pieces. The cartons in which packed shall be labeled for ease of identification. A protective film around the box must be applied in order to protect the material from rain or premature aging.
- B. Deliver, store and protect products following manufacturer's directions.
- C. Deliver products to site in sealed and labeled containers, then inspect to verify.
- D. Container labeling to include manufacturer's name, type of paint, brand name, brand code, coverage, surface preparation, drying time, cleanup, color designation, and instructions for mixing and reducing.
- E. Take precautionary measures to prevent fire hazards and spontaneous combustion.
- F. Provide Material Safety Data Sheet (MSDS) for all products used on site.

1.07 ENVIRONMENTAL REQUIREMENTS

- A. Surface and ambient temperatures must be above 45 degrees F for 24 hours before, during and 48 hours after application of finishes, unless required otherwise by manufacturer's instructions.
- B. Do not apply paint during rain or snow, or when relative humidity is above 50 percent, unless required otherwise by manufacturer's instructions.

PART 2 - PRODUCTS

2.02 MATERIALS

- A. All marking materials shall conform to all VDOT specifications. The County retains the right to test any product at the County's discretion. Samples will be provided by the contractor when requested by the Owner's Representative.
- B. Traffic Marking Paint: Acrylic alkyd, waterborne emulsion, lead and chromate free, ready mixed, complying with FS TT-P-1952, Type II.
- C. Paint shall provide excellent chemical and dirt resistance.
- D. Finish: Flat sheen

- E. Approved Manufacturer: Sherwin Williams Pro-Park Waterborne Traffic Marking Paint or approved equivalent.
- F. Number of Coats: 2.

PART 3 - EXECUTION

3.01 INSPECTIONS

- A. During and after the material application, inspections of the markings will be made by the Project Officer, or designee. The Contractor shall cooperate with the County to facilitate such inspections.
- B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.
- C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

3.02 PREPARATION

- A. Crosswalk: The Contractor will remove all previous pavement markings, as directed by Project Officer, see plans.
- B. Impervious Surfaces: Remove mildew by scrubbing with solution of tri-sodium phosphate TSP substitute and bleach. Rinse with clean water and allow surface to dry.
- C. Surfaces scheduled for paint finish: Remove foreign particles (i.e. grease, scale, dirt, etc) to permit adhesion of finishing materials.

3.03 PROTECTION

- A. Protect elements that surround the work of this Section from damage or disfiguration.
- B. Repair damage to other surfaces caused by work of this Section.
- C. Remove empty packaging/ excess materials from site.

3.05 APPLICATION

- A. Apply products in accordance with manufacturer's instructions.
- B. Do not apply finishes to surfaces that are not dry (see environmental requirements).
- C. Apply each coat to uniform finish.
- D. Apply pavement marking accurately with straight, clean-cut, sharply defined parallel edges and of uniform cross section
- E. Apply each coat of paint slightly darker than preceding coat unless otherwise approved.
- F. Sand lightly between coats to achieve required finish as needed.

- G. Allow applied coat to dry before next coat is applied.

END OF SECTION 321723

SECTION 321813 - SYNTHETIC TURF SURFACE – NOT IN BASE BID ADD ALT #3

PART 1 – GENERAL

1.01 DESCRIPTION OF WORK

- A. Provide equipment and materials, and perform work necessary to construct synthetic turf safety surfacing, as indicated on the Drawings and as specified.

1.02 SUMMARY

- A. This section includes synthetic turf for dog park areas.

1.03 SUBMITTALS

- A. Shop drawings of synthetic turf seaming and anchoring plan.
- B. Shop drawings of turf base.
- C. Samples:
 - 1. Synthetic Turf – Provide samples, for each color option available.
 - 2. List of existing installations, including County representative and telephone number.
- D. Manufacturer’s Data: Submit manufacturer’s specifications and installation instructions for all products in the synthetic turf surfacing system, including certifications and other data as may be required to show compliance with the Contract Documents.
- E. Substrate Acceptability: Submit a certified statement issued by the manufacturer of the synthetic turf surfacing materials and countersigned by the applicator, attesting that all areas and surfaces designated to receive synthetic turf surfacing have been inspected and found satisfactory for the reception of the Work covered under this Section; and not in conflict with the “Guarantee” requirements.
- F. Statement of Supervision: Upon completion of the Work, submit a written statement signed by the manufacturer stating that the field supervision of the manufacturer’s representative was sufficient to ensure proper application of the materials, that the Work was installed in accordance with the Contract Documents, and that the installation is acceptable to the manufacturer.

1.04 QUALITY ASSURANCE

- A. Contractor shall have previously installed at least one (1) similar size and type synthetic turf systems in the last five (5) years.
- B. Firms must have been in business under the same Ownership for at least three years, and shall have been installing similar sports fields for that entire period.
- C. Lay test strip and establish compaction and density rates for each course before beginning

permanent work.

- D. Installation of synthetic turf surfacing shall be done only after excavation and construction work which might injure it has been completed. Damage caused during construction shall be repaired before acceptance.
- E. The Contractor shall coordinate the installation of the synthetic turf surface and the surrounding surfaces for optimum interface at all edges.

1.05 GUARANTEE

- A. Provide a written guarantee stating that all work executed under this section will be free from defects of material and workmanship for a minimum period of five (5) years from the date of Final Acceptance. The warranty shall be signed by the certified synthetic turf installer (installer). Guarantee shall include removal and replacement of materials as required to repair defective turf at no cost to the County. Installer shall make good on any defects in materials or workmanship that may develop or become apparent during the guarantee period as spelled out in the written warranty. Installer shall warranty all products against all deficiencies, to include seams, tape, installer's products, and glue. Installer is not responsible for any existing site conditions that effect drainage or settling; roots, subservice water, irrigation systems or mistreatment of the products.
- C. Provide a written guarantee that the product will not fade for ten (10) years.

PART 2 - PRODUCTS

2.01 SYNTHETIC TURF SURFACE

- A. Synthetic Turf
 - 1. Manufacturer: SYNLawN 866-796-5296 or approved equal.
 - 2. Type: Pet Premium
 - 3. Grass Zone Denier: 9,900 / 9
 - 4. Thatch Zone Denier: 5,000 / 8
 - 5. Color: To be selected by Landscape Architect
 - 6. Pile Height: 1 5/8"
 - 7. Roll width: 15.0 feet
 - 8. Drain Rate: >1,000 inches p/hr
 - 9. Face Weight: 100 oz. / sq. yd
 - 10. Total Weight: 128 oz. / sq. yd
 - 11. Backing: 13PP/18PET 2pt / 22oz. EnviroLoc+™
- B. The finished surface shall appear as mowed grass with no irregularities and shall be as required to meet applicable ASTM, CPSC and ADA standards for the maximum fall height of each play unit. The finished surface shall resist abrasion and cutting from normal use.

2.02 BASE COURSE

- A. Base course shall be as indicated in the drawings.

- B. Compact base course as per manufacturer's recommendation.

2.03 TURF BASE

- A. Turf base per Drawings

2.04 ACCESSORIES

- A. Anchoring devices: Per drawings and manufacturer's written specifications.
- B. Nailer strip: Per manufacturer's written installation instructions.

PART 3 – EXECUTION

3.01 ACCEPTABILITY OF AGGREGATE BASE COURSE

- A. Contractor shall examine the aggregate base course to determine its ability to drain and adequately support the synthetic turf safety surfacing system. Evidence of inadequate base course shall be brought to the immediate attention of the County and remedial action taken. Contractor shall provide shop drawings for approval, prior to installation.
- B. Base course finish grades shall be verified using survey instrument with a tolerance of +/- 1/2" The survey shall be signed by the Contractor and submitted to the County for approval prior to installing the turf.
- C. Start of work of this Section shall not begin until acceptance of base course.

3.02 SYNTHETIC TURF SURFACING

- A. Synthetic turf surfacing shall be installed as per the drawings and in strict accordance with manufacturer's recommendations and instructions.
- B. Seam per manufacturer's written instructions.

3.03 ANCHORING

- A. Anchor per manufacturer's written instructions.

3.04 PROTECTION

- A. Upon completion of the synthetic turf surface, the Contractor shall be responsible for protection of the synthetic turf surface for the remainder of the Contract. Repair any damaged areas prior to acceptance by the County and prior to Final Completion.
- B. Upon completion of the synthetic field surface, the contractor shall provide the County with maintenance training to the satisfaction of the Project Officer.
- C. Upon project completion, provide to the County an operation and maintenance manual, edited for this project.

END OF SECTION 321815

SECTION 328000 IRRIGATION SYSTEMS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

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

1.02 SUMMARY

- A. Provide all materials, labor, transportation, equipment, fees, and permits necessary to design and install a fully operational irrigation system in accordance with the plans and specifications.
- B. Work includes:
 - 1. Site plans, construction details, and design and hardware submittals.
 - 2. Point of connection to approved water source including the following:
 - a. Backflow preventer assembly.
 - b. Master valve.
 - c. Flow meter.
 - 3. Piping.
 - 4. Encasement for piping.
 - 5. Manual valves.
 - 6. Pressure-reducing valves.
 - 7. Automatic control valves.
 - 8. Automatic drain valves with piped discharge to storm sewer.
 - 9. Transition fittings.
 - 10. Dielectric fittings.
 - 11. Miscellaneous piping specialties.
 - 12. Sprinklers.
 - 13. Quick couplers.
 - 14. Air/vacuum release valves.
 - 15. Drip irrigation specialties.
 - 16. Controllers.
 - 17. Boxes for automatic control valves and wire splices.
 - 18. As-built drawings.
 - 19. Initial controller programming and adjustments throughout Warranty Period.
 - 20. Operator orientation.
 - 21. Warranty.
 - 22. Related Sections:
 - 23. Division 01 Section "Temporary Tree and Plant Protection" for excavation within and/or adjacent to a Critical Root Zones.

1.03 PRE-INSTALLATION MEETING

- A. Conduct a conference/meeting at the project site. Review methods and procedures related to the site landscape irrigation system including, but not limited to the following:

1. The General Contractor is to contact the Project Officer a minimum of 14 days prior to the scheduled date of commencement of irrigation installation. Meet with Project Officer to review Contract Documents.
2. Verify current drawing release date with contractor's documents.
3. Review submittal procedure including codes, substitutions, product data, qualifications, and AS-BUILT.
4. Review project conditions including water source, permits, utility locations and water conditions.
5. Review methods and procedures related to irrigation installation.
6. Review and finalize construction schedule and verify availability of materials, contractor's personnel, equipment, and facilities needed to make progress and avoid delays.
7. Review warranty guidelines.

1.04 PERFORMANCE REQUIREMENTS

- A. Verify available irrigation water pressure and flow.
- B. Irrigation zone control shall be automatic operation with controller and automatic control valves.
- C. Coordinate with other trades to preset sleeves under pavement and walls.
- D. Location of Sprinklers and Specialties: Design location is approximate. Make minor adjustments necessary to avoid plantings and obstructions such as signs and light standards. Maintain 100 percent irrigation coverage of areas indicated.
- E. Delegated Design: Engage professional Irrigation Designer, as defined herein and approved by the Landscape Architect, to design the irrigation system and provide shop drawings.
 1. Design Requirements:
 - a. Locate the irrigation system Point of Connection and related components as indicated on plan.
 - b. Coordinate with MEP installer for space and water and electrical service requirements.
 - c. System to provide min. 30 PSI and max. 50 PSI, and max velocity of 5 ft./second.
 - d. Provide 100 percent coverage irrigation system.
 - e. Design for uniform coverage over entire spray area indicated at available water pressure.
 - f. Zone all divergent hydrozones, i.e. turf, differing soil conditions, differing exposure conditions, separately from other irrigation areas.
 - g. Group sprinklers into irrigation zones having uniform precipitation, i.e. mixed coverage arcs within a zone are prohibited unless 'matched precipitation rate' nozzles are used.
 - h. Calculate run times for each zone based on the specific requirements of each hydrozone.
 - i. Determine pipe sizes by flow of water through pipe. Velocity shall not exceed 5 feet per second in any pipe.
 - j. Design zone pipe layout so that head loss from the zone valve does not exceed 5 PSI to any sprinkler within the zone.

- k. Size remote control valves using the manufacturer's performance table. Use the smallest valve possible so that head loss through the valve at zone design flow does not exceed 5 PSI. Provide pressure-regulating modules where mainline pressure equals or exceeds 10 psi above the desired zone pipe pressure.
- l. Provide a mainline isolation gate valve for each of the following:
 - 1) Electric control valves: Install isolation valve in same valve box.
 - 2) Quick coupling valves.
 - 3) Hose bibs.
- m. Install a mainline isolation gate valve on each side of the following to facilitate easy removal:
 - 1) Irrigation sub-meter.
 - 2) Backflow preventer.
 - 3) Filtration and injection systems, if applicable.

F. Source Limitations:

- 1. All irrigation equipment shall be produced by the Manufacturer as part of a regular product line. Major components of the system shall be produced by a single Manufacturer.
 - a. Major components include, but are not limited to, irrigation heads, valves, etc.

G. Minimum Working Pressures: The following are minimum pressure requirements for piping, valves, and specialties unless otherwise indicated:

- 1. Irrigation Main Piping: 200 psig (1380 kPa).
- 2. Circuit Piping: 200 psig (1035 kPa).

H. Follow all Manufacturers' recommendations for system design, installation, and operation of products used in system.

I. Conduct first winterization of the system following final acceptance in the presence of Owner. Conduct system start-up in the spring following that winterization in the presence of Owner.

- 1. Repair freeze damaged components and correct for frost heaving of equipment at no additional cost.

J. The Contractor shall acquire the lawful authority that may be necessary for approved crossings or occupation of any roads, streets or alleys upon which the work will be done.

K. Power for the irrigation controller shall be the responsibility of the General Contractor. Refer to Electrical Drawings. The service for the controller shall be a 120-volt, 20 amp building electrical circuit. Location is approximate as shown on plan. Coordinate exact controller location with Project Officer. Contractor shall verify that electrical power meets the manufacturer's requirements for the controller. If requirements cannot be met contractor shall notify the Project Officer and irrigation consultant prior to installation.

- L. Irrigation performance specifications may be superseded by local regulations and/or building codes with approval from Project Officer.

1.05 QUALITY ASSURANCE

- A. Irrigation Designer: A firm or individual complying with the following:
 - 1. Full-time professional irrigation designer.
 - 2. Design and/or design services provided by an irrigation equipment manufacturer or distributor or other party are not acceptable.
 - 3. Professional member of the American Society of Irrigation Consultants.
 - 4. Holds a current Irrigation Association Landscape Irrigation Designer certification.
 - 5. Has a minimum of five years of experience in large landscape irrigation design. Comparable work is design of cemetery, park, commercial campus, educational campus, athletic facility, and golf course irrigation systems.
 - 6. Qualification Data:
 - a. Documentation of above membership(s) and certification(s).
 - b. A list of six past projects of similar scope, size, and program to this Project, installed within the last three years, designed by the Irrigation Designer, and demonstrating Designer's capabilities and experience. For each such project, include project name, address, year completed, and owner's contact information.
- B. Installer shall be a firm engaged in the full time installation of this type of system with at least five (5) years of successful experience. A list of three (3) past projects similar in scope to this project, including names and telephone numbers of owners/operators and date of project installation shall be submitted with the bid. References must be projects installed within the last two (2) years.
 - 1. Installation firm shall carry appropriate levels of liability, automobile, and worker compensation insurance. Certificates of insurance shall be provided to the owner prior to work.
 - 2. Materials, equipment, and methods of installation shall comply with, but not limited to, the following codes and standards:
 - a. Uniform Plumbing Code (UPC)
 - b. National Electric Code (NEC)
 - c. American Society for Testing and Materials (ASTM)
 - d. National Sanitation Foundation (NSF).
 - e. Underwriters Laboratory (UL)
 - f. The Irrigation Association (IA)
 - g. The Plastic Pipe and Fittings Association (PPFA)
 - h. All pertinent state and local codes
- C. Random product substitutions will not be accepted. The functionality of the irrigation design and system is based on characteristics of the products listed in these specifications and accompanied plan. Contractors wishing to substitute any product must submit, in writing, reasons for proposed substitution, product specifications, revised plan, and performance data to the Project Officer and Irrigation Consultant. If written approval is granted, products may

be substituted. Any products found during the final walk through, not previously approved, will be removed and replaced with an acceptable product at the contractor's expense.

D. Manufacturer

1. All irrigation equipment shall be produced by a manufacturer as part of a regular product line.
2. All irrigation products shall be purchased through a local servicing distributor.

1.06 TESTS

- A. The contractor shall perform all tests in the presence of the Project Officer.

1.07 SUBMITTALS – PRIOR TO COMMENCING INSTALLATION

- A. Product Data: Submit manufacturer's catalog cuts or equipment data sheets for the following products:

1. Controller and controller accessories
2. Electric and manual valves
3. Sprinkler heads
4. Pipe and pipe fittings
5. Valve boxes
6. Swing joints
7. Control wire, sensor wire, grounding components, and splice connectors
8. Solvent and primer

- B. Wiring Diagrams: For power, signal, and control wiring.

- C. Material List: Written schedule of components to be used in the system and a complete description of the Scope of Work. Include all service pressure, flow rate, operating pressure, etc. information. Include all information of plumbing and/or electrical permits and fees.

- D. Zoning Chart: For each new irrigation zone, list the following items in a spreadsheet compatible with Microsoft Excel.

