VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY
PROCUREMENT DEPARTMENT

ADDENDUM NO. 1

DATE:	May 19, 2026
TO:	All Offerors
FROM:	Kim Widrig, Contracting Officer
TOTAL PAGE(S):	2 pages (not including attachments)
SOLICITATION TITLE:	Improve Center Woods Complex
SOLICITATION NUMBER:	049302624

I. CLARIFICATIONS AND ADDITIONAL INFORMATION

None

II. REQUESTS FOR INFORMATION

1. Specification Section 042000 – Unit Masonry is listed in the table of contents but was not included in the provided project manual. Please provide the complete specification section.

   Virginia Tech Response: *Section 042000 – Unit Masonry will not be provided as a separate specification. Relevant unit masonry information is provided on sheets* ***S-001.***

2. Specification Section 232100 – Excavation, Trenching, Backfilling and Grading is listed in the table of contents but was not included in the provided project manual. Please provide the complete specification section.

   Virginia Tech Response: *Section 232100 – Excavation, Trenching, Backfilling and Grading will not be provided as a separate specification. All relevant information is provided in* ***Sections 331000 – Exterior Water System, 333000 – Sanitary Sewerage, and 334100 – Storm Drainage.***

3. Division 31 specifications appear to be missing from the provided project manual/specification book. The following sections were not included:

   311000 – Site Clearing
   312000 – Earthwork
   312500 – Erosion Control

   Please provide the complete specification sections and confirm any associated project requirements.

   Virginia Tech Response: ***Sections 311000 – Site Clearing, 312000 – Earthwork,*** *and* ***312500 – Erosion Control*** *have been provided in* ***Exhibit A.***

4. Division 32 specifications appear to be missing from the provided project manual/specification book. The following sections were not included:

   321216 – Asphalt Paving
   321313 – Site Concrete
   321700 – Pavement Markings, Signs, and Specialties
   329000 – Plants
   329200 – Turfs and Grasses

   Please provide the complete specification sections and confirm any associated project requirements.

   Virginia Tech Response: *Sections 321216 – Asphalt Paving, 321313 – Site Concrete, 321700 – Pavement Markings, Signs, and Specialties, 329000 – Plants,* *and* ***329200 – Turfs and Grasses*** *have been provided in* ***Exhibit A.***

5. Division 33 specifications appear to be missing from the provided project manual/specification book. The following sections were not included:

   331000 – Exterior Water System
   333000 – Sanitary Sewage
   334100 – Storm Drainage

   Virginia Tech Response: *Sections 331000 – Exterior Water System, 333000 – Sanitary Sewage,* *and* ***334100 – Storm Drainage*** *have been provided in* ***Exhibit A.***

EXHIBIT A
Missing Specification Sections from Project Manual

SECTION 042000 – UNIT MASONRY

All specifications and requirements for Unit Masonry is provided on Drawing Sheet S-001 under "Concrete Masonry Notes".

END OF SECTION 042000

SECTION 232100 – EXCAVATION, TRENCHING, BACKFILLING AND GRADING

All specifications and requirements for Excavation, Trenching, Backfilling and Grading are provided in Sections 331000 – Exterior Water System, 333000 – Sanitary Sewerage, and 334100 – Storm Drainage.

END OF SECTION 232100

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Protection of existing trees.
2. Clearing and grubbing.
3. Removal of trees and other vegetation.
4. Topsoil stripping.

1.3 DEFINITIONS

A. Remove: Remove and legally dispose of items indicated. Removal includes digging out and off-site disposing of stumps and roots.

B. Tree Protection Zone: The area surrounding individual trees or groups of trees to be protected during construction and defined by the drip line of individual trees or the perimeter drip line of groups of trees, unless otherwise indicated.

C. Topsoil: Friable, clay loam surface soil, found in varying depths.

1.4 MATERIALS OWNERSHIP

A. Except for stripped topsoil or other materials indicated to remain Owner's property, cleared materials shall become Contractor's property and shall be removed from Project site.

1.5 SUBMITTALS

A. Photographs or videotape, sufficiently detailed, of existing conditions of trees, plantings and other improvements adjoining the construction that might be misconstrued as damage caused by the Work.

1.6 PROJECT CONDITIONS

A. Traffic: Conduct site clearing operations to ensure minimum interference with roads, streets, walks, and other adjacent occupied or used facilities. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

B. Protection of Existing Improvements: Provide protections necessary to prevent damage to existing improvements indicated to remain in place.

1. Protect existing improvements on adjoining properties and on Owner's property.

2. Restore existing improvements damaged by clearing operations to their original condition.

3. Ensure a secure perimeter for the livestock fencing is provided at all times.

C. The conditions existing at the time of inspection for bidding purposes will be maintained by the Owner to the extent practical. However, minor variations may occur due to natural occurrences prior to the start of clearing work.

D. Do not commence site-clearing operations until erosion and sedimentation control measures are in place.

PART 2 - PRODUCTS

2.1 TREE PROTECTION FENCING

A. Refer to details on the plans.

PART 3 – EXECUTION

3.1 PROTECTION OF EXISTING TREES AND VEGETATION

A. Refer to Section 015639.

3.2 SITE CLEARING

A. General: Remove trees, shrubs, grass and other vegetation as required to permit installation of the Work. Cut minor roots and branches of trees indicated to remain in a clean and careful manner, where such roots and branches obstruct installation of the Work.

B. Clearing and Grubbing: Clear site of trees, shrubs and other vegetation within the clearing limits indicated.

1. Completely remove stumps, roots, and other debris.

2. Use only hand methods for grubbing inside drip line of trees indicated to remain.

3. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated. Place fill material in horizontal layers not exceeding 6 inches loose depth, and thoroughly compact to a density equal to adjacent original ground.

3.3 TOPSOIL STRIPPING

A. Remove heavy growths of grass from areas before stripping.

B. Strip topsoil to whatever depths are encountered, but to a minimum of at least 4 inches.

C. Strip topsoil in a manner to prevent intermingling with underlying subsoil or other material.

1. Remove subsoil and nonsoil materials from topsoil, including trash, debris, weeds, roots, and other waste materials.

D. Where existing trees are indicated to remain, leave existing topsoil in place within drip lines to prevent damage to root system.

E. Temporarily stockpile topsoil in storage piles in areas indicated or directed. Construct storage piles to provide free drainage of surface water. Cover storage piles, if required, to prevent wind erosion.

1. Do not stockpile topsoil within tree protection zones.

2. Stockpile surplus topsoil to allow for respreading deeper topsoil.

F. Dispose of unsuitable or excess topsoil in a legal manner off-site.

3.4 DISPOSAL OF WASTE MATERIALS

A. Burning on Owner's Property: Burning is not permitted.

B. Removal from Owner's Property: Remove waste materials generated by clearing operations from Owner's property and dispose of in a legal manner off-site.

1. Remove waste materials and debris from the site in a manner to prevent spillage. Pavements and the area adjacent to the site shall remain free from mud, dirt and debris at all times.

2. Clean up debris resulting from site clearing operations continuously with the progress of the work.

END OF SECTION

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SECTION 312000 - EARTHWORK

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Excavation, filling, backfilling, and grading indicated and necessary for proper completion of the work.

2. Preparing of subgrade for building slabs, walks, and pavements.

3. Drainage/porous fill course for support of building slabs.

4. Excavating and backfilling of trenches.

5. Detectable Warning Tape, Tracer Wire, and Marker Balls.

1.3 SUBMITTALS

A. VDOT approved Job Mixes for stone.

B. Borrow Soil (if required): Submit location of borrow pit and a sample of the soil for approval to the Owner’s Geotechnical Engineer a minimum of fourteen (14) working days prior to use.

C. Geotextile Fabric.

D. Detectable Warning Tape, Tracer Wire, and Marker Balls.

1.4 DEFINITIONS

A. Backfill: Soil material or controlled low-strength material used to fill an excavation.

1. Initial Backfill: Backfill placed beside and over pipe in a trench, including haunches to support sides of pipe.

2. Final Backfill: Backfill placed over initial backfill to fill a trench.

B. Base Course: Aggregate layer placed between the subbase course and hot-mix asphalt paving.

C. Bedding Course: Aggregate layer 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: Aggregate layer 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. All excavation on this project shall be unclassified.

G. Fill: Soil materials used to raise existing grades.

H. 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.

I. Subbase Course: Aggregate layer placed between the subgrade and base course for hot-mix asphalt pavement, or aggregate layer placed between the subgrade and a cement concrete pavement or a cement concrete or hot-mix asphalt walk.

J. Subgrade: Uppermost surface of an excavation or the top surface of a fill or backfill immediately below subbase, drainage fill, drainage course, or topsoil materials.

K. Utilities: On-site underground pipes, conduits, ducts, and cables as well as underground services within buildings.

1.5 ADDITIONAL WORK

A. The General Conditions refer to certain conditions that may require additional excavation work. This paragraph is further defined herein and, where there are conflicts, is superseded by this section.

B. The risks of concealed, unknown, or unanticipated subsurface conditions shall be included in the Contract Amount and shall not be considered as grounds for additional costs to the Contract.

C. During construction, if concealed, unknown, or unanticipated subsurface conditions are encountered which require that footings, foundations or other parts of the building be raised, lowered or revised to provide acceptable bearing for the building or if, outside the building limits, additional depth of utility trench excavation below the design subgrade or subsoil elevations is required, immediately notify the Architect/Engineer upon discovery of such condition prior to disturbing the material encountered.

D. Payment for additional Work

1. No payment will be provided for rock, additional, or unauthorized excavation.

2. Lowering of footings shall be paid for at a negotiated amount.

1.6 EARTHWORK BALANCE ADJUSTMENTS

A. Adjustments of grades may be allowed with prior written approval of the Engineer in order to accommodate shortfall or surplus of material that may occur. Should adjustments be allowed, maintenance of designed drainage patterns and required adjustments to drainage

structures shall be a Contract responsibility. No additional payment will be made for these adjustments.

B. Importation of any required material shall be a Contract responsibility. No additional payment will be made for the importation of this material.

C. Excavation and disposal of any required material off-site in a legal manner shall be a Contract responsibility. No additional payment will be made for the export and disposal of this material.

1.7 QUALITY ASSURANCE

A. Codes and Standards: Perform excavation work in compliance with applicable requirements of authorities having jurisdiction.

B. Environmental Compliance:

1. Comply with the requirements of the latest edition of the Virginia Stormwater Management Handbook Versions 1.1 during earthwork operations.

2. Comply with the requirements of the latest edition of Virginia Tech's Annual Standards and Specifications for Erosion and Sediment Control for Stormwater Management.

C. Testing and Inspection Service: Owner will employ and pay for an independent Geotechnical testing and inspection laboratory to perform soil testing and inspection service during earthwork operations. Cooperate with Owner's Geotechnical Engineer as required for testing and inspection of work. These services do not relieve the responsibility for compliance with Contract Document requirements.

1.8 PROJECT CONDITIONS

A. Site Information: Data concerning subsurface materials or conditions, which are based on test borings, have been obtained by the Owner for use in designing the project. This data is contained in a Geotechnical Report titled "Geotechnical Engineering Report – Improve Center Woods Complex Project" dated November 4, 2024 by Hurt and Proffitt. Bidders and interested parties (prior to receipt of bids) are encouraged to review these reports.

1. The accuracy or completeness of the data is not warranted or guaranteed by the Owner or the Architect/Engineer. The Owner and Architect/Engineer expressly disclaim any responsibility for the data as being representative of the conditions and materials that may be encountered.

B. Bidders and interested parties (prior to receipt of bids) are encouraged to conduct their own soil and subsurface investigations, examinations, tests, and exploratory borings to determine the nature of the soil conditions underlying the project site. Contact the Owner's office to make an appointment to enter the site for the purpose of conducting your own investigation prior to bid.

C. Existing Utilities: Do not interrupt existing utilities serving occupied facilities except when permitted under the following conditions and then only after arranging to provide acceptable temporary utility services.

1. All planned excavations on University property require notification by the CM/GC to the CAM within two hours of contacting MISS UTILITY. The notification to the CAM notifies only the University of an excavation planned by the CM/GC and does not result in notification of MISS UTILITY.

2. University is a subscriber to the MISS UTILITY underground utility location and notification system. Any excavation of state roads requires notification and coordination with the Virginia Department of Transportation (VDOT). All planned excavations require notification of MISS UTILITY per state and federal regulations. It is the responsibility of the CM/GC to notify MISS UTILITY at 1-800-552-7001 of the planned excavation and at 1-800-552-3120 to obtain subsequent verification that utilities have been marked.

3. Excavation shall not proceed without the completion of the above requirements.

1.9 SAFETY

A. Protection of Persons and Property: Barricade open excavations occurring as part of this work and post with warning lights.

1. Operate warning lights as recommended by authorities having jurisdiction and governing regulations and standards.

2. 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. Work within the road right-of-way shall meet all requirements of the latest edition of the Virginia Department of Transportation Work Area Protection Manual.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Refer to definitions and classifications within the Geotechnical Report for suitable soil classifications for different applications, including structural fill and unsuitable materials.

2.2 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. Apparent Opening Size: No. 60 sieve, maximum; ASTM D4751.

3. Permittivity: 0.2 per second, minimum; ASTM D4491.

4. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

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. Apparent Opening Size: No. 60 sieve, maximum; ASTM D4751.

3. Permittivity: 0.02 per second, minimum; ASTM D4491.

4. UV Stability: 50 percent after 500 hours' exposure; ASTM D4355.

2.3 CONTROLLED LOW-STRENGTH MATERIAL

C. Controlled Low-Strength Material: Self-compacting, flowable concrete material produced from the following:

1. Portland Cement: ASTM C150, Type I.

2. Fly Ash: ASTM C618, Class C or F.

3. Normal-Weight Aggregate: ASTM C33, 3/4-inch nominal maximum aggregate size.

2.4 ACCESSORIES

A. Warning Tape: Warning tape shall be acid- and alkali-resistant, polyethylene film with metal backing manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility; color coded according to American Public Works Association (APWA) color.

B. Tracer Wire: Tracer wire shall be a tin coated, cooper conductor with polyethylene insulation water blocking utility locating system. Core material shall be comprised of high-tenacity, woven polyester with water blocking yarns encapsulated in a 30-mil thick HDPE jacket providing corrosion resistance, flexibility, impact strength, and 1800 lbs. tensile strength. Tracer wire shall not conduct an electrical current when struck by lighting and shall be designed for direct bury and directional boring applications. All tracer wire systems shall be designed and installed to last the lifetime of the utility it accompanies. Tracer wire shall be color coded according to American Public Works Association (APWA) color.

1. Access Box: Traffic rated access box to be placed in vehicular travel ways. Access boxes shall have the utility identification on the lid with lids painted per APWA code.

2. Ground Rod: Drive-in magnesium-grounding rod with a 10-gauge copper clad wire connected to ground rod and locate clip with a watertight cap.

3. Connections, splices, and repairs: Shall be made with water blocking gel filled polycarbonate, 10-19 AWG connectors. When splices and lateral connections are

made, only gel filled connectors designed for wire with a woven polyester fiber core are to be used and installed per the manufacturer's instructions.

PART 3 – EXECUTION

3.1 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 is specified in Section 311000 "Site Clearing."

C. Protect and maintain erosion and sedimentation controls during earthwork operations.

3.2 DEWATERING

A. Prevent surface water and subsurface or groundwater from flowing into excavations and from flooding project site and surrounding area.

1. Do not allow water to accumulate in excavations. Remove water to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to stability of subgrade and foundations. Provide and maintain pumps, well points, sumps, suction and discharge lines, and other dewatering system components necessary to convey water away from excavations.

2. Establish and maintain temporary drainage ditches and other diversions outside excavation limits to convey rainwater and water removed from excavations to collecting or runoff areas. Do not use utility trench excavations as temporary drainage ditches.

