SMP
ARCHITECTS

Bethel Burying Ground

BETHEL BURYING GROUND
400 Catharine St, Philadelphia PA 19147

CONSTRUCTION DOCUMENTS SET
May 10, 2024
Specifications

Our work transforms the way people interact with each other and with their surroundings.

TABLE OF CONTENTS

SECTION	TITLE
	Table of Contents
DIVISION 01	**GENERAL REQUIREMENTS**
Section 015639	Temporary Tree and Plant Protection
DIVISION 02	**EXISTING CONDITIONS**
Section 024119	Selective Demolition
DIVISION 03	**CONCRETE**
Section 033053	Architectural Cast-in-Place Concrete
DIVISION 04	**MASONRY**
Section 044800	Site Stone Masonry
DIVISION 05	**METALS**
Section 055215	Exterior Handrails
DIVISION 11	**EQUIPMENT**
Section 116833	Athletic Equipment
DIVISION 12	**FURNISHINGS**
Section 129300	Site Furnishings
DIVISION 22	**PLUMBING**
Section 220523	Valves and Specialties for Plumbing Pipe
DIVISION 26	**ELECTRICAL**
Section 260543	Underground Ducts and Raceways for Electrical Systems
DIVISION 31	**EARTHWORK**
Section 310000	Earthwork
Section 311000	Site Clearing
Section 312316.13	Trenching
Section 312350	Sawcutting
Section 312500	Soil Erosion & Sediment Control
Section 315000	Excavation Support and Protection
DIVISION 32	**EXTERIOR IMPROVEMENT**
Section 320116	Pavement Milling
Section 321216	Asphalt Paving
Section 321216.01	Tennis Court Surface Course
Section 321223	Asphalt Pavement Colorcoating
Section 321400	Unit Paving
Section 321500	Site Masonry
Section 321613.13	Cast-In-Place Concrete Curb and Gutters
Section 321623	Concrete Paving
Section 321723	Pavement Markings
Section 323113	Chain-Link Fencing and Gates
Section 329100	Planting Preparation
Section 329300	Planting

DIVISION 33 **UTILITIES**
Section 331416 Site Water Utility Distribution Piping
Section 334009 Connections to Existing Structures

DIVISION 40 **PROCESS INTERCONNECTIONS**
Section 400581.26 Freeze Proof Yard Hydrants

SECTION 015639 –TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

2. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

3. Related Sections:

1. Division 01 Section “Construction Waste Management”
2. Division 01 Section “Field Engineering” for field engineering and surveying.
3. Division 32 Section “Soil Preparation”
4. Division 32 Section “Plants”

1.3 DEFINITIONS

4. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches above the ground for trees up to, and including, 6-inch size; and breast height (DBH) for trees larger than 6-inch size.

5. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

6. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

7. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 SUBMITTALS

8. Product Data: For each type of product indicated.

9. Samples for Verification: For each type of the following:

1. Protection-Zone Fencing: Manufacturer’s cut sheets
2. Protection-Zone Signage: Manufacturer’s cut sheets.
3. Organic Mulch: One (1) gallon of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.

10. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

4. Species and size of tree.

5. Location on site plan. Include unique identifier for each.
6. Reason for pruning.
7. Description of pruning to be performed.

11. Qualification Data: For qualified arborist and tree service firm.

12. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

13. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

14. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

8. Use sufficiently detailed photographs or video.
9. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE

15. Arborist Qualifications: Certified Arborist as certified by ISA.

16. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

17. Pre-installation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
   a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
   b. Enforcing requirements for protection zones.
   c. Arborist’s responsibilities.
   d. Field quality control.

1.6 PROJECT CONDITIONS

18. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

19. Do not direct vehicle or equipment exhaust toward protection zones.

20. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

21. Protection fencing must be approved by the Owner's Representative prior to commencing with any demolition or construction work.

22. Install protection fencing before installing erosion and sedimentation controls. Trenched silt fence is prohibited within plant protection zones. Utilize tubular sediment control device, such as Filtrexx® Sediment Control or similar product in accordance with the manufacturers instructions, in lieu of silt fencing. Trenching is prohibited within plant protection zones.

23. Flows of water redirected from construction areas or generated by construction activity are prohibited from entering or crossing plant protection zones. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

24. Work within the plant protection zone must be approved by and supervised by Owner's Representative.

25. The Owner's Representative may require additional protection fencing or relocation of fencing as work progresses.

26. Bring any unforeseen site conditions, such as structural roots, that will impact new construction to the attention of the Architect and Owner's Representative. Do not proceed with work without written authorization.

27. Arborist may require crown pruning to compensate for root loss caused by damaging or cutting of the root system. Provide subsequent maintenance during contract period as recommended by arborist.

PART 2 - GENERAL

2.1 MATERIALS

28. Topsoil: Refer to 329100 'Planting Preparation'.

29. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 3 inches (76 mm) maximum, ½ inch (13 mm) minimum.
3. Color: Natural.

30. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements.

31. Tree Protection-Zone Fencing: Orange high density polyethylene plastic fence with 3 ½" x 1 ½" openings. Height: 4 feet.Provide steel posts as shown on Drawings.

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

4. Size and Text: As shown on Drawings.
5. Lettering: 3-inch high minimum, white characters on red background.

PART 3 - EXECUTION

3.1 EXAMINATION

32. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

33. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

34. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 TREE- AND PLANT-PROTECTION ZONES

35. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts: Post shall not be driven into ground due to potential disturbance to graves below. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Landscape Architect. Do not drive posts through roots of trees to remain; utilize a weighted base in lieu of driving posts into the ground where roots are encountered.

36. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 35 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.

37. Maintain protection zones free of weeds and trash.

38. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

39. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

3. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
4. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

40. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 “Earth Moving.”

41. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate and/or air-spade under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

42. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

43. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not coat cut ends of roots with an emulsified asphalt or similar coatings.
3. Temporarily support and protect roots from damage until they are covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 312000 “Earth Moving.”

44. Root Pruning at Edge of Protection Zone: Prune roots 6 inches inside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

45. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

46. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:

1. Prune trees as indicated on the Drawings. Provide subsequent maintenance during Contract period as recommended by arborist.
2. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and the following:
   a. Type of Pruning: Cleaning, Thinning, and/or Reduction.
   b. Specialty Pruning: Restoration.
3. Cut branches with sharp pruning instruments; do not break or chop.
4. Do not apply pruning paint to wounds

47. Chip removed branches and dispose of off-site.

3.7 REGRADING

48. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

49. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

50. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

51. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

52. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

53. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed root cutting and tree and shrub repairs.
2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
3. Treat damaged trunks, limbs, and roots according to arborist’s written instructions.
4. Perform repairs within 24 hours.
5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

54. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.

6. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.
7. Provide two new trees of 4-inch caliper size for each tree being replaced that measure between 6-inch caliper and 8-inch caliper in size at a location directed by the Owner or Owner’s Representative.
8. Provide 6-inch caliper size for each tree being replaced that measure greater than 8-inch caliper in size at a location directed by the Owner or Owner’s Representative. Quantity of trees shall equal the total diameter at breast height (DBH) size of the tree removed unless directed otherwise by the Owner. For example, a 32-inch DBH shall require five new trees.
9. Species: Species selected by Landscape Architect.

10. Plant and maintain new trees as specified in Section 32 93 00 ‘Plants’.

55. Soil Aeration: Where directed by Landscape Architect, aerate surface soil compacted during construction. Aerate to extent as directed by Landscape Architect beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with approved Compost.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner’s property.

END OF SECTION

SECTION 024119 – SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Demolition and removal of selected site elements.
   2. Salvage of existing items to be reused or recycled.

B. Related Requirements:

   1. Section 011000 "Summary" for restrictions on the use of the premises, Owner-occupancy requirements, and phasing requirements.
   2. Section 015639 "Temporary Tree and Plant Protection" for temporary protection of existing trees and plants that are affected by selective demolition.
   3. Section 017300 "Execution" for cutting and patching procedures.
   4. Section 311000 "Site Clearing" for site clearing and removal of above- and below-grade improvements.

1.3 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of them off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Carefully detach from existing construction, in a manner to prevent damage, and deliver to Owner.

C. Remove and Reinstall: Detach items from existing construction, prepare for reuse, and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be permanently removed and that are not otherwise indicated to be removed, removed and salvaged, or removed and reinstalled.

1.4 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

1.5 PREINSTALLATION MEETINGS

A. Pre-demolition Conference: Conduct conference at Project site.

1. Inspect and discuss condition of construction to be selectively demolished.
2. Review Archaeologist's recommendations to prevent disturbance to intact burials.
3. Review structural load limitations of existing structure.
4. Review and finalize selective demolition schedule and verify availability of materials, demolition personnel, equipment, and facilities needed to make progress and avoid delays.
5. Review requirements of work performed by other trades that rely on substrates exposed by selective demolition operations.
6. Review areas where existing construction is to remain and requires protection.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For refrigerant recovery technician.

B. Proposed Protection Measures: Submit report, including drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection, and for dust control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity.
2. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Inventory: Submit a list of items to be removed and salvaged and deliver to Owner prior to start of demolition.

E. Pre-demolition Photographs or Video: Submit before Work begins.

1.7 FIELD CONDITIONS

A. Site is an historic burial ground with intact human burials. The Drawings assume burials may begin 12" below existing grade. Previously disturbed human remains may be found anywhere below grade. Notify Archaeologist upon discovery of any human remains.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials: It is not expected that hazardous materials will be encountered in the Work.

1. Hazardous materials will be removed by Owner before start of the Work.
2. If suspected hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. Storage or sale of removed items or materials on-site is not permitted.

F. Utility Service: Maintain existing utilities indicated to remain in service and protect them against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

PART 2 - PRODUCTS

2.1 PEFORMANCE REQUIREMENTS

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

B. Standards: Comply with ANSI/ASSE A10.6 and NFPA 241.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review record documents of existing construction provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in record documents.

C. Survey existing conditions and correlate with requirements indicated to determine extent of selective demolition required.

D. When unanticipated mechanical, electrical, or structural elements that conflict with intended function or design are encountered, investigate and measure the nature and extent of conflict. Promptly submit a written report to Architect.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs.

1. Comply with requirements specified in Section 013233 "Photographic Documentation."
2. Inventory and record the condition of items to be removed and salvaged. Provide photographs of conditions that might be misconstrued as damage caused by salvage operations.
3. Before selective demolition or removal of existing building elements that will be reproduced or duplicated in final Work, make permanent record of measurements, materials, and construction details required to make exact reproduction.

3.2 UTILITY SERVICES AND MECHANICAL/ELECTRICAL SYSTEMS

A. Existing Services/Systems to Remain: Maintain services/systems indicated to remain and protect them against damage.

1. Comply with requirements for existing services/systems interruptions specified in Section 011000 "Summary."

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off indicated utility services and mechanical/electrical systems serving areas to be selectively demolished.
   1. Arrange to shut off indicated utilities with utility companies.
   2. If services/systems are required to be removed, relocated, or abandoned, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services.

      a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
      b. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material.
      c. Equipment to Be Removed: Disconnect and cap services and remove equipment.
      d. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
      e. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
      f. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
      g. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material.

3.3 PREPARATION

A. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

   1. Comply with requirements for access and protection specified in Section 015000 "Temporary Facilities and Controls."

B. Temporary Facilities: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

   1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
   2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
   3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
   4. Cover and protect furniture, furnishings, and equipment that have not been removed.
   5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 015000 "Temporary Facilities and Controls."

C. Temporary Shoring: Provide and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

   1. All temporary shoring shall be approved by Archaeologist to ensure no disturbance to intact burials.

2. Strengthen or add new supports when required during progress of selective demolition.

3.4 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to the extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. All demolition shall comply with the Archaeological Monitoring Plan.

2. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
3. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping, to minimize disturbance of adjacent surfaces. Temporarily cover openings to remain.
4. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
5. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain fire watch and portable fire-suppression devices during flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.
10. Dispose of demolished items and materials promptly. Comply with requirements in Section 017419 "Construction Waste Management and Disposal."

B. Removed and Salvaged Items:

1. Clean salvaged items.
2. Pack or crate items after cleaning. Identify contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area off-site.
5. Protect items from damage during transport and storage.

C. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

D. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable,

protected storage location during selective demolition and cleaned and reinstalled in their original locations after selective demolition operations are complete.

3.5 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete: Demolish in small sections. Using power-driven saw, cut concrete to a depth of at least 3/4 inch (19 mm) at junctures with construction to remain. Dislodge concrete from reinforcement at perimeter of areas being demolished, cut reinforcement, and then remove remainder of concrete. Neatly trim openings to dimensions indicated.

B. Concrete: Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, then remove concrete between saw cuts.

C. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, then remove masonry between saw cuts.

D. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, then break up and remove.

3.6 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Except for items or materials indicated to be recycled, reused, salvaged, reinstalled, or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them in an EPA-approved landfill.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Comply with requirements specified in Section 017419 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

C. Disposal: Transport demolished materials and dispose of at designated spoil areas on Owner's property.

D. Disposal: Transport demolished materials off Owner's property and legally dispose of them.

3.7 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION

SECTION 033053 - ARCHITECTURAL CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes cast-in-place colored-concrete for architectural site walls with an architectural finish.

B. Related Sections:

1. Division 31, Section "Earth Moving".
2. Division 03, Section "Precast Architectural Concrete”.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: For each type of product, ingredient, or admixture requiring color, pattern, or texture selection.

C. Samples for Verification: For each type of exposed color, pattern, or texture indicated.

D. Other Action Submittal:

1. Design Mixtures: For each concrete mixture.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Material Certificates: For the following items, signed by manufacturers:

1. Cementitious materials.
2. Reinforcing materials and prestressing tendons.
3. Admixtures.
4. Bearing pads.
5. Structural-steel shapes and hollow structural sections.

C. Material Test Reports: For aggregates.

D. Source quality-control test reports.

E. Field quality-control test and special inspection reports.

1.5 QUALITY ASSURANCE

A. Ready-Mix-Concrete Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

B. Comply with the following sections of ACI 301, unless modified by requirements in the Contract Documents:

1. "General Requirements."
2. "Formwork and Formwork Accessories."
3. "Reinforcement and Reinforcement Supports."
4. "Concrete Mixtures."
5. "Handling, Placing, and Constructing."

C. Comply with ACI 117, "Specifications for Tolerances for Concrete Construction and Materials."

D. Installer Qualifications: A precast concrete erector who has retained a "PCI-Certified Field Auditor" to conduct a field audit of a project in same category as this Project before erection of precast concrete and who can produce an Erectors' Post-Audit Declaration.

E. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Section 013100 "Project Management and Coordination."

1.6 SEQUENCING

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

PART 2 - PRODUCTS

2.1 FORMWORK

A. Furnish formwork and formwork accessories according to ACI 301.

B. Form-Release Agent: Commercially formulated form-release agent that will not bond with, stain, or adversely affect concrete surfaces and that will not impair subsequent treatments of concrete surfaces.

C. Formwork: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that will provide continuous and true concrete surfaces within fabrication tolerances indicated; nonreactive with concrete and suitable for producing required finishes.

D. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1 inch to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch in diameter in concrete surface.

2.2 STEEL REINFORCEMENT

A. Recycled Content of Steel Products: Postconsumer recycled content plus one-half of preconsumer recycled content not less than 25 percent.

B. Reinforcing Bars: ASTM A 615/A 615M, Grade 60, deformed.

C. Plain-Steel Wire: ASTM A 82/A 82M, as drawn.

2.3 CONCRETE MATERIALS

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

1. Portland Cement: ASTM C 150, Type II, gray.

B. Normal-Weight Aggregate: ASTM C 33, graded, 3/4-inch nominal maximum aggregate size. Color: grays and whites.

C. Normal-Weight Aggregates: Except as modified by PCI MNL 117, ASTM C 33, with coarse aggregates complying with Class 5S. Stockpile fine and coarse aggregates for each type of exposed finish from a single source (pit or quarry) for Project.