1. Zone number.
2. Remote control valve size.
3. Feed pipe size.
4. Sprinkler complement: quantity, model, nozzle number.
5. Drip tube complement: model, emitter, spacing.
6. Design pressure.
7. Design flow.
8. Precipitation rate, inches per hour.
9. Run time required to apply 0.2 inches.
10. Soil moisture sensor to which each the zone is sensitized, if applicable.

- E. Coordination Drawings: Irrigation systems, drawn to scale, including all installation and mounting details, in which all components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and survey monuments.

- F. Delegated-Design Submittal: For irrigation systems indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional irrigation designer responsible for their preparation.
1. Shop Drawings:
 - a. Provide 100% Construction Documents for the irrigation system and all appurtenances, using the Conceptual Irrigation Plan and Specifications as the basis of design and as follows:
 - 1) Drawn to scale, including all installation and mounting details, in which all components are shown and coordinated with each other, using input from Installers of the items involved. Also include adjustments necessary to avoid plantings and obstructions such as signs and survey monuments.
 2. Calculations
 - a. Provide system design point, identifying maximum designed system flow rate and pressure required.
 - 1) Provide a tabulation of head losses from the point of connection to the most distant demand point in the irrigation system. Table is to identify the source of the losses and the magnitude of these losses at the specified flow. Items in the table include but are not limited to: backflow prevention assembly; master valve; metal pipe to the conversion to PVC pipe; main line; remote control valve assembly; lateral pipe and fittings; sprinkler design point.
 - b. Provide a memo from the mechanical or plumbing engineer attesting to the available flow and pressure at the point of connection.
- G. Qualification Data: For professional Irrigation Designer and qualified Installer.
- H. Manufacturer's Data: Provide written proof of a permanent, local, factory-authorized service center, maintained or trained by the Manufacturer, which will render satisfactory service to this installation.
- I. Zoning Chart: Show each irrigation zone and its control valve.
- J. Controller Timing Schedule: Indicate timing settings for each automatic controller zone, including seasonal adjustments.
- K. Field quality-control reports.
- L. Reference list and certificates of insurance as described in Section 1.4.

1.08 SUBMITTALS – UPON COMPLETION OF INSTALLATION

- A. Upon completion of the irrigation system and in conjunction with the application for final payment, submit the Maintenance and Operation Manual. The manual shall include the following:

1. One (1) copy of the Record Drawings at a scale matching that of the construction drawings. The record drawings shall be furnished on paper and in AutoCAD format (dwg) and portable document format (pdf). Sprinkler heads shall be drawn to a scale location accuracy of 1'-0" or less.
2. One (1) copy of a diagram illustrating the final irrigation station layout. Diagram should be sized so that it can fit in the door of the controller.
3. One (1) complete set of the "APPROVED" submittals required in paragraph 1.7.
4. One (1) copy of the suggested "SYSTEM OPERATING SCHEDULE" which shall call out the controller program required in order to provide 1.5" of water per week to each turf zone area.
5. A typewritten description of the procedures to be followed for proper winterization of the entire system.
6. Provide all digital documents, unless otherwise indicated, in PDF format as native translations from the manufacturers, not scans.
7. Provide four (4) hours of instruction for Owner's personnel upon completion of check/test/start-up/adjust operations. Notify Owner and Landscape Architect at least one (1) week in advance of check/test/start-up/adjust operations.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Pack, ship, deliver, receive, handle and store all material in a manner as to protect from damage due to weather, vandalism, theft, and other hazards.
- B. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.
- C. Project Officer will designate a storage area for material that will at all times be kept neat and orderly.

1.010 PROJECT CONDITIONS

- A. Interruption of Existing Water Service: Do not interrupt water service to facilities occupied by owner or others unless permitted under the following conditions and then only after arranging to provide temporary water service according to requirements indicated:
 1. Notify Project Officer no fewer than seven (7) days in advance of proposed interruption of water service.
 2. Do not proceed with interruption of water service without Project Officer's written permission.
- B. Locate and mark all underground utilities. These may include, but not limited to, gas, water, cable television, communication, and electric lines. Any damage to underground utilities caused by the installer shall be repaired at the contractor's expense.
- C. Protect all hardscape and planted areas from damage due to system installation. Preserve all existing tree roots over 1.5" by hand trenching these areas. Repairs to existing hardscape features such as walks, asphalt paving, curbs, etc., shall be made to restore these areas to their original condition at the contractor's expense.

1.011 WARRANTIES

- A. A Guarantee all labor and material for a minimum of one (1) year from date of substantial completion of the irrigation system.

1. Substantial completion is defined as following acceptance by Owner of corrections resulting from punch list inspection, but prior to final acceptance.
- B. Guarantee labor and material associated with pipe and fitting failure for a period of five (5) years from date of substantial completion of the irrigation system, unless otherwise indicated. In the event of a dispute with regard to the cause of the failure, an independent, mutually agreed-upon service shall be used to determine the cause of component failure.
- C. Provide a Manufacturer's warranty for all sprinkler heads, electric valves, and controllers for a minimum of two (2) years.
- D. Where a Manufacturer offers a longer warranty on a particular component, honor the extended warranty on each such component to the full extent of the Manufacturer's Warranty Statement.
 1. Provide labor for the above at no additional cost.
- E. Make all repairs during the warranty period within 48 hours after written notice or verified communication by the Landscape Architect or Owner. If the Contractor fails to make repairs, the Owner will make the repairs at the Contractor's expense.

PART 2 - PRODUCTS

2.01 PIPES AND FITTINGS

- A. Pipe below grade shall be PVC 1120, Class 200, SDR 21 and be in accordance with the latest revision of ASTM Standard 2241.
 1. 3" and larger sized pipe shall be iron pipe size rubber ring joint pipe.
 2. 2.5" and smaller sized pipe shall be solvent weld joint pipe.
 3. Acceptable manufacturers are:
 - a. Cresline Plastic Pipe Co., Inc.
 - b. J-M Manufacturing Company, Inc.
- B. Pipe size shall be as listed on plan. Velocity shall not exceed 5 feet per second in any pipe. ½", ¾", or 1 ¼" sized pipe will not be accepted.
- C. Sleeves below grade: Sleeving material shall meet or exceed specifications set by local jurisdiction. If not controlled by local codes, Class 200, SDR 21 PVC pipe shall be used. Contractor shall verify approved sleeving material prior to installation. Size shall be as noted on plan. No sleeves less than four inches will be accepted.
- D. Pipe Fittings:
 1. Fittings with at least one 3" or larger opening shall be constructed of ductile iron. Ductile iron fittings shall be manufactured of Grade 65-45-12 ductile iron in accordance with ASTM A-536. Fittings shall have deep bell push-on joints with gaskets.
 - a. Acceptable Manufacturers:

- 1) The Harrington Corporation.
 - 2) Leemco Piping Solutions, Inc.
2. Pipe fittings 2.5" or smaller shall be PVC Schedule 40 solvent weld socket type meeting or exceeding ASTM D-2466.
- a. Acceptable manufacturers:
 - 1) Dura Plastic Products, Inc.
 - 2) Spears Manufacturing Company.
 - 3) Lasco Fittings Inc.
3. PVC Schedule 80 nipples shall be used at all threaded connections. Schedule 40 male adapters are acceptable on the downstream side of remote control zone valves.
4. Fittings necessary for tapping into the water source shall be the appropriate size and type for the domestic water source pipe type.
- E. Joint Restraints shall be designed to be used on IPS PVC pipe and be manufactured in accordance with ASTM A-536. Joint Restraints shall be used on all gasketed connections where the pipe changes direction of the water, where the pipe changes size, at the end of a pipeline, and valves. Thrust blocks will not be accepted.
1. Acceptable manufacturers:
 - a. The Harrington Corporation
 - b. Leemco Piping Solutions, Inc.
- F. Swing Joints: The unified swing joint shall be factory assembled. The swing joint shall be constructed of Rigid PVC, Type 1, cell classification 12454-B per ASTM spec D1784, with a pressure rating of 315 psi at 73°F when tested in accordance to ASTM D3139. All NPT thread, sockets, spigots shall meet or exceed ASTM standards 2464 and 2466, respectfully. Lay of swing joint shall be determined by depth of pipe. Length should allow for acceptable movement if a sprinkler is hit by an object. Swing joints should not be installed perpendicular to lateral. Swing joint size to match the head inlet.
- 1) Acceptable manufacturers:
 - a. Lasco Fitting, Inc.
 - b. Dura Plastic Products, Inc.
 - c. Rain Bird Corporation

2.02 IDENTIFICATION / TRACING

- A. Install Warning Tape with all non-metallic irrigation mainlines: Standard, 4-Mil polyethylene 76 mm (3 inch) wide tape, detectable type blue with black letters imprinted with "CAUTION BURIED IRRIGATION WATER PIPE BELOW".

2.03 PIPING JOINING MATERIALS

- A. Gasket Lubricant: As recommended and documented by the pipe and fitting manufacturer(s).
- B. Primer and solvent: As recommended and documented by the pipe and fitting manufacturer(s).

C. Teflon tape: Shall be used at all NPT threaded connections.

2.04 CONTROL CABLE, COMMUNICATION CABLE, AND SPLICES

- A. Common Wire: No. 14 AWG or larger solid copper conductor with PE insulation UL approved for direct earth burial installation. Wire insulation shall be white in color. Wire shall meet spec number P7079D as manufactured by Paige Electric Company, LLP, or approved equal.
- B. Control Wires: No. 14 AWG or larger solid copper conductor with PE insulation UL approved for direct earth burial installation. Wire insulation may be any color except white, yellow, or blue. Wire shall meet spec number P7079D as manufactured by Paige Electric Company, LLP, or approved equal.
- C. Spare Wires: No. 14 AWG or larger solid copper conductor with PE insulation UL approved for direct earth burial installation. Wire insulation shall be blue in color. Wire shall meet spec number P7079D as manufactured by Paige Electric Company, LLP, or approved equal.
- D. Flow Sensor Wires: No. 19 AWG solid annealed copper conductor with PE insulation and approved for direct earth burial installation. The wire shall be shielded with electrically continuous, 0.008" thick, coated, corrugated aluminum shield, longitudinally applied with an overlap. Cable assembly shall conform to REA PE-39 requirements. Wire shall meet spec number P7315D as manufactured by Paige Electric Company, LLC, or approved equal.
- E. Splices: All splices shall be made with splice kits consisting of wire nuts and a silicon filled tube. Gel filled wire nuts are not acceptable. Splice kits shall be listed UL 486D certified for direct burial and rated for 600 VAC. Splice kits shall be model DBR/Y-6 as manufactured by the 3M Corporation, or approved equal.

2.05 MANUAL VALVES

- A. IPS Iron Push-On Gate Valve: Sizes 3" or larger. Resilient wedge, non-rising stem, 250 PSI CWP iron body gate valve. The valve shall meet or exceed performance requirements of AWWA C509 and C515. Valve shall be model number P-619-RW manufactured by Nibco, Inc., or approved equal. One 5' valve operating key for 2" square operating nut shall be provided to the owner upon completion of irrigation installation.
- B. Bronze Class 125 Gate Valve: Sizes 2.5" or smaller. Valves shall be of domestic origin, meeting specifications MSS SP-80. Valve shall have a bronze cross-handle and non-rising stem. Valve shall be model number T-113-IRR-X manufactured by Nibco, Inc., or approved equal.

2.06 AUTOMATIC CONTROL VALVES

- A. Remote Control Valves:
 - 1. PEB: The electric remote control valve shall be a normally closed 24 VAC 50/60 Hz solenoid actuated globe pattern design. The 2" sized valve shall be capable of operating at a flow rate of 75 gallons per minute with a pressure loss not to exceed 4.5 psi. The valve pressure rating shall not be less than 200 psi.

The valve body shall be constructed of heavy-duty glass-filled UV-resistant nylon and have stainless steel studs and flange nuts; diaphragm shall be of nylon reinforced nitrile rubber.

The valve shall have both internal and external manual open/close control (internal and external bleed) for manually opening and closing the valve without electrically energizing the solenoid. The valve's internal bleed shall prevent flooding of the valve box.

The valve shall house a fully encapsulated, one-piece solenoid. The solenoid shall have a captured plunger with a removable retainer. This 24 VAC 50/60 Hz solenoid shall open with 19.6 VAC minimum at 200 PSI. At 24 VAC, average inrush current shall not exceed .41 amps. Average holding current shall not exceed 0.28 amps.

The valve shall have a brass flow control stem for manual regulation and/or shut-off of outlet flow.

When called out as model PESB on the plan, the valve shall have a self-cleaning stainless steel screen designed for use in dirty water applications.

The valve construction shall be such as to provide for all internal parts to be removable from the top of the valve without disturbing the valve installation.

The valve model number shall be as listed on the plan, manufactured by Rain Bird Corporation, or approved equal.

2.07 SPRINKLERS

A. General Requirements:

1. Designed for uniform coverage over entire spray area indicated at available water pressure.

B. Rotors: Pop-up, gear-driven type with screens; ABS bodies.

1. All rotors used in turf areas shall have a pop-up stroke of 3 inches to 4 inches.
2. All rotors used in planted areas shall have a pop-up height of 12 inches. Where approved by Landscape Architect, shrub versions mounted on schedule 80 PVC or copper risers-minimum 3/4 inches may be used.
3. All rotors shall have interchangeable nozzles.
4. All part-circle rotors shall have adjustable trajectories.

C. Sprays: Spray heads with screens; ABS bodies.

1. Spray sprinkler shall include a pressure compensating module to standardize nozzle performance and a check valve to prevent lateral pipe drainage.
2. Spray sprinklers in turf areas shall have a minimum pop-up of 4 inches.
3. Spray sprinklers in planted areas shall be 12 inches pop-ups.
4. Where approved by Landscape Architect, shrub adapters may be used with spray nozzles to achieve adequate coverage. Shrub adapters shall be mounted on schedule 80 PVC or copper risers, minimum 1/2 inches size.

2.08 QUICK COUPLE VALVES

- A. Quick Coupling Valve: The quick coupling valve shall be a two piece type capable of having a discharge rate of 30 gpm with a pressure loss not to exceed 11.5 psi.

The valve body shall be constructed of red brass. The cover shall be a durable, protective self-closing locking rubber cover.

The valve shall be opened and closed by a brass key of the same manufacturer having a 1" MNPT and 3/4" FNPT outlet. The valve throat shall have a key-way with detent positions for regulating water flow.

The contractor shall provide the owner with two (2) valve keys, two (2) hose swivels, and two (2) locking cover keys. Size of swivels provided shall be approved by the Owner/ Project Officer. The valve shall be model number 44-LRC as manufactured by Rain Bird Corporation, or approved equal.

2.09 CONTROLLERS AND ACCESSORIES

A. Controller:

1. ESP-LXME: The controller shall be of a hybrid type that combines electro-mechanical and microelectronic circuitry capable of fully automatic or manual operation. The controller shall be housed in a wall-mountable, weather-resistant plastic cabinet with a key-locking cabinet door suitable for either indoor or outdoor installation.
2. The controller shall have a base station capacity of 8 or 12 stations as well as 3 expansion slots capable of receiving station modules of 4, 8, or 12 stations to create a controller capacity of up to 48 stations. All stations shall have the capability of independently obeying or ignoring the weather sensor as well as using or not using the master valve. Station timing shall be from 0 minutes to 12 hours. The controller shall have a Seasonal Adjustment by program that adjusts the station run time from 0 to 300% in 1% increments.
3. The controller shall also have a Monthly Seasonal Adjustment of 0 to 300% by month. Station timing with Seasonal Adjustment shall be from 1 second to 16 hours.
4. The controller shall have 4 separate and independent programs which can have different start times, start day cycles, and station run times. Each program shall have up to 8 start times per day for a total of 32 possible start times per day. The 4 programs shall be allowed to overlap operation based on user-defined settings which control the number of simultaneous stations per program and total for the controller. The controller shall allow up to 5 valves to operate simultaneously per program and total for the controller including the master valve/pump start circuit. The controller shall have an electronic, diagnostic circuit breaker that shall sense a station with an electrical overload or short circuit and shall bypass that station and continue to operate all other stations.
5. The controller shall have a 365-day calendar with permanent day off feature. Days set to permanent day off shall override the normal repeating schedule and not water on the specified day(s) of the week. The controller shall also have a calendar day off feature allowing the user to select up to 5 dates up to 365-days in the future when the controller shall not start programs. The controller shall incorporate a rain delay

feature allowing the user to set the number of days the controller should remain off before automatically returning to the auto mode.

6. The controller shall have water management software which is capable of operating each station for a maximum cycle time and a minimum soak time. The maximum cycle time shall not be extended by Seasonal Adjustment.
7. The controller shall incorporate a feature providing real-time flow, power, and station management. This feature shall manage the number of stations operating at any point in time based on water source capacity, station flow rate, number of valves per station; user defined simultaneous stations per program and for the controller. The controller shall provide station priorities to determine the order in which stations shall operate. The controller shall ignore the station number and instead operate the highest priority stations first and the lower priority stations last.
8. The controller shall offer water windows for each program. This function sets the allowed start and stop time where watering is allowed. If the watering cannot be completed by the time the water window closes, the stations with remaining run time are paused and watering automatically resumes when the water window opens the next time.
9. The controller shall include a module which adds flow sensing functionality. The module sensor input shall accept a direct input from a flow sensor with no flow scaling device required. Module features shall include a flow learn utility which learns the normal flow rate of each station. Each time a station runs, the utility will compare the current real-time flow rate to the learned rate and takes user defined actions if high flow, low flow, or no flow is detected. The flow learn utility shall automatically determine the location of the flow problem and isolate the problem by turning off the affected station or master valve. The utility shall be compatible with both normally closed and open master valves. A manual master valve water windows shall be provided to coordinate daytime manual watering with the flow sensing. This water windows shall offer programmable days of the week and manual watering additional flow rate.
10. The controller shall include an optional IQ 3G cellular network communication cartridge manufactured by Rain Bird Corporation. The communication cartridge will allow for remote operation from an offsite PC with IQ central software installed. Contractor shall verify that cellular reception is available at the proposed controller location, prior to ordering the communication cartridge. If reception is not available, contractor shall notify irrigation consultant, and owner, to decide on an alternative means of communication with central PC.
11. The controller shall be installed in an optional metal pedestal manufactured by the same company as the controller.
12. The controller shall be model number ESP8LXMEF as manufactured by Rain Bird Corporation, or approved equal.