B. Should any springs or running water be encountered in the excavation, notify the Architect/Engineer and provide discharge by trenches (or other acceptable means) and drain to an appropriate point of disposal. Provide temporary drainage facilities to minimize the flow of rainwater onto adjacent property. Repair any damage to property or to subgrade as a result of construction and/or dewatering (or lack thereof) operations at no additional cost to the Contract. If permanent provision must be made for disposal of water other than as indicated, the Contract price shall be adjusted.

3.3 EXPLOSIVES

A. Blasting is not permitted.

3.4 EXCAVATION

A. Excavation consists of removal, placement and disposal of material encountered when establishing required subgrade or finish grade elevations.

1. Excavation includes removal and disposal of pavements and other obstructions visible on ground surface; underground structures, utilities and other items indicated to be demolished and removed; together with earth and other materials encountered that are not classified as rock or unauthorized excavation.

B. Unclassified Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal of obstructions.

1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.

2. Remove rock to lines and grades 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 min. 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 24 inches wider than pipe.

3.5 EXCAVATION FOR BUILDING PAD AND STRUCTURES

A. Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction and for review.

B. Excavations for footings and foundations: Do not disturb bottoms of excavation. Excavate by hand to elevations required just before concrete reinforcement is placed. Trim bottoms to required lines and grades to leave solid base to receive other work.

1. Where rock is encountered, carry excavation to required elevations and backfill with crushed stone prior to installation of footing.

C. Excavation for Underground Tanks, Basins, and Mechanical or Electrical Structures: Conform to elevations and dimensions indicated within a tolerance of plus or minus 0.10 foot plus a sufficient distance to permit placing and removal of concrete formwork, installation of services, other construction and for review. Do not disturb bottom of excavations intended for bearing surface.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

A. Cut surface under pavements to comply with cross-sections, elevations and grades as indicated.

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to uniform width, sufficiently wide to provide ample working room and a minimum of 6 to 9 inches of clearance on both sides of pipe or conduit.

B. Excavate trenches to depth indicated or required to establish indicated slope and invert elevations and allow for the appropriating bedding. Refer to plan details for additional information.

3.8 EXCAVATION STABILITY

A. General: Comply with local codes, ordinances, and requirements of agencies having jurisdiction.

B. Slope sides of excavations to comply with local codes, ordinances, and requirements of agencies having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated. Maintain sides and slopes of excavations in safe condition until completion of backfilling.

C. Shoring and Bracing: Provide materials for shoring and bracing, such as sheet piling, uprights, stringers, and cross braces, in good serviceable condition. Maintain shoring and bracing in excavations regardless of time period excavations will be open. Extend shoring and bracing as excavation progresses.

3.9 SUBGRADE INSPECTION

A. Notify the Owner's Geotechnical Engineer when mass, trench, and footing excavations have reached required subgrade. The Contractor is responsible for arranging inspections of conditions by the Owner's Geotechnical Engineer. Alternative procedures for arranging this review may be implemented at the Owner's written option.

B. If the Owner's Geotechnical Engineer determines that the subgrade bearing conditions are unacceptable, the Owner will authorize additional excavation until suitable bearing conditions are encountered.

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 the Owner's Geotechnical Engineer, and replace with compacted backfill or fill as directed.

D. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner's Geotechnical Engineer, without additional compensation.

3.10 UNAUTHORIZED EXCAVATION

A. Correct Unauthorized Excavation as follows:

1. Under footings, foundation bases, or retaining walls, fill unauthorized excavation by extending indicated bottom elevation of footing or base to excavation bottom without altering required top elevation. Lean concrete fill may be used to bring elevations to proper position when acceptable to Architect/Engineer.

2. Elsewhere, backfill and compact unauthorized excavations as indicated for authorized excavations of same classification unless otherwise directed.

3.11 STORAGE OF EXCAVATED MATERIALS

A. Temporarily stockpile excavated materials acceptable for use as backfill and fill. Place, grade, and shape stockpiles for proper drainage. Cover to prevent windblown dust.

1. Stockpile excavated materials away from edge of excavations. Do not store within the drip line of trees to remain.

3.12 BACKFILL AND FILL

A. Backfill excavations as promptly as work permits, but not until completion of the following:

1. Acceptance by local authority having jurisdiction of construction below finished grade, including perimeter insulation.

2. Review, approval, and recording of the locations of underground utilities.

3. Removal of concrete formwork.

4. Removal of shoring and bracing (including backfilling of voids with satisfactory materials).

5. Removal of trash and debris from excavation.

6. Permanent or temporary horizontal bracing is in place on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow or ice.

C. Ground Surface Preparation: Remove vegetation, debris, obstructions, and deleterious materials from ground surface prior to placement of fills.

D. Bench sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material. Plow, scarify, bench or break up sloped surfaces flatter than 1 vertical to 4 horizontal so fill material will bond with existing material.

E. Place soil material in layers to required subgrade elevations, for each area classification listed below, using materials indicated in the Geotechnical Report.

1. Under grassed areas, use satisfactory excavated or borrow material.

2. Under walks, curbs, and pavements, use satisfactory structural excavated or borrow material.

3. Under building slabs, use satisfactory structural excavated or borrow materials and drainage/porous fill material as indicated.

3.13 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. All material specifications and dimensions for bedding and backfill shall be in accordance with:

1. Water: Virginia Tech's Design and Construction Standards Manual, latest edition

2. Sanitary sewer: Virginia Tech's Design and Construction Standards Manual, latest edition

3. Storm sewer: Virginia Tech's Design and Construction Standards Manual, latest edition, and VDOT specifications.

C. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

D. Place and compact initial backfill over the utility pipe or conduit.

1. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit. Coordinate backfilling with utilities testing.

E. Place and compact final backfill over initial backfill to final subgrade elevation. The final backfill material shall generally be classified as suitable fill in grass areas and VDOT 21A stone in pavement areas.

F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

G. Backfill trenches with concrete where trench excavations pass within 18 inches of column or wall footings and that are carried below bottom of such footings or that pass under wall footings. Place concrete to level of bottom of adjacent footing.

H. Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

I. Install warning tape directly above utilities.

J. Do not backfill trenches until any required testing and inspections have been completed and the Owner's Geotechnical Engineer and Geospatial Engineering Services authorizes backfilling. Backfill carefully to avoid damage or displacement of pipe systems.

K. Under piping and conduit and equipment, use crushed stone where required over rock bearing surface and for correction of unauthorized excavation. Shape excavation bottom to fit bottom 90 degrees of cylinder.

L. Place backfill and fill materials evenly adjacent to structures, piping, or conduit to required elevations. Prevent wedging action of backfill against structures or displacement of piping or conduit by carrying material uniformly around structure, piping, or conduit to approximately same elevation in each lift.

3.14 WARNING TAPE AND TRACER WIRE

A. Warning Tape: Warning tape shall be installed for all underground utilities. Tape shall be located at half of the distance between the top of the utility line and the approved finished grade height.

B. Tracer Wire: Tracer wire shall be installed on all underground utilities and brought to the surface at terminations points in approved access boxes no more than 500’ apart. Tracer wire shall be installed along the full length of the utility and placed directly on top of the utility. Tracer wire is not to be looped or coiled at any point along the utility.

1. Tracer wire and ground rods must be accessible and protected in an access box. Traffic rated access box to be placed in vehicular travel ways. Access boxes shall be installed a minimum of 500 ft apart and 12 inches horizontal distance from the appurtenance. Access boxes shall have the utility identification on the lid. Tracer wire should extend a minimum of 18 inches above the top of the access box. Access box lids shall be painted per APWA code.

2. Tracer wire is to be grounded at all termination points and access boxes. The ground wire should be accessible within 3” of the top of the lid in access boxes. The ground Rod Shall be placed 90 degrees opposite the tracer wire at all dead-end stubs.

3. All connections, splices, and repairs shall be made with water blocking gel filled polycarbonate, 10-19 AWG connectors. When splices and lateral connections are made, only gel filled connectors designed for wire with a woven polyester fiber core are to be used and installed per the manufacturer’s instructions.

3.15 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 3 percentage points 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 3 percentage points and is too wet to compact to specified dry unit weight.

B. Moisture Control: Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade or layer of soil material. Apply water in minimum quantity as necessary to prevent free water from appearing on

surface during or subsequent to compaction operations. Maintain the moisture content of the structural fill materials to within 3 percentage points of the optimum moisture content until permanently covered.

C. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to required density.

1. Stockpile or spread soil material that has been removed because it is too wet to permit compaction. Assist drying by discing, harrowing, or pulverizing until moisture content is reduced to a satisfactory value.

2. Work wet materials as directed by the Owner's Geotechnical Engineer. Base bids on working material daily for a maximum of five days of acceptable weather.

3. No additional payment will be made for these operations.

3.16 COMPACTION OF SOIL BACKFILL AND FILLS

A. Place backfill and fill materials in layers not more than 8 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. Before compaction, moisten or aerate each layer as necessary to provide optimum moisture content. Compact each layer to required percentage of maximum dry density or relative dry density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.

C. Control soil and fill compaction, providing minimum percentage of density indicated for each area classification indicated below. Correct improperly compacted areas or lifts as directed by the Owner's Geotechnical Engineer if soil density tests indicate inadequate compaction.

D. Percentage of Maximum Density Requirements: Compact soil to not less than the following percentages of maximum density at a moisture content within 3 percentage points of optimum in accordance with ASTM D698:

1. Under structures, building pad and pavements, compact each layer of backfill or fill material at 95 percent maximum density.

2. Under grass or unpaved areas, compact each layer of backfill or fill material at 90 percent maximum density.

E. Seal all fill areas at the end of each working day, utilizing a smooth drum roller.

3.17 GRADING

A. General: Rough grading of areas within the Project, including cut and fill sections and adjacent transition areas, shall be reasonably smooth, compacted and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or motor patrol except as otherwise indicated. The finished subgrade surface from

the grassed areas generally shall be not more than 0.2 feet above or below the final grade or approved cross section, with due allowance for topsoil.

B. The tolerance for areas within 10 feet of building perimeter, walks and all areas to be paved shall not exceed 0.10 feet above or below the established subgrade. Finish all ditches, swales and gutters to drain readily. Unless otherwise indicated, evenly slope the subgrade to provide drainage away from building walls in all directions at a grade not less than ¼ inch per foot. Provide rounding at top and bottom of cut and fill slopes and at other breaks in grade.

C. Protection of Graded Areas: Protect newly graded areas and areas of cut, fill and design/subgrade elevations from the actions of the elements and from deterioration as a result of construction operations and weather conditions (frost, rains, snow, sleet, hail, etc.). Repair any settlement or washing that occurs prior to or after acceptance of the work. Fill to required subgrade levels any areas where settlement occurs. Protect trees to remain, and, at all areas of the Site where construction operations are in progress, provide protection for the safety of occupants of the existing facilities.

D. 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.

E. 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 1/2 inch; but never outside ADA guidelines.

3. Pavements: Plus or minus 1/2 inch; but never outside ADA guidelines.

F. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.18 PAVEMENT SUBBASE COURSE:

A. General: Place subbase material, in layers of indicated thickness, over subgrade surface to support a pavement base course.

B. Grade Control: During construction, maintain lines and grades including crown and cross-slope of subbase course.

C. Shoulders: Place shoulders along edges of subbase course to prevent lateral movement. Construct shoulders of acceptable soil materials placed in such quantity to compact to thickness of each subbase course layer. Compact and roll at least at 12” width of shoulder simultaneously with compacting and rolling each layer of subbase course.

D. Placing: Place subbase course material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting subbase material during placement operations.

E. When a compacted subbase course is 6” thick or less, place material in a single layer. When more than 6” thick, place material in equal layers, except no single layer more than 6” or less than 3” in thickness when compacted.

F. Place subbase and base course on subgrades free of mud, frost, snow, or ice.

G. On prepared subgrade, place subbase and base course under pavements and walks as follows:

1. Place base course material over subbase course under hot-mix asphalt pavement.

2. Shape subbase and base course to required crown elevations and cross-slope grades.

3. Place subbase and base course 6 inches or less in compacted thickness in a single layer.

4. 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.

5. 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 BUILDING SLAB DRAINAGE COURSE

A. General: Place drainage/porous fill material, over subgrade surface to support concrete building slabs and sidewalks areas indicated.

B. Place drainage course on subgrades free of mud, frost, snow, or ice.

C. Placing: Place drainage/porous fill material on prepared subgrade in layers of uniform thickness, conforming to indicated cross-section and thickness. Maintain optimum moisture content for compacting material during placement operations.

D. When a compacted drainage course is indicated to be 6 inches thick or less, place material in a single layer. When indicated to be more than 6 inches thick, place material in equal layers, except no single layer more than 6 inches or less than 3 inches in thickness when compacted.

3.20 FIELD QUALITY CONTROL

A. Quality Control Testing During Construction: Allow the Owner’s Geotechnical Engineer to inspect and approve each subgrade and fill layer before further backfill or construction work is performed.

1. If in the opinion of the Owner's Geotechnical Engineer, based on reports and inspection, subgrade or fills have been placed that are below required density, perform additional compaction and testing until required density is obtained.

B. The Owner will engage, and pay for, the services of a Geotechnical Engineer whose function shall be to afford complete engineering control by testing of the conditions of all footing subgrades, the placement of all structural fills under structures, building pad and pavement areas, and all compaction where required, and to observe the proof rolling of the building pad and pavement areas.

C. The Owner's Geotechnical Engineer will be present as deemed necessary during all phases of the Work requiring filling, compaction operations or testing. The Geotechnical Engineer will provide the Architect/Engineer with written certification that fill and compaction was completed with accepted materials in accordance with the Documents, and give a professional opinion regarding shrinkage or settlement of fill and safe load bearing capacity of fill.

D. Site Preparation and Proofrolling: The Owner's Geotechnical Engineer will determine if any additional excavation or in-place densification is necessary to prepare a subgrade for fill placement for slab or pavement support.

E. Fill Placement and Compaction: The Owner's Geotechnical Engineer will witness all fill operations and take sufficient in-place density tests to verify that the indicated degree of fill compaction is achieved. The Owner's Geotechnical Engineer will observe and approve borrow materials used and shall determine if their existing moisture contents are suitable/acceptable.

F. Footing Excavation Review: The Owner's Geotechnical Engineer will review the footing excavations for the building foundations. He will verify that the design bearing pressures are available and that no loose or soft areas exist beneath the bearing surfaces of the footing excavations.

G. The Owner's Geotechnical Engineer will submit copies each of his reports, recommendations and/or opinions to the Architect/Engineer and the Owner. Pertinent information will be provided to the Contractor as required.

3.21 EROSION CONTROL

A. Provide erosion control methods in accordance with requirements of the University's Annual Standards and Specifications for Erosion and Sediment Control and stormwater Management, DEQ's Virginia Stormwater Management Handbook, and as indicated in the Contract Documents.

3.22 PROTECTION

A. Repair and reestablish grades in settled, eroded, and rutted areas to indicated tolerances.

B. Reconditioning Compacted Areas: Where subsequent construction operations or adverse weather disturbs completed compacted areas, scarify surface, reshape, and compact to required density prior to further construction.

C. Settling: Where settling is measurable or observable at excavated areas during general project warranty period, remove surface (pavement, lawn, or other finish), add backfill material, compact, and replace surface treatment. Restore appearance, quality, and condition of surface or finish to match adjacent work and eliminate evidence of restoration to greatest extent possible.

D. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees F.

3.23 DISPOSAL OF WASTE MATERIALS

A. Removal from Owner's Property: Remove excess and/or waste materials, including trash and debris, and dispose of it off Owner's property in a legal manner.

B. Dispose of excess material and materials not acceptable for use as backfill or fill legally offsite.

C. Do not remove topsoil from site until it has been demonstrated to the Owner’s satisfaction that it is excess.

END OF SECTION

SECTION 312500 - EROSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The provisions of the Contract Documents apply to the work of this Section.

B. DEQ's Virginia Stormwater Management (SWM) Handbook, latest edition.

C. Virginia Tech Annual Standards and Specifications for Erosion and Sediment Control and Stormwater Management, latest edition.