1. Face-Mixture-Fine Aggregates: Selected, natural or manufactured sand of same material as coarse aggregate, unless otherwise approved by Landscape Architect.

D. Water: ASTM C 94/C 94M.

E. Synthetic Fiber: Monofilament polypropylene fibers engineered and designed for use in concrete, complying with ASTM C 1116/C 1116M, Type III, 1/2 to 1-1/2 inches long.

F. Coloring Admixture: ASTM C 979, synthetic or natural mineral-oxide pigments or colored water-reducing admixtures, temperature stable, and nonfading.

1. Color: As selected by the Landscape Architect from the manufacturer’s full range.

2.4 ADMIXTURES

A. Air-Entraining Admixture: ASTM C 260, certified by manufacturer to be compatible with other required admixtures.

B. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures and that will not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

1. Water-Reducing Admixture: ASTM C 494/C 494M, Type A.
2. Retarding Admixture: ASTM C 494/C 494M, Type B.
3. Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type D.
4. High-Range, Water-Reducing Admixture: ASTM C 494/C 494M, Type F.
5. High-Range, Water-Reducing and Retarding Admixture: ASTM C 494/C 494M, Type G.
6. Plasticizing and Retarding Admixture: ASTM C 1017/C 1017M, Type II.

2.5 RELATED MATERIALS

A. Joint-Filler Strips: ASTM D 1751, asphalt-saturated cellulosic fiber, or ASTM D 1752, cork or self-expanding cork.

2.6 CURING MATERIALS

A. Evaporation Retarder: Waterborne, monomolecular film forming; manufactured for application to fresh concrete.

B. Absorptive Cover: AASHTO M 182, Class 3, burlap cloth or cotton mats.

C. Moisture-Retaining Cover: ASTM C 171, polyethylene film or white burlap-polyethylene sheet.

D. Water: Potable.

E. Clear, Waterborne, Membrane-Forming Curing Compound: ASTM C 309, Type 1, Class B.

2.7 CONCRETE MIXTURES

A. Comply with ACI 301 requirements for concrete mixtures.

B. Normal-Weight Concrete: Prepare design mixes, proportioned according to ACI 301, as follows:

1. Minimum Compressive Strength: 4000 psi minimum at 28 days.
2. Maximum Water-Cementitious Materials Ratio: 0.45.
3. Cementitious Materials: Use fly ash, pozzolan, ground granulated blast-furnace slag, and silica fume as needed to reduce the total amount of portland cement, which would otherwise be used, by not less than 40 percent.
4. Slump Limit: 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
5. Air Content: Maintain within range permitted by ACI 301.

C. Synthetic Fiber: Uniformly disperse in concrete mix at manufacturer's recommended rate but not less than a rate of 1.0 lb/cu. yd.

D. Color Pigment: Add color pigment to concrete mixture according to manufacturer's written instructions and to result in hardened concrete color consistent with approved mockup.

2.8 CONCRETE MIXING

A. Ready-Mixed Concrete: Measure, batch, mix, and deliver concrete according to ASTM C 94/C 94M and ASTM C 1116/C 1116, and furnish batch ticket information.

1. When air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 - EXECUTION

3.1 FORMWORK

A. Design, construct, erect, brace, and maintain formwork according to ACI 301.

B. Formwork: Accurately construct molds, mortar tight, of sufficient strength to withstand pressures due to concrete-placement operations and temperature changes and for prestressing and detensioning operations. Coat contact surfaces of formwork with release agent before

reinforcement is placed. Avoid contamination of reinforcement and prestressing tendons by release agent.

C. Maintain formwork to provide completed architectural cast-in-place concrete of shapes, lines, and dimensions indicated, within fabrication tolerances specified.

1. Edge and Corner Treatment: Uniformly chamfered.

3.2 EMBEDDED ITEMS

A. Place and secure anchorage devices and other embedded items required for adjoining work attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

3.3 STEEL REINFORCEMENT

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

1. Do not cut or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

3.4 JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete. Form joints on both wall faces.

B. Construction Joints: Locate and install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Landscape Architect.

C. Contraction Joints: Form V-shaped joints 1-inch wide by 3/4-inch deep at locations indicated on the Drawings.

3.5 CONCRETE PLACEMENT

A. Comply with ACI 301 for placing concrete.

B. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

C. Consolidate concrete with mechanical vibrating equipment.

3.6 FINISHING FORMED SURFACES

A. Smooth-Rubbed Finish: As-cast concrete texture imparted by form-facing material, arranged in an orderly and symmetrical manner with a minimum of seams. Repair and patch tie holes and defective areas. Remove fins and other projections exceeding 1/8 inch.

1. Apply to concrete surfaces exposed to public view, except walking surfaces.

3.7 CONCRETE PROTECTING AND CURING

A. General: Protect freshly placed concrete from premature drying and excessive cold or hot temperatures. Comply with ACI 306.1 for cold-weather protection and with ACI 301 for hot-weather protection during curing.

B. Evaporation Retarder: Apply evaporation retarder to concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

C. Begin curing after finishing concrete but not before free water has disappeared from concrete surface.

D. Curing Methods: Cure formed and unformed concrete for at least seven days by one or a combination of the following methods:

1. Moisture Curing: Keep surfaces continuously moist for not less than seven days with the following materials:

    a. Water.
    b. Continuous water-fog spray.
    c. Absorptive cover, water saturated and kept continuously wet. Cover concrete surfaces and edges with 12-inch lap over adjacent absorptive covers.

2. Moisture-Retaining-Cover Curing: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than seven days. Immediately repair any holes or tears during curing period using cover material and waterproof tape.
3. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

3.8 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests: Perform according to ACI 301.

1. Testing Frequency: One composite sample shall be obtained for each day's pour of each concrete mix exceeding 5 cu. yd. but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.

3.9 TOLERANCES

A. Erect architectural cast-in-place concrete units true to grade, plumb, and square, without exceeding the following noncumulative erection tolerances:

1. Plan Location: Plus or minus 1/2 inch.
2. Elevation Variation: Plus or minus 1/4 inch.
3. Plumb in Any 10 Feet of Element Height: 1/4 inch.
4. Maximum Variation of Matching Edges and Alignment of Matching Faces: 1/4 inch.

3.10 REPAIRS

A. Remove and replace concrete that does not comply with requirements in this Section.

3.11 PROTECTION AND CLEANING

A. Protect completed architectural cast-in-place concrete surfaces from damage, staining or other contaminants by subsequent construction.

B. Do not allow laitance from subsequent construction or repairs to stain or harden on surfaces that have been finished.

C. Clean concrete surfaces just prior to project submittal for acceptance.

D. Use cleaning materials and processes that do not change color or texture of the completed concrete surfaces.

E. Rinse architectural surface thoroughly with clean water after cleaning.

F. Protect adjacent materials during cleaning operations.

3.12 FINAL ACCEPTANCE OF ARCHITECTURAL CONCRETE

A. Upon completion of architectural concrete, final acceptance is based upon the matching of the architectural cast-in-place concrete with the accepted Field Mockups.

B. Only concrete listed in the specifications or identified on the plans as architectural concrete is to be included in this final acceptance.

C. Defective work, including repair areas not accepted, shall be removed and replaced.

END OF SECTION

SECTION 044800 – SITE STONE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Extent of work is shown on Drawings and includes but is limited to:

1. Stone paving

2. Headstone

1.3 RELATED SECTIONS

A. Section 033000 Cast-in-Place Concrete

B. Section 079005 Joint Sealants

C. Section 321400 Unit Paving for installation of granite paving

1.4 SUBMITTALS

A. Product Data: For each type of product indicated including, but not limited to:

1. Stone.

2. Cementitious materials. Include brand, type, and name of manufacturer.

3. Setting bed mortar mixes. Include description of type and proportions of ingredients.

4. Joint sealants and backer rods.

5. Anchors, clips, dowels, pins and other metal accessories.

6. Shims and setting buttons; plastic or nylon.

B. Samples for Initial Selection:

1. For pigmented sealant and mortar and other items involving color selection. Include sample of manufacturers full range of colors. Selected product may be a standard color or a custom blended color.

C. Samples for Verification: Samples will establish the standard by which stone provided will be judged and shall be maintained on-site in a protected, secure location.

1. Headstone:

    a. Include at least one (1) 4 inch x 4 inch x 4 inch stone samples for each color type specified, exhibiting extremes of the full range of color and other visual characteristics expected in completed work.

    b. Include at least one (1) set of 8 inch x 8 inch stone samples of the selected stone color. Samples shall receive engravings as shown on the headstone front and back face as shown on the Drawings. Engravings will be evaluated for fulfillment of the design intent.

    c. Stone thickness does not need to be full thickness required for constructed work.

2. Anchors and accessories embedded into masonry.

D. Shop Drawings:

1. Provide for all stone applications, including but not limited to paving and headstone.

2. Show sizes, dimensions, profiles, finishes, jointing, anchoring and other necessary information required to convey full scope of work.

3. Coordinate with artist on engraving text. Provide shop drawings showing all engraving text for approval by the artist.

4. Include adjacent Work, including but not limited to, paving, adjoining stonework, and soil or fill conditions at specified finished grades.

E. Mix Designs: For each type of mortar and grout. Include description of type and proportions of ingredients.

1. Include test reports for mortar mixes required to comply with property specification. Test according to ASTM C 109/C 109M for compressive strength, ASTM C 1506 for water retention, and ASTM C 91 for air content.

2. Include test reports, according to ASTM C 1019, for grout mixes required to comply with compressive strength requirement.

F. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5 QUALITY ASSURANCE

A. Source Limitations for Stone: Obtain each variety of stone, regardless of finish, from one quarry with resources to provide materials of consistent quality in appearance and physical properties.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

C. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Locations of mockups to be submitted for approval by Landscape Architect.

2. Build mockups for each type of stone masonry including, but not limited to,

a. Stone paving: Build 6’ x 6’ panel of the pavement using unit pavers, setting and jointing materials. Mock-up may be used as part of the work if conforming to specified requirements and accepted by Owner and Landscape Architect.

b. Protect accepted mockups from the elements with weather-resistant membrane.

3. Approval of mockups is for color, texture, layout and joint relationships of granite paving; and aesthetic qualities of workmanship.

a. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Landscape Architect specifically approves such deviations in writing.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained, and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.7 PROJECT CONDITIONS

A. Protection of Stone Masonry: Cover partially completed stone masonry when construction is not in progress to protect from inclement weather.

B. Stain Prevention: Immediately remove mortar to prevent staining the exposed surfaces of stone masonry and all adjacent surfaces.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 STONE

A. Defective Material: Industry standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

1. Stone paving:

a. “Bethel White” in sizes and shapes as indicated on the Drawings, as provided by Cold Spring Granite, 17482 Granite West Road, Cold Spring, MN, Phone: (800) 328-5040.

b. Finish: Rubbed and Sanded surface, sawn all other non-exposed surfaces.

c. Include engraved artwork as shown on the Drawings.

d. (10) pavers, without engravings, to be provided as attic stock, to be palletized and delivered to location as determined by Owner.

2. Stone paving

a. “Academy Black” in sizes and shapes as indicated on the Drawings, as provided by Cold Spring Granite, 17482 Granite West Road, Cold Spring, MN, Phone: (800) 328-5040.

b. Finish: “Textured” surface, sawn all other non-exposed surfaces.

c. Engravings on selected pavers as indicated on the Drawings. Typeface design and/or artwork as provided by the Landscape Architect and coordinated by the Contractor.

3. Headstone

a. Marble in size and shape indicated on the Drawings, as provided by Danby Quarries, 1591 U.S. Route 4, Mendon, VT 05701, 802-775-1065

b. Color selection to be chosen from three options: Olympian White Classico, Imperial Danby, Danby Gray.

c. Finish: Honed for all exposed surfaces, sawn for all other non-exposed surfaces

d. Engravings on selected faces as indicated on the Drawings. Typeface design and/or artwork as provided by the Landscape Architect and coordinated by the Contractor.

2.2 MORTAR MATERIALS

A. Regional Materials: When possible, provide aggregate for mortar and grout, cement, and lime that have been extracted, harvested, or recovered, as well as manufactured, within 500 miles of Project site.

B. Subject to compliance with requirements, available products that may be incorporated into the Work include the following, or approved comparable products:

1. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color cement as required to produce mortar color indicated.

2. Hydrated Lime: ASTM C 207, Type S.

3. Mortar Cement: ASTM C 1329.

4. Aggregate: ASTM C 144 and as follows: For pointing mortar, use aggregate graded with 100 percent passing No. 16 (1.18-mm) sieve.

5. Latex Additive: Manufacturer's standard, acrylic-resin or styrene-butadiene-rubber water emulsion, serving as replacement for part or all of gaging water, of type specifically recommended by latex-additive manufacturer for use with field-mixed portland cement mortar bed, and not containing a retarder.

6. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

7. Water: Potable.

C. Mortar Mixes

1. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, without approval from Architect.

a. Do not use calcium chloride.

b. Limit cementitious materials in mortar to portland cement, mortar cement, and lime.

c. Add cold-weather admixture (if used) at same rate for all mortar that will be exposed to view, regardless of weather conditions, to ensure that mortar color is consistent.

2. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in the form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

3. Mortar for Stone Masonry: Comply with ASTM C 270, Property Specification.

a. Mortar for Setting Stone: Type S.

2.3 STONE ANCHORS

A. Stone Veneer Anchors: Units fabricated with tabs or dowels designed to engage kerfs, slots or holes in stone veneer units and holes for fasteners or post-installed anchor bolts for fastening to substrates as indicated.

1. Materials: Fabricate anchors from stainless steel, ASTM A 240/A 240M, Type 304. Fabricate dowels from stainless steel, ASTM A 276, Type 304.

2. Fasteners for Stone Veneer Anchors: Annealed stainless-steel bolts, nuts, and washers; ASTM F 593 for bolts and ASTM F 594 for nuts, Alloy Group 1.

2.4 MISCELLANEOUS MASONRY ACCESSORIES

A. Backer Rod for Sealant Joints: Flexible, closed cell, polyethylene, rope-like joint backing material of appropriate diameter for specified joint size as indicated on the Drawings to resist pressure during sealant tooling. Backer rod shall not stain or adhere to sealant materials and shall be fully compatible with sealant compounds.

B. Joint Sealant: Sanded silicone with integral color to match stone. Conforms to the following properties under ASTM C–920: Type S, Grade NS, Class 25, Use NT, Use I, Use M, Use G Conforms to ASTM C-794 Adhesion Properties.

2.5 FABRICATION

A. Fabricate stone to comply with sizes, shapes, and tolerances recommended by applicable stone association.

1. For granite, comply with recommendations in NBGQA's "Specifications for Architectural Granite."

B. Cut stone to produce pieces of thickness, size, and shape indicated, including details on Drawings. Dress joints (bed and vertical) straight and at right angle to face unless otherwise indicated.

C. Cut and drill slots, sinkages and holes in stone for anchors and supports.

D. Carefully inspect stone at quarry or fabrication plant for compliance with requirements for appearance, material, and fabrication. Replace defective units before shipment.

1. Clean sawed backs of stone to remove rust stains and iron particles.

E. Thickness of Stone: Provide thickness indicated on Drawings.

F. Finish exposed faces and edges of stone to comply with requirements indicated for finish and to match approved samples and mockups.

1. Finish: As indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

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

3.2 PREPARATION

A. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 SETTING OF STONE MASONRY, GENERAL

A. Perform necessary field cutting and trimming as stone is set. Do not trim exposed ends or faces. Cuts shall be made at joints or hidden surfaces.

B. Sort stone before it is placed to remove stone that does not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

C. Arrange stones with color and size variations uniformly dispersed for an evenly blended appearance.

D. Set stone to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure stone masonry in place. Set stone accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

E. Joint widths:

1. Granite paving: Maintain uniform joint widths from stone to stone at 1/8-inch or as indicated on approved Shop Drawings.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet or more.