B. Accessories:

1. Soil Moisture Sensor: The soil moisture sensor shall be a watering control device for use with a standard 24-Volt AC irrigation controller. It shall take digital readings every 10 minutes of soil Volumetric Water Content (VWC) utilizing advanced Time

Domain Transmissometry (TDT) digital signal processing that delivers accurate readings independent of soil temperature and electrical conductivity.

It shall consist of a 304 stainless steel digital soil moisture sensor and a user interface. In operation, the soil moisture sensor shall only allow a programmed watering cycle when the soil moisture drops below a set moisture threshold. When the moisture is above that threshold, the soil moisture sensor shall suspend the normal watering cycle by interrupting the common line to the valve solenoids.

Features shall include automatic setting of soil moisture threshold with increase/decrease adjustment as well as bypass mode. User interface shall enable instant readings of soil moisture, temperature and electrical conductivity plus review of 7-cycle watering history.

The soil moisture sensor shall be manufactured by the same manufacturer as the controller.

The soil moisture sensor shall be model number SMRT-Y as manufactured for Rain Bird Corporation, or approved equal.

2. Flow Sensor: The flow sensor shall be an in-line type with a nonmagnetic, spinning impeller (paddle wheel) as the only moving part. The sensor shall be capable of operating in line pressure up to 100 psi and liquid temperatures up to 140° F, and operating in flows of 1/2 foot per second to 30 feet per second with linearity of $\pm 1\%$ and repeatability of $\pm 1\%$. The meter body shall be fabricated from a Schedule 80 PVC tee, with socket end connections.

The flow sensor shall be manufactured by the same manufacturer as the controller.

This flow sensor shall be model number FS200P as manufactured by Rain Bird Corporation, or approved equal.

3. Rain/Freeze Sensor: The rain sensor shall be capable of shutting the irrigation system off during periods of significant rainfall or low temperatures. The rain sensor shall communicate wirelessly to the controller. The sensor shall be manufactured by the same manufacturer as the controller. The rain sensor shall be model number WR2-RFC as manufactured by Rain Bird Corporation.

2.010 BOXES FOR AUTOMATIC CONTROL VALVES

- A. Valve boxes: Boxes shall be constructed of HDPE structural foam with polymer covers. Covers shall be locked to the box using a captive bolt and loc-kit. "IRRIGATION CONTROL VALVE" shall be factory printed on all covers. Valve boxes and covers shall be manufactured by Carson Industries, L.L.C., The Rain Bird Corporation, or approved equal.

2.011 CONTROL WIRE, TAGS AND SPLICES

- A. Decoder Cable: Paige Electric model P7072D-REV 15, 14 AWG.

B.Splices: Waterproof underground rated connectors that are UL listed.

1. Product: 3M model DBR/Y-6.

C. Valve Identification Tags: T. Christy model ID.STD.B2 or Paige Electric model 270WMT. Printed with station number on both sides of tag. Valves shall be numbered sequentially with sprinkler zone valves grouped together and drip zone valves grouped together. Numbering shall correspond to the controller station number.

D. Decoder-to-Solenoid cable: Paige Electric model P7351D.

E. Spare wires: Furnish and install two spare conductors from the controller to the most distant electric control valve on each mainline section. Loop the spares into each passed valve box and label as SPARE in each passed valve box. Spare wires shall differ in color from other field wires.

2.012 DRIP IRRIGATION SPECIALTIES

A. On-Surface Drip Tube System

1. Products: Subject to compliance with requirements, provide products by one of the following:

- a. Netafim USA.
- b. Rain Bird Corporation.
- c. The Toro Company; Irrigation Division.

2. Drip Tubes: Pressure-Compensating Landscape Dripline

a. Flexible polyethylene tubing with plugged end; brown in color; outside diameter (O.D.) of 0.630 inches (16 mm), an inside diameter (I.D.) of 0.540 inches (13.7 mm) and wall thickness of 0.045 inches (1.1 mm).

1) Inline emitters, factory-welded to the inner circumference of the tubing, with dual outlet ports opposed at 180 degrees, 18 inches on center, unless otherwise indicated.

2) Emitters shall be pressure compensating for uniform flow of 0.6 gallons per hour when supplied with water at pressure between 8.5 and 60 psi. Emitters shall pressure compensate by lengthening the emitter's turbulent flow path.

b. The emitter shall be cylindrical in shape and provide surface area for filtration throughout 360 degrees of its outer circumference.

c. Emitter Spacing, unless otherwise indicated:

1) Sandy soils: one emitter every 12 inches.

2) Heavy soils: one emitter every 16 inches.

- d. Pressure regulating valve, filtration, and line flushing valves per Manufacturer's written specifications.
 - e. Soil Staples: 6" stainless steel soil staple.
2. Fittings:
- a. Compression Fittings: For use with typical connections.
 - 1) UV-resistant ABS material with a Buna seal; compatible with all polyethylene tubing from 0.630 to 0.710 inches outside diameter and provide a leak-free compression fit.
 - 2) Configuration: Tee, coupling, elbow and adapter.
 - 3) Removable flush caps:
 - a) Purple: non-potable water.
 - b) Black: potable water.
 - 4) Operating range: 0 to 60 PSI.
 - b. Barbed Insert Fittings:
 - 1) General:
 - a) Maximum drip line length: 20 feet.
 - b) For drip line lengths in excess of 20 feet, secure fitting with stainless steel pipe clamp.
 - 2) UV-resistant acetyl; compatible with polyethylene tubing from 0.54 inches inside diameter and provide a leak-free fit.
 - 3) Configuration: Tee, coupling, elbow and adapter.
 - 4) Operating range: 0 to 45 PSI.
- B. Filter Units: Brass or plastic housing, with corrosion-resistant internal parts; of size and capacity required for devices downstream from unit.
- C. Air Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts.
- D. Vacuum Relief Valves: Brass or plastic housing, with corrosion-resistant internal parts, and designed to be used on a large irrigation system.

PART 3 - EXECUTION

3.01 GENERAL

- A. Examine the site for the conditions under which the work is to be performed. Communicate the existence of any unsatisfactory site condition to the Project Officer prior to the

commencement of installation. Start of installation means contractor accepts existing site conditions.

- B. Examine construction and shop drawings. Note any discrepancies or conflicts and bring to the attention of the Project Officer.
- C. Make all field measurements necessary for the work noting the relationship of the irrigation work to other trades. Coordinate the irrigation system installation with the work of other trades as required. The irrigation system shall be laid out essentially as indicated on the irrigation drawing, with minor adjustments for variations in the final landscape plan. Major changes will require review and acceptance in writing from the Project Officer.
- D. Approved Irrigation Designer shall set stakes to identify locations of proposed irrigation system. Obtain Landscape Architect's approval before excavation.
- E. Location of Sprinklers: Locations of sprinklers shown on drawings is assumed to be approximate, except where dimensions are indicated. Make minor adjustments necessary to avoid plantings and obstruction, but adhere carefully to the following requirements.
 - 1. Spacing of sprinklers shall be uniform
- F. Protect existing landscaping, hardscaping, structures, utilities, etc. from damage. Damage to any existing entity on the site will be the responsibility of the contractor.
- G. Contractor's on-site field supervisor must have thorough knowledge of irrigation system installation. Project Officer must have a means of communication with field supervisor through mobile phone for emergency purposes.
- H. All items and materials shall be installed following manufacturer's recommendations.

3.02 EARTHWORK

- A. Excavating, trenching, and backfilling are specified in Division 31 Section "Earth Moving."
- B. Trench Installation
 - 1. All main pipe shall have a minimum of 24 inches of cover. All lateral pipes shall have a minimum of 18 inches of cover.
 - 2. Accomplish depth changes by sloping the pipe or by using 45 degree fittings.

3. The minimum trench width for pipe sized 3 inches or less shall be 6 inches. Provide at least four inches of space on each side of any pipe larger than 3 inches.
4. Do not use blocking to change pipe grade or to intermittently support pipe across excavated sections. Grade pipelines down to drain valves. Do not lay pipe so that local low spots occur that will not allow the water to drain.
5. Install pipe in open trenches so that it snakes back and forth through the trench to allow for expansion and contraction.
6. At the end of each work day, cover the open end of the pipe with 10 mil plastic held securely in place with tape.
7. Contractor is responsible for disposal of uncovered rock and debris.

C. Deleterious Material:

1. Final determination of deleterious material shall be made the Landscape Architect.
2. Remove deleterious material and dispose of legally off Owner's property.
3. Obtain and install suitable replacement backfill, as approved by the Landscape Architect.

D. Extraordinary Excavation:

1. Propose the use of rock hammers, rock saws, or excavators larger than standard (18,000 to 20,000 lbs.) when conditions dictate.
2. Propose blasting by professional licensed personnel when conditions dictate.

E. Bedding:

1. Grade the bottom of the trench to a line so that the pipe will have bearing for its full length.
2. The trench bottom shall be smooth and free from any stones greater than ½ inch diameter, dirt clods greater than 2 inches diameter, and any frozen material.
3. Remove all rock and organic material from the trench bottom prior to installing pipe.
4. Provide a layer of loose, clean earth to provide proper bearing. Hand excavate for bells and fittings if the loose fill is inadequate to properly support the barrel without placing excess load on the bells or fittings.
5. Provide minimum 6 inches of clearance between the pipe and any rock. Increase excavation as necessary. Where such condition occurs beneath the pipe, excavate to a depth of 6 inches below pipe grade and fill with well-compacted earth to pipe grade.
6. Remove and replace unstable bedding material with suitable material.

F. Backfill:

1. Compact backfill to 95 percent standard proctor density. The backfill material shall be sufficiently damp to permit thorough compaction under and on each side of the pipe to provide support, free from voids. Exercise extreme care to prevent deforming, displacing, or damaging the pipe.

2. The initial backfill in contact with the pipe and immediately surrounding it shall be of fine-grained material free from rocks, stones, or clods greater than approximately ½ inch diameter and earth clods greater than approximately 2 inches diameter. Tamp in 6 inch lifts and compact firmly around the pipe and up to at least 6 inches above the top of the pipe.
 3. Place and spread the final backfill in uniform layers in such a manner as to fill the trench completely so that there will be no unfilled spaces under or around rocks or lumps of earth. Final backfill shall be free of large rocks, frozen clods, and other debris greater than 3 inches in diameter. Tamp final backfill mechanically to 95% standard proctor density and finish with a grade that permits proper restoration, whether using sod or seed.
 - a. Contractor shall be responsible for the repair or restoration of trench settlement in excess of 0.25 inches.
 - b. Mounding of final backfill in anticipation of natural settling is not acceptable.
- G. Thrust Blocking:
1. Thrust blocks or mechanical joint restraints are required on all gasket connections where the pipe changes the direction of the water, where the pipe changes size, at the end of a pipeline, and where there is a gasketed knock-on valve. Plastic or paper lining must be installed between the concrete and the PVC pipe and fittings.
 2. When multiple pipes are installed in a common trench, provide mechanical restraints only. Restraint hardware shall not come in contact with adjacent pipes.
- H. Install sleeving under all existing hardscape via boring. Coordinate with other trades to preset sleeves under all proposed hardscape.
1. In the event sleeves are not preset, install sleeves under completed hardscape solely by means of jack and bore.
- I. Use chain-type trencher set for 4 inches wide trench maximum for all pipe over 1.25 inches. Smaller lateral pipes may be installed using a vibratory plow, provided no control wires occupy the trench.
- J. Cut, fit, and solvent-weld pipe and fittings strictly following manufacturer guidelines. Allow all joints to cure a minimum of 24 hours prior to applying pressure to system.

3.03 PIPING INSTALLATION

- A. Location and Arrangement: Drawings indicate location and arrangement of piping systems. Install piping as indicated unless deviations are approved by the Project Officer.
- B. Install sleeving as required under all existing hardscape features via boring. Sleeves may be installed by trenching where hardscape features are not in place. Sleeving shall have a cover of 24" above the pipe where vehicular traffic is not a concern. Sleeving installed in areas of vehicular traffic shall have a cover of 36" above the pipe.

- C. Mainline pipe shall be installed using a wheel trencher or other suitable equipment. Lateral pipe 1.5" or smaller may be installed using a vibratory plow at the contractor's discretion.
- D. All mainline pipe shall have a cover of 18". Lateral piping shall have a cover of 18". If sharp edged debris or rock is encountered, excavate to width and depth required to allow 3" of sand bedding around pipe while maintaining this depth specification.
- E. Locating tape shall be installed with the mainline in areas that do not have control wire.
- F. Pipe shall be snaked from side to side in the trench to allow for expansion and contraction.
- G. Install groups of pipes parallel to each other, spaced to permit valve servicing.
- H. Cut, fit, and solvent-weld pipe and fittings strictly following manufacturer guidelines. Allow all joints to cure a minimum of 24 hours prior to applying pressure to system. Solvent-weld joints shall not have signs of puddling or excessive primer and/or solvent. Pipe and fittings with signs of excessive primer/solvent outside of joints will be replaced at the contractor's expense.
- I. Gasketed connections shall utilize pipe lube and be properly beveled.
- J. Joint Restraints shall be used on all gasketed connections where the pipe changes direction of the water, where the pipe changes size, at the end of a pipeline, and valves.
- K. Backfilling shall be accomplished in 6" maximum lifts, with the first being placed by hand to exclude all debris over 1" in diameter and all sharp-edged rock of any dimension. Mechanical tamping shall be done after each lift to eliminate trench settling. Contractor shall be responsible for the repair or restoration of trench settlement.

3.04 JOINT CONSTRUCTION

- A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.
- B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.
- C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
 - 1. Apply appropriate thread compound to external pipe threads unless dry seal threading is specified.
 - 2. Hand tighten PVC joints, then apply mild wrench torque for 1.25 to 1.5 additional turns.
 - 3. Do not use any tape or compound containing Teflon or other thread lubricant for any joint in which at least one of the two joined items is PVC.
 - 4. Female PVC threaded fittings shall be used with male PVC threaded fittings only.
 - 5. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.
- D. PVC Piping Solvent-Cemented Joints:

1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Pressure Piping: Join PVC pipe and socket fittings according to ASTM D 2855.
 - a. Do not move joints until the set time prescribed by the solvent cement manufacturer has elapsed or as specified in ASTM D 2855.
 - b. Move joints gently without torque or bending after the set time has elapsed and until the cure time has elapsed. Cure time is as specified by the solvent cement manufacturer or as shown in table X2.1 of ASTM D 2855.
 - c. Do not restrict air flow around the joint until the cure time has elapsed.
- E. HDPE Piping Heat-Fusion Joints: Clean and dry joining surfaces by wiping with clean cloth or paper towels. Join according to ASTM D 2657.
 1. Plain-End HDPE Pipe and Fittings: Use butt fusion.
 2. Plain-End HDPE Pipe and Socket Fittings: Use socket fusion.
 3. Sections of polyethylene pipe should be joined into continuous lengths on the jobsite above ground. The joining method shall be the butt fusion method and shall be performed in strict accordance with the pipe supplier's recommendations. The butt fusion equipment used in the joining procedures should be capable of meeting all conditions recommended by the pipe supplier, including, but not limited to, temperature requirements of 400 degrees Fahrenheit, alignment, and an interfacial fusion pressure of 75 PSI. The fusion equipment used shall be manufactured by McElroy Manufacturing, or equal. The butt fusion joining must produce a joint weld strength equal to or greater than the tensile strength of the pipe itself.
 4. Electro-fusion is to be used where the butt fusion method cannot be used.
- F. Flanged Joints: Select rubber gasket material, size, type, and thickness for service application. Install gasket concentrically positioned. Use suitable lubricants on bolt threads.
- G. Ductile-Iron Piping Gasketed Joints: Comply with AWWA C600 and AWWA M41.
- H. Copper-Tubing Brazed Joints: Construct joints according to CDA's "Copper Tube Handbook," using copper-phosphorus brazing filler metal.
- I. Copper-Tubing Soldered Joints: Apply ASTM B813 water-flushable flux to tube end unless otherwise indicated. Construct joints according to ASTM B828 or CDA's "Copper Tube Handbook," using lead-free solder alloy (0.20 percent maximum lead content) complying with ASTM B32.
 1. Plain-End PE Pipe and Fittings: Use butt fusion.
 2. Plain-End PE Pipe and Socket Fittings: Use socket fusion.

3.05 VALVE INSTALLATION

- A. Lines shall be thoroughly flushed prior to valve installation.
- B. Manual gate valves shall be installed with the operating handle in a vertical position and centered in a 10" nominal diameter valve box with a 6" or 8" sleeve.
- C. Remote control valves shall be installed with the flow control handle in a vertical position and positioned in a 10" circular valve box (single valves) or 12" x 17" nominal rectangular valve box (two valves) to allow ready access for adjustment and/or minor repair. The bottom of the valve box shall contain a 3" gravel sump. There shall be 2" of clearance between the bottom of the valve and gravel sump.
- D. Quick coupler valves shall be installed with the top of the cover parallel and two inches below the valve box cover. The valve shall be centered in a 10" circular valve box. Quick coupler valve shall be restrained using rebar and stainless steel hose clamps or Snap-LOK.
- E. Splices, grounding connections, etc. shall be installed inside a 10" nominal diameter valve box.