D. EPA's NPDES 2022 Construction General Permit (CGP)

1.2 SUMMARY

A. This Section includes the installation, maintenance and removal of erosion control measures required for prevention of sediment leaving the project site.

B. This Section also includes the requirement to file the Virginia Stormwater Management Program (VSMP) General Permit Registration Statement for Storm Water Discharges from Construction Activities with the State Department of Environmental Quality (DEQ).

C. For LEED compliance, all erosion and sediment control measures and inspections shall comply with the EPA's 2022 CGP or DEQ' Stormwater Management Handbook, whichever is stricter.

1.3 EROSION AND SEDIMENT CONTROL PRE-CONSTRUCTION

A. Prior to commencement of work, obtain a copy of the approved Erosion and Sediment Control Plan from the University.

B. Schedule a pre-construction conference with the Virginia Tech (VT) Department of Environmental Resources (ER). Hold this meeting prior to the start of any construction activities.

1.4 VSMP REGISTRATION

A. The VSMP Construction General Permit (CGP) will be applied for by the Contractor. The Engineer will provide a Registration Statement template and the AS&S Entity Form for the Contractor to finalize and sign. Prior to the pre-construction meeting, the Contractor shall complete the paperwork and file with DEQ to obtain coverage. The Contractor will be responsible for CGP application and renewal fees.

B. During construction, the following requirements shall be met:

1. A copy of the Stormwater Pollution Prevention Plan (SWPPP) shall be kept at the job site at all times. A SWPPP following the VT AS&S has been prepared by the Engineer and will be provided to the Contractor prior to the pre-construction meeting.

2. The Contractor shall amend the SWPPP as necessary to account for significant changes in design, construction, or maintenance that would increase the pollution potential of the site. All changes shall be documented in the SWPPP and be available for review by VT ER and the Engineer.

3. The Responsible Land Disturber or other personnel designated by the Contractor shall perform inspections of the erosion and sediment control measures in accordance with the CGP. Inspection reports shall be filed as an appendix to the SWPPP.

4. The Contractor is responsible for posting, maintaining, and updating the SWPPP throughout construction.

C. Following final acceptance of the site by the Owner and sign off by the VT ER, work with VT and the Engineer to file a Notice of Termination with DEQ.

1.5 SUBMITTALS

A. Responsible Land Disturber registration information.

B. Copies of the SWPPP inspection reports. Inspection reports should be maintained in the onsite SWPPP binder for review at the monthly progress meetings.

C. All materials used to satisfy erosion control plans.

D. All documentation required for stormwater management certification.

1.6 PAYMENT PROCEDURES FOR EROSION CONTROL MEASURES

A. Establish a line item in the Schedule of Values for Erosion Control Maintenance. Erosion control maintenance will be paid on a monthly basis, following the satisfactory installation and maintenance of the erosion control measures.

PART 2 - PRODUCTS

2.1 EROSION CONTROL PRODUCTS:

A. Construction Entrance

1. Heavy-duty stone aggregate and filter fabric construction entrance, complying with the requirements of Standard and Specification C-SCM-03 of the DEQ SWM Handbook.

2. Reinforced concrete wash-rack, draining to a sediment trapping measure.

3. The water source for washing operations shall be the responsibility of the Contractor.

B. Silt Fence and Super Silt Fence

1. Synthetic filter fabric, complying with the requirements of Standard and Specification C-PCM-04 of the DEQ SWM Handbook.

2. For silt fence, wooden stakes shall be 2” oak, a minimum length of five feet.

3. For super silt fence, 2.5-in galvanized or aluminum poles shall be used and shall be set at a maximum of 10 feet apart. Poles shall be installed to a minimum depth of 24 inches. Reinforced chain link fence shall be galvanized no. 11.5 gage steel wire with 2.25 inch opening.

C. Temporary Diversion Dike

1. Diversions shall be installed prior to disturbance of up slope land. The diversion shall be adequately compacted and shall provide positive drainage to the erosion control measure to which it is directly runoff to.

2. Apply temporary or permanent seeding and mulch to the diversion immediately following installation.

D. Storm Drain Inlet Protection

1. Drop Inlet Sediment Filter, complying with the requirements of Standard and Specification C-SCM-04 of the DEQ SWM Handbook.

E. Culvert Inlet Protection

1. Culvert Inlet Protection, complying with the requirements of Standard and Specification C-SCM-05 of the DEQ SWM Handbook.

F. Temporary Seeding

1. Temporary vegetative cover for disturbed areas, complying with the requirements of Standard and Specification C-SSM-09 of the DEQ SWM Handbook.

G. Permanent Seeding

1. Refer to Section “Lawns and Grasses” for permanent seeding requirements.

H. Tree Protection Fencing

1. Refer to plans for fence types and materials.

PART 3 - EXECUTION

3.1 INSTALLATION OF EROSION CONTROL MEASURES

A. Install all erosion and sediment control measures per the requirements of DEQ’s SWM Handbook.

B. Protect all points of construction ingress and egress to the site to prevent tracking of mud onto public streets. Provide temporary construction entrances at all points of access to the site.

C. Clear only those areas necessary for installation of the perimeter erosion control measures.

The balance of the site shall not be cleared or otherwise disturbed until the perimeter erosion control measures are installed, functional and approved by VT's ER Inspector.

D. Follow the construction sequence and install erosion control measures as indicated on the Drawings and as directed by the VT's ER Inspector.

E. Install additional measures as necessary to prevent sediment from leaving the project site.

3.2 MAINTENANCE OF EROSION CONTROL MEASURES

A. Maintain all erosion and sediment control measures per the requirements of DEQ's SWM Handbook.

B. At a minimum, the following maintenance is required:

1. Construction Entrance

a) Wash and rework stone and/or place additional stone as required to prevent tracking of mud onto the roadways.

b) Clean out the sediment-trapping device for the washrack.

c) Remove all materials spilled, dropped, washed or otherwise tracked onto roadways or into storm sewers immediately. Do not use water trucks to wash the roadways.

2. Silt Fence

a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.

b) Make any required repairs immediately. Give special attention to damage resulting from end-runs and undercutting.

c) Replace fabric that is decomposing or is otherwise ineffective.

d) Clean out accumulated sediment following every storm event. Do not allow sediment to accumulate higher than one-half the height of the barrier.

3. Storm Drain Inlet Protection

a) Inspect immediately following each rainfall and at least daily during prolonged rainfall.

b) Remove and clean or replace stone filters that have been clogged with sediment. Make any required repairs immediately.

c) Remove accumulated sediment as required. Do not allow sediment to accumulate higher than one-half the height of the measure.

4. Temporary Seeding

a) Re-seed and mulch areas where cover is inadequate to protect against erosion until adequate cover is obtained.

C. Remove accumulated sediment as required and at appropriate intervals to maintain the effective function of all erosion control measures.

D. Inspect, repair, and remove accumulated sediment from erosion control measures following significant (greater than ½") rainfall events.

E. If erosion control measures become clogged, causing the impoundment of water, restore the measures immediately. Ponded water poses a potential drowning hazard and shall be relieved immediately by either pumping (through an approved dewatering structure) or by removal of the blockage.

3.3 REMOVAL OF EROSION CONTROL MEASURES

A. Remove all temporary erosion control measures following the stabilization of the site. Do not remove erosion control measures until authorized by VT's ER Inspector.

B. Topsoil, permanently seed, and stabilize areas occupied by erosion control measures.

END OF SECTION 312500

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SECTION 321216 - ASPHALT PAVEMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hot-mix asphalt paving over prepared subbase.

2. Hot-mix asphalt patching.

3. Hot-mix asphalt overlays.

4. Asphalt surface treatments

1.3 SUBMITTALS

A. Job-Mix Designs: VDOT certifications for each job mix proposed for the Work.

B. Material Certification: Certification signed by Contractor certifying that each material complies with requirements.

C. Traffic maintenance and Work Area Protection Plan: Submit a plan indicating sequencing and measures to be used for the maintenance and protection of traffic during operations within or immediately adjacent to existing roadways open to vehicular traffic.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

B. Asphalt paving materials and installation shall conform to the requirements of the latest edition of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications and Road and Bridge Standards.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not apply asphalt materials if substrate is wet or excessively damp or if the following conditions are not met:

1. Prime and Tack Coats: Minimum ambient temperature of 50 deg F, and when temperature has not been below 35 deg F for 12 hours immediately prior to application.

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 40 deg F and rising at time of placement.

1.6 TESTING AND INSPECTION

A. The Owner's Geotechnical Engineer shall observe the asphalt placement.

PART 2 - PRODUCTS

2.1 ASPHALT-AGGREGATE MIXTURE

A. General: Provide plant-mixed, hot-laid asphalt-aggregate mixtures complying with the requirements of the VDOT Road and Bridge Specifications.

2.2 ASPHALT MATERIALS

A. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, cationic emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.

B. Prime Coat: Asphalt emulsion prime conforming to VDOT requirements.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that subgrade is dry and in suitable condition to support paving and imposed loads.

B. Proof-roll subbase using heavy, pneumatic-tired rollers to locate areas that are unstable or that require further compaction as determined by the Owner's Geotechnical Engineer.

C. Notify Owner and Engineer in writing of any unsatisfactory conditions. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 MAINTENANCE AND PROTECTION OF TRAFFIC

A. Utilize flagmen, barricades, warning signs and warning lights as required by the Virginia Work Area Protection Manual.

3.3 PATCHING AND REPAIRS

A. Patching: Saw cut perimeter of patch and excavate existing pavement section to sound base. Recompact new subgrade. Excavate rectangular or trapezoidal patches, extending 12 inches into adjacent sound pavement, unless otherwise indicated. Cut excavation faces vertically.

1. Tack coat faces of excavation and allow to cure before paving.

2. Fill excavation with dense-graded, hot-mix asphalt base mix and, while still hot, compact flush with adjacent surface.

B. Leveling Course: Install and compact leveling course consisting of dense-graded, hot-mix asphalt surface course to level sags and fill depressions deeper than 1 inch in existing pavements.

1. Install leveling wedges in compacted lifts not exceeding 3 inches thick.

C. Crack and Joint Filling: Remove existing filler material from cracks or joints to a depth of 1/4 inch. Refill with asphalt joint-filling material to restore watertight condition. Remove excess filler that has accumulated near cracks or joints.

D. Tack Coat: Apply uniformly to existing surfaces of previously constructed asphalt or Portland cement concrete paving and to surfaces abutting or projecting into new, hot-mix asphalt pavement. Apply at a uniform rate of 0.05 to 0.15 gal./sq. yd. of surface.

1. Allow tack coat to cure undisturbed before paving.

2. Avoid smearing or staining adjoining surfaces, appurtenances, and surroundings. Remove spillage and clean affected surfaces.

3.4 SURFACE PREPARATION

A. General: Immediately before placing asphalt materials, remove loose and deleterious material from substrate surfaces. Ensure that prepared subgrade is ready to receive paving.

B. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb aggregate embedded in compacted surface of base course.

C. Prime Coat: For asphalt sections less than 4” thick, apply uniformly over surface of compacted-aggregate base at a rate of 0.15 to 0.50 gal./sq. yd. Apply enough material to penetrate and seal, but not flood, surface. Allow prime coat to cure for 24 hours minimum.

1. If prime coat is not entirely absorbed within 24 hours after application, spread sand over surface to blot excess asphalt. Use just enough sand to prevent pickup under traffic. Remove loose sand by sweeping before pavement is placed and after volatiles have evaporated.

2. Protect primed substrate from damage until ready to receive paving.

3.5 HOT-MIX ASPHALT PLACING

A. Machine place hot-mix asphalt mix 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. Place hot-mix asphalt base course in number of lifts and thickness indicated.

2. Spread mix at minimum temperature of 225 deg F.

B. Place paving in consecutive strips not less than 10 feet wide, except where infill edge strips of a lesser width are required.

1. After first strip has been placed and rolled, place succeeding strips and extend rolling to overlap previous strips. Complete asphalt base course for a section before placing intermediate or surface courses.

C. 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.

3.6 JOINTS

A. Construct joints between old and new pavement, or between successive days work, to ensure continuous bond between adjoining paving sections. Construct joints free of depressions with same texture and smoothness as other sections of hot-mix asphalt course.

1. Clean contact surfaces and apply tack coat.

2. Offset longitudinal joints in successive courses a minimum of 6 inches.

3. Offset transverse joints in successive courses a minimum of 24 inches.

4. Construct transverse joints as required by the VDOT Road and Bridge Specifications.

5. Compact joints as soon as hot-mix asphalt will bear roller weight without excessive displacement.

3.7 COMPACTION

A. 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.

B. Breakdown Rolling: Accomplish breakdown or initial rolling immediately after rolling joints and outside edge. Examine surface immediately after breakdown rolling for indicated crown, grade, and smoothness. Repair surfaces by loosening displaced material, filling with hot-mix asphalt, and rerolling to required elevations.

C. Intermediate Rolling: Begin intermediate rolling immediately after breakdown rolling, while hot-mix asphalt is still hot enough to achieve indicated density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 95 percent of reference laboratory density according to ASTM D 1559.

D. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm. Surface course average density shall be 95 percent of reference laboratory density.

E. Edge Shaping: While surface is being compacted and finished, trim edges of pavement to proper alignment. Bevel edges while still hot, with back of rake or smooth iron. Compact thoroughly using tamper or other satisfactory method. Edges adjacent to curbs and curb and gutter sections shall be flush with the edge of concrete.

F. Repairs: Remove paved areas that are defective or contaminated with foreign materials. Remove paving course over area affected and replace with fresh, hot-mix asphalt. Compact by rolling to specified density and surface smoothness.

G. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

H. Erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCES

A. 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.

B. 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: 3/16 inch.

3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch.

3.9 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing agency (Geotechnical Engineer) to perform field inspections and tests and to prepare test reports.

1. Testing agency will conduct and interpret tests as required to demonstrate for general compliance with the project documents. Reports shall be provided documenting whether tested Work complies with or deviates from requirements.

B. Additional testing, at Contractor's expense, will be performed to determine compliance of corrected Work with requirements.

C. Remove and replace or install additional hot-mix asphalt where test results or measurements indicate that it does not comply with requirements.

END OF SECTION 321216

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SECTION 321313 - SITE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 DESCRIPTION OF WORK:

A. Extent of Portland cement concrete paving is shown on drawings, including:

1. Walkways
2. ADA Parking Areas
3. Driveway apron

1.3 SUBMITTALS

A. Job-Mix Designs: VDOT Certification of approval of each job mix proposed for the Work.

B. Material Certification: Certification signed by Contractor certifying that each material complies with requirements.

1.4 JOB CONDITIONS

A. Traffic Control: Maintain access for vehicular and pedestrian traffic as required for other construction activities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Forms: Steel, wood, or other suitable material of size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use straight forms, free of distortion and defects.

1. Use flexible spring steel forms or laminated boards to form radius bends as required.
2. Coat forms with a nonstaining form release agent that will not discolor or deface surface of concrete.

B. Welded Wire Mesh: Welded plain cold-drawn steel wire fabric, ASTM A 185.

C. Reinforcing Steel: ASTM A 615, Grade 60, deformed

D. Concrete Materials: Comply with requirements of applicable Division 3 sections for concrete materials, admixtures, bonding materials, curing materials, and others as required.

E. Expansion Joint Materials: Comply with requirements of applicable Division 7 sections for preformed expansion joint fillers and sealers.

F. Antispalling Compound: Combination of boiled linseed oil and mineral spirits, complying with AASHTO M-233.

G. Liquid-Membrane Forming and Sealing Curing Compound: Comply with VDOT Road and Bridge Specifications.

2.2 CONCRETE MIX, DESIGN, AND TESTING

A. Comply with requirements of applicable Division 3 sections for concrete mix design, sampling and testing, and quality control or VDOT Road and Bridge Specifications whichever is more stringent.