B. Variation from Level: For joints and lines of sills, coping, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or more.

C. Measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each stone from level, plumb, or dimensioned plane.

D. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

E. Variation in Plane between Adjacent Rough Stones: Do not exceed one-half of tolerance specified for thickness of stone.

3.5 INSTALLATION OF ANCHORED STONE MASONRY

A. Anchor stone masonry to concrete backup with adjustable, anchors unless otherwise indicated.

B. Embed veneer anchors in mortar joints of stone masonry at least halfway, but not less than 1-1/2 inches, through stone masonry and with at least 5/8-inch cover on outside face.

C. Space anchors as required to support masonry veneer. Install additional anchors within 12 inches of openings, sealant joints, and perimeter at intervals not exceeding 12 inches.

D. Anchor stone veneer with stone veneer anchors where indicated. Install anchors by fastening to substrate and inserting tabs and dowels into kerfs and holes in stone units. Provide compressible filler in ends of dowel holes and bottoms of kerfs to prevent end bearing of dowels and anchor tabs on stone. Fill remainder of anchor holes and kerfs with mortar.

E. Cavity:

1. For rough veneer stone, fill collar joint with mortar as stone is set. Unless otherwise indicated on the Drawings.

2. For granite panels, provide cavity as indicated on the Drawings.

F. Joints:

1. Rough wall veneer stone and coping: Rake out visible mortar from joints of stone so that mortar is not visible, before setting mortar has hardened.

2. Sills: Rake out joints for pointing with mortar to depth of not less than 1/2 inch before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.6 ADJUSTING AND CLEANING

A. Remove and replace stone masonry of the following description:

1. Broken, chipped, stained, or otherwise damaged stone. Stone may be repaired if methods and results are approved by Architect.

2. Defective joints.

3. Stone masonry not matching approved samples and mockups.

4. Stone masonry not complying with other requirements indicated.

B. Replace in a manner that results in stone masonry matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. Final Cleaning: After mortar is thoroughly set and cured, clean stone masonry as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before cleaning stone masonry.

3.7 EXCESS MATERIALS AND WASTE

A. Excess Stone: Remove from jobsite and legally dispose of off Owner's property.

B. Excess Masonry Waste: Remove excess masonry waste and other waste, and legally dispose of off Owner's property.

END OF SECTION

SECTION 055215 – EXTERIOR HANDRAILS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Painted steel tube handrails.

B. This Section includes requirements for detailing and engineering of railing systems to fulfill performance requirements and conform to design intent indicated on Drawings.

1.2 RELATED SECTIONS

A. Section 033000 Cast-in-Place Concrete

1.3 PERFORMANCE STANDARDS

A. Delegated-Design: Install handrails and guardrails to resist the simultaneous application of a lateral force of 50lbs./LF and a vertical load of 100 lbs./LF, both applied to the top of the railing. The rail shall resist a total lateral force and total vertical load of at least 200 lbs. each.

B. Submit calculations and drawings signed and sealed by a Professional Engineer licensed in the Pennsylvania indicating that the railings can meet these performance criteria. Railings shall be fully coordinated with field measured conditions including but not limited to expansion joint locations.

C. Control of corrosion: prevent galvanic action and other forms of corrosion by insulating metals and other materials from direct contact with incompatible materials.

1.4 SUBMITTALS

A. Product Data: for each type of product indicated, including finishing materials and color chart for selection.

B. Shop Drawings: Indicate profiles, sizes, anchorage, and accessories. Indicate materials of each item. Provide plans, elevations, and details as required to clearly illustrate the full scope of work. Include material information, finishes, and types of joinery, fasteners, anchorages, and accessory items.

1. Include structural analysis data, signed and sealed by a qualified professional engineer responsible for analysis preparation.
2. Verify actual conditions by field measurements before fabrication and indicate measurements on shop drawings.

C. Samples

1. Submit one handrail sample, 12 inches long including a typical weld, indicating material and finish.

1.5 QUALITY ASSURANCE

A. Contractor shall have had experience with at least two (2) other projects of similar scope and complexity and shall perform work with personnel totally familiar with furnishings installation and

construction techniques under the supervision of an experienced foreperson.

B. Manufacturer: Company specializing in the manufacture of products specified in this Section with a minimum of three (3) years of experience.

1.6 DELIVERY STORAGE AND HANDLING

A. Deliver, store, handle and protect all materials from damage.

1.7 WARRANTY

A. Manufacturer's Warranty: Provide manufacturer's standard 3-year limited warranty.

PART 2 - PRODUCTS

2.1 METALS, GENERAL

A. Metal surfaces: provide materials with smooth surfaces, without seam marks, roller marks, rolled trade names, stains, discolorations, or blemishes.

B. Brackets, Flanges and Anchors: Same metal and finish as supported rails, unless otherwise indicated.

2.2 TUBE RAILING MATERIALS

A. Steel Pipe: ASTM A53, Type S, Grade A, standard weight (Schedule 40), unless another grade and weight are required by structural loads.

B. Steel tubing: ASTM A500, Grade A, standard weight (Schedule 40), unless another grade and weight are required by structural loads.

C. Plates, Shapes and Bars: ASTM A36/A36M.

D. Welding materials: AWS D1.1, type required for materials being welded.

2.3 FASTENERS

A. Unless otherwise indicated, provide Type 304 stainless steel fasteners.

B. Provide concealed fasteners for interconnecting components and for attaching rails to other work, unless otherwise indicated.

C. Anchors: provide chemical or torque-controlled expansion anchors, fabricated from corrosion-resistant materials with capability to sustain, without failure, a load equal to four times the load imposed, as determined by testing per ASTM E 488 conducted by a qualified independent testing agency.

2.4 PAINTED FINISHES

A. Shop Painted Finish: Provide a uniform smooth finish on all railing surfaces using the following products, or approved equal. Fully prepare surfaces in accordance with the manufacturer’s recommendations.

1. Primer: Rust-Oleum Commercial C740 System DTM Alkyd Enamel Primer.
2. Finish Coat: Rust-Oleum Commercial C740 System 400 VOC DTM Alkyd Enamel.
3. Color: Black.

2.5 ACCESSORIES

A. Grout: CE CRD-C621; Non-shrink type, premixed compound consisting of nonmetallic aggregate, cement, water reducing and plasticizing additives, capable of developing a minimum compressive strength of 5,000 psi at 7 days.

1. Five Star Products, Inc.; Five Star Grout.
2. L&M Construction Chemicals, Inc.; Duragrout.
3. Euclid Chemical Company; NS Grout.

B. Cover Flange: Item # 637, Steel Flat Base Flange For 1-1/2" Pipe (1.90" Diameter) With No Mounting Holes and Set Screw, Unfinished, Kit as manufactured by R&B Wagner, Inc., Milwaukee, WI 53224, (888) 243-6914, or approved equal.

2.6 FABRICATION

A. Fabricate railings to comply with requirements indicated for design, dimensions, member sizes and spacing, details, finishes and anchorage, but not less than that required to support structural loads.

B. Fabricate connections that will be exposed to weather in a manner to exclude water; provide weep holes where water may accumulate and slip joints in handrails that span structure.

C. Cut, reinforce, drill and tap as indicated to receive finish hardware, screws and similar items.

D. Welded connections: finish exposed surfaces smooth and blended so not roughness shows after finishing and welded surface matches contours of adjoining materials.

E. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

F. Close exposed ends of hollow railing members with prefabricated end fittings.

G. Provide inserts and other anchorage devices for connecting railings to concrete.

H. For railing posts set in concrete, provide steel sleeves not less that 6 inches long with inside dimensions not less than ½ inch greater than outside dimensions of post, with steel plate forming bottom closure.

I. Assemble railings in the shop to the greatest extent possible to minimize field splicing and assembly. Disassemble units only as necessary for shipping and handling limitations. Clearly mark units for reassembly and coordinated installation. Use connections that maintain structural value of joined pieces.

J. Nonwelded connections: connect members with concealed mechanical fasteners and fittings. Fabricate members and fittings to produce flush, smooth, rigid, hairline joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work. Notify Landscape Architect in writing of deviations from the manufacturer's recommended installation tolerances and conditions.

B. Commencement of installation constitutes acceptance of conditions.

3.2 PREPARATION

A. Supply items required to be cast into concrete.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Install expansion joints as required to accommodate thermal movement. Provide slip joint internal sleeve extending 2 inches beyond joint on either side, fasten internal sleeve securely to one side and locate joint within 6 inches of post.

C. Use metal sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout mixed and placed to comply with anchoring material manufacturer's written instructions.

D. Cover anchorage joint with flange of same metal as post either welded to post after placing anchoring material or attached to post with set screws.

E. Set railing in sleeves where indicated. Grout annular space between sleeves and railing posts.

F. Field weld anchors as indicated on shop drawings. Touch-up welds with primer. Grind welds smooth.

G. Conceal bolts and screws whenever possible. Where not concealed, use flush countersunk fastenings.

H. Assemble with spigots and sleeves to accommodate tight, hairline joints and secure installation.

I. Provide anchorage devices and fittings to secure to in-place construction to adjacent construction. Separate dissimilar materials with bushings, grommets or washers to prevent electrolytic corrosion.

J. Secure mounting brackets to building structure in a positive manner using manufacturer recommended reinforcement and anchorage methods for substrate conditions. Locate brackets and hardware at spacing required to support structural loads.

K. Installation of railing system shall be rigid and secure, installed by mechanics experienced in erection of architectural metal. Mounting hardware shall be drawn up tightly. Rails shall be set plumb and aligned.

3.4 ADJUSTING AND CLEANING AND PROTECTION

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with the same material as used for shop painting. Apply by brush or spray to provide a minimum of 2.0-mil dry film thickness.

B. Protect finishes of railings from damage during construction period with temporary protective coverings approved by railing manufacturer. Remove protective coverings at time of Substantial Completion.

3.5 ERECTION TOLERANCES

A. Maximum Variation from Plumb: 1/4 inch in 10 feet, non-cumulative.

B. Maximum Offset from True Alignment: 1/4 inch.

C. Maximum Out-of-Position: 1/4 inch.

END OF SECTION

SECTION 116833 – ATHLETIC EQUIPMENT

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes the tennis system.

B. Related Sections:

1. Section 321216 "Asphalt Paving" for surfacing under and around equipment.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

1.4 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Plans, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:
1. Tennis System.

B. Qualification Data: For qualified Installer, manufacturer and testing agency.

C. Warranty: Sample of special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For equipment and finishes to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: To be approved by Philadelphia Parks and Recreation.

B. Installer Qualifications: An employer of workers approved by manufacturer.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of equipment that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures.
b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 ATHLETIC EQUIPMENT

A. Tennis: subject to compliance with requirements, provide products by Bison Inc., 603 L Street, Lincoln, NE, 68508, 1 (800) 247-7668, or approved equal.
1. Recreational Tennis Post and Net System Item: Model#TN05 Post System and Model#TN235 Steel Sleeves.

2.2 CAST-IN-PLACE CONCRETE

A. Concrete Materials and Properties: Comply with requirements in Section 033000 "Cast-in-Place Concrete" to produce normal-weight, air-entrained concrete with a minimum 28-day compressive strength of 3500 psi (20.7 MPa), 3-inch (75-mm) slump, and 1-inch- (25-mm-) maximum-size aggregate.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, site surface and subgrade drainage, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 PREPARATION

A. Verify locations of perimeter and pathways. Verify that equipment layout complies with requirements for each type and component of equipment.

3.3 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of mini-pitch system where required.

B. Install equipment level, plumb, true, and securely anchored at locations indicated on Drawings, and as per Manufacturer.

END OF SECTION

SECTION 129300 - SITE FURNISHINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Bollard

B. Related Requirements:

1. Section 321613 "Cast-in-Place Concrete" for installing equipment and/or anchor bolts cast in concrete footings.
2. Section 312000 "Earth Moving" for excavation for installing concrete footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Anchors, Fasteners, Fittings, and Hardware: Provide Stainless steel; commercial quality, tamperproof, vandal and theft resistant unless indicated otherwise on the Drawings.

B. Nonshrink, Nonmetallic Grout: Premixed, factory-packaged, nonstaining, noncorrosive, nongaseous grout complying with ASTM C 1107; recommended in writing by manufacturer, for exterior applications.

C. Erosion-Resistant Anchoring Cement: Factory-packaged, nonshrink, nonstaining, hydraulic-controlled expansion cement formulation for mixing with potable water at Project site to create pourable anchoring, patching, and grouting compound; resistant to erosion from water exposure without needing protection by a sealer or waterproof coating; recommended in writing by manufacturer, for exterior applications.

2.2 Bollard

A. Basis-of-Design Manufacturer: Subject to compliance with requirements, provide furnishings manufactured by Dumor, Inc., P.O. Box 142, Mifflintown, PA 17059, 717-436-2106 or 800-598-4018, www.dumor.com, or approved comparable product.
1. Model: 400-42, S-1

2. Finish / Color: Black

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for correct and level finished grade, mounting surfaces, installation tolerances, and other conditions affecting performance of the Work.

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

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written installation instructions unless more stringent requirements are indicated. Complete field assembly of site furnishings where required.

B. Unless otherwise indicated, install site furnishings after landscaping and paving have been completed.

C. Install site furnishings level, plumb, true, and **securely anchored** at locations indicated on Drawings.

D. Post Setting: Set cast-in support posts in concrete footing with smooth top, shaped to shed water. Protect portion of posts above footing from concrete splatter. Verify that posts are set plumb or at correct angle and are aligned and at correct height and spacing. Hold posts in position during placement and finishing operations until concrete is sufficiently cured.

E. Pipe Sleeves: Use steel pipe sleeves preset and anchored into concrete for installing posts. After posts have been inserted into sleeves, fill annular space between post and sleeve with nonshrink, nonmetallic grout or anchoring cement, mixed and placed to comply with anchoring material manufacturer's written instructions, with top smoothed and shaped to shed water.

3.3 CLEANING

A. After completing site furnishing installation, inspect components. Remove spots, dirt, and debris. Repair damaged finishes to match original finish or replace component.

END OF SECTION

SECTION 220523 - VALVES AND SPECIALTIES FOR PLUMBING PIPE

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Brass ball valves.
   2. Drain valves.
   3. Water-hammer arresters.

1.3 DEFINITIONS

A. CWP: Cold working pressure.
B. NRS: Non-rising stem.
C. OS & Y: Outside screw and yoke.
D. RS: Rising stem

1.4 ACTION SUBMITTALS

A. Product Data: For each type of valve.
   1. Certification that products comply with NSF 61 Annex G and NSF 372.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:
   1. Protect internal parts against rust and corrosion.
   2. Protect threads, flange faces, and soldered ends.
   3. Set ball valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:
   1. Maintain valve end protection.
   2. Store valves indoors and maintain at higher-than-ambient-dew-point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

C. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR VALVES

A. Source Limitations for Valves: Obtain each type of valve from single source from single manufacturer.
B. ASME Compliance:
   1. ASME B1.20.1 for threads for threaded end valves.
   2. ASME B16.1 for flanges on iron valves.
   3. ASME B16.5 for flanges on steel valves.
   4. ASME B16.10 and ASME B16.34 for ferrous valve dimensions and design criteria.
   5. ASME B16.18 for solder-joint connections.
   6. ASME B31.9 for building services piping valves.

C. Retain "NSF Compliance" Paragraph below if products come into contact with potable water.
D. NSF Compliance: NSF 61 Annex G and NSF 372 for valve materials for potable-water service.
E. Bronze valves shall be made with dezincification-resistant materials. Bronze valves made with copper alloy (brass) containing more than 15 percent zinc are not permitted.
F. Valve Pressure-Temperature Ratings: Not less than indicated and as required for system pressures and temperatures.
G. Valve Sizes: Same as upstream piping unless otherwise indicated.
H. Valve Actuator Types:
   1. Handlever: For quarter-turn valves smaller than NPS 4.