3.06 SPRINKLER INSTALLATION

- A. Lines shall be thoroughly flushed prior to installing sprinklers.
- B. Sprinklers to be installed flush and plumb with final grade. All heads to be installed approximately 2" from the nearest hardscape feature.
- C. Adjust sprinklers for proper distribution and to prevent overspray onto walkways, driveways, buildings, and other unattended surfaces as much as possible.
- D. Spacing shall not exceed that shown on irrigation plan.

3.07 DRIP IRRIGATION SPECIALTY INSTALLATION

- A. General:
 - 1. Install soil staples at 3 feet on center. Install 2 staples at each tee, elbow, cross, and change in direction. Do not crimp drip tube.
 - 2. Install pressure regulating filter downstream of each zone valve.
 - 3. Install at least one line flushing valve per zone at the low point of the zone. Additional flushing valves are to be used if the topography of the zone would result in water remaining in the tubing following flushing.
 - 4. Install one drip zone activity indicator per zone.
 - 5. Install drip tubes with direct-attached emitters on ground.
 - 6. Install application pressure regulators and filter units in piping near device being protected, and in control-valve boxes.
 - 7. Install air relief valves and vacuum relief valves in piping, and in control-valve boxes.

B. Drip Tube Layout:

1. Set all peripheral drip tubes 4 inches from edge of planter or zone.
2. Orient drip tubes perpendicular to slopes in a manifold-type layout with supply and exhaust headers, and as follows:
 - a. Surface installation: on surface of soil, below mulch.
 - b. Subsurface installation: 4-6 inches below surface of soil.
 - c. Refer to Manufacturer's written specifications for maximum drip tube spacing, maximum length of a single lateral, drip tube layout at trees, and adjustments to spacing for changes in elevation.

3.08 WIRE INSTALLATION

- A. Wiring shall be laid along with the mainline with enough slack to avoid wire being pulled taut during backfill procedure
- B. Approximately 5' of wire shall be left at all remote control valves to allow extraction of the solenoid from the valve box without cutting the wire. The extra wire shall be neatly coiled in the valve box.
- C. Do not place more than one wire connection in a splice kit.
- D. All wires passing under hardscaped areas shall pass through approved sleeving.

3.09 IRRIGATION CONTROLLER INSTALLATION

- A. Controller shall be located approximately where shown, with Owner's/ Project Officer's approval.
- B. Controller shall be located at least 15 feet from high current drawing electric motors such as pumps, AC units, compressors, etc.
- C. Controller shall be grounded as recommended by manufacturer.
- D. Rain sensor shall be installed in controller vicinity as shown on plan. Final location shall be approved, in writing, by the Owner/ Project Officer and irrigation consultant. Sensor shall be mounted in an area exposed to direct rainfall, but not exposed to spray from sprinklers.
- E. Contractor shall be responsible for verifying that cellular reception is adequate for the communication card to connect to the remote located PC based central control system. If reception is inadequate, contractor shall notify owner and irrigation consultant prior to ordering the controller.

3.010 IRRIGATION CONTROLLER PROGRAMMING

- A. Controller shall be programmed by irrigation contractor. Initially the controller shall be programmed for the water application rate requested by the landscape architect. This initial

program should remain in effect until after the “grow-in” period. After this period, the controller shall be reprogrammed to run based on plant material, soil type, slope, and soil moisture readings.

- B. Contractor shall include with their scope of work, time necessary to adjust controller as recommended by the manufacturer to provide optimal operation. This shall include site visits during and after the grow-in period to set zone percentage adjustments to promote water conservation, plant health, and encourage deep root growth.
- C. Contractor shall provide the owner with on-site controller training.
- D. Contractor shall be responsible for linking the site controller with the remote located PC based central control system.

3.011 GROUNDING IRRIGATION CONTROL SYSTEM

- A. A good ground source is a mandatory component of overall surge protection for Irrigation Control Systems. Grounding electrode(s) should be placed at the controller location. The resistance to the grounding electrode must not exceed 10 ohms when measured with a Megger Earth Resistance Testing Instrument or equivalent. One or more of the following grounding methods should enable 10 ohms or less resistance to be accomplished.
- B. Connection of a #8 bare copper wire to a 3/8“ inch diameter by 8 foot long (minimum) copper clad steel rod driven into the earth at a distance greater than 8 feet from the controller. Additional lengths may be required to achieve the required resistance reading. Connection of the wire to the grounding rod shall be made utilizing a CADWELD or similar product that will not be affected by expansion and contraction due to temperature variances. Split bolt type connections will not be accepted. Connection shall be made inside of a valve box.
- C. If soil conditions (i.e., ledge rock) prevent copper clad rod installation, one or more copper plates can be buried under well compacted soil or grounding enhancement material.

3.012 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.
 - 2. Operational Test: After electrical circuitry has been energized, operate controllers and automatic control valves to confirm proper system operation.
 - 3. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.
 - 4. Grounding Test: Confirm manufacturer’s minimum resistance has been satisfied.
 - 5. Contractor shall demonstrate operation of each zone to Project Officer.
- B. Any irrigation product will be considered defective if it does not pass tests and inspections.

3.13 STARTUP SERVICE

- A. Complete installation and startup checks according to manufacturer's written instructions.

3.014 ADJUSTING

- A. Adjust settings of controllers as recommended by manufacturer.
- B. Adjust automatic control valves to provide flow rate at rated operating pressure required for each sprinkler circuit.
- C. Adjust sprinklers and devices, except those intended to be mounted aboveground, so they will be flush with finish grade.

3.015 CLEANUP

- A. Upon completion of daily work, remove all debris relating to the installation of the system and clean adjacent hardscape features as necessary. Upon completion of all irrigation installation work, remove from the site all leftover material and equipment as to leave the site in the same or better condition as when work was started.

3.016 OBSERVATION AND ACCEPTANCE

- A. Periodic site visits will be made by the Project Officer or Irrigation Consultant to review the quality and progress of work. Work found to be unacceptable must be corrected within five (5) calendar days. Remove rejected materials promptly from the project.
- B. Upon completion of work, the Project Officer or Irrigation Consultant will issue a punch list for work to be corrected. Where work does not comply with requirements, rejected work must be replaced.

3.17 DEMONSTRATION

- A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain controllers.
 - 1. Demonstrate the operation of the system and provide operator orientation. Minimum time is 4 hours, during which the following items and activities are to be covered.
 - a. Demonstrate operation of each control valve and all other operable components.
 - b. Walk through the site with a print of the record drawing, identifying the objects in the ground and showing their location on the record drawing.
 - c. Demonstrate field adjustment of sprinklers and remote control valves.
 - 2. Provide instruction for winterization and seasonal start-up.

END OF SECTION 328000

SECTION 329100 - PLANTING PREPARATION

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes erosion control materials, soil amendments, mulching and topsoil.
- B. Provide all labor, materials, tools and equipment as required to have topsoil, planting soil mix, soil stabilization, amendments, and mulch applied per the specifications on all areas disturbed by construction to receive plant materials as indicated in the approved plans.
- C. Related Sections:
 - 1. Section 310000 Earthwork
 - 2. Section 311000 Site Clearing, Preparation, Demolition and Removals
 - 3. Section 311300 Tree Protection and Root Pruning
 - 4. Section 312500 Temporary Erosion and Sediment Control
 - 5. Section 329200 Seeding and Sodding
 - 6. Section 329300 Exterior Plants
 - 7. Section 02910 Soil Profile Rebuilding
- D. In addition to the specifications contained herein, Work shall be performed in accordance with the:
 - 1. Drawings and general provisions of the contract, including general and supplementary conditions
 - 2. Arlington County Department of Parks & Recreation Design Standards as shown on the plans and available online at:

<https://www.arlingtonva.us/Government/Departments/Parks-Recreation/About/Design-Standards>

1.02 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Imported Topsoil: Soil obtained off-site that meets the specifications herein for topsoil and is suitable for use in planting soil/backfill soil mixture when existing soil quantities are insufficient.
- C. Planting Soil/Backfill Soil Mixture: Existing soil modified as specified to be suitable for planting.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.
- E. ISA: International Society of Arboriculture

- F. CBAY: Chesapeake Bay, typically referring to CBAY watershed.
- G. Urban Forester/County Urban Forester: Refers to the Arlington County Urban Forester
- H. Landscape Architect: Refers to an Arlington County Landscape Architect or their designee.

1.03 SUBMITTALS

- A. Samples of all materials specified shall be submitted to the Project Officer for approval with coordination of the Landscape Architect. All approvals shall be in writing.
- B. Samples:
 - 1. Existing Topsoil: Provide 1-pound sample of existing topsoil with the following soil test reports.
 - a. Fertility: pH, nitrate nitrogen, ammonia nitrogen, phosphate phosphorous, potassium, calcium, magnesium, zinc, iron, manganese.
 - b. Suitability: total salinity, boron, sodium, potassium, calcium, magnesium, chloride, sulfate.
 - c. Physical properties including organic content and particle size distribution.
 - 2. Imported Topsoil: If imported topsoil is required, Contractor shall provide a 1-pound sample of the imported topsoil with the soil test reports as noted above for "Existing Topsoil."
 - 3. Imported Topsoil for Bioretention Areas: If bioretention areas are indicated in the approved plans, the Contractor shall submit soil sample per specifications.
 - 4. Mulches and Organic Matter/Compost: Sample of mulch and organic matter/compost may be requested in lieu of inspection.
 - 5. Product certificates: Contractor shall submit for each type of manufactured product, to be approved by the Project Officer in coordination with Landscape Architect or Urban Forester and complying with the following:
 - a. Manufacturer's certified analysis for standard products.

PART 1 - Geotextile/Soil Stabilization/Erosion Control Fabric: Sample

1.04 QUALITY ASSURANCE

- A. Contractor shall have all existing and furnished topsoil to be used for seeding and sodding, and for planting areas tested by a state laboratory or recognized commercial soil-testing laboratory in order to determine recommendations for the types and quantities of soil amendments. The results of this test will determine the rates and types of fertilizers, lime, soil conditioners, and other amendments, if necessary.
 - 1. Soil tests shall use a representative sample of on-site soils. If existing soil has been undisturbed and is suitable as determined by the soil test, no additional amendments are required.
 - 2. Adjustments should be made based on soil test results.

PART 2 - PRODUCTS

2.01 MATERIALS

- A. All materials shall conform to those stipulated below, unless otherwise approved in writing by the Project Officer with confirmation by the Landscape Architect or County Urban Forester.
- B. Specified materials to be applied in amounts and methods herein stipulated.
- C. Delivery tickets indicating date, weight, analysis and vendor's name, to be submitted to Project Officer.

2.02 SOIL AMENDMENTS

- A. Lime: Application rates for liming materials and lime material type chosen shall be determined by required soil tests and approved by the Project Officer in coordination with the Landscape Architect or Urban Forester.
 - 1. When required and unless test results indicate otherwise, lime material shall be dry and free flowing pulverized limestone, hydrate lime or burnt lime that contains at least 50% total oxides (calcium oxide plus magnesium oxide). Ground limestone shall be ground to such fineness that at a minimum of 50% will pass through a 100 mesh sieve and 98% - 100% will pass through a 20 mesh sieve. Lime material shall meet the Virginia Agricultural Liming Materials Act, Code of Virginia Section 3.1-126.1.
- B. Fertilizer: Fertilizer type and application rate shall be determined by results of required soil tests and approved by the Project Officer in coordination with the Landscape Architect or Urban Forester:
 - 1. When required and unless test results indicate otherwise, commercial-grade complete fertilizer will be of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - a. Composition: 10 percent nitrogen, 20 percent phosphorous, and 10 percent potassium, by weight.
 - 2. All fertilizers shall be uniform in composition, free flowing, and suitable for application with approved equipment.
 - 3. Fertilizers shall be delivered to the site fully labeled according to applicable state fertilizer laws and shall bear the name, trade name, or trademark and warranty of the product.
- C. Delay mixing fertilizer with planting soil if planting will not proceed within 2 days.
- D. Spread fertilizer and lime with approved equipment.

2.03 EXISTING TOPSOIL

- A. Existing, native surface topsoil formed under natural conditions with the duff layer retained during excavation period and stockpiled.
 - 1. Contractor shall verify suitability of stockpiled soil to produce or to be amended to produce viable planting soil for lawns and planting beds as described herein.

- E. Existing topsoil is to be used to extent possible for lawn areas and is to be amended per the specifications to become the Planting Soil/Backfill Soil Mixture for use in planting pits and bed areas.
- F. Prior to use for lawn areas or in planting soil mix, Contractor shall remove all stones, roots, plants, sod, clods, and clay lumps larger than 1/2 –inch in any direction, pockets of coarse sand, concrete slurry, concrete layers or chunks, cement, plaster, building debris and other extraneous materials that are harmful to plant growth.
- G. After removal of debris and extraneous materials noted above, the Contractor shall obtain soil tests for the existing soil per the requirements in section 1.04 “Quality Assurance.”
- H. Contractor shall submit soil test results to the Project Officer for approval with confirmation by the Landscape Architect or Urban Forester.
- I. Contractor shall supplement the existing soil as recommended in soil test results to achieve a viable planting soil for lawns and/or planting beds. Contractor shall supplement with imported topsoil per the specifications from off-site sources when quantities of approved, existing topsoil are insufficient for lawns and planting beds.
- J. Contractor shall submit a sample of the topsoil that has been amended based on soil test results for approval by the Project Officer with confirmation by Landscape Architect or Urban Forester prior to use in lawn areas or planting beds or pits.
- K. Topsoil installed on grade shall attempt to match existing soil texture, except for situations where clay subsoil exists. In the event that clay subsoil exists, use loam or silt loam topsoil.
- L. Imported topsoil rather than existing topsoil is to be used for planting in bioretention areas, unless otherwise indicated on the approved plans.

2.04 PLANTING SOIL MIX/BACKFILL SOIL MIXTURE

- A. The planting soil mix (also known as backfill soil mixture) shall consist of existing topsoil that has been approved for planting per the specifications above and approved organic matter.
- B. The planting soil mix/backfill soil mixture shall be composed of $\frac{3}{4}$ approved existing topsoil and $\frac{1}{4}$ approved organic matter as described in the Arlington County DPR Standard planting details, unless otherwise indicated by the Project Officer with confirmation by the Landscape Architect or Urban Forester.

2.05 IMPORTED TOPSOIL

- A. Contractor shall add imported topsoil when required on the drawings, when quantity of existing topsoil is insufficient or when determined to be necessary due to soil testing results.
- B. Topsoil shall be the natural, original surface soil, a sandy loam uniform in composition and shall be in a friable condition and shall contain less than 3 percent subsoil, hardpan material, stones and clods larger than 1/2 inch in diameter in any direction. It shall also be free of sticks, tree or shrub roots, debris and other material undesirable for plant growth. The area and the topsoil shall be free of undesirable plant such as, but not limited to, Bermuda grass, nut sedge, mugwort or noxious weeds as set forth in the Federal Seed Act.

- C. The topsoil shall contain at least 5 percent organic matter. It shall be a sandy loam consisting of at least 5 but not more than 20% clay, at least 10 but not more than 80% sand. It shall have a pH between 5.5 to 6.5. Soluble salts (salinity) shall not exceed 500 ppm. Soil fertility shall be "High" in natural nutrients based on the coordinated ratings in pounds per acre as established by the National Soil and Fertilizer Research Committee.
- D. Topsoil which has been manufactured by blending materials which individually do not meet the requirements of this specification will not be accepted even though the resulting blend meets the organic matter, mechanical analysis, pH and soluble salts requirements. Agricultural limestone at not more than 5 pounds per cubic yard of topsoil may be used to adjust the pH provided it is well mixed in a manner which does not destroy the structure of the soil.

2.06 IMPORTED TOPSOIL FOR BIO-RETENTION AREAS

- A. If bioretention is specified in the approved plans, soil for bioretention areas shall comply with the Filter Media and Surface Cover section of the Virginia Department of Environmental Quality's (DEQ) Design Specification No. 9 for Bioretention, Version 2.0, January 1, 2013.

2.07 MULCHES AND ORGANIC MATTER

- A. Straw Mulch for Seeded Areas: Provide air-dry, clean, mildew and seed-free, salt hay or threshed straw of wheat, rye, oats or barley.
- B. Wood Chip Bark Mulch for Planted Areas: Wood Chip Bark Mulch shall be double-shredded hardwood bark mulch, uniform in size and free of stones, clods, non-organic debris or other foreign material and aged for at least 6 months from an approved source. Insufficiently or improperly aged mulch containing high bacterial counts or high levels of bark or other materials resistant to decomposition shall not be used. Mulch shall not contain the trunk of trees.
- C. Organic Matter/Compost Mulch: Well-composted, trash-free, stable, and weed-free organic matter such as composted bark, leaf mold or other plant debris material that has been composted to a point of decay and is mature.
 - 1. pH range of 5.5 to 8; moisture content 35 to 55 percent by weight
 - 2. 100 percent passing through 1-inch sieve
 - 3. Peat moss shall not be used.
 - 4. Organic amendments shall be commercially prepared and shall comply with the U.S. Compost Council Seal of Testing Assurance Program's Test Methods for the Examination of Composting and Compost (STA/TMECC) criteria, or as modified in approved plan documents.