B. Design mix to produce normal-weight concrete consisting of Portland cement, aggregate, water-reducing or high-range water-reducing admixture (superplasticizer), air-entraining admixture, and water to produce the following properties:

1. Comply with the requirements of VDOT Std. Class A3 Concrete, unless otherwise indicated.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION

A. Remove loose material from compacted subbase surface immediately before placing concrete.

B. Proof-roll prepared subbase surface to check for unstable areas and need for additional compaction. Do not begin paving work until such conditions have been corrected and are ready to receive paving,

3.2 FORM CONSTRUCTION

A. Set forms to required grades and lines, braced and secured. Install forms to allow continuous progress of work and so that forms can remain in place at least 24 hours after concrete placement.

B. Check completed formwork for grade and alignment to following tolerances:

1. Top of forms not more than 1/8 inch in 10 feet.

2. Vertical face on longitudinal axis, not more than 1/4 inches in 10 feet.

C. Clean forms after each use and coat with form release agent as required to ensure separation from concrete without damage.

3.3 REINFORCEMENT

A. Locate, place and support reinforcement as specified in Division 3 sections, unless otherwise indicated.

3.4 CONCRETE PLACEMENT

A. General: Comply with requirements of applicable Division 3 sections for mixing and placing concrete or VDOT Road and Bridge Specifications whichever is more stringent.

B. Do not place concrete until subbase and forms have been checked for line and grade. Moisten subbase if required to provide a uniform dampened condition at time concrete is placed. Do not place concrete around manholes or other structures until they are at required finish elevation and alignment.

C. Place concrete by methods that prevent segregation of mix. Consolidate concrete along face of forms and adjacent to transverse joints with internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Use only square-faced shovels for hand spreading and consolidation. Consolidate with care to prevent dislocation of reinforcing, dowels, and joint devices.

D. Deposit and spread concrete in a continuous operation between transverse joints as far as possible. If interrupted for more than 1/2 hour, place a construction joint.

E. Fabricated Bar Mats: Keep mats clean and free from excessive rust, and handle units to keep them flat and free of distortions. Straighten bends, kinks, and other irregularities or replace units as required before placement. Set mats for a minimum 2-inch overlap to adjacent mats.

F. Place concrete in 2 operations; strike off initial pour for entire width of placement and to the required depth below finish surface. Lay fabricated bar mats immediately in final position. Place top layer of concrete, strike off, and screed.

G. Remove and replace portions of bottom layer of concrete that have been placed more than 15 minutes without being covered by top layer or use bonding agent if acceptable to Architect.

3.5 JOINTS

A. General: Construct expansion, weakened-plane (contraction), and construction joints true to line with face perpendicular to surface of concrete. Construct transverse joints at right angles to the centerline, unless otherwise indicated.

B. Weakened-Plane (Contraction) Joints: Provide weakened-plane (contraction) joints in sidewalk at a spacing to match the width of the sidewalk, or as detailed on the plans. Construct weakened-plane joints for a depth equal to at least 1/4 concrete thickness, as follows:

1. Tooled Joints: Form weakened-plane joints in fresh concrete by grooving top portion with a recommended cutting tool and finishing edges with a jointer.

2. Sawed Joints: Form weakened-plane joints with powered saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into hardened concrete as soon as surface will not be torn, abraded, or otherwise damaged by cutting action.

C. Construction Joints: Place construction joints at end of placements and at locations where placement operations are stopped for more than 1/2 hour, except where such placements terminate at expansion joints.

1. Construct joints as indicated using standard metal keyway-section forms.

D. Expansion Joints: Provide premolded joint filler for expansion joints abutting concrete curbs, catch basins, manholes, inlets, structures, walks, and other fixed objects, unless otherwise indicated.

1. Locate expansion joints at 30 feet o.c. for each pavement lane unless otherwise indicated.

E. Extend joint fillers full width and depth of joint, not less than 1/2 inch or more than 1 inch below finished surface with joint sealer.

F. Provide joint fillers in one-piece lengths for full width being placed wherever possible. Where more than one length is required, lace or clip joint filler sections together.

G. Protect top edge of joint filler during concrete placement with a metal cap or other temporary material. Remove protection after concrete has been placed on both sides of joint.

H. Fillers and Sealants: Comply with VDOT requirements.

3.6 CONCRETE FINISHING

A. After striking-off and consolidating concrete, smooth surface by screeding and floating. Use hand methods only where mechanical floating is not possible. Adjust floating to compact surface and produce uniform texture.

B. After floating, test surface for trueness with a 10-ft. straightedge. Distribute concrete as required to remove surface irregularities and refloat repaired areas to provide a continuous smooth finish.

C. Work edges of slabs, gutters, back top edge of curb, and formed joints with an edging tool, and round to 1/2-inch radius, unless otherwise indicated. Eliminate tool marks on concrete surface.

D. After completion of floating and when excess moisture or surface sheen has disappeared, complete troweling and finish surface as follows:

1. Broom finish by drawing a fine-hair broom across concrete surface perpendicular to line of traffic. Repeat operation if required to provide a fine line texture acceptable to Owner.

E. Do not remove forms for 24 hours after concrete has been placed. After form removal, clean ends of joints and point-up any minor honeycombed areas. Remove and replace areas or sections with major defects, as directed by Architect.

3.7 CURING

A. Protect and cure finished concrete paving in compliance with applicable requirements of Division 3 sections. Use membrane-forming curing and sealing compound or approved moist-curing methods.

3.8 REPAIRS AND PROTECTIONS

A. Repair or replace cracked, broken or defective concrete curbs, sidewalk, and pavements as directed by Engineer or Owner.

B. Drill test cores where directed by Engineer when necessary to determine magnitude of cracks or defective areas. Fill drilled core holes in satisfactory pavement areas with Portland cement concrete bonded to pavement with epoxy adhesive.

C. Protect concrete from damage until acceptance of work. Exclude traffic from pavement for at least 14 days after placement. When construction traffic is permitted, maintain pavement as clean as possible by removing surface stains and spillage of materials as they occur.

D. Sweep concrete pavement and wash free of stains, discolorations, dirt, and other foreign material just before final inspection.

END OF SECTION

SECTION 321700 - PAVEMENT MARKINGS, SIGNS AND SPECIALTIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

1.2 SUMMARY

A. This Section includes, but is not limited to, the following:

1. Establishing the location of pavement markings and applying pavement markings for parking space lines, fire lane and accessible spaces.

2. Installation of signs for traffic control and accessible spaces.

1.3 QUALITY ASSURANCE

A. All work and materials shall conform to the requirements of the latest edition of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications and Road and Bridge Standards, Virginia Tech's Signage Standards, and the Virginia Tech Desing and Construction Standards Manual.

B. All materials for signs shall conform to the requirements of the latest edition of the Virginia Department of Transportation (VDOT) Road and Bridge Specifications and Road and Bridge Standards and to the requirements of the latest edition of the Manual of Uniform Traffic Control Devices for traffic signs.

C. Installer Qualifications: Engage an experienced installer, who has successfully completed striping and signage projects similar in size and complexity to this project. The installer's primary business (defined as a minimum of 60% of total billings) shall be striping and signage.

1.4 SUBMITTALS

A. Product Data and written confirmation that the following materials are included on VDOT's list of approved construction materials:

1. Pavement marking material

2. Signs

3. Posts

PART 2 - PRODUCTS

2.1 PAVEMENT MARKINGS

A. Markings shall be VDOT Type B, Class 1 thermoplastic pavement markings conforming to the requirements of Section 246 and 704 of the VDOT Road and Bridge Specifications.

2.2 SIGNS AND POSTS

A. Signs shall conform to the requirements of Section 701 of the VDOT Road and Bridge Specifications. Signs shall be fabricated with encapsulated lens sheeting.

B. Signposts shall be square tube sign post conforming to the requirements of STP-1 of the VDOT Road and Bridge Standards.

2.3 CONCRETE

A. Concrete shall be Class A3, General concrete, conforming to the requirements of Section 217 of the VDOT Road and Bridge Specifications, unless otherwise noted.

PART 3 - EXECUTION

3.1 SURFACE PREPARATION FOR PAVEMENT MARKING

A. Prepare surfaces in accordance paint in accordance with the requirements of Section 704 of the VDOT Road and Bridge Specifications and the manufacturer's recommendations.

B. Apply pavement markings only when the ambient temperatures is above 50°F and less than 95°F, unless otherwise approved.

C. Allow pavement to cure for a period recommended by the manufacturer before applying pavement marking.

D. Clean surfaces thoroughly before application of paint. Remove, dust, dirt and other granular surface deposits by sweeping, blowing with compressed air, rinsing with water, or a combination of these methods as required.

E. Remove existing pavement markings, residual curing compounds and other coating adhering to the pavement with scrapers, wire brushes, waterblasting, sandblasting or mechanical abrasion as required. Areas of existing pavement affected by oil or grease shall be scrubbed with an approved chemical and rinsed thoroughly. Seal oil-soaked areas with shellac or primer after cleaning.

F. Pavement surfaces shall be dry and clean prior to painting. Pavement markings shall not be applied within 24 hours following rain or other inclement weather or when rain is imminent.

G. Apply seal coat across the existing pavement to provide a uniform surface appearance.

3.2 APPLICATION OF PAVEMENT MARKING

A. Apply paint in accordance with the requirements of Section 704 of the VDOT Road and Bridge Specifications and the manufacturer's recommendations.

B. Lay out lines and markings to the width and length as indicated. All parking space lines shall be 4 inches wide.

C. Apply markings with an approved applicator.

D. Apply markings at manufacturer recommended rates.

3.3 INSTALLATION OF SIGNS

A. Install signs on signposts in accordance with the requirements of Section 701 of the VDOT Road and Bridge Specifications and STP-1 of the VDOT Road and Bridge Standards.

END OF SECTION

SECTION 32 9000 – PLANTS

PART 1 – GENERAL

1.1 SUBMITTALS

A. LEED Submittals: Comply with Section 018113.
    1. SS Credit 2: Protect or Restore Habitat.
        i. Provide documentation that confirms all criteria listed in Part 2 of this Section is met for all imported soils.

1.2 SUMMARY

A. OF/OI - Trees, shrubs and plants.
B. The contractor will be responsible to prepare the subgrade and plant beds (including any mulch) as part of the construction project. With the contractor providing turf / grass / mulched plant beds, the site will be fully stabilized when they complete their work and SWM/ESC permits can be closed. VT Grounds Department will then plant trees, shrubs, plants following completion of construction and within the specified planting season.
C. Work included: Provide all labor, materials and installation necessary to complete the fine grading, incidental grading, planting and related work as required.
D. Section Includes:
    1. Plants.
    2. Planting soils.
E. Related Sections:
    1. Division 01 Section "Temporary Tree and Plant Protection" for protecting, trimming, pruning, repairing, and replacing existing trees to remain that interfere with, or are affected by, execution of the Work.
    2. Division 31 Section "Site Clearing" for protection of existing trees and plantings, topsoil stripping and stockpiling, and site clearing.
    3. Division 31 Section "Earthwork" for excavation, filling, and rough grading and for subsurface aggregate drainage and drainage backfill materials.
    4. Division 32 Section "Turf and Grasses" for turf (lawn) and meadow planting, hydroseeding, and erosion-control materials.

1.3 DEFINITIONS

A. Backfill: The earth used to replace or the act of replacing earth in an excavation.
B. Caliper Inch: The diameter of a young tree, measured 6” above ground for trees up to 4” caliper size. If caliper exceeds 4”, tree shall be measured at 12” above ground. Nursery stock trees are measured in caliper inches.
C. Certified Arborist: An arborist certified through the International Society of Arboriculture (ISA) after meeting experience requirements and passing a test demonstrating basic knowledge about trees and their management, fulfilling ongoing continuing education requirements and paying regularly scheduled certification fees.
D. Container-Grown Stock: Healthy, vigorous, well-rooted plants grown in a container, with a well-established root system reaching sides of container and maintaining a firm ball when removed

from container. Container shall be rigid enough to hold ball shape and protect root mass during shipping and be sized according to ANSI Z60.1 for type and size of plant required.

E. Dripline (tree): The area under the total branch spread of the tree, all around the tree. This should not be confused with critical root zone.
F. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
G. Finish Grade: Elevation of finished surface of planting soil.
H. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
I. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
J. Pests: Living organisms that occur where they are not desired, or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
K. Planting Area: Areas to be planted.
L. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
M. Plant; Plants; Plant Material: These terms refer to vegetation in general, including trees, shrubs, vines, ground covers, ornamental grasses, bulbs, corms, tubers, or herbaceous vegetation.
N. Root Flare: Also called "trunk flare." The area at the base of the plant's stem or trunk where the stem or trunk broadens to form roots, the area of transition between the root system and the stem or trunk.
O. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.
P. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or the top surface of a fill or backfill before planting soil is placed.
Q. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.
R. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil; but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
    1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
    2. Experience: Five years’ experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
    3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.

4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
    i. Certified Landscape Technician - Exterior, with installation specialty area(s), designated CLT-Exterior.
    ii. Certified Landscape Technician - Interior, designated CLT-Interior.
    iii. Certified Ornamental Landscape Professional, designated COLP.
5. Pesticide Applicator: State licensed, commercial.

B. Provide quality, size, genus, species, and variety of plants indicated, complying with applicable requirements in ANSI Z60.1.

C. 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 the 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.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

D. Plant Material Observation: Landscape 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. Landscape 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 Landscape Architect of sources of planting materials seven days in advance of delivery to site.

E. Preinstallation Conference: Conduct conference at Project site.

F. Responsible Department
1. The Virginia Tech University Arborist office, located within the CPIF and under the direction of the VPCPIF, is responsible for the development of the Virginia Tech tree planting and care standards and for managing natural tree assets on campus.

G. Campus Tree Advisory Committee
1. The campus tree advisory committee is formally known as the Arboretum Committee and is comprised of faculty and staff from many plant-related programs within the university and the town of Blacksburg, VA. The committee meets biannually or as needed and provides important input into the care and improvement of the campus landscape.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws if applicable.

B. Bulk Materials:
1. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

2. Provide erosion-control measures to prevent erosion or displacement of bulk materials, discharge of soil-bearing water runoff, and airborne dust reaching adjacent properties, water conveyance systems, or walkways.
3. Accompany each delivery of bulk fertilizers with appropriate certificates.

C. Do not prune trees and shrubs before delivery. Protect bark, branches, and root systems from sun scald, drying, wind burn, 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 plants during shipping and delivery. Do not drop plants during delivery and handling.

D. Handle planting stock by root ball.

E. Deliver plants after preparations for planting have been completed, and install immediately. If planting is delayed more than six hours after delivery, set plants and trees in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.
1. Do not remove container-grown stock from containers before time of planting.
2. Water root systems of plants stored on-site deeply and thoroughly with a fine-mist spray. Water as often as necessary to maintain root systems in a moist, but not overly wet condition.

1.6 PROJECT CONDITIONS

A. 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.

B. Interruption of Existing Services or Utilities: Do not interrupt services or utilities to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary services or utilities according to requirements indicated:
1. Notify Architect no fewer than two days in advance of proposed interruption of each service or utility.
2. Do not proceed with interruption of services or utilities without Architect's written permission.

C. 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. Spring Planting: March 15 – May 15.
2. Fall Planting: September 15 – October 15.

D. 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. Apply products during favorable weather conditions according to manufacturer's written instructions and warranty requirements.

E. Coordination with Turf Areas (Lawns): 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, protect turf areas, and promptly repair damage caused by planting operations.

1.7 WARRANTY

A. Special Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period.
    1. Failures include, but are not limited to, the following:
        i. Death and unsatisfactory growth, except for defects resulting from abuse, lack of adequate maintenance, or neglect by Owner, or incidents that are beyond Contractor's control.
        ii. Structural failures including plantings falling or blowing over.
        iii. Faulty performance of tree stabilization.
        iv. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    2. Warranty Periods from Date of Substantial Completion:
        i. Trees, Shrubs: 12 months.
    3. Include the following remedial actions as a minimum:
        i. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
        ii. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
        iii. A limit of one replacement of each plant will be required except for losses or replacements due to failure to comply with requirements.
        iv. Provide extended warranty for period equal to original warranty period, for replaced plant material.