I. Valves in Insulated Piping:
   1. Include 2-inch stem extensions.
   2. Extended operating handles of nonthermal-conductive material and protective sleeves that allow operation of valves without breaking vapor seals or disturbing insulation.

J. RS Valves in Insulated Piping: With 2-inch stem extensions.
K. Valve Bypass and Drain Connections: MSS SP-45

2.2 BRASS BALL VALVES

A. Two-Piece, Brass Ball Valves with Full Port and Brass Trim:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
      a. American Valve, Inc.
      b. Conbraco Industries, Inc.
      c. Crane; Crane Energy Flow Solutions.
      d. DynaQuip Controls.
      e. Hammond Valve.
      f. Jomar Valve.
      g. KITZ Corporation.
      h. Legend Valve & Fitting, Inc.
      i. Marwin Valve; Richards Industries.
      j. Milwaukee Valve Company.
      k. NIBCO INC.
      l. Red-White Valve Corporation.
      m. Stockham; Crane Energy Flow Solutions.
      n. Watts; a Watts Water Technologies company.
   2. Description:

a. Standard: MSS SP-110.
b. CWP Rating: 600 psig.
c. Body Design: Two piece.
d. Body Material: Forged brass.
e. Ends: Threaded and soldered.
f. Seats: PTFE.
g. Stem: Brass.
h. Ball: Chrome-plated brass.
i. Port: Full.

2.3 DRAIN VALVES

A. Ball-Valve-Type, Hose-End Drain Valves:
1. Standard: MSS SP-110 for standard-port, two-piece ball valves.
2. Pressure Rating: 400-psig minimum CWP.
3. Size: NPS 3/4.
4. Body: Copper alloy.
5. Ball: Chrome-plated brass.
6. Seats and Seals: Replaceable.
7. Handle: Vinyl-covered steel.
8. Inlet: Threaded or solder joint.
9. Outlet: Threaded, short nipple with garden-hose thread complying with ASME B1.20.7 and cap with brass chain.

2.4 WATER-HAMMER ARRESTERS

A. Water-Hammer Arresters:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. AMTROL, Inc.
b. Jay R. Smith Mfg. Co.
c. Josam Company.
d. MIFAB, Inc.
e. Precision Plumbing Products.
f. Sioux Chief Manufacturing Company, Inc.
g. Tyler Pipe; a subsidiary of McWane Inc.
h. Watts; a Watts Water Technologies company.
i. Zurn Industries, LLC.
2. Standard: ASSE 1010 or PDI-WH 201.
3. Type: Copper tube with piston.
4. Size: ASSE 1010, Sizes AA and A through F, or PDI-WH 201, Sizes A through F.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine valve interior for cleanliness, freedom from foreign matter, and corrosion. Remove special packing materials, such as blocks, used to prevent movement during shipping and handling.
B. Operate valves in positions from fully open to fully closed. Examine guides and seats made accessible by such operations.
C. Do not attempt to repair defective valves; replace with new valves.

3.2 VALVE INSTALLATION

A. Install valves with unions or flanges at each piece of equipment arranged to allow service, maintenance, and equipment removal without system shutdown.
B. Locate valves for easy access and provide separate support where necessary.
C. Install valves in horizontal piping with stem at or above center of pipe.
D. Install valves in position to allow full stem movement.
E. Install valve tags. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment" for valve tags and schedules.

3.3 CONNECTIONS

A. Comply with requirements for ground equipment in Section 260526 "Grounding and Bonding for Electrical Systems."

3.4 ADJUSTING

A. Adjust or replace valve packing after piping systems have been tested and put into service but before final adjusting and performing balancing. Replace valves if persistent leaking occurs.
B. Set field-adjustable temperature set points of temperature-actuated, water mixing valves.

3.5 GENERAL REQUIREMENTS FOR VALVE APPLICATIONS

A. If valves with specified CWP ratings are unavailable, the same types of valves with higher CWP ratings may be substituted.
B. Select valves with the following end connections:
    1. For Copper Tubing, NPS 2 and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.

2. For Copper Tubing, NPS 2-1/2 to NPS 4: Flanged ends except where threaded valve-end option is indicated in valve schedules below.

3.6 DOMESTIC HOT- AND COLD-WATER BALL VALVE SCHEDULE

A. Pipe NPS 2 and Smaller:
   1. Bronze Valves: May be provided with solder-joint ends instead of threaded ends.
   2. Two-piece, brass ball valves with full port and brass trim.

END OF SECTION 220523

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SECTION 260543- UNDERGROUND DUCTS AND RACEWAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:
   1. Metal conduits and fittings, including GRC and PVC-coated steel conduit.
   2. Rigid nonmetallic duct.
   3. Duct accessories.
   4. Precast concrete handholes.
   5. Polymer concrete handholes and boxes with polymer concrete cover.

1.3 DEFINITIONS

A. Direct Buried: Duct or a duct bank that is buried in the ground, without any additional casing materials such as concrete.
B. Duct: A single duct or multiple ducts. Duct may be either installed singly or as component of a duct bank.
C. Duct Bank:
   1. Two or more ducts installed in parallel, with or without additional casing materials.
   2. Multiple duct banks.

D. GRC: Galvanized rigid (steel) conduit.
E. Trafficways: Locations where vehicular or pedestrian traffic is a normal course of events.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
   1. Include duct-bank materials, including spacers and miscellaneous components.
   2. Include duct, conduits, and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
   3. Include accessories for manholes, handholes, boxes.
   4. Include underground-line warning tape.
   5. Include warning planks.

B. Shop Drawings:
   1. Precast or Factory-Fabricated Underground Utility Structures:
      a. Include plans, elevations, sections, details, attachments to other work, and accessories.
      b. Include duct entry provisions, including locations and duct sizes.

c. Include reinforcement details.
d. Include grounding details.
e. Include dimensioned locations of cable rack inserts, pulling-in and lifting irons, and sumps.
f. Include joint details.

2. Factory-Fabricated Handholes and Boxes Other Than Precast Concrete:
a. Include dimensioned plans, sections, and elevations, and fabrication and installation details.
b. Include duct entry provisions, including locations and duct sizes.
c. Include cover design.
d. Include grounding details.
e. Include dimensioned locations of cable rack inserts, and pulling-in and lifting irons.

1.5 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: For duct and duct bank. Show duct profiles and coordination with other utilities and underground structures.
1. Include plans and sections, drawn to scale, and show bends and locations of expansion fittings.
2. Drawings shall be signed and sealed by a qualified professional engineer.

B. Qualification Data: For professional engineer and testing agency responsible for testing nonconcrete handholes and boxes.
C. Product Certificates: For concrete and steel used in precast concrete handholes, as required by ASTM C858.
D. Source quality-control reports.
E. Field quality-control reports.

1.6 MAINTENANCE MATERIALS SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

1.8 FIELD CONDITIONS

A. Interruption of Existing Electrical Service: Do not interrupt electrical service to facilities occupied by Owner or others unless permitted under the following conditions, and then only after arranging to provide temporary electrical service according to requirements indicated:
1. Notify Construction Manager and Owner no fewer than two days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Owner's written permission.

B. Ground Water: Assume ground-water level is at grade level unless a lower water table is noted on Drawings.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND FITTINGS

A. GRC: Comply with ANSI C80.1 and UL 6.
B. Coated Steel Conduit: PVC-coated GRC.
   1. Comply with NEMA RN 1.
   2. Coating Thickness: 0.040 inch, minimum.

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ABB, Electrification Products Division.
   2. AFC Cable Systems; Atkore International.
   3. Allied Tube & Conduit; Atkore International.
   4. Anaconda Sealtite; Anamet Electrical, Inc.
   5. Calconduit; Atkore International.
   6. Champion Fiberglass, Inc.
   7. Electri-Flex Company.
   8. FSR Inc.
   9. Korkap.
   10. NEC, Inc.
   11. NewBasis.
   12. Opti-Com Manufacturing Network, Inc (OMNI).
   13. O-Z/Gedney; Emerson Electric Co., Automation Solutions, Appleton Group.
   14. Patriot Aluminum Products, LLC.
   15. Perma-Cote; Robroy Industries.
   16. Picoma; Zekelman Industries.
   17. Plasti-Bond; Robroy Industries.
   18. Republic Conduit; Nucor Corporation, Nucor Tubular Products.
   19. Southwire Company.
   20. Topaz Lighting & Electric.
   21. Western Tube; Zekelman Industries.
   22. Wheatland Tube; Zekelman Industries.

D. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.2 RIGID NONMETALLIC DUCT

A. Underground Plastic Utilities Duct: Type EPC-40-PVC RNC, complying with NEMA TC 2 and UL 651, with matching fittings complying with NEMA TC 3 by same manufacturer as duct.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. ARNCO Corp.
   2. Beck Manufacturing.
   3. Cantex Inc.

4. CertainTeed Corporation; Saint-Gobain North America.
5. Condux International, Inc.
6. Crown Line Plastics.
7. ElecSys, Inc.
8. Electri-Flex Company.
9. Endot Industries Inc.
10. IPEX USA LLC.
11. Lamson & Sessions.
12. Manhattan/CDT.
13. National Pipe & Plastics.
14. Opti-Com Manufacturing Network, Inc (OMNI).
15. Spiraduct/AFC Cable Systems, Inc.

C. Listed and labeled as defined in NFPA 70, by a nationally recognized testing laboratory, and marked for intended location and application.

2.3 PRECAST CONCRETE HANDHOLES AND BOXES

A. Description: Factory-fabricated, reinforced-concrete, monolithically poured walls and bottom unless open-bottom enclosures are indicated. Frame and cover shall form top of enclosure and shall have load rating consistent with that of handhole or box.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Christy Concrete Products.
   2. Elmhurst-Chicago Stone Co.
   3. Oldcastle Infrastructure Inc.; CRH Americas.
   4. Rinker Group, Ltd.
   5. Riverton Concrete Products.
   6. Utility Concrete Products, LLC.
   7. Utility Vault Co.
   8. Wausau Tile Inc.

C. Comply with ASTM C858 for design and manufacturing processes.
D. Frame and Cover:
   1. Weatherproof cast-iron frame, with cast-iron cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
   2. Weatherproof steel frame, with steel cover with recessed cover hook eyes and tamper-resistant, captive, cover-securing bolts.
   3. Weatherproof steel frame, with hinged steel access door assembly with tamper- resistant, captive, cover-securing bolts.
      a. Cover Hinges: Concealed, with hold-open ratchet assembly.
      b. Cover Handle: Recessed.
   4. Weatherproof aluminum frame with hinged aluminum access door assembly with tamper-resistant, captive, cover-securing bolts.
      a. Cover Hinges: Concealed, with hold-open ratchet assembly.
      b. Cover Handle: Recessed.

E. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
F. Cover Legend: Molded lettering, "ELECTRIC".

G. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.
H. Extensions and Slabs: Designed to mate with bottom of enclosure. Same material as enclosure.
   1. Extension shall provide increased depth of 12 inches.
   2. Slab: Same dimensions as bottom of enclosure and arranged to provide closure.

I. Joint Sealant: Asphaltic-butyl material with adhesion, cohesion, flexibility, and durability properties necessary to withstand maximum hydrostatic pressures at the installation location with the ground-water level at grade.
J. Knockout Panels: Precast openings in walls, arranged to match dimensions and elevations of approaching duct, plus an additional 12 inches vertically and horizontally to accommodate alignment variations.
   1. Splayed location.
   2. Knockout panels shall be located no less than 6 inches from interior surfaces of walls, floors, or frames and covers of handholes, but close enough to corners to facilitate racking of cables on walls.
   3. Knockout panel opening shall have cast-in-place, welded-wire fabric reinforcement for field cutting and bending to tie into concrete envelopes of duct.
   4. Knockout panels shall be framed with at least two additional No. 3 steel reinforcing bars in concrete around each opening.
   5. Knockout panels shall be 1-1/2 to 2 inches thick.

K. Duct Entrances in Handhole Walls: Cast end-bell or duct-terminating fitting in wall for each entering duct.
   1. Type and size shall match fittings to duct to be terminated.
   2. Fittings shall align with elevations of approaching duct and be located near interior corners of handholes to facilitate racking of cable.

L. Handholes 12 inches wide by 24 inches long and larger shall have inserts for cable racks and pulling-in irons installed before concrete is poured.

2.4 POLYMER CONCRETE HANDHOLES AND BOXES WITH POLYMER CONCRETE COVER

A. Description: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Armorcast Products Company.
   2. MacLean Highline.
   3. NewBasis.
   4. Oldcastle Infrastructure Inc.; CRH Americas.
   5. Quazite; Hubbell Incorporated, Power Systems.

C. Standard: Comply with SCTE 77. Comply with tier requirements in "Underground Enclosure Application" Article.
D. Color: Gray.
E. Configuration: Units shall be designed for flush burial and have open bottom unless otherwise indicated.

F. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
G. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
H. Cover Legend: Molded lettering, "ELECTRIC".
I. Direct-Buried Wiring Entrance Provisions: Knockouts equipped with insulated bushings or end-bell fittings, selected to suit box material, sized for wiring indicated, and arranged for secure, fixed installation in enclosure wall.
J. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering duct for secure, fixed installation in enclosure wall.
K. Handholes 12 inches wide by 24 inches long and larger shall have factory-installed inserts for cable racks and pulling-in irons.

2.5 SOURCE QUALITY CONTROL

A. Test and inspect precast concrete utility structures according to ASTM C1037.
B. Nonconcrete Handhole and Pull-Box Prototype Test: Test prototypes of manholes and boxes for compliance with SCTE 77. Strength tests shall be for specified tier ratings of products supplied.
   1. Tests of materials shall be performed by an independent testing agency.
   2. Strength tests of complete boxes and covers shall be by an independent testing agency or manufacturer. A qualified registered professional engineer shall certify tests by manufacturer.
   3. Testing machine pressure gages shall have current calibration certification, complying with ISO 9000 and ISO 10012, and traceable to NIST standards.

PART 3 - EXECUTION

3.1 PREPARATION

A. Coordinate layout and installation of duct, duct bank, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field. Notify Engineer if there is a conflict between areas of excavation and existing structures or archaeological sites to remain.
B. Coordinate elevations of duct and duct-bank entrances into manholes, handholes, and boxes with final locations and profiles of duct and duct banks, as determined by coordination with other utilities, underground obstructions, and surface features. Revise locations and elevations as required to suit field conditions and to ensure that duct and duct bank will drain to manholes and handholes, and as approved by Architect.
C. Clear and grub vegetation to be removed and protect vegetation to remain according to Section 311000 "Site Clearing." Remove and stockpile topsoil for reapplication according to Section 311000 "Site Clearing."

3.2 UNDERGROUND DUCT APPLCATION

A. Duct for Electrical Branch Circuits: Type EPC-40-PVC RNC, direct-buried unless otherwise indicated.

3.3 UNDERGROUND ENCLOSURE APPLICATION

A. Handholes and Boxes for 600 V and Less:
   1. Units in Roadways and Other Deliberate Traffic Paths: Precast concrete. AASHTO HB 17, H-25 structural load rating.
   2. Units in Driveway, Parking Lot, and Off-Roadway Locations, Subject to Occasional, Nondeliberate Loading by Heavy Vehicles: Precast concrete, AASHTO HB 17, H-20 or Polymer concrete, SCTE 77, Tier 15 structural load rating.
   3. Units in Sidewalk and Similar Applications with a Safety Factor for Nondeliberate Loading by Vehicles: Precast concrete, AASHTO HB 17, H-10 or Polymer concrete units, SCTE 77, Tier 8 structural load rating.
   4. Cover design load shall not exceed the design load of the handhole or box.