2.08 SOIL STABILIZATION/EROSION CONTROL FABRIC

- A. ECS-2B Double New Straw Biodegradable Rolled Erosion Control Product, or an approved equal shall be used in all planting beds/reforestation areas.
 - 1. Shall meet Type 2.D specifications for ECTC and HFWA FP-03 Section 713.17
 - 2. Shall have two (2) layers of organic jute netting sewn together with biodegradable thread.

3. Overlap sections 12” and secure with manufacturer’s recommended steel wire staples, 6 inches long.
- B. Erosion-Control Blankets: Biodegradable wood excelsior, straw, or coconut-fiber mat enclosed in a photodegradable plastic mesh. Include manufacturer’s recommended steel wire staples, 6 inches long.
- C. Erosion-Control Fiber Mesh: Biodegradable burlap or spun-coir mesh, a minimum of 0.92 lb/sq. yd with 50 to 65 percent open area. Include manufacturer’s recommended steel wire staples, 6 inches.
- D. Erosion-Control Mats: Cellular, non-biodegradable slope-stabilization mats designed to isolate and contain small areas of soil over steeply sloped grades, of 3 inch nominal mat thickness. Include manufacturer’s recommended anchorage system for slope conditions.
 1. Products: Subject to compliance with requirements and plan documents, the products below, or an approved equivalent, be used:
 - a. Invisible Structures, Inc.; Slopetame 2
 - b. Tenax Corporation – USA; Tenweb.

PART 3 - EXECUTION

3.01 PREPARATION

- A. All identified areas within the project limits shall have approved topsoil mix spread on them and be prepared for seeding and sodding by bringing ground surfaces to grades shown on the drawings. Planting pits and bed areas identified on the approved plans shall be prepared in accordance with the applicable DPR Landscape Standard details.
 1. No seeding shall be done on frozen ground or when the temperature is 32F or lower. Refer to specification 329200, “Seeding and Sodding.” Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties, sidewalks and areas.
 2. Rototilling shall not be performed within the critical root zone of trees to be preserved.
 3. The soil shall not be tilled or amended when the soil’s moisture capacity is above field capacity or when the soil is frozen.
 4. Contractor shall identify utilities, existing irrigation and underground utilities. All areas on either side of the utility marking shall be amended by hand.
 5. Contractor shall verify that no foreign or deleterious material or liquid has been deposited in soil within a planting area.
 6. Contractor shall proceed with installation only after both unsatisfactory conditions have been corrected and rough grading has been completed and approved by the Project Officer in coordination with the Landscape Architect or Urban Forester.

7. Contractor shall protect structures, utilities, sidewalks, pavements and other facilities, trees, shrubs and plantings from damage caused by planting operations.
 - a. Protect adjacent and adjoining areas from hydro-seeding and hydro-mulching overspray.
 - b. Protect grade stakes set by others until directed to move them.
 8. Surfaces shall conform to finish grade, free of water retaining depressions, soil friable, free of clay and of uniformly firm texture.
- B. Newly Graded Subgrades: Loosen subgrade to a minimum depth of 6 inches. Remove stones larger than 1/2 inch in any direction and sticks, roots, rubbish, and other extraneous matter including grass vegetation and turf and legally dispose of them off of Arlington County property. Do not mix into surface soil.
1. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix. Delay mixing amendments with soil if planting will not proceed within 2 days.
 2. Loosen surface soil to a depth of at least of 6 inches. Apply soil amendments and fertilizers according to planting soil mix proportions and mix thoroughly into top 4 inches of soil. Till soil to a homogeneous mixture of fine texture.
 3. Spread planting soil mix to a depth of 4 inches but not less than required to meet finish grades after light rolling and natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
- C. Unchanged Subgrades: If lawns are to be planted in areas unaltered or undisturbed by excavating, grading, or surface soil stripping operations, prepare surface soil as follows:
- a. Remove stones larger than 1/2 inch in any dimension and sticks, roots, trash, and other extraneous matter. Legally dispose them off of Arlington County property. Do not mix into surface soil
 - b. Loosen surface soil to a depth of at least 6 inches, apply soil amendments and fertilizers according to the planting soil mix proportion and mix thoroughly into the top 4 inches of soil.
- D. Finish Grading: Grade landscape areas to a smooth, uniform surface plane with loose, uniformly fine texture. Grade to within plus or minus 1/2 inch of finish elevation. Adjust for the thickness of sod, where applicable. Roll and rake, remove ridges, and fill depressions to meet finish grades. Limit fine grading to areas that can be planted in the immediate future.
- E. If bioretention areas are specified in the approved plans, the Contractor shall construct these areas in accordance with the Virginia DEQ Stormwater Design Specification No. 9, Version 2.0, January 1, 2013.
- F. Contractor shall construct gravel bed area per detail provided.
- G. Contractor shall avoid unnecessary compaction of the soil during grading.
- H. Contractor shall ensure appropriate slopes of the swales, berms and final grades.

- I. Immediately following each day's work, contractor shall clean all dirt, excess soil, debris and trash from the site. Contractor shall protect and store additional soils in stockpiles protected from saturation, erosion, weed growth and contamination with plastic sheeting or tarps.
- J. Amendments for seeding and sodding areas shall be applied after determining by soils test as follows:
 - 1. Lime as specified shall be spread uniformly over designated area. Rate depends on soil tests. Soil tests shall be made before lime application at 8 to 10 plugs per acre taken by the method prescribed the United States Department of Agriculture.
 - 2. Fertilizer shall be spread after the lime has been applied. Rate shall be as recommended per the soil tests.
 - 3. Fertilizer shall be spread with approved equipment and at an even rate over the area to be seeded or sodded.
 - 4. Work lime and fertilizer into top 4 inches of topsoil and grade to smooth surface ready for seeding.
- K. Restore areas if eroded or otherwise disturbed after finish grading and before planting.
- L. Prepared lawns and planting areas shall be inspected and approved by Project Officer in coordination with Landscape Architect prior to seeding, sodding or planting.
- M. If the graded areas develop volunteer weed growth, the growth shall be eliminated at the expense of the Contractor.

3.02 SOIL STABILIZATION MATERIALS

- A. Prepare planting area as specified.
- B. Moisten prepared planting area before planting if surface is dry. Water thoroughly and allow surface to dry before planting. Do not create muddy soil.
- C. Install Soil Stabilization from top of slope, overlapping joints by 12 inches, working downward, and as recommended by material manufacturer for site conditions. Fasten as recommended by material manufacturer.
- D. Plant shrubs, trees and perennials through Soil Stabilization fabric by carefully separating fabric layers to allow space for planting.
- E. Remove non-biodegradable stabilization materials after plant establishment.

END OF SECTION 329100

SECTION 329200 - SEEDING AND SODDING

PART 1 - GENERAL

1.01 SUMMARY

- A. Provide all labor, materials, tools and equipment as required to have topsoil, fertilizer, lime, mulch, see and/or sod applied on all areas disturbed by construction and all areas called for on the approved plans.

1.02 DESCRIPTION

- A. The work includes, but is not limited to, the provision of all material, services, labor, and equipment necessary to construct the following:
 - 1. Seed bed preparation
 - 2. Soil Testing
 - 3. Seeding shall be done within all disturbed areas in contract limit lines except where paving, sodding or shrub beds are indicated.
 - 4. Refer to materials plan for limits of sod.

1.03 RELATED SECTIONS

- A. Construction Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 1-33 Specification Sections, apply to this Section.
- B. Section 310000 Earthwork
- C. Section 311000 Site Clearing, Preparation, Demolition and Removals
- D. Section 311300 Tree Protection and Root Pruning
- E. Erosion and Sediment Control Ordinance (Chapter 57 of the Arlington County Code)

1.04 SUBMITTALS

- A. Submit copies of the seed mix, topsoil and sod seed mixture with sources identified to the Project Officer. The County Landscape Architect reserves the right to make adjustments to the mixtures listed on the submittals, but within the total quantities listed for each material.
- B. Samples:
 - 1. Seed Mix: Samples or photos may be requested in lieu of inspection.
 - 2. Topsoil Mix: Provide the following soil test reports.
 - a. Fertility: pH, nitrate nitrogen, ammonia nitrogen, phosphate phosphorous, potassium, calcium, magnesium, zinc, iron, manganese.
 - b. Suitability: total salinity, boron, sodium, potassium, calcium, magnesium, chloride, sulfate.

- c. Physical properties including organic content and particle size distribution.

- 3. Sod Mix: Samples or photos may be requested in lieu of inspection.

1.05 QUALITY ASSURANCE

- A. The Project Officer reserves the right to have topsoil tested at Contractor’s expense to ensure that proper types and quantities of soil conditioners, and fertilizers, will be used resulting in a dense, vigorous growth of perennial lawn-quality grass. The results of this test will determine rates and types of fertilizers and lime.

PART 2 - PRODUCT

2.01 MATERIALS

- A. All materials shall conform to those stipulated below, unless otherwise approved in writing by the Project Officer with confirmation by the Landscape Architect.
- B. Specified materials to be applied in amounts and methods herein stipulated.
- C. Delivery tickets indicating date, weight, analysis and vendor's name, to be submitted to Project Officer.
- D. Sod mixes must be acquired from a Virginia State Certified grower/propagator.
- E. Sod shall be fresh and clean and comply with purity and germination requirements.

2.02 SEED

- A. Grass seed shall be fresh new crop seed complying with purity and germination requirements stipulated herein. All cultivars must be on the current “Virginia Turfgrass Variety Recommendations” or in the top 25 for transitional zone sites-overall of the latest National Turfgrass Evaluation Program (NTEP) as approved by Owner. The Turf-type Tall Fescue component shall be comprised of a minimum of two cultivars with each cultivar comprising no less than 30 percent nor more than 70 percent of the blend. The use of K-31 Tall Fescue or Common Kentucky Bluegrass in the mix is prohibited. The mix shall have 2.5 percent maximum inert matter, 0.5 percent maximum crop seed, and 0.1 percent maximum weed seed and 0.0 percent noxious weed. The mix shall comply with the current Virginia Seed Law and Virginia Seed Regulations and approximate the following:

Kind of Seed	% by Weight	% Purity	% Germination
Turf-type Tall Fescue	80	97	85
Bluegrass	10	97	80
Perennial Ryegrass	10	97	90

- B. Substitution of seed type or percent only on approval of Project Officer. Seed to be free of noxious weed seed.

2.03 FERTILIZER

- A. Fertilizer shall be pellet form 3.5-3.5-5.5 at time of sod/ seed installation. No Dyanimide compound or hydrated lime shall be permitted in mixed fertilizer.

2.04 LIME

- A. No lime shall be added to existing soil. If soil is imported (in field area, refer to section 2.06D).

2.05 EXISTING TOPSOIL

- A. Existing topsoil is to be used to extent possible for lawn areas. Scrap and remove topsoil from proposed concrete areas for reuse at disturbed areas.
- B. Remove existing turf from existing topsoil.

2.06 IMPORTED TOPSOIL

- A. To be used only if there is insufficient existing topsoil to achieve the proper contour at lawn areas.
- B. Topsoil shall be the natural, original surface soil, shall be in a friable condition and shall contain less than 3 percent subsoil, hardpan material, stones and clods larger than 1 inch in diameter. It shall also be free of sticks, tree or shrub roots, debris and other material undesirable for plant growth. The area and the topsoil shall be free of undesirable plant such as, but not limited to, Bermuda grass, nut sedge, mugwort or noxious weeds as set forth in the Federal Seed Act.
- C. The topsoil shall contain at least 5 percent organic matter. It shall be a sandy loam consisting of at least 5 but not more than 20% clay, at least 10 but not more than 80% sand. It shall have a pH between 6.0 and 7.5. Soluble salts (salinity) shall not exceed 500 ppm. Soil fertility shall be "High" in natural nutrients based on the coordinated ratings in pounds per acre as established by the National Soil and Fertilizer Research Committee.
- D. Topsoil which has been manufactured by blending materials which individually do not meet the requirements of this specification will not be accepted even though the resulting blend meets the organic matter, mechanical analysis, pH and soluble salts requirements. Agricultural limestone at not more than 5 pounds per cubic yard of topsoil may be used to adjust the pH provided it is well mixed in a manner that does not destroy the structure of the soil.

2.07 SODDING

- A. Certified Number 1 Quality/Premium, including limitations on thatch, weeds, diseases, nematodes, and insects, complying with "Specifications for Turfgrass Sod Materials" in TPI's "Guideline Specifications to Turfgrass Sodding." Furnish viable sod of uniform density, color, and texture that is strongly rooted and capable of vigorous growth and development when planted.

- B. Viable sod of uniform density, color, and texture, strongly rooted, and capable of vigorous growth and development when planted. Sod shall be cut to uniform 3/4-1 inch thickness, kept sufficiently moist so that the soil will adhere to the roots when handled, not more than 5% broken rolls, free of moldy, withered, yellow, or dry areas.
- C. Sod cultivated from state-certified seed of grass species indicated, with not less than 95 percent germination, not less than 85 percent pure seed, and not more than 0.5 percent weed seed.
- D. Varieties: Varieties listed by the latest publication of the Maryland-Virginia Turfgrass Variety Recommendation Work Group for Category 1 tall fescue variety recommendations.
 - 1. K-31 is prohibited.
- E. Sod containing netting is not acceptable or can be removed during placement. Grower's name, together with substantiating information as to field location from which sod is to be cut and species, percent purity and mixture of grass sod to be applied shall be submitted for the Project Officer's approval prior to delivery. Failure to obtain advance approval will constitute grounds for rejection of all sod delivered to the site. Invoices for all sod to clearly state point of origin and have attached to them a facsimile of the Grower's Nursery Certificate issued by the U.S. Department of Agriculture or Certified Delivery Ticket per truckload. All grass sod shall meet the following basic requirements.

- 1. Sod shall be free of disease and soil borne insects.
- 2. Sod shall be free of clover, broadleaf weeds and noxious weeds. Sod considered free of such weeds if less than 2 such plants are found per 100 square feet of area.
- 3. Sod shall be of uniform color and density.

Kind of Seed	% by Weight
Turf Type Tall Fescue	90
Kentucky Bluegrass	10

- 4. Sod sample shall be submitted to and approved by Project Officer before cutting. Sod placed on the job shall conform to the approved sample or shall be removed and replaced at the Contractor's expense.
- 5. Sod shall have been mowed prior to stripping and shall have been maintained for a minimum of three months.
- 6. Sod shall be relatively free of thatch. Thatch build up that significantly detracts from the appearance of the sod may be sufficient cause for rejection.
- 7. Individual pieces of sod shall be cut to supplier's standard width and length. Maximum allowable deviation from standard widths and lengths shall be 5%. Broken pads, torn or uneven ends shall not be permitted.
- 8. Root development shall be such that standard size pieces will support their own weight and retain their size and shape when suspended vertically from a firm grasp on uppermost 10% of the area.
- 9. Under moderate moisture conditions, weight shall not exceed 7 pounds per square foot. Minimum weight shall not be less than 4 lbs. per square foot.

PART 3 - EXECUTION

3.01 PREPARATION

- A. All areas within the project limits, shall have topsoil spread on them and be prepared for seeding and sodding by bringing ground surfaces to grades shown on the drawings, (with allowances for sod thickness, where applicable) free of sticks, stones, or other foreign material over one inch in any dimension. Surfaces shall conform to finish grade, free of water retaining depressions, soil friable, free of clay and of uniformly firm texture. Area is shall be inspected by Project Officer before seeding/ sodding.
- B. Work fertilizer into top 4 inches of rootzone (during tilling operation and/ or within 7 days of sodding) and grade to smooth surface ready for sodding.

3.02 SEEDING

- A. All areas within the project limits that are not shown for paving, sodding, or special treatment shall be seeded with the specified mix.
- B. Seed shall be uniformly distributed by hydro-seeding methods as specified:
 - 1. Slurry
 - a. Seed as specified at a rate of 350 lbs./acre.
 - b. Mulch: virgin wood fiber type applied at a rate of 1200 lbs./acre.
 - c. Tackifier: Guar type or approved equal applied at a rate of 40 lbs./acre.
 - d. Fertilizer: 10-0-20 granular applied at a rate of 12 lbs./1,000 SF
 - e. Lime: Flowable liquid lime at a rate of 5 gallons per acre.
 - f. Dye: Slurry must be green with dye added if not included with the mulch.
 - g. Application rate: 3000 gallons per acre. Agitation must be maintained throughout mixing and application.
 - h. Slurry shall be applied within 8 hours of the start of mixing.
- C. Seeding shall take place between August 15th and October 15th or between March 15th and May15th. Approval from Project Officer will be required before seeding is to begin.
- D. Use 2" min to 4" of prepared topsoil as base for areas to be seeded.
- E. No seeding shall be done during windy weather (winds over 5 mph) or when ground is wet or otherwise non-tillable.
- F. In lieu of hydroseeding, seed may be drilled or an alternate method may be used. If an alternate method is used, seeding will have to be run in two directions. The second direction being at right angles to the first direction. Requests for using alternate methods shall be approved by the Project Officer prior to application of seed.

3.03 SODDING

- A. All sod shall be transplanted within 24 hours from the time it is harvested unless stacked at its destination in a manner satisfactory to Project Officer.
- B. All sod in stacks shall be kept moist and protected from exposure to air and sun and from freezing. Any sod permitted to dry out may be rejected whenever, in judgment of Project

Officer, its survival after placing is doubtful. No payment shall be made for rejected sod. In any event, no more than forty-eight hours shall lapse between cutting and planting of sod is permitted.