1.8 MAINTENANCE SERVICE

A. Initial Maintenance Service for Trees and Shrubs: Provide maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after plants are installed and continue until plantings are acceptably healthy and well established but for not less than maintenance period below. Watering not to occur after 1 year.
    1. Maintenance Period: 12 months from date of Substantial Completion.
B. Continuing Maintenance Proposal: From Installer to Owner, in the form of a standard yearly (or other period) maintenance agreement, starting on date initial maintenance service is concluded. State services, obligations, conditions, and terms for agreement period and for future renewal options.

PART 2 – PRODUCTS

2.1 PLANT MATERIAL

A. Planting
    1. The University Landscape Architect and University Arborist shall be consulted on all planting-related project components. See the VT Design Standard Detail Library for planting and tree protection details. The use of sod is recommended on all disturbed areas. Areas of focus include, but are not limited to:
        i. Planting preparation

a. Soil Profile Rebuilding: This specification sheet is provided through the VT Urban Forestry website.
b. Mulching
c. Planting soil mix
d. Planting beds

ii. Turf and Grasses
a. Hydro-mulching
b. Seeding
c. Sodding

iii. Plants
a. Groundcovers
b. Plants and bulbs
c. Shrubs
d. Trees

iv. Planting accessories
a. Landscape edging
b. Tree grates
c. Silva cells

v. Transplanting
a. Groundcover
b. Plant and bulb
c. Shrub
d. Tree

2.2 ORGANIC SOIL AMENDMENTS (AS RECOMMENDED PER SOIL ANALYSIS)

A. Compost
1. Compost shall be fully finished and meet or exceed the requirements set forth by the United States Department of Agriculture, the United States Composting Council, and State composting requirements.
2. Acceptable compost is predominantly plant-based, such as cotton bur or leaf mold. Approval by University Landscape Architect and/or University Arborist is required.

2.3 FERTILIZERS

A. There is no regular tree fertilization beyond the treatment received as a result of fall lawn fertilization. Specimen or high-value trees may receive prescription fertilization when severe nutrient deficiencies are diagnosed.

2.4 PLANTING SOILS

A. Imported Soils: Comply with the following criteria:
1. Original function is comparable to reuse function.
2. Not classified as prime farmland, unique farmland or farmland of statewide or local importance.
3. Not extracted from a greenfield site.

4. Does not include sphagnum peat moss.

B. Topsoil
   1. Topsoil shall consist of friable surface soil, sandy clay loam, obtained from well drained areas, free from objects larger than 1-1/2 inches maximum dimension, and free of subsoil, roots, grass, other foreign matter, hazardous or toxic substances, and deleterious material that may be harmful to plant growth or may hinder grading, planting, or maintenance.
   2. Composition shall be in general accordance with ASTM D5268:
      i. Gravel-sized fraction: Maximum 5 percent by weight retained on a No. 10 sieve.
      ii. Sand-sized fraction: Minimum 20 to 60 percent passing No. 10 sieve.
      iii. Silt and clay-sized fraction: Minimum 35 to 70 percent.
      iv. Organic matter: Minimum 1.5 percent by dry weight as determined in accordance with ASTM D2974.
      v. pH: Range 5.5 to 7.0.
      vi. Test topsoil at Virginia Tech Soil Testing Lab and follow amendment recommendations for landscape plants.

2.5 MULCHES

A. For tree mulching, apply mulch to a depth no greater than 3 inches; care shall be taken to prevent mulching around the root collar. Mulch shall be applied every two years for trees up to approximately 6 inches in diameter. Periodically, drip lines of larger trees, tree stands, and high-value trees are mulched extensively with coarse wood chips.

2.6 PESTICIDES

A. Trees are treated for pest problems as needed. There is an extensive Dutch elm disease treatment program on campus. There is some regular treatment of hemlocks on campus for hemlock wooly adelgid and ash trees for the emerald ash borer.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine areas to receive landscape installation for compliance with requirements and conditions affecting installation and performance. Proceed with installation only after unsatisfactory conditions have been corrected, including all irrigation, per approvals by University Landscape Architect and/or University Arborist.

3.2 PREPARATION

A. Construction Site Location
   1. Avoid locating the general construction site around high priority trees where possible.
   2. Soil Compatibility Tests: Perform required soil testing before completing rough grading.
   3. Plan all construction activities including new utility corridors, staging areas, new sidewalks, and new roads for a minimum clearance of 25 feet away from the base of

trees, and not within the critical root zone as determined by the University Arborist. Greater distances are desirable.

4. Protect structures, utilities, sidewalks, pavements, and other facilities, and existing vegetation from damage caused by landscape installation operations.
5. High priority trees should receive more consideration than low priority trees in planning corridors, staging areas, walks, and roads.

3.3 PLANTING AREA ESTABLISHMENT

A. Topsoil Preparation
   1. Spread topsoil to 4” minimum depth after subsoil preparation.
   2. Compact topsoil to 80% Standard Proctor.

B. Staging Area Restoration
   1. Staging areas to receive landscaping in any form (lawn, trees, shrubs, etc.) must be restored using the specifications provided in the Soil Profile Rebuilding document located on the VT Soil Profile Rebuilding website.

3.4 TREE, SHRUB EXCAVATION & PLANTING

A. Planting Specifications
   1. Planting shall consist of excavating all planting holes, planting, and maintaining new trees of the type designated on the Virginia Tech Core Campus Approved Tree List (see Appendix I: Approved Plant and Tree Lists). All work shall be in accordance with these specifications and to the satisfaction of the University Arborist office.
   2. It is the responsibility of the installer to notify all owners and operators of underground facilities and have all utilities located and marked before work occurs.
   3. Once work begins, the installer takes full responsibility for the planting locations. All excavated materials that are not backfilled into the planting hole shall be removed from the site and disposed of properly. The area shall be safe and secure throughout the job and at the end of the workday.
   4. Site characteristics, such as overhead utilities, existing vegetation, and infrastructure items (e.g., curbs and sidewalks) shall be considered prior to tree design and installation. Trees that grow taller than 25 feet should not be planted directly under utility lines. When possible, the tree leader shall be offset from power lines. Where subsurface obstructions (e.g., vaults, utilities, or sprinklers) are encountered during excavation and restrict the planting of a tree, the installer shall restore the disturbed area to its original condition. If damage is done to an underground obstruction, it is the responsibility of the installer to restore the site to its original condition. A new planting location will be designated if conditions permit.
   5. Trees shall be transported and handled with care to ensure adequate protection against injury and desiccation. When transported in closed vehicles, plants shall receive adequate ventilation to prevent sweating. When transported in open vehicles, plants shall be protected by tarps or other suitable cover material. Balled and burlapped trees shall be set on the ground and balls covered with soil. Until planted, all materials shall be properly maintained and kept adequately watered. Installers are liable for any

damage to property caused by planting operations and related work. All disturbed areas shall be restored to their original condition.

6. Traffic shall not be disrupted at any time during planting operations, unless VT Parking and Transportation has permitted the disruption. Work shall not be performed on opposite sides of the street at the same time.

B. Planting Seasons
    1. All planting steps shall be performed and shall conclude within the same planting season. Planting stock shall be dug at the nursery in the dormant season (November-March) and retained temporarily in holding yards. Planting stock shall be delivered to the site directly before installation. Stock shall not be held or stored beyond the planting season. No planting is permitted in the summer. Any off-season planting must be approved by the University Arborist office.

C. Installation
    1. Remove all materials from the planting hole for the full length and width of the planting hole to the depth of the tree's root ball. For excavation of a lawn strip that is not restricted by hardscape, excavate an area at least three times the diameter of the root ball. If the lawn strip is restricted by hardscape on two sides, excavate a planting hole parallel to the hardscape that is three times the diameter of the root ball. Extreme care shall be taken to avoid excavation to a depth greater than required. The subgrade below the root ball shall be tamped slightly to prevent settlement. All ropes, stones, etc., shall be removed from the planting site before backfilling. All excavated materials remaining above grade after tree installation shall be removed from the site and disposed of in an acceptable manner.
    2. Place balled and burlapped material in the prepared planting hole by lifting and carrying it by the root ball so that the ball will not be loosened. Set the tree straight and in the center of the pit. All trees shall sit, after settlement, with the base of the trunk and the beginning of the roots, known as the "trunk flare", level with the site soil grade. If the top of the root ball is not consistent with this area, the depth of the planting site should be adjusted by adding or removing soil below the root ball to make the trunk flare level with the sidewalk grade.
    3. Cut and remove rope and wire from the root ball. All rope, wire, twine, burlap, and other materials shall be removed and not backfilled into the hole. Backfill shall be loose and friable and clumped; this will reduce air pockets and settling. Soil shall be firmed as the hole is backfilled but not compacted. All planting holes shall be filled with the backfill and made level with existing conditions. Cultivate and rake over finished planting areas leaving them in a clean condition. At no time should soil or mulch be mounded to cover the trunk of the tree. The trunk flare shall always be visible. The final soil level shall be flush with the surrounding soil grade to prevent a potential tripping hazard.

D. Staking and Tree Wrap
    1. All staking shall be done during the planting operation and shall be maintained throughout the first year of the 2-year guarantee period. After the first year, the stakes shall be removed. Stakes shall be of seasoned hardwood, preferably oak, and shall show no sign of cracking or decay.

2. Stakes shall be cut evenly so they are the same height. All trees shall be supported by two five-foot-long stakes. The diameter at the mid-point of the tree stake shall not be less than 2 inches. Stakes shall be placed outside of the root ball, driven 30 inches into the ground, and fastened to the tree with a suitable length of 3/4″ wide, flat, woven polypropylene material (i.e., arbor tie).
3. Unless otherwise directed, trees shall be staked as shown on the plans and in accordance with these specifications. Stakes shall be set parallel to curbs. Trees shall stand plumb after staking. Stakes and arbor tie shall be removed at the end of the first year of the 2-year guarantee period, unless otherwise directed by the University Arborist office. At the time the stakes are removed, any holes left by the stakes shall be filled. No tree trunks shall be wrapped. Remove all nursery tags and protective wrapping. No material shall be left that may girdle the stem.

3.5 TREE, SHRUB PRUNING

A. Pruning shall be done in accordance with ANSI A300 Part 1 Standard Practices for structural pruning. Pruning before and for two years after planting shall be limited to the removal of dead, broken, or diseased branches. All diseased branches and all dead branches shall be removed. Any branch which may be partly dead, yet has a healthy lateral branch at least one third the diameter of the parent branch shall be pruned back to the healthy lateral branch.
B. All stubs or improper cuts resulting from former pruning shall be removed. All cuts shall be cleanly made with sharp and sterile tools as close to the parent trunk or limb as possible without disturbing the branch bark ridge or callus collar. Any existing nails, spikes, wire, plastic, or other materials found driven into or fastened to the trunk or branches shall be removed or, if approved by the University Arborist, they shall be cut flush in a manner to permit complete sealing over.
C. Pruning Schedule: The maintenance pruning schedule shall be dictated by tree species, age, condition, function, and location.
    1. Trees classified as young in the Virginia Tech Tree Inventory shall receive structural pruning every 4 years or more frequently as needed.
    2. Trees classified as immature in the Virginia Tech Tree Inventory shall receive structural pruning every 4 years or more frequently as needed.
    3. Trees classified as mature in the Virginia Tech Tree Inventory shall receive maintenance pruning every 5 years to remove dead, diseased, dying, and defective branches from the crown or to resolve any tree and human conflicts. Some mature trees may require more frequent maintenance and shall be assessed as needed.
    4. Trees adjacent to roadways, walkways, signs, buildings, and street lights should be inspected annually for safety and clearance issues. Maintenance pruning should be scheduled as necessary.
D. Pruning Practices: To encourage the development of a strong, healthy tree, the following guidelines shall be followed when pruning.
    1. General
        i. Pruning shall not be conducted without a clear objective.
        ii. Prune first for safety, next for health, and finally for aesthetics.

iii. When removing branches, the pruning cut shall not damage the branch bark ridge and branch collar.
iv. Internode (heading) cuts should not be used except in storm response and crown restoration procedures.
v. Branch reduction or thinning should be used to achieve pruning objectives rather than making large (greater than 8 inches in diameter) branch removal cuts.

2. Dead Wood Pruning
   i. Pruning shall be performed to remove dead, diseased, dying, and compromised branches; this practice reduces risk, promotes health, and improves appearance.
   ii. Large branches shall be removed with the aid of ropes and rigging equipment to minimize the risk of tree injury from falling debris.
   iii. Some dead wood may be retained in low occupancy areas for the benefit of wildlife and to aid in education and outreach.
3. Thinning
   i. Thinning shall be performed to reduce the density of branches which increases light penetration, improves visibility, and decreases wind load.
   ii. Assess how a tree will be pruned from the top down.
   iii. Branches with strong, U-shaped angles of attachment shall be favored. Remove branches with weak, V-shaped angles of attachment and the included bark.
   iv. Evenly space lateral branches on the main stem of young trees.
   v. Remove any branches that rub or cross another branch.
   vi. Ensure that lateral branches are no more than one-half to three-quarters of the diameter of the main stem to discourage the development of codominant stems.
   vii. Do not remove more than one-quarter of the living crown of a tree at one time. If it is necessary to remove more, do it over successive years.
4. Raising
   i. Raising shall be performed to provide vertical clearance from thoroughfares, around signs and street lights, and near structures.
   ii. Always maintain live branches on at least two-thirds of a tree's total height. Removing too many lower branches will hinder the development of a strong main stem.
   iii. Remove basal sprouts and vigorous epicormic sprouts.
5. Reduction
   i. Reduction shall be performed to decrease the overall height of a tree, to decrease the length of an individual branch, or to reduce the size of a tree's crown.
   ii. Use reduction pruning only when absolutely necessary. Make the pruning cut at a lateral branch that is a least one-third the diameter of the stem to be removed.
   iii. If it is necessary to remove more than half of the foliage from a branch, remove the entire branch.

6. Topping of Trees
    i. Topping, heading, hat-racking, or any other form of damaging crown- or branch-reduction pruning shall not be permitted except in emergency situations or while executing a crown restoration practice.

3.6 GROUND COVER AND PLANT PLANTING

A. Seed Materials and Topsoil
    1. Seed Mixes:
        i. Spring and fall seasons (March 1–May 15 and August 15–November 1): New crop, blue tag certified. Mix to consist of: 15% Kentucky Bluegrass (mix of 3 varieties) and 85% Turf Type Tall Fescue (mix of 3 varieties). Percentages determined by weight.
        ii. Summer seeding (May 15–August 15): New crop, blue tag certified. Mix to consist of: 15% Kentucky Bluegrass (mix of 3 varieties), 80% Turf Type Tall Fescue (mix of 3 varieties), and 5% German Millet. Percentages determined by weight.
        iii. Winter seeding (November 1–March 1): New crop, blue tag certified. Mix to consist of: 15% Kentucky Bluegrass (mix of 3 varieties), 80% Turf Type Tall Fescue (mix of 3 varieties), and 5% Annual Rye. Percentages determined by weight.
    2. Hydroseeding fertilizer: 20-20-20 soluble.
    3. Straw: Clean oat or wheat straw well-seasoned before bailing, free from mature seed-bearing stalks or prohibited or noxious weeds.
    4. Test topsoil at the Virginia Tech Soil Testing Lab and follow recommendations for landscape plants.