3.4 EARTHWORK

A. Excavation and Backfill: Comply with Section 310000 "Earthwork" and 312316.13 “Trenching,” but do not use heavy-duty, hydraulic-operated, compaction equipment.
B. Restoration: Replace area immediately after backfilling is completed or after construction vehicle traffic in immediate area is complete.
C. Restore surface features at areas disturbed by excavation and re-establish original grades unless otherwise indicated. Replace removed sod immediately after backfilling is completed.
D. Restore areas disturbed by trenching, storing of dirt, cable laying, and other work. Restore vegetation and include necessary topsoiling, fertilizing, liming, seeding, sodding, sprigging, and mulching. Comply with Section 329200 "Lawn & Meadow" and Section 329300 "Plants."
E. Cut and patch existing pavement in the path of underground duct, duct bank, and underground structures according to Section 312350 "Sawcutting,” Section 321116 “Subbase Course,” and Section 321216 “Asphalt Paving.”

3.5 DUCT AND DUCT-BANK INSTALLATION

A. Where indicated on Drawings, install duct, spacers, and accessories into the duct-bank configuration shown. Duct installation requirements in this Section also apply to duct bank.
B. Install duct according to NEMA TCB 2.
C. Slope: Pitch duct a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope duct from a high point between two manholes, to drain in both directions.
D. Joints: Use solvent-cemented joints in duct and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent duct do not lie in same plane.

E. Installation Adjacent to High-Temperature Steam Lines: Where duct is installed parallel to underground steam lines, perform calculations showing the duct will not be subject to environmental temperatures above 40 deg C. Where environmental temperatures are calculated to rise above 40 deg C, and anywhere the duct crosses above an underground steam line, install insulation blankets listed for direct burial to isolate the duct bank from the steam line.

F. End Bell Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use end bells, spaced approximately 10 inches o.c. for 5-inch duct, and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to end-bell spacing 10 feet from the end bell, without reducing duct slope and without forming a trap in the line.
   2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line direct-buried duct with calculated expansion of more than 3/4 inch.
   3. Grout end bells into structure walls from both sides to provide watertight entrances.

G. Terminator Entrances to Manholes and Concrete and Polymer Concrete Handholes: Use manufactured, cast-in-place duct terminators, with entrances into structure spaced approximately 6 inches o.c. for 4-inch duct and vary proportionately for other duct sizes.
   1. Begin change from regular spacing to terminator spacing 10 feet from the terminator, without reducing duct line slope and without forming a trap in the line.
   2. Expansion and Deflection Fittings: Install an expansion and deflection fitting in each duct in the area of disturbed earth adjacent to manhole or handhole. Install an expansion fitting near the center of all straight line duct with calculated expansion of more than 3/4 inch.

H. Building Wall Penetrations: Make a transition from underground duct to GRC at least 10 feet outside the building wall, without reducing duct line slope away from the building and without forming a trap in the line. Use fittings manufactured for RNC-to-GRC transition. Install GRC penetrations of building walls as specified in Section 260544 "Sleeves and Sleeve Seals for Electrical Raceways and Cabling."

I. Sealing: Provide temporary closure at terminations of duct with pulled cables. Seal spare duct at terminations. Use sealing compound and plugs to withstand at least 15-psig hydrostatic pressure.

J. Pulling Cord: Install 200-lbf-test nylon cord in empty ducts.

K. Concrete-Encased Ducts and Duct Bank:
   1. Excavate trench bottom to provide firm and uniform support for duct. Prepare trench bottoms as specified in Section 312316.13 "Trenching" for pipes less than 6 inches in nominal diameter.
   2. Width: Excavate trench 12 inches wider than duct on each side.
   3. Depth: Install so top of duct envelope is at least 24 inches below finished grade in areas not subject to deliberate traffic, and at least 30 inches below finished grade in deliberate traffic paths for vehicles unless otherwise indicated.
   4. Support duct on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
   5. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to duct to prevent floating during concreting. Tie entire assembly together using

fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.

6. Minimum Space between Duct: 3 inches between edge of duct and exterior envelope wall, 2 inches between ducts for like services, and 4 inches between power and communications ducts.
7. Elbows: Use manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct unless otherwise indicated. Extend encasement throughout length of elbow.
8. Elbows: Use manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct run.
    a. Couple RNC duct to GRC with adapters designed for this purpose and encase coupling with 3 inches of concrete.
    b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
        1) Stub-ups shall be minimum 4 inches above finished floor and minimum 3 inches from conduit side to edge of slab.
    c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.
        1) Stub-ups shall be minimum 4 inches above finished floor and no less than 3 inches from conduit side to edge of slab.
9. Reinforcement: Reinforce concrete-encased duct where crossing disturbed earth and where indicated. Arrange reinforcing rods and ties without forming conductive or magnetic loops around ducts or duct groups.
10. Forms: Use walls of trench to form side walls of duct bank where soil is self-supporting and concrete envelope can be poured without soil inclusions; otherwise, use forms.
11. Concrete Cover: Install a minimum of 3 inches of concrete cover between edge of duct to exterior envelope wall, 2 inches between duct of like services, and 4 inches between power and communications ducts.
12. Concreting Sequence: Pour each run of envelope between manholes or other terminations in one continuous operation.
    a. Start at one end and finish at the other, allowing for expansion and contraction of duct as its temperature changes during and after the pour. Use expansion fittings installed according to manufacturer's written instructions or use other specific measures to prevent expansion- contraction damage.
    b. If more than one pour is necessary, terminate each pour in a vertical plane and install 3/4- inch reinforcing-rod dowels extending a minimum of 18 inches into concrete on both sides of joint near corners of envelope.
13. Pouring Concrete: Comply with requirements in "Concrete Placement" Article in Section 033053 "Site Cast-in-Place Concrete." Place concrete carefully during pours to prevent voids under and between duct and at exterior surface of envelope. Do not allow a heavy mass of concrete to fall directly onto ducts. Allow concrete to flow around duct and rise up in middle, uniformly filling all open spaces. Do not use power-driven agitating equipment unless specifically designed for duct- installation application.

L. Direct-Buried Duct and Duct Bank:
1. Excavate trench bottom to provide firm and uniform support for duct. Comply with requirements in Section 310000 "Earthwork" for preparation of trench bottoms for pipes less than 6 inches in nominal diameter.
2. Width: Excavate trench 12 inches wider than duct on each side.
3. Width: Excavate trench 3 inches wider than duct on each side.
4. Depth: Install top of duct at least 36 inches below finished grade unless otherwise indicated.
5. Set elevation of bottom of duct bank below frost line.

6. Support ducts on duct spacers coordinated with duct size, duct spacing, and outdoor temperature.
7. Spacer Installation: Place spacers close enough to prevent sagging and deforming of duct, with not less than four spacers per 20 feet of duct. Place spacers within 24 inches of duct ends. Stagger spacers approximately 6 inches between tiers. Secure spacers to earth and to ducts to prevent floating during concreting. Tie entire assembly together using fabric straps; do not use tie wires or reinforcing steel that may form conductive or magnetic loops around ducts or duct groups.
8. Install duct with a minimum of 3 inches between ducts for like services and 6 inches between power and communications duct.
9. Elbows: Install manufactured duct elbows for stub-ups, at building entrances, and at changes of direction in duct direction unless otherwise indicated. Encase elbows for stub-up ducts throughout length of elbow.
10. Install manufactured GRC elbows for stub-ups, at building entrances, and at changes of direction in duct.
    a. Couple RNC duct to GRC with adapters designed for this purpose and encase coupling with 3 inches of concrete.
    b. Stub-ups to Outdoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of base. Install insulated grounding bushings on terminations at equipment.
        1) Stub-ups shall be minimum 4 inches above finished floor and minimum 3 inches from conduit side to edge of slab.
    c. Stub-ups to Indoor Equipment: Extend concrete-encased GRC horizontally a minimum of 60 inches from edge of wall. Install insulated grounding bushings on terminations at equipment.
        1) Stub-ups shall be minimum 4 inches above finished floor and no less than 3 inches from conduit side to edge of slab.
11. After installing first tier of duct, backfill and compact. Start at tie-in point and work toward end of duct run, leaving ducts at end of run free to move with expansion and contraction as temperature changes during this process. Repeat procedure after placing each tier. After placing last tier, hand place backfill to 4 inches over duct and hand tamp. Firmly tamp backfill around ducts to provide maximum supporting strength. Use hand tamper only. After placing controlled backfill over final tier, make final duct connections at end of run and complete backfilling with normal compaction. Comply with requirements in Section 310000 "Earthwork" for installation of backfill materials.
    a. Place minimum 3 inches of sand as a bed for duct. Place sand to a minimum of 6 inches above top level of duct.
    b. Place minimum 6 inches of engineered fill above concrete encasement of duct.

M. Warning Planks: Bury warning planks approximately 12 inches above direct-buried duct, placing them 24 inches o.c. Align planks along the width and along the centerline of duct or duct bank. Provide an additional plank for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional planks 12 inches apart, horizontally.

N. Underground-Line Warning Tape: Bury nonconducting underground line no less than 12 inches above all concrete-encased duct and duct banks. Align tape parallel to and within 3 inches of centerline of duct bank. Provide an additional warning tape for each 12-inch increment of duct-bank width over a nominal 18 inches. Space additional tapes 12 inches apart, horizontally.

3.6 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handhole and Manhole Installation:
1. Comply with ASTM C891 unless otherwise indicated.

2. Install units level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1- inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:
1. Install handholes with bottom below frost line.
2. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade. Set covers of other handholes 1 inch above finished grade.
3. Where indicated, cast handhole cover frame integrally with handhole structure.

C. Waterproofing: Apply waterproofing to exterior surfaces of manholes and handholes after concrete has cured at least three days. Waterproofing materials and installation are specified in Section 071353 "Elastomeric Sheet Waterproofing". After duct has been connected and grouted, and before backfilling, waterproof joints and connections, and touch up abrasions and scars. Waterproof exterior of manhole chimneys after mortar has cured at least three days.

D. Field-Installed Bolting Anchors in Manholes and Concrete Handholes: Do not drill deeper than 3-7/8 inches for manholes and 2 inches for handholes, for anchor bolts installed in the field. Use a minimum of two anchors for each cable stanchion.

3.7 INSTALLATION OF HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting duct, to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of duct, and seal joint between box and extension as recommended by manufacturer.

B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set cover flush with finished grade. Set covers of other handholes 1 inch above finished grade.

D. Install handholes and boxes with bottom below frost line.

E. Install removable hardware, including pulling eyes, cable stanchions, cable arms, and insulators, as required for installation and support of cables and conductors and as indicated. Select arm lengths to be long enough to provide spare space for future cables, but short enough to preserve adequate working clearances in enclosure.

F. Field cut openings for duct according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

G. For enclosures installed in asphalt paving and subject to occasional, nondeliberate, heavy-vehicle loading, form and pour a concrete ring encircling, and in contact with, enclosure and with top surface screeded to top of box cover frame. Bottom of ring shall rest on compacted earth.
1. Concrete: 3000 psi, 28-day strength, complying with Section 033053 "Site Cast-in-Place Concrete," with a troweled finish.
2. Dimensions: 10 inches wide by 12 inches deep.

3.8 GROUNDING

A. Ground underground ducts and utility structures according to Section 260526 "Grounding and Bonding for Electrical Systems."

3.9 FIELD QUALITY CONTROL

A. Perform the following tests and inspections:
   1. Demonstrate capability and compliance with requirements on completion of installation of underground duct, duct bank, and utility structures.
   2. Pull solid aluminum or wood test mandrel through duct to prove joint integrity and adequate bend radii, and test for out-of-round duct. Provide a minimum 12-inch-long mandrel equal to duct size minus 1/4 inch. If obstructions are indicated, remove obstructions and retest.
   3. Test handhole grounding to ensure electrical continuity of grounding and bonding connections. Measure and report ground resistance as specified in Section 260526 "Grounding and Bonding for Electrical Systems."

B. Correct deficiencies and retest as specified above to demonstrate compliance.
C. Prepare test and inspection reports.

3.10 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of duct until duct cleaner indicates that duct is clear of dirt and debris. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.
B. Clean internal surfaces of manholes, including sump.
   1. Sweep floor, removing dirt and debris.
   2. Remove foreign material.

END OF DOCUMENT 26054

SECTION 310000- EARTHWORK

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work under this Section shall include all labor, material, equipment and all else necessary for cutting, proof rolling, filling and grading to required lines, dimensions, contours and elevations for proposed improvements as hereinafter specified and/or as otherwise required for the proper and timely completion of this Contract. Work under this Section includes, but is not limited to, subgrade preparation, excavating, backfilling, and compaction for structures and foundations, pavements, sidewalks, landscaping areas, and utilities. The contractor shall pay for and coordinate the services of a geotechnical engineer and testing agency to perform quality control of the earthwork.

B. Scarifying, compaction, moisture content conditioning and control, and removal of unsuitable material to ensure proper preparation of areas for the proposed improvements.

C. Undertake any special construction procedures for the project as shown in the drawings and described by these specifications for preparation of pavement areas.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials (ASTM), latest edition

1. C 33 Concrete Aggregates
2. D 698 Laboratory Compaction Characteristics of Soil Using Standard Effort
3. D 1556 Density and Unit Weight of Soils in Place by the Sand-Cone Method
4. D 1557 Laboratory Compaction Characteristics of Soil Using Modified Effort
5. D 2167 Density and Unit Weight of Soil in Place by Rubber Balloon Method
6. D 2216 Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
7. D 2487 Classification of Soils for Engineering Purposes (Unified Soil Classification System)
8. D 2937 Density of Soil in Place by the Drive-Cylinder Method
9. D 3740 Minimum Requirements for Agencies Engaged in Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction
10. D 4318 Liquid Limit, Plastic Limit, and Plasticity Index of Soils
11. D 4254 Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
12. D 6938 In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)

B. American Association of State Highway and Transportation Officials (AASHTO), latest edition

1. T 88 Particle Size Analysis of Soils

C. Associated General Contractors of America

1. Manual of Accident Prevention in Construction

1.4 QUALITY ASSURANCE

A. A geotechnical engineer familiar with the project requirements, selected and paid by the Owner, may be retained to perform construction inspection on site based on density testing, visual observation, and judgement. This inspection will not relieve the Contractor from their responsibility to complete the work in accordance with the drawings and specifications.

B. Visual field confirmation and density testing of subgrade preparation and fill placement procedures shall be performed by the field geotechnical engineer as part of the construction testing requirements. The Contractor shall be informed as soon as possible of the test results.

C. The geotechnical engineer shall prepare field reports that indicate compaction test location, elevation data, testing results and acceptability. The Owner, engineer, and Contractor shall be provided with written copies of the results within 24 hours of time test was performed.

D. All costs related to reinspection due to failures shall be paid for by the Contractor at no additional expense to Owner. The Owner reserves the right to direct any inspection that is deemed necessary. Contractor shall provide free access to site for inspection activities.

1.5 SUBMITTALS

A. Testing Agency Qualifications: Provide a statement of qualifications of the geotechnical engineer and testing agency that will perform the quality control tasks required in Article 3.08.

1. The geotechnical engineer shall be an experienced inspector working under the direction of the professional engineer licensed to practice in the Commonwealth of Pennsylvania who is experienced in providing engineering services related to earthwork.
2. The testing agency shall be an independent laboratory having a minimum of three (3) years' experience in conducting the testing indicated herein.
3. The testing laboratory shall meet the requirements of ASTM D 3740.

B. Material Test Reports: Shall be provided from the testing agency indicating and interpreting test results for compliance on the following:

1. Classification according to ASTM D 2487 of each on-site or borrow soil material proposed for fill and backfill.
2. Laboratory compaction curve according to ASTM D 1557 for each on-site or borrow soil material proposed for fill and backfill; provide for each material type and for every 5,000 cubic yards of each material.
3. Material Gradation Tests.
4. Electrical Resistivity and pH tests for sand used for water pipe bedding and backfill.

C. Within 10 days after award of the contract, the Contractor shall submit to the Owner and engineer a schedule detailing the sequence, and time of completion of all phases of work under this section.

D. At least two weeks in advance of imported fill use, the Contractor shall submit the following laboratory test data to the geotechnical engineer for each type of imported soil/gravel material to be used as compacted fill.