- C. Before placing or depositing sod upon any surfaces, all shaping and redressing of such surfaces as described under Seeding Soil Preparation shall be completed. The bed area for sod shall be dug out so that when the sod is installed the adjacent soil will be flush with the top of the sod root mat. Areas shall be watered lightly before the placing of sod; sod shall not be placed on dry surfaces. Completed areas to be sodded shall be a smooth, uniform, well-tilled surface true to line and cross section. Any raking required shall be done immediately prior to placement of the sod at no additional cost to Owner.
- D. No sod shall be placed at any time temperature is below 32 degrees Fahrenheit. No frozen sod shall be used and no sod shall be placed upon frozen, powder dry or excessively wet soil.
- E. Sod shall be lifted from trucks or storage piles by hand and placed with closed joints and no overlapping. All cracks, seams and voids shall be closed with small pieces of sod. After laying sod shall be sprinkled thoroughly and then tamped. "Tamping" consists of firmly closing seams between strips by use of hand tampers or approved rollers. All sod shall be thoroughly rolled after closing all seams. Correct any slipping of sod.
- F. Adequate water and watering equipment must be on hand before sodding begins and sod shall be kept moist until root system adheres to original seed bed and becomes established and accepted by Project Officer.
- G. Sod shall be laid with long edges parallel to contours, except in swales or ditches where it shall be placed perpendicular to the flow line. Only sod placed in swales, ditches, and steep slopes shall be staked using 2 stakes per roll of sod. Stakes shall be wood wedges ½" x 1" x 12". Successive strips to be neatly matched and all joints staggered. Sod will be laid in all areas indicated on landscape plans.
- H. Apply first application of fertilizer at a rate of 40lbs per 1000 sf at time of sod installation.

3.04 PROTECTION

- A. Install post and rope barriers around seeded and sodded areas. Tie cloth or ribbon to rope at 10' intervals.
- B. Install "KEEP OFF TURF" signs at appropriate locations as directed by Project Officer.

3.05 MAINTENANCE

- A. Maintain surfaces and supply additional topsoil where necessary, including areas affected by erosion.
- B. Water to ensure uniform seed germination and to keep surface of soil damp.
- C. Apply water slowly so that surface of soil will not puddle and crust.
- D. Cut lawn areas when grass reached height of 3". Maintain minimum height of 2". Do not cut more than 1/3 of blade at any one mowing.

- E. After first mowing of lawn, water grass sufficiently to moisten soil from 3” to 5” deep.
- F. Reseed damaged grass areas showing root growth failure, deterioration, bare or thin spots and erosion.

3.06 GUARANTEE

- A. The Contractor shall be responsible for mowing all sodded and seeded areas and maintaining them in a healthy, vigorous condition at his own expense until all contracted work is completed and accepted by Project Officer.
- B. The Contractor shall, at his own expense, replace any seed or sod which has died or been damaged during the establishment period.
- C. Ten percent of the total cost of seed and sod will be withheld from final payment until final approval is given by Project Officer.

3.07 ACCEPTANCE

- A. Seeded areas will be accepted when an even and uniform stand of turf, 3” tall is properly established. Bare spots in excess of 4” shall be re-seeded at a rate per section 3.02 of this specification.
- B. Sodded areas shall be accepted provided all requirements, including maintenance, have been complied with and sod is well established in a healthy, vigorous growing condition.
- C. Upon acceptance at Final Completion, the Owner shall assume all lawn maintenance responsibilities.

END OF SECTION 329100

SECTION 329300 - EXTERIOR PLANTS

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes the following:
 - 1. Wood Chip Mulch
 - 2. Trees
 - 3. Shrubs
 - 4. Perennials/Grasses
 - 5. Steel Edging.
- B. Related Sections:
 - 1. Construction Drawings and general provisions of the Contract, including General and Supplementary Conditions and Divisions 1-33 Specification Sections, apply to this Section.
 - 2. Section 329200 Seeding and Sodding
 - 3. Section 329100 Planting Preparation

1.02 DEFINITIONS

- A. Finish Grade: Elevation of finished surface of planting soil.
- B. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
- C. Planting Soil: Native or imported topsoil, manufactured topsoil, or surface soil modified to become topsoil; mixed with soil amendments.
- D. Subgrade: Surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing planting soil.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Product certificates.
- C. Planting Schedule: Indicating anticipated planting dates for exterior plants.

- D. Maintenance Instructions: Recommended procedures to be established by Project Officer for maintenance of exterior plants during a calendar year.

1.04 COORDINATION

- A. Plant trees, shrubs, and other plants after finish grades are established and before planting turf areas unless otherwise indicated.
 - 1. When planting trees, shrubs, and other plants after planting turf areas is necessary and approved by Architect, protect turf areas, and promptly repair damage caused by planting operations.
 - 2. Prevent mixing, contamination or reversing soil profile from other Work. Repair any disturbance to the soil layers after placing to comply with the specified requirements.
- B. Complete all Work on slopes, including irrigation, soil, erosion control, before preparing adjacent flatter areas.

1.05 ACTION SUBMITTALS

- A. Product Data: For each type of product indicated, including soils. Provide also the following specific items.
 - 1. Plant Materials:
 - a. Not later than 60 days following the General Contractor's Notice to Proceed and a minimum 21 days prior to tree-tagging trips, submit list of proposed sources for all plant materials, including certificates of inspection of plant materials, as may be required by Federal, State, or other authorities to accompany shipments.
 - 1) Source List:
 - a) Include quantities, sizes, quality, and sources for plant materials.
 - b) Include identification of any supply difficulties and substantiate if any material specified is not obtainable, including copies of supplier's correspondence.
 - c) Review of sources is provisional, pending review of Plant Photographs for Prequalification.
 - 2) Substitutions: Submit any proposed substitutions, with itemized adjustments of Contract Price. No substitutions will be accepted unless approved in writing by the Architect at least seven days prior to bid.
- B. Plant Photographs for Prequalification:
 - 1. Not later than 60 days following the General Contractor's Notice to Proceed, provide Plant Photographs for prequalification:

- a. Two color photographs, minimum 3- by 5-inch (76- by 127-mm), of each required cultivar and size of plant material, as follows:
- 1) Take photographs from angles depicting true sizes and conditions of the material, representing the full range of qualities available within the lot.
 - 2) Include a scale rod or other measuring device in each photograph for reference.
 - 3) For trees, provide clear views of canopies to demonstrate representational form, vigor, and health. Provide clear views of trunks to demonstrate representational form, health, and absence of scars and damages. Remove trunk wrap.
 - 4) Arrange multiple photographs on letter-size pages in *.pdf format.
 - 5) Label each photograph with the following:
 - a) Plant key, as noted on the Plant Schedule.
 - b) Sequential number.
Botanical name, plant size, and name of the growing nursery.
 - c) Example:

GS-1
Genus species 'Cultivar'
The Nursery, Inc.
- b. Provide the above a minimum 21 days prior to tree-tagging trips.
2. Architect may reject individual plants, groups of plants, and/or suppliers on the basis of photographs submitted and/or other conditions deemed pertinent by the Architect.
 3. Do not dig or otherwise reserve other material prior to receiving Architect's approval of photos submitted for initial selection.
- C. Samples for Verification: For each of the following:
1. Mulch[es]: 1-pint volume of each mulch required; in clear, sealed, heavy-duty plastic bags or rigid containers, labeled with composition of materials by percentage of weight and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and makeup.
 2. Edging Materials and Accessories: Manufacturer's standard size, to verify color selected.
- D. Schedule: Two weeks following contract award, submit description of Work and schedule dates for each type of planting and maintenance. Re-submit as proposed schedule changes occur. Include dates for each of the following items of work:

1. Plant material order verification.
2. Delivery of plant materials to the project site.
3. Installation.
4. Substantial Completion.
5. Maintenance period.
6. Warranty period.
7. Final acceptance.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications: A qualified landscape installer who maintains an experienced full-time supervisor on Project site when exterior planting is in progress.
- B. Topsoil Analysis: Furnish soil analysis by a qualified soil-testing laboratory.
- C. Provide quality, size, genus, species, and variety of exterior plants indicated, complying with applicable requirements in ANSI Z60.1, "American Standard for Nursery Stock."
- D. Preinstallation Conference: Conduct conference at Project site.
- E. Urban Forester Notification: Notify the Project Officer at least 72 hours prior to commencement of tree planting operations, so that the County's Urban Forester can be present on-site to supervise the work.
- F. Delivery Inspection: Architect and Installer shall inspect plant material upon delivery to the site. Notify Architect not less than fourteen (14) days prior to delivery. Unload trees in an upright position with tops untied to enable inspection of all sides.
 1. For plant material not in accordance with the Contract Documents:
 - a. Reject and remove the plant material from site and replace within 2 days at no cost.
 - b. If approved in writing by the Architect, plant(s) not in accordance with Contract Documents may be provisionally accepted at lower value, as assessed by the Architect.
- G. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.
- H. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.
 1. Trees and Shrubs: Measure with branches and trunks or canes in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree or shrub for height and spread; do not measure branches or roots tip to tip. Take caliper measurements 6 inches (150 mm) above the root flare for trees up to 4-inch (100-mm) caliper size, and 12 inches (300 mm) above the root flare for larger sizes.
 - a. Measure following pruning, when pruning is required.

- b. When ranges are specified, provide minimum 50% of each respective plant size/type at the maximum size.
 2. Measure with stems, petioles, and foliage in their normal position.
- I. Source Limitations: All material of a specific size and cultivar shall be grown at the same nursery and in the same lot.
1. Notify Architect of sources of planting materials minimum 60 days in advance of delivery to site.
 2. Trees may be obtained from up to three different locations, each within approximately 75 miles of the Washington, D.C. metropolitan area, unless otherwise approved by the Architect.
- J. Lead Times: Some materials may require longer than anticipated lead times, seasonal dependencies, and/or may be in limited supply. No extensions of time or variations shall be considered if supply is compromised by late sourcing and/or ordering.
- K. Plant Material Observation: Architect may observe plant material either at place of growth or at site before planting for compliance with requirements for genus, species, variety, cultivar, size, and quality. Architect retains right to observe trees and shrubs further for size and condition of balls and root systems, pests, disease symptoms, injuries, and latent defects and to reject unsatisfactory or defective material at any time during progress of work. Remove rejected trees or shrubs immediately from Project site.
1. Notify Architect of sources of planting materials minimum 30 days in advance of delivery to site.
- L. Tagging: Following acceptable review of plant photographs for Initial Selection and Sources, Architect will select and tag trees at places of growth prior to being prepared for transplanting.
1. Notify Architect of request to tag trees minimum 21 days in advance of proposed date(s).
 2. Contractor shall limit tagging trips to no more than **[two]** at a maximum of one day each.
 3. Contractor is responsible for verifying that adequate numbers of acceptable trees are available at their place(s) of growth, as indicated in the List of Sources, for Architect's consideration prior to the tagging visit.
 4. Contractor shall pay for Architect's time and costs associated with tagging trip(s) in excess of that herein or if sufficient quantities and acceptable material, as defined by the Architect, are not available upon arrival.
 5. In lieu of tagging, and solely at the Architect's discretion, Architect may request Photographs for Final Selection of some or all individual trees to be tagged.

- a. Submit not less than two 5- by 8 inch clear, color photos of each individual tree being review, taken 90 degrees opposed to each other, depicting full view of trunk, structure, and canopy.
 - b. Comply with additional requirements of preceding Plant Photographs for Prequalification article.
6. Do not dig or otherwise reserve trees prior to Architect's tagging.
- a. The Contractor shall be responsible for all costs related to material dug and/or reserved prior to the above.
7. Approval of photographs of plants is for visual compliance only. Architect may subsequently reject previously pre-qualified individual plants at any time that no longer meet specification for reasons of damage, infestation, mineral deficiency, chlorosis, necrosis, circling roots, unsatisfactory subsequent growth, or other conditions that were not readily discernible at time of tagging or developed/occurred following tagging.
- M. Mockup: Construct a full-size mockup of fine grading for landforms, if applicable, at locations as directed in the field by Architect. Establish fine grading standards for sharp ridges, toes, and planar grading of slopes to the satisfaction of the Architect.
- 1. Notify Architect minimum 14 days' notice in advance of proposed date(s).
 - 2. If approved, mockup may be incorporated into the works.

1.07 PROJECT CONDITIONS

- A. Contractor is responsible for inspecting the site and reviewing entire set of Construction Documents to become familiar with effects and potential effects on Planting installation, including but not limited to the following: access, known and potentially known utilities, persistent winds, surface drainage, and drainage of subgrade.
- B. Field Measurements: Verify actual grade elevations, service and utility locations, irrigation system components, and dimensions of plantings and construction contiguous with new plantings by field measurements before proceeding with planting work.
- C. B&B Digging Restrictions: Dig during one of the following periods or as agreed to by the Nursery and Architect in writing:
 - 1. Spring digging for deciduous trees: April to May.
 - 2. Fall Digging for deciduous and evergreen trees: September to October.
- D. Planting Restrictions: Plant during one of the following periods. Coordinate planting periods with maintenance periods to provide required maintenance from date of Substantial Completion.
 - 1. Deciduous Trees and Shrubs: March 1 to May 30 or September 15 to December (Oak, tupelo, and beech shall be planted only in the spring, unless container-grown).

2. Evergreen Trees, Shrubs, Groundcover and Perennials: March 1 to May 15 or September 15 to November 15.
- E. Seasonal Contingencies: In the event that scheduled planting is delayed, Contractor is responsible for including and executing acceptable contingencies to reduce the risk of seasonal stress, meet completion dates, and protect the Warranty.
1. Acceptable contingencies may include:
 - a. Pre-digging and hardening-off.
 - b. Digging larger root ball.
 - c. Storage while in leaf.
 - d. Winterizing mulch.
 - e. Early planting of individual species more susceptible to stress.
 2. Unacceptable contingencies include:
 - a. Delayed planting of trees.
 - b. Species substitution.
- F. Weather Limitations: Proceed with planting only when existing and forecasted weather conditions permit planting to be performed when beneficial and optimum results may be obtained. Do not proceed with work when soil is frozen or wet. Apply products during favorable weather conditions according to manufacturers' written instructions and warranty requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, sweating, whipping, and other handling and tying damage. Do not bend or bind-tie trees or shrubs in such a manner as to destroy their natural shape. Provide protective covering of exterior plants during delivery. Do not drop exterior plants during delivery.
- B. Deliver exterior plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after delivery, set exterior plants trees in shade, protect from weather and mechanical damage, and keep roots moist.

1.09 WARRANTY

- A. Special Warranty: Warrant the following exterior plants, for the warranty period indicated, against defects including death and unsatisfactory growth, except for defects resulting from lack of adequate maintenance, neglect, or abuse by Owner, or incidents that are beyond Contractor's control.
 1. Warranty Period for Trees and Shrubs: One year from date of Final Completion.
 2. Warranty Period for Ground Cover and Plants: One year from date of Final Completion.

1.010 MAINTENANCE

- A. Trees and Shrubs: Maintain during warranty period by pruning, cultivating, watering, weeding, fertilizing, restoring planting saucers, tightening and repairing stakes and guy supports, and resetting to proper grades or vertical position, as required to establish healthy, viable plantings. Spray as required to keep trees and shrubs free of insects and disease.
- B. Ground Cover and Plants: Maintain during warranty period by watering, weeding, fertilizing, and other operations as required to establish healthy, viable plantings.

PART 2 - PRODUCTS

2.01 EXTERIOR PLANTS

- A. Tree and Shrub Material: Furnish nursery-grown trees and shrubs complying with ANSI Z60.1, with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock free of disease, insects, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.
 - 1. Provide balled and burlapped or container-grown trees and shrubs, as indicated on the Drawings.
- B. Perennials/Groundcovers/Grasses: Provide healthy, field-grown plants or bulbs (as indicated) from a commercial nursery, of species and variety shown in the Drawings.

2.02 PLANTING MATERIALS

- A. Topsoil: ASTM D 5268, pH range of 5.5 to 7, a minimum of 2 percent organic material content; free of stones 1 inch or larger in any dimension and other extraneous materials harmful to plant growth.
 - 1. Topsoil Source: see Section 329100 PLANTING PREPARATION.
- B. Inorganic Soil Amendments:
 - 1. Lime: ASTM C 602, Class T or O, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent.
 - 2. Sulfur: Granular, biodegradable, containing a minimum of 90 percent sulfur, with a minimum 99 percent passing through No. 6 sieve and a maximum 10 percent passing through No. 40 sieve.
- C. Organic Soil Amendments:
 - 1. Compost: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve.
 - 2. Peat: Sphagnum peat moss, partially decomposed, finely divided or granular texture, with a pH range of 3.4 to 4.8.

3. Wood Derivatives: Decomposed, nitrogen-treated sawdust, ground bark, or wood waste; of uniform texture, free of chips, stones, sticks, soil, or toxic materials.
- D. Fertilizer:
1. Superphosphate: Commercial, phosphate mixture, soluble; a minimum of 20 percent available phosphoric acid.
 2. Commercial Fertilizer: Commercial-grade complete fertilizer of neutral character, consisting of fast- and slow-release nitrogen, 50 percent derived from natural organic sources of urea formaldehyde, phosphorous, and potassium in the following composition:
 - a. Composition: 10 percent nitrogen, 6 percent phosphorous, and 4 percent potassium, by weight.
- E. Wood Chip Mulches:
1. Organic Mulch: Shredded hardwood.
 2. Compost Mulch: Well-composted, stable, and weed-free organic matter, pH range of 5.5 to 8; moisture content 35 to 55 percent by weight; 100 percent passing through 1-inch sieve.
- F. Weed-Control Barriers:
1. Nonwoven Fabric: Polypropylene or polyester fabric, 3 oz./sq. yd. minimum.
 2. Composite Fabric: Woven, needle-punched polypropylene substrate bonded to a nonwoven polypropylene fabric, 4.8 oz./sq. yd.