B. Seeding Process
    1. Grade seed bed to a smooth, free-draining, even surface with a loose, fine, texture.
    2. Remove stones over 1″ in any dimension, sticks, roots, rubbish, and extraneous matter from graded seed bed.
    3. Seed immediately after preparation of bed.
    4. Seed areas within contract limits and any areas outside contract limits disturbed as a result of construction operations.
    5. Apply seed with a rotary or drop type distributor. Install seed evenly by sowing equal quantities in two directions, at right angles to each other. Apply seed at 8 lb./1000 sq. ft. or 340 lb./acre.
    6. Incorporate seed into top 1/8″ of soil and roll.
    7. Seeded area mulching:
        i. Blown straw tacked with a light coating of hydromulch is preferred.
        ii. Place straw or fiber mulch on seeded areas within 24 hours after seeding, in a continuous blanket, and at the rate of 2-1/2 tons per acre, or 2 bales per 1,000 square feet of area. The Contractor will be asked to remove any straw clumps left on the seeded area.
        iii. A mechanical blower may be used for straw mulch application when acceptable to OUP and VT Grounds. Coordinate through the VT PM.

iv. For areas requiring an erosion control blanket (e.g., slopes exceeding 4:1), provide a straw fiber mat with a single polypropylene netting sewn with degradable thread. The mat thickness shall be approximately 0.45″ and all components of the mat shall photodegrade in approximately 45 days. The basis of design is EroNet DS75.

8. Seeded area protection:
    i. It is the Contractor's responsibility to protect seeded areas from various types of traffic (vehicles, bikes, pedestrians, etc.). Seeded areas should be identified with signs and isolated using a form of temporary perimeter control.
    ii. No construction traffic will be permitted on seeded areas. Any seeded area disturbed by the Contractor must be re-tilled to 4″ depth and re seeded.

3.7 PLANTING AREA - MULCHING

A. Bark mulch, arborist chips, or coarse woody debris shall be applied as a ground cover to the surface of all planting beds at the time of planting and again after the tree stakes have been removed, one year after planting.
B. Mulch shall be applied to a uniform depth of 3 inches and shall be distributed to create a smooth, level cover over the exposed soil. A gap of approximately 2 inches should be left between the mulch and the trunk of the tree to avoid mounding above the trunk flare.

3.8 WATERING

A. Provide hoses, connections, and other equipment necessary to distribute water from source to required locations. Do not waste water or let it run into university thoroughfares.
B. At the time of planting, the soil around each tree shall be thoroughly saturated with at least 20 gallons of potable water. Care shall be taken to avoid compacting the backfill or eroding the planting hole. Water shall not be applied in a manner which damages plants, stakes, or adjacent areas. Each tree bed shall be watered evenly in a manner which does not erode the soil or mulch. Watering shall not cause uprooting or exposure of plant roots to the air.

3.9 PLANT SELECTION, DIVERSITY REQUIREMENTS, AND PLANTING STOCK STANDARDS

A. As the campus is used as a teaching lab and a resilient canopy is a priority, increasing the diversity of tree species is extremely important. Diversity thresholds of 5% of any one species, 10% of any one genus, and 15% of any family should be implemented during planting projects; this practice will ensure adequate diversity as tree populations are installed.
B. Small, mostly ornamental, tree species should be limited on new planting projects to no more than 10% of the population installed. However, species selection must be dictated by site conditions, available planting stock, and expected changes in the climate. See Appendix I: Approved Plant and Tree Lists.
C. All planting projects shall specify bare root or balled and burlapped planting stock. Container grown trees will not be approved by the University Arborist office. Planting stock shall not be specified at sizes greater than 2.5-inch caliper.

3.10 PLANT MAINTENANCE

A. Watering
    1. Watering shall take place throughout the two-year guarantee period, at a rate of at least 20 gallons at approximately two-week intervals from May 15 to October 31. The frequency of watering may increase or decrease based on weather conditions, the resulting soil water content, other physical factors, or at the request of the University Arborist office.
    2. Water shall not be applied in a manner which damages plants, stakes, or adjacent areas. Each tree bed shall be watered evenly in a manner which does not erode soil or mulch. Watering shall not cause uprooting or exposure of the plant's roots to the air. Damages resulting from these operations shall be immediately repaired at the expense of the installer.

B. Other Maintenance Activities
    1. All newly planted trees shall be maintained by the installer until 2 years after the final inspection by the University Arborist office. Maintenance for the trees shall include weeding, cultivating, edging, pruning, adjustment, and timely removal of stakes and arbor tie (one year after tree installation).
    2. Maintenance for the planting area shall include the repair of minor washouts, mulching, soil replacement, and any other horticultural operations necessary for proper growth of all trees and for keeping the entire planting area neat in appearance. All planting areas shall be cultivated and weeded with hoes or other appropriate tools within the period from May 15 to October 31, and such cultivating and weeding shall be repeated at least every 3 weeks. Under no conditions shall weeds be allowed to attain more than 6 inches of growth.

3.11 PESTICIDE APPLICATION

A. Trees are treated for pest problems as needed. There is an extensive Dutch elm disease treatment program on campus. There is some regular treatment of hemlocks on campus for hemlock wooly adelgid and ash trees for the emerald ash borer.

3.12 CLEANUP AND PROTECTION

A. Tree Protection and Preservation Procedures
    1. For tree protection procedures, see the tree protection detail in the VT Design Standard Detail Library. Coordinate trees to be removed with the University Arborist.
    2. For risk assessment and tree inspection procedures, contact the University Arborist office for copies of the VT Tree Risk Assessment Procedure and VT Tree Inspection Procedure.

B. Preservation During Design Phase
    1. Construction, renovation, and development shall not occur within specified tree protection zones.
    2. On the site survey map, identify all trees that may be impacted (above and below ground) by construction equipment, cut and fill activities, utility corridors, proposed

walks and roads, and potential construction staging areas. All trees that will remain and the tree protection zones for those trees shall be indicated on the site plans.

3. If trees are grouped in a forest or woodlot, then only the location of the woodlot and any trees greater than 15 inches in diameter at 4.5 feet above grade (the diameter at breast height or DBH) should be identified.

C. Low Priority for Preservation
   1. Small trees (less than 5 inches DBH) that will likely be impacted by construction activities.
   2. Larger trees with relatively low landscape value. Examples include but are not limited to, trees with poor form, trees of undesirable species, or trees with inadequate space to accommodate current or future growth even if the site is ameliorated, as determined by the University Arborist office.

D. High Priority for Preservation
   1. Larger trees (greater than 5 inches DBH) of desirable species with fair to good form, good health, and room to continue to grow, as determined by the University Arborist office.
   2. Trees that were planted as memorials, commencement trees, or commemorative trees.

E. Guarantee Period
   1. All trees must be guaranteed for 2 years. All installers shall provide a guarantee for the trees planted.

F. Tree Replacement
   1. Any tree planted as dead or, in the opinion of University Arborist office, planted in an unhealthy or unsightly condition prior to final acceptance shall be replaced immediately, or in the next planting season, if a seasonal delay is necessary. Such trees include those that have lost the natural shape due to dead branches, excessive pruning, inadequate or improper maintenance, or have been damaged through actions or negligence by the Contractor or subcontractor.
   2. There shall be a 2-year guarantee on trees commencing after the final inspection by the University Arborist office. Where dead trees have been identified, whether due to natural causes, improper actions, or negligence, the dead material along with stakes and arbor ties shall be removed within 30 days of notification. When necessary, topsoil, grass seed, or appropriate paving material shall be added to the pit at the time of tree removal to eliminate potential tripping hazards. Photos shall be submitted to the University Arborist office showing the proper removal of trees. A renewed approval is required for any replanting during the planting season.

G. Tree Removals
   1. Live trees are generally removed to reduce risk to the public, property, and services. Rarely does tree removal occur to improve the quality of the landscape. Trees may be removed after assessment by the University Arborist office, which will consult with and seek consensus from the Arboretum Committee.
   2. When the University Arborist office and the Arboretum Committee cannot reach a consensus, an independent assessment by a consulting arborist may be required and submitted to the committee for review.

H. Storm Response and Recovery

1. Storm response and recovery are generally accomplished in-house. In a crisis, the first priority is to remove tree debris that blocks campus thoroughfares, disrupts campus operations, or poses a high or imminent risk to the campus community. Once these critical needs are addressed, a prioritized recovery plan is implemented during which seriously damaged trees are systematically removed and other impacted trees are pruned to restore their health and structure while reducing risk.
2. As the tree planting budget permits, lost trees are strategically replaced to restore the structure and function of the campus urban forest in a reasonable time frame. During storm response and recovery, needs for trees requiring specialized equipment or skills not available in-house are addressed by an outside contractor.

I. Destruction of Trees
   1. Whether partial or complete, any damage or destruction of trees, shrubs, or other growth on University property without prior approval is unlawful and is a misdemeanor (Code of Virginia § 18.2-140). If damage or destruction of trees is anticipated, prior approval for those actions shall be obtained from the University Arborist. If damage or destruction of shrubs or other growth is anticipated, prior approval for those actions shall be obtained from VT Grounds.

J. Tree and Plant Protection
   1. Tree Protection Fencing
      i. Tree protection fencing is required for all trees within construction limit fencing or as noted on plans for projects where no construction limit fencing is specified.
      ii. Tree protection fencing shall be installed around existing trees noted to remain on plans within the fenced area. Fencing shall be installed and maintained at a distance from the trunk equal to 1.5 feet per inch of trunk diameter as measured at 4.5 feet above grade (DBH) or 10 feet, whichever is greater. For example, a tree with a 12-inch trunk diameter shall be fenced 18 feet from the trunk (36-foot diameter). See the tree protection detail located in the VT Design Standard Detail Library for specific requirements for tree protection zones (TPZ). Alternative shapes and sizes of TPZ may be considered on sites with size or location constraints and must be approved by the University Arborist office.
      iii. Fencing shall be installed before any equipment is placed on the site. Work may not begin until fencing is installed.
      iv. Fencing shall be galvanized chain link with a minimum height of 4 feet. The use of plastic fencing or snow fencing with wood stakes or T-posts is not acceptable.
      v. Fencing shall be maintained for the duration of the project and shall not be removed without permission from the University Arborist.
      vi. No material storage, vehicles, or any other activity shall occur at any time within tree protection fencing. Coordinate with the VT PM if any landscape maintenance is required while the tree protection is installed.
      vii. Contractors shall pay for tree asset appraisal, replacement, and soil compaction remediation costs, as directed by the University Arborist office, if there is any incursion into tree protection zones.

3.13 SITE CLEANUP

A. Remove all tags, stakes, tape, twine from nursery stock.
B. Remove surplus soil and waste material, including excess subsoil, unsuitable soil, trash, debris, and legally dispose of them off Campus property at Contractor's expense.
C. Clean all pavement of cement, soil and mulch created by this work from site.
D. There should be no construction equipment or waste materials left on the project site upon construction completion.
E. Project shall repair any damage done to existing or new landscape (inside or outside limit of construction).
F. After final approval and all punch list items have been addressed, remove tree protection including all fencing, wood chips, trunk and branch protection, and other tree protection materials from site.

SECTION 32 9200 – TURF AND GRASSES

PART 1 – GENERAL

1.1 SUBMITTALS

A. LEED Submittals: Comply with Section 018113.
    1. SS Credit 2: Protect or Restore Habitat.
        i. Provide documentation that confirms all criteria listed in Part 2 of this Section is met for all imported soils.

1.2 SUMMARY

A. Provide labor and materials necessary for installation of turf sod and other related work as required.
B. Section Includes:
    1. Seeding
    2. Sodding
    3. Meadow grasses and wildflowers
C. Related Sections:
    1. Division 31 Section “Site Clearing” for topsoil stripping and stockpiling.
    2. Division 31 Section “Earthwork” for excavation, filling & backfilling, and rough grading.
    3. Division 32 Section “Plants” for general planting bed preparation.

1.3 DEFINITIONS

A. Duff Layer: The surface layer of native topsoil that is composed of mostly decayed leaves, twigs, and detritus.
B. Finish Grade: Elevation of finished surface of planting soil.
C. Manufactured Topsoil: Soil produced off-site by homogeneously blending mineral soils or sand with stabilized organic soil amendments to produce topsoil or planting soil.
D. Pesticide: A substance or mixture intended for preventing, destroying, repelling, or mitigating a pest. This includes insecticides, miticides, herbicides, fungicides, rodenticides, and molluscicides. It also includes substances or mixtures intended for use as a plant regulator, defoliant, or desiccant.
E. Pests: Living organisms that occur where they are not desired or that cause damage to plants, animals, or people. These include insects, mites, grubs, mollusks (snails and slugs), rodents (gophers, moles, and mice), unwanted plants (weeds), fungi, bacteria, and viruses.
F. Planting Soil: Standardized topsoil; existing, native surface topsoil; existing, in-place surface soil; imported topsoil; or manufactured topsoil that is modified with soil amendments and perhaps fertilizers to produce a soil mixture best for plant growth.
G. Subgrade: Surface or elevation of subsoil remaining after excavation is complete, or top surface of a fill or backfill before planting soil is placed.
H. Subsoil: All soil beneath the topsoil layer of the soil profile and typified by the lack of organic matter and soil organisms.

I. Surface Soil: Soil that is present at the top layer of the existing soil profile at the Project site. In undisturbed areas, the surface soil is typically topsoil, but in disturbed areas such as urban environments, the surface soil can be subsoil.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.
   1. Professional Membership: Installer shall be a member in good standing of either the Professional Landcare Network or the American Nursery and Landscape Association.
   2. Experience: Five years' experience in landscape installation in addition to requirements in Division 01 Section "Quality Requirements."
   3. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
   4. Personnel Certifications: Installer's field supervisor shall have certification in one of the following categories from the Professional Landcare Network:
      i. Certified Landscape Technician - Exterior, with installation specialty area(s), designated CLT-Exterior.
      ii. Certified Landscape Technician - Interior, designated CLT-Interior.
      iii. Certified Ornamental Landscape Professional, designated COLP.
   5. Pesticide Applicator: State licensed, commercial.
B. A certified laboratory retained by the contractor (if not being tested at Virginia Tech's Soil Testing Lab) shall provide testing and verification of representative common area turf material samples proposed for use on this project. Testing includes, but is not limited to, the following:
   1. Plasticity index
   2. Soil pH
   3. Particle size, percentage soil texture
   4. Percentage organic material
   5. Nutrient level analysis
      i. macro, secondary and micro nutrients
      ii. Nitrate
      iii. Potassium
      iv. Phosphorus
      v. Calcium
      vi. Magnesium
      vii. Percolation rate
      viii. Conductivity
C. Based on above testing, laboratory shall make recommendations on type and quantity of amendments required to bring levels into acceptable ranges.
D. Preinstallation Conference: Conduct conference at Project site.

1.5 DELIVERY, STORAGE AND HANDLING

A. Seed and Other Packaged Materials: Deliver packaged materials in original, unopened containers showing weight, certified analysis, name and address of manufacturer, and indication of conformance with state and federal laws, as applicable.

1. Deliver materials in clean, washed, and covered trucks to eliminate contamination during transportation. Coordinate on-site stockpiling locations with Owner. Stockpile in areas free of debris and away from drainage routes. Cover bulk material with plastic or geotextile if material is to be stockpiled more than 24 hours.

B. Sod: Harvest, deliver, store, and handle sod according to requirements in "Specifications for Turfgrass Sod Materials" and "Specifications for Turfgrass Sod Transplanting and Installation" in TPI's "Guideline Specifications to Turfgrass Sodding." Deliver sod in time for planting within 24 hours of harvesting. Only deliver what can be installed within 24 hours timeframe.

C. Protect sod from breakage and drying. Protect sod from sun, wind and dehydration prior to installation. Do not tear, stretch, or drop sod during installation.

1.6 PROJECT CONDITIONS

A. Planting Restrictions: Plant during the following period. Coordinate planting period with initial maintenance periods to provide required maintenance from date of Substantial Completion.
   1. Season 1: May 1 –September 15 (Bermuda).
   2. Season 2: September 15 – May 1 (Overseed with Annual Ryegrass).

B. 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. Apply products during favorable weather conditions according to manufacturer's written instructions.

C. Protect existing utilities, paving, and other facilities from damage caused by sod installation.

D. Restrict traffic from lawn areas until grass is established. Erect signs and barriers as required.

E. Provide hose and lawn watering equipment as required.

1.7 MAINTENANCE SERVICE

A. Initial Turf Maintenance Service: Provide full maintenance by skilled employees of landscape Installer. Maintain as required in Part 3. Begin maintenance immediately after each area is planted and continue until acceptable turf is established but for not less than the following periods:
   1. Seeded Turf: 90 days from date of Substantial Completion.
      i. When initial maintenance period has not elapsed before end of planting season, or if turf is not fully established, continue maintenance during next planting season.
   2. Sodded Turf: 90 days from date of Substantial Completion.