1. Moisture and Density Relationship: ASTM D1557;
2. Particle-Size Analysis: ASTM D2487; and,
3. Plasticity Index: ASTM D 4318.

E. Together with the above test data, the Contractor shall submit a 25-pound sample of each type of off site fill material in an air tight container for the approval of the geotechnical engineer.

F. Submit the name of each material supplier and specific type and source of each material. Any change in source or soil type throughout the job requires approval of the Owner and the engineer.

1.6 DEFINITIONS

A. Backfill: Soil materials used to fill an excavation.
B. Base Course: Layer placed between the subgrade and paving.
C. Bedding Course: Layer placed over the excavated subgrade in a trench before laying pipe.
D. Borrow: Approved soil materials imported from off-site for use as fill or backfill.
E. Classification: No consideration will be given to the nature of earthen materials, and all excavation required for this Project will be designated as unclassified.
F. Degree of Compaction: Degree of compaction required is expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557 abbreviated hereinafter as percent laboratory maximum density. For granular material, relative density is determined in accordance with ASTM D 4254.
G. Excavation: Removal of material encountered down to subgrade elevations:

1. Bulk Excavation: Excavation more than 10 feet in width.
2. Overexcavation: Excavation of existing unsuitable material beyond limits shown on the Drawings for replacement with structural fill as directed by the Owner.
3. Unauthorized Excavation: Excavation below subgrade elevations or beyond limits shown on the Drawings without direction by the Owner.

H. Hard Material: Weathered rock, dense consolidated deposits, or buried construction debris (i.e., demolished brick walls, concrete, etc.) which are not included in the definition of “rock” but which usually require the use of heavy excavation equipment, ripper teeth, or jack hammers for removal.
I. Rock:

1. General Excavation - Any material that cannot be excavated with a single-toothed ripper drawn by a crawler tractor having a minimum draw bar pull rated at not less than 71,000 lbs. (Caterpillar D9N or equivalent), and occupying an original volume of at least 2 cubic yards or more; and,
2. Trench Excavation - Any material that cannot be excavated with a backhoe having a break out force rated at not less than 44,000 lbs. (Caterpillar 235D or equivalent), and occupying an original volume of at least 2 cubic yards.

J. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below base or topsoil materials.
K. Subbase: Material shown on the Drawings between the pavement base and subgrade.
L. Utilities: On-site underground pipes, conduits, ducts, and cables, as well as underground services within buildings.

1.7 REGULATORY COMPLIANCE

A. Codes and Standards: Perform earthwork complying with federal, state, and local regulations including the Occupational Safety and Health Act of 1970 as amended. Excavation and trenching

are regulated by OSHA. The Contractor shall perform all excavation and trenching work in accordance with 29 CFR 1926 Subpart P.

B. Conform with Pennsylvania Act 287 and all amendments and other applicable regulations regarding notification of utility companies.

C. Any pumped water shall be discharged from the Site in accordance with federal, state and local codes and regulations. Comply with all Philadelphia Water Department permit requirements.

1.8 PROJECT CONDITIONS

A. Utility Identification: Notify PA One-Call System at 1-800-242-1776 at least 3 days prior to excavation.

B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted in writing by Owner and then only after arranging to provide temporary utility services according to requirements indicated:

1. Notify the Owner not less than 72 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without the Owner's written permission.

C. Demolish and completely remove from site existing underground utilities indicated to be removed. Coordinate with utility companies to shut off services if lines are active.

D. Existing improvements, adjacent property, and other facilities and trees and plants that are not to be removed shall be protected from injury or damage, which may result from Contractor's operation.

PART 2 - PRODUCTS

2.1 ON-SITE FILL

A. On-site excavated materials may be used as backfill provided they meet the following criteria:

1. Suitable backfill materials include soil that complies with ASTM D 2487 soil classifications GW, GP, GM, SW, SP, and SM and having a maximum particle size of three (3) inches in any one dimension.
2. Unsuitable backfill materials include any material having an excess of wood, timber, metal, rebar, organics, debris, or any other deleterious materials.

B. It is not permitted for excavated materials unsuitable for fill in their as-is state to be processed on-site to comply with suitable backfill requirements. Concrete, brick, asphalt debris is not permitted to be broken or crushed on site to meet the above particle size requirement.

C. The Contractor shall use the on-site soil judiciously to facilitate the construction schedule.

D. Prior to placement, on-site material to be used as fill shall not contain:

1. Debris other than crushed concrete and brick meeting the above requirements.
2. Timber or railroad ties.
3. Other deleterious materials such as steel rails, rebar, trash, etc.
4. Hazardous material - Unsuitable and deleterious materials and debris shall be disposed of off-site in accordance with all applicable regulations.

E. Any bituminous concrete on the site shall be milled/removed prior to placing any fill and shall be reused only onsite immediately below the pavement stone base course.

2.2 OFF-SITE IMPORTED FILL

A. If necessary, off-site fill shall be obtained and provided by the Contractor;
B. Fill shall be clean, well graded granular soil which is non-expansive and non-collapsible and shall have between 5% and 15% by weight passing the #200 sieve. The portion passing the #200 shall be non-plastic with a plasticity index not greater than five. Fill with less fines (less than #200) may be required on project specific basis and as required by geotechnical engineer. Likewise, fill with more than 20% fines may be acceptable on a project specific basis or as identified in the geotechnical engineering study;
C. Imported fill shall be free of all hazardous substances. Certification of compliance and, if requested, test results substantiating compliance shall be furnished to the Owner and geotechnical engineer by the Contractor not less than one week prior to its intended use;
D. The Owner reserves the right to test off-site fill material for conformance with these specifications; and,
E. The Contractor shall be responsible for all permits and regulatory requirements associated with off-site borrow sources.

2.3 STONE BACKFILL

A. In accordance with PennDOT Publication 408, Section 703 for AASHTO No. 57 Stone.

2.4 GEOTEXTILES

A. Separation Geotextile: Woven geotextile fabric, manufactured for separation applications, made from polyolefins or polyesters; with elongation less than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2; AASHTO M 288.
2. Grab Tensile Strength: 247 lbf; ASTM D 4632.
3. Sewn Seam Strength: 222 lbf; ASTM D 4632.
4. Tear Strength: 90 lbf; ASTM D 4533.
5. Puncture Strength: 90 lbf; ASTM D 4833.
6. Apparent Opening Size: No. 60 sieve, maximum; ASTM D 4751.
7. Permittivity: 0.02 per second, minimum; ASTM D 4491.
8. UV Stability: 50 percent after 500 hours' exposure; ASTM D 4355.

2.5 EQUIPMENT

A. Compactor for mass earthwork shall be minimum 10-ton static-drum weight vibratory roller or 10-ton static-drum weight sheep foot compactor as appropriate for the type of soil material at the site or other compactor approved by the geotechnical engineer.
B. Compactor for trenches and where access or maneuverability is limited, use a double drum walk-behind roller or vibratory plate compactor or "jumping jack" tampers.

PART 3 - EXECUTION

3.1 GENERAL

A. Prior to all work of this section, the Contractor shall become thoroughly familiar with the site, site conditions, and all portions of the work falling under this section.
B. The Contractor shall refer to the soil erosion and sediment control drawings for staging of earthwork operations and for erosion control measures to be implemented prior to commencement of earthwork.
C. Locate and identify existing utilities that are to remain and protect them from damage.
D. Notify utility companies to allow removal and/or relocation of any utilities that are in conflict with the proposed improvements.
E. Protect fences, structures, sidewalks, paving, curbs, etc. to remain from equipment and vehicular traffic.
F. Protect benchmarks, property corners and all other survey monuments from damage or displacement. If a marker needs to be removed/relocated it shall be referenced by a licensed land surveyor and replaced, as necessary, by the same at no additional cost to the Owner.
G. Remove from the site, material encountered in grading operations that, in opinion of Owner or geotechnical engineer, is unsuitable or undesirable for backfilling as per Article 2.01.
H. Identify required lines, levels, contours and datum to bring site grades to the proposed subgrade conditions inferred from the drawings.
I. Do not allow or cause any of the work performed or installed to be covered by work of this section prior to all inspections, tests and approvals.
J. Perform excavation using capable, well maintained equipment and methods acceptable to the Owner and regulatory authorities having jurisdiction.
K. When performing grading operations during periods of prolonged wet or dry weather, provide adequate measures for surface drainage and ground water control, and moisture control of soils (i.e., wetting or drying, scarify and discing) so as to place and compact the soil within the moisture content range two (2) percentage points of its optimum water content. Any disturbed areas should be proofrolled at the end of each day.
L. Sloping, shoring, bracing, and fencing shall be installed in accordance with Federal OSHA requirements as well as the requirements of all regulatory authorities having jurisdiction.
M. Allow no debris to accumulate on-site. Haul debris away from the site and dispose of at no cost to the Owner.

3.2 COMPACTION OF SUBGRADE SURFACES

A. In areas to receive fill and at the final cut subgrade, proof roll and compact the exposed ground surface following clearing and grubbing and any required excavation with a minimum of four (4) passes of an approved compactor and obtain at least the following density requirement:

Location	Percent of Maximum Dry Density per ASTM D1557

Foundation Support, Pavements, Sidewalks and Wall Backfill	95%
Non-structural	90%

B. The proof roll, truck and compactor equipment shall traverse the area at speed that permits the geotechnical engineer to comfortably walk alongside the equipment.

C. Any soft areas exhibiting excessive weaving or unsatisfactory material identified during excavation, fill placement, compaction and proof testing shall be removed, replaced with suitable fill, and compacted as specified above.

3.3 UNDERCUT EXCAVATION

A. When approved by the Owner and recommended by the geotechnical engineer, the Contractor may be required to remove natural soil materials in areas where fills are to be placed when determined to be undesirable in their location or condition. The Contractor shall be required to remove the undesirable material and backfill with approved material properly compacted.

B. At locations where unstable or unsuitable soil is shown on the drawings or identified within the geotechnical engineering study, the removal and replacement of such soil shall be as directed on the drawings or as directed by the geotechnical engineer and the Owner.

C. All material removed in the work of undercut excavation will be classified by the geotechnical engineer and Owner as either suitable for other use without excessive manipulation and utilized by the Contractor elsewhere in the work, or unsuitable for future use and manipulated as per Article 2.01.

D. The Contractor shall conduct undercut operations in such a way that the necessary measurements can be taken before any backfill is placed.

E. Backfill in undercut areas shall be placed as a continuous operation along with the undercutting operation. No backfill material shall be placed in water unless otherwise permitted by the geotechnical engineer.

3.4 EXCAVATION, FILL AND SUBGRADE PREPARATION

A. GENERAL

1. The Contractor shall cut or fill to the proposed subgrade elevations based on finished grades and the pavement thicknesses as shown on the drawings. Subgrade elevations shall be constructed to within 0 to minus ½ inch of the proposed grades specified.

B. EXCAVATION

1. Where existing grades are above proposed subgrade elevation, excavate materials to line and grade as shown in the drawings being careful not to over excavate beyond the elevations needed for building subgrades;
2. Excavate organic soils that do not provide adequate foundation support. Excavated on-site organic soils, which are unsuitable for fill may be used in landscaped areas and, if approved by the geotechnical engineer, as fill in parking area at least 5 feet below final elevation. Otherwise this material shall be disposed of as directed by Owner;
3. Excavated on-site soils, which meet the requirements of suitable fill may be used as fill; and,
4. Unsuitable material, such as wood and any other deleterious materials determined to be unsuitable by the geotechnical engineer for use as on-site fill, shall be disposed of as directed by Owner.

C. SUBGRADE PREPARATION FOR FILL

1. Existing grades below proposed grades and thus requiring fill shall be leveled prior to fill placement. The Contractor shall remove existing lawn and top soil in these areas prior to placement of any fill; and,
2. All existing grades to receive fill areas shall be proof rolled and compacted per Article 3.02.
3. Loose/Soft and unstable subgrade resulting from excessive moisture may be aerated and dried in-place. Following adequate drying time, the subgrade is to be densified in-place. Subgrade that cannot be aerated, dried, and densified in place shall be removed as described in Article 3.03.

D. FILL PLACEMENT

1. Rock or processed suitable debris pieces larger than six inches (6 inches) across shall not be part of fill;
2. Reduce soil clod size to a maximum of 2 inches before placement. Do not place frozen fill material;
3. No fill material shall be placed in areas of standing water, in areas of frozen or thawing ground, or in areas that have not been approved by the geotechnical engineer;
4. No fill materials shall be placed during unfavorable weather conditions. When work is interrupted by heavy rains, fill operations shall not be resumed until all saturated surficial soils are returned to a satisfactory moisture content as determined by the geotechnical engineer;
5. Fill lift surfaces shall be made smooth and free from ruts or indentations at the end of any work day when precipitation is forecast to prevent saturation of surficial fill material. Fill surfaces shall be graded to drain and sealed with a smooth drum roller at the completion of each work day;
6. The fill shall be placed in uniform loose lifts not exceeding 8-inches thick and compacted with at least 4 coverages of a 10-ton static-drum weight roller;
7. Each lift shall be compacted to the minimum densities listed in Article 3.02 as appropriate for the project and as specified in the geotechnical engineering study;
8. The Contractor shall adjust the water content by aeration or adding water to achieve the required density. Assist drying by discing, harrowing or pulverizing until moisture content is reduced to achieve proper compaction and facilitate the construction schedule;
9. Wet, saturated material shall be air dried as necessary to achieve the field densities specified in this Section. Removal and replacement shall not occur without prior approval or Owner. Removal and replacement shall be used if necessary to facilitate the construction schedule;
10. Remove areas of finished subgrade found to have insufficient compaction density of depth necessary and replace with suitable compacted fill as approved by the Owner or Owners

representative. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross section; and,

11. Fill placed on slopes greater than 1 vertical to 3 horizontal shall have each lift benched onto the slope at least 3 feet.

3.5 PROOFROLLING

A. The work covered by this subsection consists of furnishing and operating, proofrolling equipment at the direction of the Owner's representative and/or geotechnical engineer.

B. Proofrolling shall be under the observation of the Owner's representative and/or the geotechnical engineer as described herein and under the following schedule:

1. Immediately following the completion of excavation to proposed subgrades in cut areas, proofrolling shall be performed as specified; and,
2. Immediately prior to and following stone base course placement, in pavement and building pad areas for final floor slab preparation, all subgrade and stone base areas shall be proofrolled. Any areas which deflect, rut or pump under the roller shall be undercut and replaced with compacted fill material or stone base course as directed by the geotechnical engineer and approved by the Owner.

C. Proofrolling shall be done with 1 pass of a fully loaded tandem dump truck equal to or exceeding 50,000 lbs., or other construction equipment if approved by the geotechnical engineer.

D. Construction methods shall be as follows:

1. After the subgrade or stone base course has been completed within 0.50 foot of final grade, the subgrade or stone base course shall then be compacted and tested prior to commencement of proofrolling. The coverage areas and methods will be identified by the Owner's representative and/or geotechnical engineer. However, the roll shall be operated in a systematic manner so that the number of coverages over all areas to be proofrolled can be readily determined and recorded;
2. The equipment shall be operated at a speed that the geotechnical engineer can comfortably and slowly walk alongside the equipment;
3. If it becomes necessary to take corrective action, such as but not limited to underdrain installation, undercut and backfill of an unsuitable material, and aeration of excessively wet material in areas that have been proofrolled, see Article 3.03. These areas shall be proofrolled again following the completion of the necessary corrections. If the corrections are necessary due to the negligence of the Contractor or weather, the corrective work and additional proofrolling shall be performed by the Contractor at no cost to the Owner; and,
4. The Contractor shall protect all structural facilities on the project, such as but not limited to box culverts, pipe culverts, and utilities, from damage by the proofrolling equipment.

3.6 MAINTENANCE OF SUBGRADE

A. Finished subgrades shall be verified by the Contractor to ensure proper elevation and conditions for construction above subgrade.