2.03 PLANTING SOIL MIX

- A. Planting Soil Mix: see Section 329100 – PLANTING PREPARATION

2.04 TEMPORARY WATERING DEVICES

- A. Slow-Release Watering Device: Standard product manufactured for drip-irrigation of plants and emptying its water contents over a period of 2 to 5 hours; manufactured from UV-light stabilized nylon-reinforced polyethylene sheet, PVC, or HDPE plastic.
1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include, but are not limited to, the following:
 - a. Spectrum Products, Inc; Treegator (Original).
 - b. A.M. Leonard Horticultural Tool and Supply Company; Leonard ArborRain Hydration System, 20 Gallon.
 - c. A.M. Leonard Horticultural Tool and Supply Company; Ooze Tube Tree Watering System, 25 Gallon

2.05 LANDSCAPE EDGINGS

- A. Steel Edging: Standard commercial-steel edging, rolled edge, fabricated in sections of standard lengths, with loops stamped from or welded to face of sections to receive stakes.
 - 1. Basis-of-Design Product: Subject to compliance with requirements, provide product indicated or a comparable product by one of the following:
 - a. Border Concepts, Inc.
 - b. Collier Metal Specialties, Inc.
 - c. Russell, J. D. Company (The).
 - d. Sure-Loc Edging Corporation.
 - 2. Edging Size: 4 inch minimum height, 1/8 inch minimum thickness
 - 3. Accessories: Standard stakes, tapered ends, corners, and splicers.
 - 4. Finish: Enamel based paint.
 - 5. Paint Color: Black

PART 3 - EXECUTION

3.01 EXTERIOR PLANTING

- A. Bed Establishment:
 - 1. Loosen subgrade of planting beds to a minimum depth of 24 inches.
 - 2. Remove stones larger than 1 inch in any dimension and sticks, roots, rubbish, and other extraneous matter and legally dispose of them off Owner's property.
 - 3. Thoroughly blend planting soil mix off-site before spreading or spread topsoil, apply soil amendments and fertilizer on surface, and thoroughly blend planting soil mix.
 - 4. Spread planting soil mix to a depth of 24 inches but not less than required to meet finish grades after natural settlement. Do not spread if planting soil or subgrade is frozen, muddy, or excessively wet.
 - 5. Finish Grading: Grade planting beds to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.
- B. Trees and Shrubs:
 - 1. Pits and Trenches: Excavate circular pits with sides sloped inward. Trim base leaving center area raised slightly to support root ball and assist in drainage. Do not further disturb base. Scarify sides of plant pit smeared or smoothed during excavation. Excavate approximately three times as wide as ball diameter.

2. Set trees and shrubs plumb and in center of pit or trench with top of root ball 1 inch above adjacent finish grades.
 - a. Balled and Burlapped: Remove burlap and wire baskets from tops of root balls and partially from sides, but do not remove from under root balls. Remove pallets, if any, before setting. Do not use planting stock if root ball is cracked or broken before or during planting operation.
 - b. Container Grown: Carefully remove root ball from container without damaging root ball or plant.
 - c. Place planting soil mix around root ball in layers, tamping to settle mix and eliminate voids and air pockets. When pit is approximately one-half backfilled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed. Water again after placing and tamping final layer of planting soil mix. Never cover top of tree ball with soil.
 3. Organic Mulching: Apply 3-inch average thickness of organic mulch extending 12 inches beyond edge of planting pit or trench. Do not place mulch within 3 inches of trunks or stems.
- C. Tree and Shrub Pruning: Prune, thin, and shape trees and shrubs according to standard horticultural practice. Prune trees to retain required height and spread. Do not cut tree leaders; remove only injured or dead branches from flowering trees. Prune shrubs to retain natural character. Shrub sizes indicated are sizes after pruning.
- D. Ground Cover, Vine, and Perennials Planting:
1. Set out and space ground cover and plants as indicated.
 2. Dig holes large enough to allow spreading of roots, and backfill with planting soil.
 3. Work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water.
 4. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.
 5. Protect plants from hot sun and wind; remove protection if plants show evidence of recovery from transplanting shock.
- E. Planting Bed Mulching:
1. Completely cover area to be mulched, overlapping edges a minimum of 6 inches.
 2. Mulch backfilled surfaces of planting beds and other areas indicated. Apply 3-inch average thickness of mulch, and finish level with adjacent finish grades. Do not place mulch against plant stems.

- F. Protect exterior plants from damage due to landscape operations, operations by other contractors and trades, and others. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged exterior planting.
- G. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, and debris, and legally dispose of them off Owner's property.

3.02 INSTALLING SLOW-RELEASE WATERING DEVICE

- A. Provide one device for each tree.
- B. Place device on top of the mulch at base of tree and fill with water according to manufacturer's written instructions.

3.03 EDGING INSTALLATION

- A. **Steel Edging:** Install steel edging where indicated according to manufacturer's written instructions. Anchor with steel stakes spaced approximately 30 inches (760 mm) apart, driven below top elevation of edging.

3.04 PLANT MAINTENANCE

- A. **Maintenance Period:**
 - 1. 90 days from date of Substantial Completion.
 - 2. Throughout length of Warranty Period.
- B. Maintain plantings throughout Maintenance Period by pruning, cultivating, providing supplementary water, weeding, fertilizing, mulching, restoring planting grade, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings. Treat as required to keep plant material free of insects and disease. Monitor for boring insects and signs of stress.
 - 1. Contractor remains responsible for Maintenance operations herein, except where specific maintenance operations are turned over to and accepted in writing by the Owner.
- C. **Grow-in Watering:** Ensure that adequate moisture is provided to all plants.
 - 1. **General:**
 - a. Water thoroughly at time of planting.
 - b. Provide water weekly for a period of 1 month following planting. Provide a minimum of 1 inch of precipitation per week.
 - c. Provide water bi-weekly for 2 additional months.
 - d. Provide additional watering during periods of heat and drought as necessary to maintain good health and vigor of all plant material.

2. Advise the Architect if adjustments are required to the automatic irrigation system to provide adequate moisture to plant materials.
 - a. The Contractor remains responsible for providing adequate and appropriate water to all areas of the plantings.
 3. Slow Release Watering Devices may be used.
 - a. Provide water delivery at uniform rate, appropriate to the soil, exposure, and other relevant conditions.
 - b. Scout weekly to provide seasonal adjustment to application rate, reset to proper position, correct clogged or missing emitters, and replaced damaged and missing Devices. Provide documentation of each visit, signed by Owner's representative, noting conditions encountered, deficient devices, and remedial action taken
- D. Weeding:
1. Promptly remove weeds from tree plantings.
 2. Do not let weeds exceed 10% of total ground cover in herbaceous plantings.
- E. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.
- F. Provide Integrated Pest Management (IPM) and chemical and biological treatments during maintenance and aftercare period, by Certified Pesticide Applicator. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.
- 3.05 Fertilizer, General: Fertilize 60 days after Substantial Completion.

END OF SECTION 329300

DIVISION 33

UTILITIES

SECTION 331116 - WATER DISTRIBUTION

PART 1 - GENERAL

1.01 SUMMARY

- A. This Section includes water-distribution piping and related components outside the for water service.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Shop Drawings: Detail precast concrete vault assemblies and indicate dimensions, method of field assembly, and components.
- C. Field quality-control test reports.
- D. Operation and maintenance data.

1.04 QUALITY ASSURANCE

- B. Regulatory Requirements:
 - 1. Comply with requirements of utility company supplying water. Include tapping of water mains and backflow prevention.
 - 2. Comply with standards of authorities having jurisdiction for potable-water-service piping, including materials, installation, testing, and disinfection.
 - 3. Comply with standards of authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
 - 4. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.

1.05 COORDINATION

- A. Coordinate connection to water main with utility company.

PART 2 - PRODUCTS

2.01 PIPE AND FITTINGS

- A. Soft Copper Tube: ASTM B 88, Type K, water tube, annealed temper.
- B. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.
- C. Hard Copper Tube: ASTM B 88, Type K, water tube, drawn temper.

- D. Copper, Solder-Joint Fittings: ASME B16.18, cast-copper-alloy or ASME B16.22, wrought-copper, solder-joint pressure type. Furnish only wrought-copper fittings if indicated.

2.02 JOINING MATERIALS

- A. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.
- B. Brazing Filler Metals: AWS A5.8, BCuP Series.

2.03 PIPING SPECIALTIES

- A. Transition Fittings: Manufactured fitting or coupling same size as, with pressure rating at least equal to and ends compatible with, piping to be joined.
- B. Tubular-Sleeve Pipe Couplings:
 - 1. Description: Metal, bolted, sleeve-type, reducing or transition coupling, with center sleeve, gaskets, end rings, and bolt fasteners and with ends of same sizes as piping to be joined.
 - a. Standard: AWWA C219.

2.04 GATE VALVES

- A. Description: 3/4" lead free, brass, ball valve; Model LFB6011 by Watts Water Technologies, Inc. or approved equal.
 - 1. Valve Box:
 - a. Lid and frame as manufactured by Advance Drainage Systems, Inc. or approved equal.
 - b. Manufactured or supplied by the manufacturer or approved equal per details shown on Construction Drawings.

2.05 CONCRETE VAULTS

- B. Description: Utility Vault Model 550-CUS by Smith-Midland PCC or approved equal per details shown on Construction Drawings.
 - 1. Manhole:
 - a. Ductile Iron Vault Cover and frame by Nyloplast-ADS or approved equal, painted black.
 - 2. Drain: 4" Typ. Drain line with strainer connected to drainage system.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Refer to Division 30 Section "Earthwork" for excavating, trenching, and backfilling.

3.02 PIPING APPLICATIONS

- A. General: Use pipe, fittings, and joining methods for piping systems according to the following applications.
- B. Transition couplings and special fittings with pressure ratings at least equal to piping pressure rating may be used, unless otherwise indicated.
- C. Do not use flanges or unions for underground piping.
- D. Flanges, unions, and special fittings may be used, instead of joints indicated, on aboveground piping and piping in vaults.
- E. Underground water-service piping NPS 3/4 to NPS 3 shall be soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- F. Underground water-service piping NPS 4 and NPS 6 shall be the following:
 - 1. Soft copper tube, ASTM B 88, Type K; wrought-copper, solder-joint fittings; and brazed joints.
- G. Water Meter Box Water-Service Piping NPS 3/4 to NPS 2 shall be same as underground water-service piping.

3.03 VALVE APPLICATIONS

- A. General Application: Use mechanical-joint-end valves for NPS 3 and larger underground installation. Use threaded- or flanged-end valves for installation in vaults. Use UL/FMG, nonrising-stem gate valves for installation with indicator posts. Use corporation valves and curb valves with ends compatible with piping, for NPS 2 and smaller installation.
- B. Drawings indicate valve types to be used. Where specific valve types are not indicated, the following requirements apply: Retain one of first two subparagraphs below.
 - 1. Underground Valves, NPS 3 and Larger: AWWA, cast-iron, nonrising-stem, metal-seated gate valves with valve box.
 - 2. Underground Valves, NPS 4 and Larger, for Indicator Posts: UL/FMG, cast-iron, nonrising-stem gate valves with indicator post.
 - 3. Use the following for valves in vaults and aboveground:
 - a. Gate Valves, NPS 2 and Smaller: Bronze.
 - b. Gate Valves, NPS 3 and Larger: AWWA, cast iron, OS&Y rising stem, metal seated.

3.04 PIPING INSTALLATION

- A. Water-Main Connection: Arrange with utility company for tap of size and in location indicated in water main.
 - 1. Make connections NPS 2 and smaller with drilling machine according to the following:
 - a. Install service-saddle assemblies and corporation valves in size, quantity, and arrangement required by utility company standards.
 - b. Install service-saddle assemblies on water-service pipe to be tapped. Position outlets for corporation valves.
 - c. Use drilling machine compatible with service-saddle assemblies and corporation valves. Drill hole in main. Remove drilling machine and connect water-service piping.
 - d. Install corporation valves into service-saddle assemblies.
 - e. Install manifold for multiple taps in water main.
 - f. Install curb valve in water-service piping with head pointing up and with service box.
- B. Bury piping with depth of cover over top at least 42 inches, with top at least 12 inches below level of maximum frost penetration.

3.05 JOINT CONSTRUCTION

- A. Make pipe joints according to the following:
 - 1. Install copper tube and fittings according to CDA's "Copper Tube Handbook."

3.06 ANCHORAGE INSTALLATION

- A. Anchorage, General: Anchorages that may be used include the following:
 - 1. Locking mechanical joints.
 - 2. Set-screw mechanical retainer glands.
 - 3. Bolted flanged joints.
 - 4. Heat-fused joints.
 - 5. Pipe clamps and tie rods.
- B. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.07 VALVE INSTALLATION

- A. AWWA Gate Valves: Comply with AWWA C600 and AWWA M44. Install each underground valve with stem pointing up and with valve box.
- B. UL/FMG, Gate Valves: Comply with NFPA 24. Install each underground valve and valves in vaults with stem pointing up and with vertical cast-iron indicator post.
- C. MSS Valves: Install as component of connected piping system.

- D. Corporation Valves and Curb Valves: Install each underground curb valve with head pointed up and with service box.

3.08 FIELD QUALITY CONTROL

- A. Piping Tests: Conduct piping tests before joints are covered. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
- B. Hydrostatic Tests: Test at not less than one-and-one-half times working pressure for two hours.
 - 1. Increase pressure in 50-psig increments and inspect each joint between increments. Hold at test pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour. Maximum allowable leakage is 2 quarts per hour per 100 joints. Remake leaking joints with new materials and repeat test until leakage is within allowed limits.
- C. Prepare reports of testing activities.

3.09 IDENTIFICATION

- A. Install continuous underground warning tape during backfilling of trench for underground water-distribution piping. Locate below finished grade, directly over piping. Underground warning tapes are specified in Division 02 Section "Earthwork."

3.010 CLEANING

- A. Clean and disinfect water-distribution piping as follows:
 - 1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use.
 - 2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet.
 - 3. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or do as follows:
 - a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
 - b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
 - c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
 - d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination.

- B. Prepare reports of purging and disinfecting activities.

END OF SECTION 331116

SECTION 334000 - STORM DRAINAGE

PART 1 - GENERAL

1.01 SUMMARY

- A. Site storm sewer drainage piping, fitting, accessories, and bedding.

1.02 RELATED SECTIONS

- A. Section 312000 - Earthwork
- B. Virginia Erosion and Sedimentation Control Handbook, Latest Edition
- C. Underground Utility Protection Ordinance – Chapter 55 Arlington County Code
- D. Local Governing Authority and Code Requirements – Chapter. 57 Arlington County Code
- E. Arlington County DES Construction Standards and Specifications
- F. Construction Drawings

1.03 REFERENCE STANDARDS

- A. American Society for Testing and Materials (ASTM) latest edition.
 - 1. A 536 Ductile Iron Castings
 - 2. D 1056 Flexible Cellular Materials
 - 3. D 2321 Underground Installation of Flexible Thermoplastic Sewer Pipe
 - 4. D 3034 Type PSM Poly (Vinyl Chloride) (PVC) Sewer Pipe and Fittings
 - 5. D 3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
 - 6. D 5926 Poly (Vinyl Chloride) (PVC) Gaskets for Drain and Sewer Systems.
 - 7. F 477 Elastomeric Seals for Joining Plastic Pipe
 - 8. F 1336 Poly (Vinyl Chloride)(PVC) Gasketed Sewer Fittings
 - 9. F 2619 Standard Specification for High-Density Polyethylene (PE) Line Pipe
- B. American Association of State Highway and Transportation Officials (AASHTO) latest edition.
 - 1. M 252 Corrugated Polyethylene Drainage Pipe
 - 2. M 294 Corrugated Polyethylene Pipe

1.04 SUBMITTALS

- A. Product Data: Provide data on all pipe materials, pipe fittings, and accessories.
- B. Shop Drawings: Provide shop drawings for inlet and manhole installation.

- C. Product Certificates: For each type of cast-iron pipe and fitting, from manufacturer.

1.05 PROJECT CONDITIONS

- A. Accurately record actual locations of pipe runs, connections, inlets, cleanouts, and invert elevations.
- B. Identify and describe unexpected variations to subsoil conditions and location of uncharted utilities.
- C. Interruption of Existing Storm Drainage Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated.
- D. Coordinate work with replacement of storm sewer inlets and connection to existing storm sewer system.

1.06 QUALITY ASSURANCE

- A. A manufacturer's certification that the product was manufactured, tested, and supplied in accordance with this specification, together with a report of the test results, and the date of each test was completed, shall be signed by a person authorized by the manufacturer.

PART 2 - PRODUCTS

2.01 PE PIPE AND FITTINGS

- A. Corrugated PE Drainage Pipe and Fittings NPS 3 to NPS 10: AASHTO M 252M, type S, with smooth waterway for coupling joints.
 - 1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
 - 2. Soiltight Couplings: AASHTO M 252M, corrugated, matching tube and fittings.
- B. Corrugated PE Pipe and Fittings NPS 12 to NPS 60: AASHTO M 2594M, Type S, with smooth waterway for coupling joints.
 - 1. Silttight Couplings: PE sleeve with ASTM D 1056, Type 2, Class A, Grade 2 gasket material that mates with pipe and fittings.
 - 2. Soiltight Couplings: AASHTO M 294M, corrugated, matching pipe and fittings.