B. Meadow Maintenance:
   1. Begin maintenance immediately after each area is planted and continue until acceptable meadow is established, but for not less than 40 days from date of Substantial Completion.
   2. Maintain and establish meadow by watering, weeding, mowing, trimming, replanting, and other operations. Roll, regrade, and replant bare or eroded areas and re-mulch.

PART 2 – PRODUCTS

2.1 SEED

A. Seed Mixes:
    1. Spring and fall seasons (March 1–May 15 and August 15–November 1): New crop, blue tag certified. Mix to consist of: 15% Kentucky Bluegrass (mix of 3 varieties) and 85% Turf Type Tall Fescue (mix of 3 varieties). Percentages determined by weight.
B. Summer seeding (May 15–August 15): New crop, blue tag certified. Mix to consist of: 15% Kentucky Bluegrass (mix of 3 varieties), 80% Turf Type Tall Fescue (mix of 3 varieties), and 5% German Millet. Percentages determined by weight.
C. Winter seeding (November 1–March 1): New crop, blue tag certified. Mix to consist of: 15% Kentucky Bluegrass (mix of 3 varieties), 80% Turf Type Tall Fescue (mix of 3 varieties), and 5% Annual Rye. Percentages determined by weight.
D. Hydroseeding fertilizer: 20-20-20 soluble.
E. Straw: Clean oat or wheat straw well-seasoned before bailing, free from mature seed-bearing stalks or prohibited or noxious weeds.
F. Test topsoil at the Virginia Tech Soil Testing Lab and follow recommendations for landscape plants.

2.2 SOD

A. Sod shall be a locally grown blend of fescue and bluegrass (85% fescue/15% bluegrass).
B. Apply sod to topsoil surfaces prepared in equal manner to seeded areas.
C. Time Limitations: Sod shall be harvested and delivered within a period of 24 hours.
    1. Sod shall be installed/transplanted as soon as possible after delivery, unless a suitable preservation method is approved prior to delivery.
D. Water sod sufficiently to maintain moist root zone soil until establishment.
E. Sod installation may be extended in to summer months with understanding that Contractor will be required to adequately water until establishment.
F. Diseases, Nematodes and Insects: shall be free of diseases, nematodes and soil-borne insects. Specific nursery and/or plant materials laws may require that all sod entering inter-state commerce be inspected and approved for sale. The inspections and approval must be made by the appropriate government representative of the agriculture department or office of entomologist.
G. Weeds: Field Grown sod shall be 100% free of all noxious weeds. Field shall be considered free of grassy and broad leaf weeds. Sod containing common nutgrass, dandelion, or other deleterious weeds will not be accepted.

2.3 MEADOW

A. Seed Mix:
    1. MMF Native Grass Mix by Mellow Mushroom Farm.
    2. Native Grass consists of:
        i. 12% Andropogon gerardii
        ii. 12% Elymus virginicus
        iii. 40% Panicum virgatum
        iv. 12% Schizachyrium scoparium
        v. 12% Sorghastrum nutans

vi. 12% Tridens flava

3. Provide MMF Native Grass Mix at a rate of 20-25 pounds per acre (1lb. / 2,000 sf) as provided by Mellow Mushroom Farm or approved equal by University Landscape Architect and/or University Arborist.

2.4 TOPSOIL

A. Imported soils: Comply with the following criteria:
   1. Original function is comparable to reuse function.
   2. Not classified as prime farmland, unique farmland or farmland of statewide or local importance.
   3. Not extracted from a greenfield site.
   4. Does not include sphagnum peat moss.
B. Composition of Topsoil shall be as follows:
   1. Silt: 20-30%
   2. Clay: 20-30%
   3. Sand: 40-45%
   4. Organic Material: 2% maximum
   5. pH: 6.5-8.0
   6. Soluble Salts: less than 700 ppm
   7. Nutrients: enough to bring to levels of acceptable plant growth
C. Topsoil shall not have a mixture of subsoil and shall contain no slag, cinders, stones, lumps of soil, sticks, roots, trash or other extraneous materials larger than 1.5 inches (40 mm) in diameter. Topsoil must also be free of viable plants or plant parts of common bermudagrass, quackgrass, johnsongrass, nutsedge, poison ivy, thistles, or others as may be specified. All topsoil shall be tested by a reputable laboratory for pH and soluble salts. If needed, pH correction material shall be applied at a rate sufficient to correct the pH to a range of 6.5 to 7.5. Soluble salts shall not be higher than 700 parts per million.
D. No sod shall be placed on soil which has been chemically treated until sufficient time has elapsed to permit dissipation of all harmful materials (see manufacturers recommendations for re-entry date calculation). The general contractor shall assume full responsibility for any loss or damage to Bermuda ‘Celebration’ or Zoysia ‘Palasaides’ arising from improper use of chemicals or due to his failure to allow sufficient time to permit dissipation of chemical residues, whether or not such materials are specified herein.
E. Percolation rate: between 3 to 4 inches per hour.

2.5 PESTICIDES

A. As requested by University Landscape Architect. Notify University Landscape Architect and/or University Arborist of proposed pesticide use prior to application.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine finish surfaces, grades, topsoil quality, and depth. Do not start sod installation until unsatisfactory conditions are corrected.

3.2 PREPARATION

A. Limit preparation to areas that will be immediately planted.
B. Scarify existing soil surface and cultivate to minimum 8-inch depth to alleviate compaction from site excavation work. Remove debris, stones over ½-inch in diameter, sticks, roots, rubbish, and other extraneous materials and dispose of off site. Rototill to thoroughly incorporate following soil amendments into top 6-inches of scarified soil:
    1. Soil conditioner/compost - 2 inches deep, (approx. 6 cubic yards / 1,000 SF)
    2. Fertilizer
        i. Microlife 6-2-4
        ii. Ladybug 8-2-4
        iii. Humates 0-0-4 (Microlife) Carbon
    3. Fine grade
C. The topsoil shall be uniformly distributed on the designated area(s) and it shall be a minimum of 6 inches (75 mm) deep after firming. Spreading shall be performed in such a manner that sod installation can proceed with a minimum of additional soil preparation and tillage. Any irregularities in the surface resulting from topsoil removal or other operations shall be corrected in order to prevent the formation of depressions or water pockets. Topsoil shall not be placed while in a frozen or muddy condition, when the subgrade is excessively wet, or in a condition that may otherwise be detrimental to proper grading or proposed for turfgrass sod installation.
D. A licensed chemical applicator shall treat lawn areas with 'Round Up' by Monsanto, or approved equal, per label directions as required to kill existing vegetation at least 30 days prior to turf installation.
E. Grade turf area to smooth, even surface with loose, uniformly fine texture. Roll, water settle, rake to remove ridges and fill depressions to meet final grade.
F. Restore prepared area to specified condition if eroded, settled, or otherwise disturbed after fine grading and prior to installation of turf.
G. Weeds shall be removed by hand throughout the duration of warranty period or until project is turned over to Virginia Tech.

3.3 SEEDING

A. Grade seed bed to a smooth, free-draining, even surface with a loose, fine, texture.
B. Remove stones over 1' in any dimension, sticks, roots, rubbish, and extraneous matter from graded seed bed.
C. Seed immediately after preparation of bed.
D. Seed areas within contract limits and any areas outside contract limits
E. disturbed as a result of construction operations.
F. Apply seed with a rotary or drop type distributor. Install seed evenly by sowing equal quantities in two directions, at right angles to each other. Apply seed at 8 lb./1000 sq. ft. or 340 lb./acre.
G. Incorporate seed into top 1/8" of soil and roll.
H. Seeded area mulching:
    1. Blown straw tacked with a light coating of hydromulch is preferred.
    2. Place straw or fiber mulch on seeded areas within 24 hours after seeding, in a continuous blanket, and at the rate of 2-1/2 tons per acre, or 2 bales per 1,000 square

feet of area. The Contractor will be asked to remove any straw clumps left on the seeded area.

3. A mechanical blower may be used for straw mulch application when acceptable to OUP and VT Grounds. Coordinate through the VT PM.
4. For areas requiring an erosion control blanket (e.g., slopes exceeding 4:1), provide a straw fiber mat with a single polypropylene netting sewn with degradable thread. The mat thickness shall be approximately 0.45” and all components of the mat shall photodegrade in approximately 45 days. The basis of design is EroNet DS75.

I. Seeded area protection:
   1. It is the Contractor’s responsibility to protect seeded areas from various types of traffic (vehicles, bikes, pedestrians, etc.). Seeded areas should be identified with signs and isolated using a form of temporary perimeter control.
   2. No construction traffic will be permitted on seeded areas. Any seeded area disturbed by the Contractor must be re-tilled to 4” depth and reseeded.

3.4 SODDING

A. Transplant sod when temperatures are above 65 degrees F.
B. Lawn areas should be weed free, smoothly raked seedbed. Time Limitations: Sod shall be transplanted/installed as soon as possible following delivery, unless a suitable preservation method is approved prior to delivery. Sod not transplanted shortly after delivery shall be inspected and approved by the Landscape Architect prior to its installation.
C. Transplanting
   1. Moistening the Soil: After all unevenness in the soil surface has been corrected, the soil shall be lightly moistened immediately prior to installation of sod.
   2. Starter Strip: The first row of sod shall be laid in a straight line, with subsequent rows placed parallel to and tightly against each other. Lateral joints shall be staggered to promote more uniform growth and strength. Care shall be exercised to insure that the pieces are not stretched or overlapped and that all joints are butted tightly to prevent voids that would cause air drying of the roots.
   3. Sloping Surfaces: On 3:1 or greater slopes, traditional size (1 sq yd / 1 sq m) Sod shall be laid across the angle of the slope (perpendicular), with staggered joints and secured by tamping, pegging, stapling or other approved methods of temporarily securing each piece. Large-roll sod shall be laid in the direction of the slope, with temporary securing being at the discretion of the installation contractor.
   4. Swales and Intermittent Waterways: The installation of turfgrass sod within drainways or intermittent waterways shall be determined after considering maximum channel velocities for storms of a designated intensity. Traditional size sod shall be laid perpendicular to the direction of flow and pegged to resist washout during the establishment period, while large-roll pieces shall be laid in the direction of the flow, with temporary securing being at the discretion of the installation contractor.
   5. Watering and Rolling: The installation contractor shall water the sod immediately after transplanting to prevent excessive drying during progress of the work. As sodding is completed in any one section, the entire area shall be lightly rolled in (2) different directions to ensure good contact with subgrade. It shall then be thoroughly watered to

a depth sufficient that the underside of the new sod pad and soil immediately below the pad are thoroughly wet.

3.5 MEADOW

A. Sow seed with spreader or seeding machine. Do not broadcast or drop seed when wind velocity exceeds 5 mph (8 km/h). Evenly distribute seed by sowing equal quantities in two directions at right angles to each other.
    1. Do not use wet seed or seed that is moldy or otherwise damaged.
B. Sow seed at the net rate as recommended by manufacturer.
C. Brush seed into top 1/16 inch (1.6 mm) of topsoil, roll lightly, and water with fine spray.
D. Water newly planted areas and keep moist until meadow is established.

3.6 TURF MAINTENANCE

A. Maintain and establish turf by watering, fertilizing, weeding, mowing, trimming, replanting, and performing other operations as required to establish healthy, viable turf. Roll, regrade, and replant bare or eroded areas and re-mulch to produce a uniformly smooth turf. Provide materials and installation the same as those used in the original installation.
    1. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace materials and turf damaged or lost in areas of subsidence.
    2. In areas where mulch has been disturbed by wind or maintenance operations, add new mulch and anchor as required to prevent displacement.
    3. As requested by University Landscape Architect. Notify University Landscape Architect and/or University Arborist of proposed pesticide use prior to application. Apply treatments as required to keep turf and soil free of pests and pathogens or disease. Use integrated pest management practices whenever possible to minimize the use of pesticides and reduce hazards.
B. Mow turf as soon as top growth is tall enough to cut. Repeat mowing to maintain specified height without cutting more than 1/3 of grass height. Remove no more than 1/3 of grass-leaf growth in initial or subsequent mowings. Do not delay mowing until grass blades bend over and become matted. Do not mow when grass is wet. Turf Postfertilization: Apply fertilizer after initial mowing and when grass is dry.
    1. Use fertilizer that will provide actual nitrogen of at least 1 lb/1000 sq. ft. to turf area.

3.7 MEADOW MAINTENANCE

A. Year One
    1. Spring: Remove weeds and smother existing noxious vegetation if necessary. Compress the seedlings (do not bury) and water so that the soil is consistently moist until the plants are 4”-6” tall. Mowing frequency will be dependent upon rainfall within the first growing season. Mowing may be necessary up to once a month. University Landscape Architect to advise.
    2. Summer: Weed control will be necessary. Weeds may not be pulled due to wildflower seedling disturbance. Herbicides may not be used due to killing wildflower seedlings and plants. Weeds must be cut back 4”-6”, and may not grow over one foot in height.

3. Fall: Young grasses must be allowed to go-to-seed before the last mow of the season. Continue removing weeds by trimming.
4. Winter: No actions.

B. Year Two
1. Spring: Mow once during the early spring (March-April) about 6 inches. After the first year, avoid mowing during bird nesting season (May to July).
2. Summer: Weed management must be continued. Continue to avoid pulling weeds and applying herbicides to protect wildflowers. Continue removing weeds by trimming.
3. Fall: Young grasses must be allowed to go-to-seed before the last mow of the season. Continue removing weeds by trimming.
4. Winter: No actions.

C. Year Three
1. Spring: Mow the meadow close to the ground (2”-3”) in early Spring (March-April). Remove debris after mowing to encourage wildflowers over cool-season weeds.
2. Summer: Grasses are more established, significant weeding may not be necessary. Continue removing weeding by trimming.
3. Fall: No actions.
4. Winter: No actions.

3.8 WATERING

A. Watering shall take place throughout the two-year guarantee period, at a rate of at least 20 gallons at approximately two-week intervals from May 15 to October 31. The frequency of watering may increase or decrease based on weather conditions, the resulting soil water content, other physical factors, or at the request of the University Arborist office.

B. Water shall not be applied in a manner which damages plants, stakes, or adjacent areas. Each tree bed shall be watered evenly in a manner which does not erode soil or mulch. Watering shall not cause uprooting or exposure of the plant’s roots to the air. Damages resulting from these operations shall be immediately repaired at the expense of the installer.

3.9 PESTICIDE APPLICATION

A. As requested by University Landscape Architect. Notify University Landscape Architect and/or University Arborist of proposed pesticide use prior to application.

3.10 CLEANUP AND PROTECTION

A. Lawn Restoration
1. Lawn restoration shall be performed as a one-time action at project closeout. On existing lawns where substantial (greater than 50%) turf remains within the construction fencing, rake, aerate (twice in opposite directions), fertilize and overseed as noted above at 5 pounds per 1000 square feet. Straw is not required on overseeded lawns.
2. Provide fertilizer, seed, and soil amendments as specified for new lawns and as required to provide a satisfactorily reconditioned lawn. Provide topsoil as required to fill low areas and meet new finished grades.

SECTION 331000 - EXTERIOR WATER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

B. The New River Valley (NRV) Regional Water Authority Standards and Specifications

C. Virginia Tech Design and Construction Standards Manual (DCSM)

1.2 SUMMARY

A. This section includes water service piping, fire protection service mains, and appurtenances from the source of water to a point 5 feet outside the building.

1.3 SUBMITTALS

A. Product data for piping, valves, vaults, fire hydrants, and identification devices.

1.4 QUALITY ASSURANCE

A. Comply with local utility department and fire department standards pertaining to materials, meter boxes, hose threads and installation.