B. Protect subgrade from excessive construction traffic and wheel loading including concrete and dump trucks.

C. Remove areas of finished subgrade judged to be unsatisfactory to the depth necessary and replace in a manner that will comply with compaction requirements by use of material equal to or better than the best subgrade material on site. Surface of subgrade after compaction shall be hard, uniform, smooth, stable, and true to grade and cross section.

3.7 FINISH ELEVATIONS AND LINES

A. For setting and establishing finish elevations and lines, secure the services of a licensed land surveyor acceptable to the Owner and engineer.
B. Provide elevation grade stakes and any other surveying necessary for the layout of the work. The Contractor shall conduct their work in such a manner that survey stakes will be protected as long as their need exists. Grade stakes, which are damaged or stolen, shall be replaced by the Contractor's surveyor at the Contractor's expense.
C. Graded areas shall be uniform, hard and smooth, free from rock, debris, or irregular surface changes. Any deviation shall not result in changes in drainage areas or ponding. All ground surfaces shall vary uniformly between indicated elevations. Finish drainage ditches shall be graded to allow for proper drainage without ponding and in a manner that will minimize the potential for erosion.
D. Correct all settlement and eroded areas for one year after date of project completion at no additional expense to Owner. Bring paved and landscaped areas to proper elevation. Replant or replace any grass, shrubs, bushes, or other vegetation disturbed by construction using corrective measures.

3.8 FIELD QUALITY CONTROL

A. The contractor shall coordinate all earthwork with the testing agency and geotechnical engineer to allow for inspection and testing. The geotechnical engineer shall provide full-time observation and testing of the compaction operations and provide documentation to the Owner.
B. Allow geotechnical engineer to inspect and test each subgrade and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.
C. The geotechnical engineer shall test compaction of soils in place according to ASTM D 1556, ASTM D 1557, ASTM D 2167, ASTM D 2922, ASTM D 2937, and ASTM D 4254 as applicable. Tests shall be performed at the following locations and frequencies:
    1. Paved Areas: At subgrade and at each compacted fill and backfill layer, at least one test for every 2200 sq. ft. or less of paved areas or building slab, but in no case fewer than three tests.
    2. Trench Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench, but no fewer than two tests.
    3. Structural Backfill: At each compacted initial and final backfill layer, at least one test for each 150 feet or less of trench, but no fewer than two tests.
D. When the geotechnical engineer reports that subgrades, fills or backfills have not achieved degree of compaction specified, recompact and retest until specified compaction is obtained.

3.9 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off site to a regulated and permitted facility. Provide two copies of load manifest and permit from owner of the property where material is deposited.

END OF DOCUMENT 310000

SECTION 311000 – SITE CLEARING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work under this Section shall include all labor, materials and equipment necessary for the Site Clearing as herein after specified and/or as otherwise required for the proper and timely completion of the Contract.
B. This Section includes the following:

1. Clearing, grubbing and disposal
2. Demolition of existing features, including, but not limited to inlets, pipes, fencing, trees, stumps, curbing and underground tanks.

1.2 MATERIALS OWNERSHIP

A. Except for materials indicated to be stockpiled or to remain Owner's property, cleared materials shall become the Contractor's property and shall be disposed of in accordance with all applicable regulations.

1.3 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.
B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.
C. Notify utility locator service for area where Project is located prior to site clearing.
D. Contractor shall verify existing grades prior to performing work under this section. If existing grades are at variance with the drawings, notify the Owner and engineer to receive instructions prior to proceeding. No additional compensation will be considered resulting from grade variances once site clearing has commenced.
E. All benchmarks and monuments shall be protected during construction. If disturbed or destroyed, they shall be replaced in original position by a licensed surveyor at the Contractor's expense.
F. Protect areas outside limits of disturbance from encroachment by construction personnel or equipment, regardless of property Ownership. Access shall be by specific, written permission or easement only.

PART 2 - PRODUCTS

2.1 EQUIPMENT AND MATERIALS

A. Contractor shall provide and use all necessary equipment and materials to perform work.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide erosion control measures in accordance with Section 312500, Soil Erosion and Sediment Control, prior to any construction activity.
B. Locate and clearly flag trees and vegetation to remain or to be relocated (if applicable). All trees and vegetation to remain shall be barricaded and protected during the construction process in accordance with plans and specifications.
C. Limit of clearing is to be staked and verified by Owner or engineer prior to removal of any material.
D. All trees and shrubs not designated to remain within the area to be graded, whether shown or not on the drawings, shall be cut and the stumps shall be completely dug out including all major root structures. Burning on site is not permitted.

3.2 UTILITIES

A. The Contractor shall protect existing underground utilities from damage. The accuracy of the utilities shown on the plan as to line and grade is not guaranteed. Any damage caused by the Contractor to any utility shall be the responsibility of the contractor to correct.
B. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted. If utilities are interrupted, arrange to provide temporary utility services.

1. Notify Owner not less than 72 hours in advance of proposed utility interruptions.
2. Do not proceed with utility interruption without Owner’s written permission.

3.3 CLEARING AND GRUBBING

A. Perform all clearing and grubbing work in accordance with PennDOT Publication 408 Specifications, Section 201.3, Clearing and Grubbing or as specified here.
B. Clear the ground of existing organic matter within excavation areas to a depth of eight (8) inches below the existing ground. Remove remaining topsoil over 8 inches in depth, when directed. Stockpile removed topsoil as specified in Section 312500 – Soil Erosion & Sediment Control. Utilize stockpiled topsoil as needed throughout the project. Dispose of unused topsoil in accordance with section 3.03 below.
C. Remove obstructions, objectionable material, rubbish, junk, trees, shrubs, grass, and other vegetation within the limit of disturbance to permit installation of new construction. Removal includes digging out stumps and obstructions and grubbing roots, unless otherwise specified. Existing three foot high site chain link fence to be cut flush with existing paving, grinded down if necessary and patched to match surrounding asphalt.
D. Fill depressions caused by clearing and grubbing operations with satisfactory soil material, unless further excavation or earthwork is indicated.

1. Place fill material in horizontal layers and compact each layer to a density equal to adjacent original ground as in accordance with Section 31 0000 - Earthwork.

3.4 DISPOSAL

A. Disposal: Remove surplus soil material, unsuitable or excess topsoil, obstructions, demolished materials, and waste materials, including trash and debris, and legally dispose of them off Owner's property in accordance with all applicable regulations.

END OF SECTION 311000

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SECTION 312316.13 - TRENCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavating trenches for utilities from 5 feet outside building to utility service.
2. Compacted fill from top of utility bedding to subgrade elevations.
3. Backfilling and compaction.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Sections:

1. Section 310000 - Earthwork.
2. Section 311000 – Site Clearing.
3. Section 333313 – Site Sanitary Sewerage Gravity Piping.

C. American Association of State Highway and Transportation Officials:

1. AASHTO T180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54-kg (10-lb) Rammer and a 457-mm (18-in.) Drop.

D. ASTM International:

1. ASTM D698 - Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3).
2. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3).
4. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method.
5. ASTM D2922 - Standard Test Method for Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth).
6. ASTM D3017 - Standard Test Method for Water Content of Soil and Rock in Place by Nuclear Methods (Shallow Depth).

1.3 DEFINITIONS

A. Utility: Any buried pipe, duct, conduit, or cable.

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.

B. Excavation Protection Plan: Describe sheeting, shoring, and bracing materials and installation required to protect excavations and adjacent structures and property; include structural calculations to support plan.

C. Product Data: Submit data for geotextile fabric indicating fabric and construction.

D. Samples: Submit, in air-tight containers, 10 lb. sample of each type of fill to testing laboratory.
E. Materials Source: Submit name of imported fill materials suppliers.
F. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with City of Philadelphia standard.
B. Maintain one copy of document on site.

1.6 QUALIFICATIONS

A. Prepare excavation protection plan under direct supervision of Professional Engineer experienced in design of this Work and licensed in the City of Philadelphia.

1.7 RELATED DOCUMENTS

A. Verify field measurements prior to fabrication.

1.8 COORDINATION

A. Section 013000 - Administrative Requirements: Coordination and project conditions.
B. Verify Work associated with lower elevation utilities is complete before placing higher elevation utilities.

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 LINES AND GRADES

A. Lay pipes to lines and grades indicated on Drawings.
    1. Architect/Engineer reserves right to make changes in lines, grades, and depths of utilities when changes are required for Project conditions.

B. Use laser-beam instrument with qualified operator to establish lines and grades.

3.2 PREPARATION

A. Contact the Pennsylvania One Call System, Inc at 8-1-1 or 1-800-242-1776 not less than three, but no more than ten business days before performing Work. A business day is any day except Saturday, Sunday, or legal holiday prescribed by statute in the law. A business day begins at 12:00:00 am and end at 11:59:59 pm.
    1. Request underground utilities to be located and marked within and surrounding construction areas.

B. Identify required lines, levels, contours, and datum locations.

C. Protect plant life, lawns, and other features remaining as portion of final landscaping.
D. Protect benchmarks, fences, sidewalks, paving, and curbs from excavating equipment and vehicular traffic.
E. Maintain and protect above and below grade utilities indicated to remain.
F. Establish temporary traffic control and detours when trenching is performed in public right-of-way. Obtain all necessary permits to perform work within the public right-of-way. Relocate controls and reroute traffic as required during progress of Work.

3.3 TRENCHING

A. Excavate subsoil required for utilities to utility service.
B. Remove lumped subsoil, boulders, and rock up of 1/6 cu. yd., measured by volume. Remove larger material as specified in Section 310000.
C. Perform excavation within 24 inches of existing utility service in accordance with utility company's requirements.
D. Do not advance open trench more than 200 feet ahead of installed pipe.
E. Cut trenches sufficiently wide to enable installation and allow inspection. Remove water or materials that interfere with Work.
F. Excavate bottom of trenches maximum 2 feet wider than outside diameter of pipe.
G. Excavate trenches to depth indicated on Drawings. Provide uniform and continuous bearing and support for bedding material and utilities.
H. Do not interfere with 45 degree bearing splay of foundations.
I. When Project conditions permit, slope side walls of excavation starting 2 feet above top of pipe. Slope excavation at a maximum slope of 2 horizontal to 1 vertical. When side walls cannot be sloped, provide sheeting and shoring to protect excavation as specified in this section.
J. When subsurface materials at bottom of trench are loose or soft, excavate to greater depth as directed by Architect/Engineer until suitable material is encountered.
K. Cut out soft areas of subgrade not capable of compaction in place. Backfill with clean sand or sand and gravel with a maximum gravel size of 1.5-inches and compact to density equal to or greater than requirements for subsequent backfill material.
L. Correct areas over excavated areas with compacted backfill as specified for authorized excavation or replace with fill concrete as directed by Architect/Engineer.
M. Stockpile subsoil in area designated on site to depth not exceeding 20 feet and protect from erosion.

3.4 SHEETING AND SHORING

A. Sheet, shore, and brace excavations to prevent danger to persons, structures and adjacent properties and to prevent caving, erosion, and loss of surrounding subsoil.

B. Support trenches more than 5 feet deep excavated through unstable, loose, or soft material. Provide sheeting, shoring, bracing, or other protection to maintain stability of excavation.
C. Design sheeting and shoring to be left in place as part of the completed Work, cut off minimum 18 inches below finished grade.
D. Repair damage caused by failure of the sheeting, shoring, or bracing and for settlement of filled excavations or adjacent soil.
E. Repair damage to new and existing Work from settlement, water or earth pressure or other causes resulting from inadequate sheeting, shoring, or bracing.

3.5 BACKFILLING

A. Backfill trenches to contours and elevations with unfrozen fill materials.
B. Systematically backfill to allow maximum time for natural settlement. Do not backfill over porous, wet, frozen, or spongy subgrade surfaces.
C. Place fill material in continuous layers and compact in accordance with Section 310000 - Earthwork.
D. Employ placement method that does not disturb or damage utilities in trench.
E. Maintain optimum moisture content of fill materials to attain required compaction density.
F. Do not leave more than 50 feet of trench open at end of working day.
G. Protect open trench to prevent danger to the public.

3.6 TOLERANCES

A. Top Surface of Backfilling: Plus or minus 1 inch from required elevations.

3.7 FIELD QUALITY CONTROL

A. Perform laboratory material tests in accordance with ASTM D1557.
B. Perform in place compaction tests in accordance with the following:

1. Density Tests: ASTM D1556.
2. Moisture Tests: ASTM D3017.

C. When tests indicate Work does not meet specified requirements, remove Work, replace, compact, and retest.

3.8 PROTECTION OF FINISHED WORK

A. Reshape and re-compact fills subjected to vehicular traffic during construction.

END OF DOCUMENT 312316.13

SECTION 312350 - SAWCUTTING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes the saw-cutting of existing concrete, bituminous pavement, and footway at the locations indicated on the plans.

1.2 RELATED DOCUMENTS

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

PART 2 - PRODUCTS

2.1 NOT USED

PART 3 - EXECUTION

3.1 GENERAL

A. Saws shall be equipped with guides, blade guards, water-cooling system and cut-depth control. Sawcut shall be done at the nearest joint, if applicable. The joint shall be sawed continuously and shall be of sufficient depth to allow removal of the paving without disturbing the paving that is to remain.
B. Contractor to mark out sawcut lines in field for approval by the Owner or Authorized Representative prior to proceeding with the pavement removal.

END OF SECTION 312350

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SECTION 312500 - SOIL EROSION & SEDIMENT CONTROL

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work of this Section includes all temporary erosion and sediment control and related and incidental operations, including:

1. Filter Bag Inlet protection;
2. Stone and Concrete Block Inlet Protection;
3. Compost filter sock;
4. Temporary seeding and mulching;
5. Rumble Pad Construction Entrance;
6. Pumped Water Filter Bag;
7. Temporary Stockpile Protection;
8. Compost Sock Washout Station; and,
9. Maintenance and repair of erosion and sediment control measures.

1.2 SUBMITTALS

A. Submit complete shop drawings and product information for all items to be furnished under this Section upon receipt of notice to proceed and prior to construction.

1.3 QUALITY ASSURANCE

A. Use adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary trades and who are completely familiar with the specified requirements and methods needed for proper performance of the work of this Section.

B. Codes and Standards: Perform work in compliance with applicable requirements of governing authorities having jurisdiction. Construction operations shall be carried out in a manner such that soil erosion, air pollution, and water pollution is minimized. State, County, and Municipal laws concerning pollution abatement shall be followed.

C. The recommendations and Standards set forth in the Erosion and Sediment Pollution Control Program Manual, published by the PA Department of Environmental Protection, shall be applicable where the work is not specifically detailed in this Specification, the accompanying Drawings, or the Erosion and Sediment Pollution Control Plan.

D. The Contractor shall take action to remedy unforeseen erosion conditions and to prevent damage to adjacent properties as a result of increased runoff and/or sediment displacement. Stockpiles of wood chips, hay bales, crushed stone, and other mulches shall be held in readiness to deal immediately with emergency problems of erosion. All erosion control checks and structures shall be inspected after heavy rainfalls, and if damaged, repaired or replaced.

E. No other construction activities may take place until appropriate Erosion and Sedimentation Control devices have been installed and approved by Owner/Authorized Representative. All changes to the Erosion and Sedimentation Control Plan must be approved by Owner/Authorized Representative prior to implementation.

1.4 REFERENCES

A. PennDOT, Publication 408 Specifications (most recent edition).

B. Pennsylvania Department of Environmental Protection, Erosion and Sediment Pollution Control Program Manual (most recent version).
C. Commonwealth of Pennsylvania, Department of Transportation (PennDOT)
    1. Bulletin No. 15: Approved Construction Materials.