2.02 PVC PIPE AND FITTINGS

A. PVC Corrugated Sewer Piping:

1. Pipe: ASTM F 949, PVC, corrugated pipe with bell-and-spigot ends for gasketed joints.
2. Fittings: ASTM F 949, PVC molded or fabricated, socket type.
3. Gaskets: ASTM F 477, elastomeric seals.

2.03 NONPRESSURE TRANSITION COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.

B. Sleeve Materials:

1. For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.

C. Unshielded, Flexible Couplings:

1. Description: Elastomeric sleeve with stainless-steel shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.

D. Shielded, Flexible Couplings:

1. Description: ASTM C 1460, elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

E. Ring-Type, Flexible Couplings:

1. Description: Elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

2.04 INLETS AND CATCH BASINS

A. Lid and frame as manufactured by Advanced Drainage Systems, Inc or equivalent.

1. Manufactured or supplied by the inlet manufacturer or equivalent per details shown on Construction Drawings.
2. Shall be made specifically for each drain basin so as to provide a round bottom flange that closely matches the diameter of the surface drainage inlet.
3. Shall be capable of supporting H-10 loading for pedestrian traffic.

B. Metal used from the manufacture of the castings shall conform to ASTM A 536 grade 70-50-05 for ductile iron and shall be provided painted black.

C. Drain Basins as manufactured by Advanced Drainage Systems, Inc or equivalent.

1. Shall be manufactured from PVC pipe stock, utilizing a thermo-molding process to reform the pipe stock to the specified configuration, to be ADS or equivalent manufactured to dimensions specified on Construction Drawings.
- D. Structure construction in accordance with manufacturer's instructions and details shown on Construction Drawings.
1. The drainage pipe connection stubs shall be manufactured from PVC stock and formed to provide a watertight connection with the specified pipe system.
 2. The joint tightness shall conform to ASTM D3212 for joints for drain and sewer plastic pipe using flexible electrometric seals.
 3. The pipe bell spigot shall be joined to the main body of the drain basin. This pipe stick used to manufacture the main body and pipe stubs of the surface drainage inlets shall meet the mechanical property requirements for fabricated fittings as described by ASTM D3034, Standard for Sewer PVC Pipe and Fittings: ASTM F1336 Standard for PVC Gasketed Sewer Fittings.

2.05 PIPE OUTLETS

- A. End Sections: HDPE Flared End Section by Advance Drainage Systems, Inc. or equivalent.

1. The invert of the pipe and the end section shall be the same elevation.

2.06 POLYMER-CONCRETE, CHANNEL DRAINAGE SYSTEMS

- A. General Requirements for Polymer-Concrete, Channel Drainage Systems: Modular system of precast, polymer-concrete channel sections, grates, and appurtenances; designed so grates fit into channel recesses without rocking or rattling. Include quantity of units required to form total lengths indicated.

1. Sloped-Invert, Polymer-Concrete Systems:

2. Channel Sections:

- a. Interlocking-joint, precast, modular units with end caps.
- b. 4-inch (102-mm) inside width and deep, rounded bottom, with built-in invert slope of 0.6 percent and with outlets in quantities, sizes, and locations indicated.
- c. Extension sections necessary for required depth.
- d. Frame: Include gray-iron or steel frame for grate.

3. Grates:

- a. Manufacturer's designation "Medium Duty," with slots or perforations that fit recesses in channels. Must be ADA accessible

4. Material: Gray iron

- B. Locking Mechanism: Manufacturer's standard device for securing grates to channel sections.

PART 3 - EXECUTION

3.01 EARTHWORK

- A. Excavation, trenching, and backfilling are specified in Section 023150 – Earthwork.

3.02 PIPING INSTALLATION

- A. General Locations and Arrangements: Drawing plans and details indicate general location and arrangement of underground storm drainage piping. Location and arrangement of piping layout take into account design considerations. Install piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Install piping beginning at low point, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
- C. When installing pipe under streets or other obstructions that cannot be disturbed, use pipe-jacking process of microtunneling.
- D. Install gravity-flow, nonpressure drainage piping according to the following:
 - 1. Install piping pitched down in direction of flow.
 - 2. Install piping-NPS 6 and larger with restrained joints at tee fittings and at changes in direction. Use corrosion-resistant rods, pipe or fitting manufacturer's proprietary restraint system, or cast-in-place concrete supports or anchors.
 - 3. Install piping with 24 inch minimum cover.
 - 4. Install PE corrugated sewer piping according to ASTM D 2321.

3.03 PIPE JOINT CONSTRUCTION

- A. Join gravity-flow, nonpressure drainage piping according to the following:
 - 1. Join corrugated PE piping according to ASTM D 3212 for push-on joints.

3.04 CATH BASIN INSTALLATION

- A. Form bottom of excavation clean and smooth to correct elevation.
- B. Refer to Construction Drawings and manufacturer's instructions and requirements.

3.05 CONNECTIONS

- A. Make connections to existing piping and underground manholes.
 - 1. Make branch connections from side into existing piping, NPS 21 or larger, or to underground manholes and structures by cutting into existing unit and creating an opening large enough to allow 3 inches of concrete to be packed around entering

connection. Cut end of connection pipe passing through pipe or structure wall to conform to shape of and be flush with inside wall unless otherwise indicated. On outside of pipe, manhole, or structure wall, encase entering connection in 6 inches of concrete for minimum length of 12 inches (300 mm) to provide additional support of collar from connection to undisturbed ground.

- a. Use concrete that will attain a minimum 28-day compressive strength of 3000 psi, unless otherwise indicated.
 - b. Use epoxy-bonding compound as interface between new and existing concrete and piping materials.
2. Protect existing piping, manholes, and structures to prevent concrete or debris from entering while making tap connections. Remove debris or other extraneous material that may accumulate.
- B. Pipe couplings and expansion joints with pressure ratings at least equal to piping rating may be used in applications below, unless otherwise indicated.
1. Use nonpressure-type flexible couplings where required to join gravity-flow, nonpressure sewer piping, unless otherwise indicated.
 - a. Shielded flexible couplings for same or minor difference OD pipes.
 - b. Unshielded, increaser/reducer-pattern, flexible couplings for pipes with different OD.
 - c. Ring-type flexible couplings for piping of different sizes where annular space between smaller piping's OD and larger piping's ID permits installation.

3.06 IDENTIFICATION

- A. Materials and their installation are specified in Division 31 Section "Earthwork." Arrange for installation of green warning tape directly over piping and at outside edge of underground structures.
1. Use detectable warning tape over ferrous piping.
 2. Use detectable warning tape over nonferrous piping and over edges of underground structures.

3.07 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.
- B. Submit separate report for each system inspection.
- C. Defects requiring correction include the following:
1. Alignment: Less than full diameter of inside of pipe is visible between structures.

2. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
 3. Crushed, broken, cracked, or otherwise damaged piping.
 4. Infiltration: Water leakage into piping.
 5. Exfiltration: Water leakage from or around piping.
- D. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
- E. Re-inspect and repeat procedure until results are satisfactory.
- F. Test new piping systems, and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
- G. Do not enclose, cover, or put into service before inspection and approval.
- H. Test completed piping systems according to requirements of authorities having jurisdiction.
- I. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
- J. Submit separate report for each test.
- K. Air Tests: Test storm drainage according to requirements of authorities having jurisdiction, UNI-B-6, and the following:
1. Option: Test plastic gravity sewer piping according to ASTM F 1417.
 2. Leaks and loss in test pressure constitute defects that must be repaired.
- L. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

END OF SECTION 334000

SECTION 33 46 01 –SUBDRAINAGE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes subdrainage systems for the following:
 - 1. Bio-retention Areas
 - 2. Planting Areas (as specified on drawings)
- B. This Section does not include the following:
 - 1. Subdrainage systems for foundation, underslab, or plaza deck drainage.
 - 2. Use of drainage panels against and for waterproofing membrane protection.

1.03 DEFINITIONS

- A. ABS: Acrylonitrile-butadiene-styrene plastic.
- B. HDPE: High-density polyethylene plastic.
- C. PE: Polyethylene plastic.
- D. PP: Polypropylene plastic.
- E. PS: Polystyrene plastic.
- F. PVC: Polyvinyl chloride plastic.
- G. Subdrainage: Drainage system that collects and removes subsurface or seepage water.

1.04 SUBMITTALS

- A. The Contractor acknowledges its responsibility to submit complete submittals in a timely fashion. Failure to do so may result in automatic rejection of work and/or materials. Incomplete submittals will be returned to the Contractor unreviewed. No time extensions or cost increases will be allowed for delays or costs caused by un-submitted or late submittals or the return of incomplete or incorrect submittals.
- B. Product Data: For the following:

1. Perforated-wall pipe and fittings.
 2. Solid-wall pipe and fittings.
 3. Drainage conduits.
 4. Drainage panels.
 5. Geotextile filter fabrics.
- A. Samples: 12-by-12-inch (300-by-300-mm) Sample of each geotextile.
- B. Shop Drawings: Plan identifying all planter subdrainage pipes, drainage boards, and appurtenances. Indicate all conduits and conduit sizes, as well as each connection to the adjacent storm water system and/or approved outfall, whether one is indicated or not

PART 2 - PRODUCTS

2.01 MANUFACTURERS

- A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:
1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, manufacturers specified.

2.02 PIPING MATERIALS

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

2.03 PERFORATED-WALL PIPES AND FITTINGS

- A. General: Fabric socks are prohibited.
- B. Perforated PE Pipe and Fittings:
1. NPS 6 (DN 150) and Smaller: ASTM F 405 or AASHTO M 252, Type CP; corrugated, for coupled joints.
 2. NPS 8 (DN 200) and Larger: ASTM F 667; AASHTO M 252, Type CP; or AASHTO M 294, Type CP; corrugated; for coupled joints.
 3. Couplings: Manufacturer's standard, band type.
 4. Perforations: Per AASHTO Class I.

2.04 SOLID-WALL PIPES AND FITTINGS

- A. ABS Sewer Pipe and Fittings: ASTM D 2751.
1. Solvent Cement: ASTM D 2235.

2. Gaskets: ASTM F 477, elastomeric seal.
- B. PE Drainage Tubing and Fittings: AASHTO M 252, Type S, corrugated, with smooth waterway, for coupled joints.
 1. Couplings: AASHTO M 252, corrugated, band type, matching tubing and fittings.
- C. PE Pipe and Fittings: AASHTO M 294, Type S, corrugated, with smooth waterway, for coupled joints.
 1. Couplings: AASHTO M 294, corrugated, band type, matching tubing and fittings.

2.05 CLEANOUTS

- A. PVC Cleanouts: ASTM D 3034, PVC cleanout threaded, countersunk plug and threaded pipe hub.

2.06 DRAINAGE PANELS

- A. Molded-Strip Drainage Panels: Prefabricated geocomposite, with drainage core faced with geotextile filter fabric.
 1. FIBAR 300 or approved equal
 2. Drainage Core: Three-dimensional, non-biodegradable, molded PP or PS.
 3. Filter Fabric: Non-woven needle-punched geotextile, manufactured for subsurface drainage, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with the following properties determined according to AASHTO M 288:
- B. Oblong corrugated pipe and fittings for use in subsurface drainage applications made from polyethylene with a minimum cell classification of 424420C as defined and described in the latest version of ASTM D3350.
 1. Panel Dimension: 1½ by 12½ inches.
 2. Slot Length: 1.125 inches (29 mm) average.
 3. Slot Width: 0.125 (3.2 mm) average.
 4. Water Inlet Area: 15 square inches/foot

2.07 SOIL MATERIALS

- A. Backfill, drainage course, impervious fill, and satisfactory soil materials are specified in Division 02 Earthwork .

2.08 GEOTEXTILE FILTER FABRICS

- A. Description: Fabric of PP or polyester fibers or combination of both, with flow rate range from 110 to 330 gpm/sq. ft. (4480 to 13 440 L/min. per sq. m) when tested according to ASTM D 4491.

1. Structure Type: Nonwoven, needle-punched continuous filament.
2. Style(s): Flat.

2.09 DRAINAGE COURSES

- A. Drainage Aggregate: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch (37.5-mm) sieve and 0 to 5 percent passing a No. 8 (2.36-mm) sieve.
- B. Leveling Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone; ASTM D 2940; size as indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine surfaces and areas for suitable conditions where subdrainage systems are to be installed.
- B. If subdrainage is required for landscaping, locate and mark existing utilities, underground structures, and aboveground obstructions before beginning installation and avoid disruption and damage of services.
- C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 EARTHWORK

- A. Excavating and trenching are specified in Division 31 Section "Earth Moving." Backfill of planting areas is specified in Division 31 Section "Earth Moving – Landscape."

3.03 PIPING APPLICATIONS

- A. Underground Subdrainage Piping:
 1. Perforated PE pipe and fittings, couplings, and coupled joints.
- B. Header Piping:
 1. ABS pipe and fittings, solvent-cemented joints.
 2. PE drainage tubing and fittings, couplings, and coupled joints.

3.04 CLEANOUT APPLICATIONS

- A. In Underground Subdrainage Piping:
 1. At Grade in Earth: PVC cleanouts.
 2. At Grade in Paved Areas: Cast-iron cleanouts.

3.05 DRAINAGE CONDUIT INSTALLATION

- A. Provide trench width to allow installation of drainage conduit. Grade bottom of trench excavations to required slope, and compact to firm, solid bed for drainage system.
- B. Lay flat-style geotextile filter fabric in trench and overlap trench sides.
- C. Place supporting layer of drainage course over compacted subgrade and geotextile filter fabric, to compacted depth of not less than 4 inches (100 mm).
- D. Install drainage conduits as indicated in Part 3 "Piping Installation" Article for landscaping subdrainage with horizontal distance of at least 6 inches (150 mm) between conduit and trench walls. Wrap drainage conduits without integral geotextile filter fabric with flat-style geotextile filter fabric before installation. Connect fabric sections with adhesive tape.
- E. Add drainage course to top of drainage conduits.
- F. After satisfactory testing, cover drainage conduit to within 12 inches (300 mm) of finish grade.
- G. Install drainage course and wrap top of drainage course with flat-style geotextile filter fabric.
- H. Place layer of flat-style geotextile filter fabric over top of drainage course, overlapping edges at least 4 inches (100 mm).
- I. Place initial backfill material over compacted drainage course. Place material in loose-depth layers not exceeding 6 inches (150 mm). Compact each layer to 85% density in planting areas. Final backfill to finish elevations and slope away from building.

3.06 LEVELING COURSE

- A. Place Leveling Course on subgrades free of moisture, mud, frost, snow, or ice.
 - 1. Install indicated geotextile on prepared subgrade according to Manufacturer's written instructions, overlapping sides and ends.
 - 2. Place drainage course 6 inches (150 mm) or less in compacted thickness in a single layer.
 - 3. Place drainage course that exceeds 6 inches (150 mm) in compacted thickness in layers of equal thickness, with no compacted layer more than 6 inches (150 mm) thick or less than 3 inches (75 mm) thick.
- B. Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with grade to cross sections, lines, and elevations indicated.
 - 1. Compact each layer of drainage course to required cross sections and thicknesses to not less than 95 percent of maximum dry unit weight according to ASTM D 698.
 - 2. Provide a smooth transition between adjacent existing grades and new grades.
 - 3. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

- a. Plus or minus 1/4 inch (6 mm) unless otherwise indicated.

3.07 PIPING INSTALLATION

- A. Install piping beginning at low points of system, true to grades and alignment indicated, with unbroken continuity of invert. Bed piping with full bearing in filtering material. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions and other requirements indicated.
 1. Landscaping Subdrainage: Install piping pitched down in direction of flow, at a minimum slope of 0.5 percent and with a minimum cover of 36 inches (915 mm), unless otherwise indicated.
 2. Lay perforated pipe with perforations down.
 3. Excavate recesses in trench bottom for bell ends of pipe. Lay pipe with bells facing upslope and with spigot end entered fully into adjacent bell.
- B. Use increasers, reducers, and couplings made for different sizes or materials of pipes and fittings being connected. Reduction of pipe size in direction of flow is prohibited.
- C. Install ABS piping according to ASTM D 2321
- D. Install PE piping according to ASTM D 2321.
- E. Install Drainage Panels per Manufacturer's written specifications.

3.08 PIPE JOINT CONSTRUCTION

- A. Join ABS pipe and fittings according to ASTM D 2751.
- B. Join PE pipe, tubing, and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties."
- C. Join perforated, PE pipe and fittings with couplings for soil-tight joints according to AASHTO's "Standard Specifications for Highway Bridges," Division II, Section 26.4.2.4, "Joint Properties"; or according to ASTM D 2321.
- D. Join Drainage Panels per Manufacturer's written specifications.

3.09 CLEANOUT INSTALLATION

- A. Cleanouts for Landscaping Subdrainage:
 1. Install cleanouts from piping to grade. Locate cleanouts at beginning of piping run and at changes in direction. Install fittings so cleanouts open in direction of flow in piping.
 2. In non-vehicular-traffic areas, use NPS 4 (DN 100) cast-iron or PVC pipe and fittings, as indicated, for piping branch fittings and riser extensions to cleanout. Set cleanout frames and covers in a cast-in-place concrete anchor, 12 by 12 by 4

inches (300 by 300 by 100 mm) in depth. Set top of cleanout plug 1 inch (25 mm) above grade.

3.010 CONNECTIONS

- A. Drawings indicate general arrangement of piping, fittings, and specialties.
- B. Connect low elevations of subdrainage system to solid-wall-piping storm drainage system.

3.011 FIELD QUALITY CONTROL

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

3.012 CLEANING

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

END OF SECTION 33 46 01