B. Comply with the requirements of the latest edition of the University's DCSM

1.5 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport: Prepare valves, including fire hydrants, for shipping as follows:

1. Ensure valves are dry and internally protected against rust and corrosion.

2. Protect valves against damage to threaded ends, flange faces, and weld ends.

3. Set valves in best position for handling. Set gate valves and fire hydrants closed to prevent rattling.

B. Storage: Use the following precautions for valves, including fire hydrants, during storage:

1. Do not remove end protectors unless necessary for inspection; then reinstall for storage.

2. Protect valves from weather. Store valves indoors. Maintain valve temperature higher than the ambient dew point temperature. If outdoor storage is necessary, support valves off the ground or pavement in watertight enclosures.

C. Handling: Use a sling to handle valves, including fire hydrants, whose size requires handling by crane or lift. Rig valves to avoid damage to exposed valve parts. Do not use handwheels or stems as lifting or rigging points.

D. Deliver piping with factory-applied end caps. Maintain end caps through shipping, storage, and handling to prevent pipe-end damage and to prevent entrance of dirt, debris, and moisture.

E. Protect stored piping from moisture and dirt. Elevate above grade. Do not exceed structural capacity of floor when storing inside.

F. Protect flanges, fittings, and specialties from moisture and dirt.

G. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

1.6 PROJECT CONDITIONS

A. Site Information: Perform site surveys, research public utility records, and verify existing utility locations. Verify that exterior water system may be installed in compliance with the original design and referenced standards. Notify Engineer immediately of any discrepancies.

B. Coordinate connection to the existing water service with Virginia Tech Utilities and the NRV Regional Water Authority.

C. Existing Utilities: Locate and coordinate with VT in accordance with Section 312000.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with interior water piping and interior fire protection piping.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 GENERAL

A. All piping, valves, fittings, fire hydrants, meters, meter vaults, appurtenances and other products shall conform to the following requirements:

1. Public - The latest edition of the New River Valley Regional Water Authority

2. Private (VT) – VT DCSM.

PART 3 - EXECUTION

3.1 GENERAL

A. Installation of the exterior water system shall comply with the requirements of the latest edition of the NRV Regional Water Authority construction standards and specifications (public) and VT DCSM (private).

3.2 PREPARATION OF BURIED PIPE FOUNDATION

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with bedding material to indicated level.

C. Install pipe bedding as required by the NRV Regional Water Authority construction standards and specifications (public) and VT DCSM (private).

3.3 PIPE AND PIPE FITTINGS INSTALLATION

A. Depth of Cover: Provide minimum cover over piping of 42 inches below finished grade.

B. Water Service Termination: Terminate water service piping 5'-0" from building foundation in location and invert as indicated. Coordinate location with interior water piping and interior fire service piping. Provide temporary pipe plug for piping extension into building.

3.4 IDENTIFICATION INSTALLATION

A. Install underground warning tape and tracing wire for all piping as required. Refer to Section 312000 for additional information.

3.5 FIELD QUALITY CONTROL

A. Testing and Disinfection: Disinfect, flush, and test in accordance with the requirements of the latest edition of the NRV Regional Water Authority construction standards and specifications (public) and VT DCSM (private).

END OF SECTION

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SECTION 333000 - SANITARY SEWERAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. The provisions of the Contract Documents apply to the work of this Section.

B. The Town of Blacksburg and the VPI Sanitation Authority

C. Virginia Tech Design and Construction Standards Manual (DCSM), Latest Edition

1.2 SUMMARY

A. This Section includes sanitary sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal.

1.3 SUBMITTALS

A. Product data for sewer piping specialties.

B. Shop drawings for concrete sanitary manholes, including frames and covers.

C. Inspection and test reports, including video recordings.

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of the Virginia Department of Health pertaining to sanitary sewerage systems.

B. Utility Compliance: Comply with the requirements of the latest edition of the VT DCSM

1.5 DELIVERY, STORAGE, AND HANDLING

1. Do not store plastic structures in direct sunlight.

2. Do not store plastic pipe or fittings in direct sunlight.

3. Protect pipe, pipe fittings, and seals from dirt and damage.

4. Handle precast concrete manholes and other structures according to manufacturer's rigging instructions.

1.6 PROJECT CONDITIONS

A. Site Information: Perform site surveys, research public utility records, and verify existing utility locations. Verify that sanitary sewerage system piping may be installed in compliance with original design and referenced standards.

B. Locate existing structures and piping to be closed and abandoned.

C. Remove and/or abandon the existing septic system and drainfield in accordance with Virginia Department of Health requirements.

D. Existing Utilities: Locate and coordinate with VT in accordance with Section 312000.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate with interior building sanitary drainage piping.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. General: Provide pipe and pipe fitting materials compatible with each other. All materials shall comply with the requirements of the latest edition of the VT DCSM

2.2 MANHOLES

A. Precast Concrete Manholes, Steps, and Frames and Covers: Shall comply with the latest edition of the VT DCSM

2.3 CLEANOUTS

A. General: Provide cleanout plug with round cast-iron access frame and heavy-duty, secured, scoriated cast-iron cover in accordance with the requirements of the latest edition of the VT DCSM.

B. Sewer pipe fitting and riser to cleanout: 4” or 6" dia. PVC.

2.4 SEWAGE COMBINATION AIR VALVE

A. The combination air valve shall be a single body valve with a double orifice. The smaller orifice shall remain open during normal system operation to allow small pockets of air accumulation to escape automatically and independently of the large orifice. The larger orifice shall remain closed when the pipeline is full and pressurized and is used to allow large volumes of air to escape when filling or draining the pipeline.

B. The air valve shall include a valve seat used for shut-off and a valve float.

PART 3 - EXECUTION

3.1 PREPARATION OF FOUNDATION FOR BURIED SANITARY SEWERAGE SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated level.

C. Install pipe bedding as required by the latest edition of the VT DCSM

3.2 PIPE INSTALLATION

A. Install the sanitary sewerage system in accordance with the latest edition of the VT DCSM

B. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

C. Use manholes for changes in direction, except where a fitting is indicated. Use fittings for branch connections, except where direct tap into existing sewer is indicated.

D. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

E. Install piping pitched down in direction of flow, at minimum slope of 2 percent, except where indicated otherwise.

F. Extend sanitary sewerage system piping to connect to building sanitary drains, of sizes and in locations indicated.

3.3 PIPE JOINT CONSTRUCTION AND INSTALLATION

A. Join and install PVC pipe as follows:

1. Joints in accordance with ASTM D2855.

2. Installation in accordance with ASTM D1668 and ASTM D2774.

B. Join different types of pipe with standard manufactured couplings and fittings intended for that purpose.

3.4 MANHOLES

A. Install concrete manholes in accordance with the latest edition of the VT DCSM

B. Provide rubber joint gasket complying with ASTM C 443 at joints of sections.

C. Apply bituminous mastic coating at joints of sections.

3.5 CLEANOUTS

A. Provide cleanouts as indicated on the plans, and as required by the latest edition of the VT DCSM.

3.6 SEWAGE COMBINATION AIRVALVE INSTALLATION

A. The air valve shall be installed per manufacturer's specifications and per VT DCSM guidelines.

B. The valve seat shall be a resilient material and must be fastened to the valve cover without any distortion.

C. The valve float shall be heavily constructed stainless steel, hermetically sealed, and have a concave bottom impact area to provide resistance to flow.

D. If required, a backflush attachment shall be provided with two shutoff valves that are 316 stainless steel piping and have 5 feet of hose with galvanized steel quick disconnected couplings.

3.7 IDENTIFICATION INSTALLATION

A. Install underground warning tape and tracing wire. Refer to Section 312000 for additional information.

3.8 FIELD QUALITY CONTROL

A. Cleaning: Clear interior of 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.

1. In large, accessible piping, brushes and brooms may be used for cleaning.

2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.

3. Flush piping between manholes, if required by local authority, to remove collected debris.

B. Interior Inspection: Inspect piping with a crawler style camera, or approved equal, to provide sufficient video quality to determine whether line displacement or other damage has occurred. It is the contractor's responsibility to coordinate, complete, and pay for the inspections.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.

2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects correct such defects, and reinspect.

3. Provide video recordings to Owner/Engineer for review.

C. Test new piping systems and parts of existing systems that have been altered, extended, or repaired for leaks and defects.

1. Do not enclose, cover, or put into service before inspection and approval.

2. Test all completed piping systems (public and private) according to the requirements of the Blacksburg-VPI Sanitation Authority Construction Specifications and the VT DCSM.

3. Schedule tests and inspections with Blacksburg-VPI Sanitation Authority (public) or Owner’s testing agency (private) with at least 24 hours' advance notice.

4. Submit separate reports for each test.

END OF SECTION

SECTION 334100 - STORM DRAINAGE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS:

A. The provisions of the Contract Documents apply to the work of this Section.

B. Virginia Tech Design and Construction Standards Manual (DCSM)

C. Virginia Tech (VT) Annual Standards and Specifications for Erosion and Sediment Control and Stormwater Management (AS&S).

1.2 SUMMARY:

A. This Section includes the roof drainage collection system, the storm sewerage system piping and appurtenances from a point 5 feet outside the building to the point of disposal.

1.3 SUBMITTALS

A. Product data for:

1. Pipe
2. Structures
3. Frames and covers
4. Grates
5. Underground Detention Structure

B. Certification, signed by material producer and contractor, that standard precast and cast in place concrete storm drainage manholes and Drop Inlets comply with VDOT standards and specifications.

C. VDOT approved job mix for bedding stone.

D. Shop drawings for:

1. Storm Structures.
2. All components of the Stormwater Management Facilities.

E. Video recordings of storm sewer inspections.

F. Record drawings of installed storm drainage system.

G. All documentation required to achieve stormwater management certification through VT at the end of the project.

1.4 QUALITY ASSURANCE

A. Environmental Compliance: Comply with applicable portions of VT guidelines and regulations.

B. All materials shall be new and free of defects (i.e. pipe shall not have chipped spigots or bells).

1.5 PROJECT CONDITIONS

A. Site Information: Perform site surveys, research public utility records, and verify existing utility locations. Verify that storm sewerage system piping may be installed in compliance with original design and referenced standards.

B. Locate existing structures and piping to be closed and abandoned.

C. Existing Utilities: Locate and coordinate with VT in accordance with Section 312000.

1.6 SEQUENCING AND SCHEDULING

A. Coordinate with interior building storm drainage piping.

B. Coordinate with other utility work.

PART 2 - PRODUCTS

2.1 GENERAL

A. All materials used for construction of the storm sewerage system shall comply with the requirements of the latest edition of the Virginia Department of Transportation Road and Bridge Standards and Road and Bridge Specifications and the VT DCSM.

2.2 PIPE AND FITTINGS

A. Provide pipe and pipe fitting materials compatible with each other. Pipe materials are indicated on the drawings.

B. Corrugated, Double Wall High Density Polyethylene Pipe (HDPE): Shall conform to the requirements of ASTM F2648 and have a smooth interior with angular exterior corrugations. Joints shall be watertight meeting the requirements of ASTM D3212. Gaskets installed by the pipe manufacturer shall meet the requirements of ASTM F477.

2.3 MANHOLES

A. Precast Concrete Manholes: Comply with the requirements of the latest edition of the Virginia Department of Transportation’s Road and Bridge Standards, and Road and Bridge Specifications.

B. Manhole Steps, Safety Slabs, and Inlet Shaping: Comply with the requirements of the latest edition of the Virginia Department of Transportation’s Road and Bridge Standards, and Road and Bridge Specifications.

C. Manhole Frames and Covers: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

2.4 DROP INLETS

A. Precast Concrete Drop Inlets: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

B. Drop Inlet Steps, Safety Slabs and Inlet Shaping: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

C. Drop Inlet Frames and Grates: Comply with the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards, and Road and Bridge Specifications.

D. Yard Drain Basins: Comply with specifications on the plans.

2.5 CONCRETE AND REINFORCEMENT

A. Concrete: Conform to the requirements of VDOT Standard Class A3 concrete.

B. Reinforcement: Steel conforming to the following:

1. Fabric: ASTM A 185 welded wire fabric, plain.

2. Reinforcement Bars: ASTM A 615, Grade 60, deformed.

2.6 END SECTIONS

A. End sections: All end sections shall be reinforced concrete. Conform to the requirements of the latest edition of the VDOT Road and Bridge Specifications and the VDOT Road and Bridge Standards for the size of pipe indicated.

2.7 UNDERGROUND DETENTION

A. The underground detention shall follow product specifications and shall follow the size requirements as noted on the plans. The system used shall have a filtering system that is approved for 40% phosphorous removal per Virginia DEQ.

PART 3 - EXECUTION

3.1 GENERAL

A. Install the storm sewerage system in accordance with the latest edition of the Virginia Department of Transportation's Road and Bridge Standards and Road and Bridge Specifications.

3.2 PREPARATION OF FOUNDATION FOR BURIED STORM SEWERAGE SYSTEMS

A. Grade trench bottom to provide a smooth, firm, stable, and rock-free foundation, throughout the length of the pipe.

B. Remove unstable, soft, and unsuitable materials at the surface upon which pipes are to be laid and backfill with clean sand or pea gravel to indicated level.

C. Install pipe bedding conforming to the requirements of the latest edition of the Virginia Department of Transportation's Road and Bridge Standards and Road and Bridge Specifications.

3.3 PIPE INSTALLATION

A. Install piping beginning at low point of systems, true to grades and alignment indicated with unbroken continuity of invert. Place bell ends of piping facing upstream. Install gaskets, seals, sleeves, and couplings in accordance with manufacturer's recommendations for use of lubricants, cements, and other installation requirements. Maintain swab or drag in line and pull past each joint as it is completed.

B. Use proper size increasers, reducers, and couplings, where different size or material of pipes and fittings are connected. Reduction of the size of piping in the direction of flow is prohibited.

C. Extend storm sewerage system piping to connect to building storm drains, of sizes and in locations indicated.

D. Join and install pipe and fittings per manufacturer's recommendations.

E. Join different types of pipes with standard manufactured couplings and fittings intended for that purpose.

3.4 MANHOLES

A. General: Install manholes complete with accessories as indicated. Form continuous concrete or split pipe section channel and benches between inlets and outlet. Set tops of frames and covers flush with finish grade, unless otherwise indicated.

B. Place precast concrete manhole sections as indicated and install in accordance with ASTM C 891.

C. Construct cast-in-place manholes as indicated.

D. Apply bituminous mastic coating at joints of sections.

3.5 DROP INLETS

A. Construct drop inlets to sizes and shapes indicated.

B. Set frames and grates to elevations indicated.

3.6 INLET SHAPING

A. Construct inlet shaping conforming to VDOT Standard IS-1 at all concrete drop inlets and manholes.

3.7 IDENTIFICATION INSTALLATION

A. Install underground warning tape and tracing wire. Refer to Section 312000 for additional information.

3.8 UNDERGROUND DETENTION

A. Schedule a pre-construction meeting with VT, the product manufacturer, and the Engineer prior to beginning construction.

B. The underground detention shall be kept off line for as long as possible or until all upstream areas have been stabilized.

C. Utilize the details on the plans for all dimensions.

D. The contractor shall document the installation at each step of the project with as-built elevations, photographs, and other information as needed to certify the facility.

3.9 FIELD QUALITY CONTROL

A. Cleaning: Clear interior of 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.

1. In large, accessible piping, brushes and brooms may be used for cleaning.

2. Place plugs in ends of uncompleted pipe at end of day or whenever work stops.

3. Flush piping between manholes and drop inlets to remove collected debris. Flush pipes through an approved erosion and sediment control measure.

B. Interior Inspection: Inspect piping with a crawler style camera, or approved equal designed for large diameter pipes, to provide sufficient video quality to determine whether line displacement or other damage has occurred. It is the contractor's responsibility to coordinate, complete, and pay for the inspections.

1. Make inspections after pipe between manholes and manhole locations has been installed and approximately 2 feet of backfill is in place, and again at completion of project.

2. If inspection indicates poor alignment, debris, displaced pipe, infiltration or other defects correct such defects, and reinspect.

3. Provide video recordings to Owner/Engineer for review.

END OF SECTION