PART 2 - PRODUCTS

2.1 FILTER BAG INLET PROTECTION

A. Filter bags shall be provided in accordance with PennDOT Publication 408, Section 860.
B. Filter bags shall be manufactured to fit the opening of the catch basin or drop inlet. Filter bags will have the following features:
    1. Two dump straps attached at the bottom to facilitate the emptying of the bag;
    2. Lifting loops as an internal part of the system to be used to lift the filter bag from the basin;
    3. Restraint cord approximately halfway up the sack to keep the sides away from the basin walls, this cord is also a visual means of indicating when the sack should be emptied.
C. Filter bag seams shall have a minimum certified average wide width strength per ASTM D-4884 of 300 psi.
D. Inlet filter bags for installation in new or existing highway grate and open mouth grate inlets shall be listed in PennDOT Bulletin 15 or approved equal.
E. City inlet (and curb opening portion of open-mouth grate inlet) protection shall be a synthetic filter manufactured from recycled synthetic fibers listed in PennDOT Bulletin 15 or approved equal.

2.2 STONE AND CONCRETE BLOCK INLET PROTECTION

A. In accordance with PennDOT Publication 408, Section 860.2(b).
B. Inlet protection in roadway is not to include stone or berms.

2.3 COMPOST FILTER SOCK

A. Compost filter sock shall be provided in accordance with PennDOT Publication 408, Section 867.
B. The compost socks shall be Filtrexx Siltsox manufactured by Filtrexx International LLC of Grafton, Ohio or approved equal as listed in PennDOT Bulletin 15

2.4 PUMPED WATER FILTER BAG

A. Pumped water filter bags shall be provided in accordance with PennDOT Publication 408, Section 855.
B. Sediment filter bag shall be manufactured of non-woven geotextile material that filters soil particles while allowing discharge water to pass through the bag.
C. The sediment filter bag seams shall be a double 401 lock chain stitch seam with minimum 200 lbs/inch sewn seam strength, tested in accordance with ASTM D-4884.

D. The sediment filter bag shall have an adjustable spout large enough to accommodate a six-inch (6”) diameter discharge hose.
E. The pump discharge hose shall be inserted into the bags in the manner specified by the manufacturer and securely clamped.
F. Filter bag shall be inspected daily. If any problem is detected pumping shall cease immediately and not resume until the problem is corrected.
G. Filter bag shall be GTF-FB series from Frank Roberts and Sons, Inc., Dirtbag by ACF Environmental, or approved equal, and shall have a rated flow rate fifty percent (50%) greater than the attached pump.

2.5 TEMPORARY SEEDING AND MULCHING

A. All stockpiles and inactive disturbed areas shall be seeded and mulched in accordance with the design plans if they are to be left exposed for more than twenty (20) days.

2.6 RUMBLE PAD CONSTRUCTION ENTRANCE

A. Prefabricated rumble pad shall be installed according to manufacturer’s recommendations. A sufficient number of pads shall be installed to provide a minimum of four (4) tire revolutions while on pad.

1. More pads may be needed depending on site conditions.

B. Accumulated materials shall be cleaned from the pads daily and as necessary and disposed of in accordance with all applicable regulations.

2.7 TEMPORARY STOCKPILE PROTECTION

A. Compost Filter Sock provided in accordance with PennDOT Publication 408, Section 867.
B. Seeding in accordance with PennDOT Publication 408, Section 804.2(b), Formula E.

2.8 COMPOST SOCK WASHOUT STATION

A. Concrete washout water shall be directed to the compost sock washout station as indicated on the plans. The compost sock washout station shall be comprised of a compost filter sock in accordance with this specification.

2.9 TEMPORARY STABILIZATION MEASURES

A. Rolled Erosion Control Products (RECPs) shall be in accordance with PennDOT Pub. 408 Section 806, and from an approved supplier named in Bulletin 15. Non-biodegradable materials shall not be acceptable (including pins or stakes). Installed RECPs shall also be seeded or mulched as appropriate.
B. Temporary seeding or sodding shall be in accordance with the specified permanent seeding and/or sod requirements, or in the absence of such specified materials shall be in conformance with PennDOT Pub. 408 Section 804, Formula E seed mixture.
C. Mulch shall be in accordance with the specified permanent mulch, or in the absence of such specified materials shall be in conformance with PennDOT Pub. 408 Section 805, Wood Fiber or

Wood Chips. Recycled materials shall not be acceptable for use as mulch (wood pulp, cellulose, etc.).

D. Straw or hay temporary stabilization shall only be permitted when use of seeding/sodding or mulch is impracticable (subject to approval by Owner/Authorized Representative). The use of blown straw shall only be accepted when used in conjunction with a tackifier as specified herein. Straw or hay shall be free of weed seeds or other contaminants.

E. Tackifier shall be Earth Bond tackifier (Turf Guard Manufacturing Inc.) or approved equal. Tackifier shall be composed of organic compounds, and contain no toxins or hazardous materials.

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All temporary erosion and sediment control measures specified herein shall be in place before the beginning of any earthwork or excavation.

B. All erosion and sediment control devices shall be installed according to the manufacturer's specifications, or in accordance with PennDOT Pub. 408 if no manufacturer recommendation exists.

C. When temporary erosion and sediment control measures as described herein do not provide adequate control, replacement or relocation of measures shall be required as directed by the Owner/Authorized Representative.

D. Erosion and sediment control measures shall be inspected weekly and after every precipitation event.

E. Contractor shall maintain complete written logs of inspections and shall make them available to PWD Inspector/Owner/Engineer upon request.

F. All maintenance work, including but not limited to cleaning, repair, replacement, regrading, and restabilization of temporary erosion and sediment control measures shall be performed immediately.

G. Contractor shall ensure that erosion and sedimentation control measures remain in place and fully functional until site achieves final stabilization.

H. Orange fencing shall be used to delineate the limits of earth disturbance in all off street applications, and as specified in Section 015639 for tree protection.

3.2 PUMPED WATER FILTER BAG

A. Sediment-laden water shall be pumped through a pumped water filter bag as specified herein.

B. Filter bags shall be removed and replaced when they have reached their capacity to filter sediment effectively, or upon any breach of the filter bag.

C. The Contractor shall not discharge to any sewer without the prior approval of PWD from the Industrial Waste Unit.

3.3 TEMPORARY INLET PROTECTION

A. The downstream inlets from the site of any disturbance or construction on the project site shall be protected with approved inlet protection practices. Downstream inlets are considered to be the next immediate inlet downslope that will receive runoff from the site of any disturbance, as well as any and all inlets within the site itself.
B. All new inlets shall be protected with approved inlet protection practices upon installation. Inlets draining exclusively to a stormwater feature shall remain fully closed to runoff until final site cleanup.
C. Final site cleanup shall include removal of all temporary inlet protection, cleaning of all permanent inlet protection, and cleaning of all inlets (existing downstream inlets and newly installed) of accumulated construction debris and sediment.
D. Highway grate and open mouth grate inlets shall be protected using inlet filter bags as specified herein.
E. Open mouth grate inlets and open mouth inlets (city inlets) shall be protected with a compost sock or synthetic filter as specified herein.
F. Inlet protection shall be installed, inspected, cleaned and replaced according to manufacturer's specifications.

    1. Inlet filter bags and open mouth inlet protection shall be removed and replaced when filled with silt or when extended periods of ponding occur following a precipitation event. New inlet filter bags or approved inlet protection devices shall be installed and secured immediately after removal of silted protection devices.

3.4 STORAGE STOCKPLIES

A. Stockpiles of all loose materials (aggregate, fill, soils, etc) shall be protected from dust and rain by use of a cover. The cover shall be free of defects, and secured adequately to maintain protection of the materials. Owner/Authorized Representative reserves the right to refuse use of any material that has been compromised by inadequate protection onsite.
B. Stockpiles shall not be placed upslope from any infiltration structure. Any drainage structure (such as but not exclusively inlets) downslope of a stockpile shall be adequately protected from runoff.
C. Stockpile heights are not to exceed 20 feet high. Stockpile slopes shall be 2:1 or flatter.

3.5 TEMPORARY STABILIZATION

A. Any disturbed surfaces to remain unfinished and unprotected for more than four (4) days shall be temporarily stabilized. Method to be used shall be approved by the Project Manager and shall be appropriate to the expected length of time employed (for example, use of hay alone without seeding would not be appropriate for a several month application, but could be appropriate for a week-long site delay).

3.6 REMOVAL AND FINAL CLEANUP

A. Once the site has been fully stabilized and approval is given by Owner/Authorized Representative, temporary erosion and sedimentation control measures and all accumulated silt and sediment shall be removed. All permanent inlet protection measures shall be cleaned, inspected, and verified to be in working order.

B. Any remaining dirt or debris within the public right of way shall be removed by the Contractor, using necessary means as sufficient to remove the dirt and debris from the public right of way. This may include, but is not limited to, street sweeping, sidewalk vacuuming, inlet cleaning, power washing, or hand removal.

C. Silt and waste materials shall be disposed of in a proper manner. No extra construction materials are to remain onsite upon completion of the Work. The Work of this Contract shall not be considered complete until all extraneous construction-related items have been removed (temporary traffic control devices, signage, etc).

END OF SECTION 31 25 00

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work under this Section shall include all labor, on-site materials, and equipment necessary for the excavation of trench and grading as hereinafter specified and/or as otherwise required for the proper and timely completion of this Contract.

1.2 RULES AND REGULATIONS

A. American Society for Testing and Materials (ASTM):

1. ASTM C131 Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angles Machine
2. ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates
3. ASTM C535 Standard Test Method for Resistance to Degradation of Large-Size Aggregate by Abrasion and Impact in the Los Angeles Machine
4. ASTM D653 Standard Terminology Relating to Soil, Rock, and Contained Fluids
5. ASTM D1140 Standard Test Methods for Determining the Amount of Material Finer than 75-µm (No. 200) Sieve in Soils by Washing
6. ASTM D1557 Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN-m/m3))
7. ASTM D2216 Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
8. ASTM D2487 Standard Practice for Classification of Soils for Engineering Purposes
9. ASTM D6938 Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
10. ASTM D4253 Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table
11. ASTM D4254 Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density
12. ASTM D4318 Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
13. AASHTO T180 Standard Method of Test for Moisture-Density Relations of Soils Using 4.54-kg (10-lb) Rammer and 457-mm (18-in.) Drop

1.3 SUBMITTALS

A. Samples

1. Furnish and deliver samples of fill and backfill materials as selected by the Engineer.

1.4 PERFORMANCE REQUIREMENTS

A. If any hazardous waste materials are discovered on the site, the Contractor shall cease operations in that area until authorized to resume. The Contractor shall notify the Engineer of such material and cooperate with any outside agency or specialist that may be called in to determine the extent of the hazard and methods of its disposition.

B. Tolerances:

1. Construct finished sub-grades to plus 0 inches minus ½ inch of the elevation indicated.

2. Construct finished grade of slopes not steeper than 3H:1V to plus or minus 1/2 inch and on slopes steeper than 3H:1V to plus or minus 2 inches. Slopes shall not encroach upon roadbeds.
3. Maintain the moisture content of fill material as it is being placed within plus or minus 3 percent of the optimum, moisture content of the material as determined by the laboratory test herein specified.
4. Protect all existing and new construction including utilities, finishes and equipment from water, damage, weakening or other disturbance.

1.5 DEFINITIONS

A. Earthwork Terminology used in this Section and not defined herein shall be interpreted in accordance with the definitions given in ASTM D653.

1. Sub-grade: Sub-grade is the lowest elevation of excavation and the highest elevation if embankment required to accommodate the indicated construction.
2. Backfill: Soil or soil-rock material used to refill excavations and to refill excavated spaces around building walls.
3. Imported Material: Soil or granular material which is hauled in from off-site areas.
4. Unsuitable Material: Excavated material or material below the natural ground surface in embankment areas or below sub-grade elevation in excavated areas, which is unsuitable for its planned use.
5. Relative Compaction: The ratio, expressed as a percentage, of the in-place place dry density of fill material as compacted in the field to the maximum dry density of the same material as determined by laboratory test ASTM D1557, Method D.
6. Optimum Moisture Content: The water content at which a soil can be compacted to a maximum dry unit weight by a given compactive effort.
7. Relative Density: Refer to ASTM D4253 and ASTM D4254.
8. Excavation: Excavation is the removing of all materials encountered within the Contract Limits, regardless of the nature of the material encountered and the method by which it is removed, for grading, sub-grading for roadways or paved areas and other structures not specified elsewhere in these specifications. All excavation is unclassified and no additional compensation will be made for rock.

1.6 PROJECT CONDITIONS

A. Protection

1. Provide the necessary barricades, signs, lights, etc. to prevent accidents, to avoid all hazards and to protect the public, the work and property at all times, including Saturdays, Sundays, and holidays.
2. Be responsible for any and all damages which may arise or occur to any party whatsoever by reason of neglect in providing proper lights, guards, barriers or any other safeguards to prevent damage to property, life and limb.
3. Prior to any excavation the Contractor, with the cooperation of the Owner of the respective existing utility or its agents shall locate and paint the location of all water services, gas services, gas mains, water mains, sanitary sewers, telephone raceways or conduits and drains, within five (5) feet of the proposed excavations.
4. In case water, gas pipes, conduits, or other utilities are broken in the prosecution of the work, the Contractor shall stop work and give immediate notice to the proper authorities and shall be responsible for any damage to persons or property caused by such breaks. Failure to give prompt notice to the authorities shall deem the Contractor responsible for any damages legal or otherwise caused by the interruption or loss of utility service.

B. Parking and Storage

1. Parking of vehicles and storage of materials shall be confined to designated areas approved by the Owner.

C. Dust Control

1. During the progress or work, the Contractor shall conduct his operation and maintain the area of his activities so as to minimize the creation and dispersion of dust.

1.7 ENVIRONMENTAL REQUIREMENTS

A. Unfavorable Weather Conditions

1. Excavating, filling, backfilling, and grading work shall not be performed during weather conditions which might damage the condition of existing ground, in-progress work, or completed work. When the work is interrupted by rain, excavating, filling, backfilling and grading work shall not resume until the site is suitable for the work.
2. Sub-grade shall be free from mud, snow, ice, and deleterious material when work is resumed.

PART 2 - PRODUCTS

2.1 FILL AND BACKFILL

A. Material suitable for use as fill and backfill shall be an inert, non-expansive soil, free from organic matter and of such quality that it will compact thoroughly without the presence of voids. Excavated on-site soil will be considered suitable for fill and backfill.
B. Suitable excavated material shall be conditioned for reuse and properly stockpiled for later filling and backfilling operations. Conditioning shall consist of spreading material in layers not to exceed 8 inches and raking free of debris and rubble. Rocks exceeding four inches in largest dimension and deleterious material shall be moved from the site and disposed of.

PART 3 - EXECUTION

3.1 EXISTING UTILITIES

A. Verify on site the location and depth (elevation) of all existing utilities and services before performing any excavation work. Excavation within 3 feet of a utility line shall be performed by hand.

3.2 EXCAVATION

A. General

1. Excavation consists of the removal and on-site placement or disposal of whatever material is encountered when establishing required sub-grade elevations.
2. Excavation shall be made to the grades as shown on the Contract Drawings.
3. Where excavation grades are not shown on the Contract drawings, excavation shall be made as required to accommodate the installation of all facilities.

B. Cold Weather Protection

1. Protect excavation bottoms against freezing when atmospheric temperature is less than 35 degrees Fahrenheit.

C. Stability of Excavations

1. Sloped sides of excavation shall comply with state and local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.

D. Shoring and Bracing

1. Provide materials for shoring and bracing, such as sheet piling, uprights, stringers and cross-braces, in good serviceable condition.
2. Establish requirements for trench shoring and bracing to comply with local Codes and authorities having jurisdiction.
3. Maintain shoring and bracing excavations regardless of the time period excavations will be open. Carry down shoring and bracing as excavation progresses.

E. Material Storage

1. Stockpile suitable excavated materials where directed, as required for fill.
2. Locate and retain soil materials away from edge of excavation.

3.3 BACKFILL

A. Backfill excavation as promptly as work permits, but not until waterproofing membrane is applied and is ready to be backfilled, if applicable.

B. Placement and Compaction

1. Place backfill materials in layers not more than 4” in loose depth for materials by hand-operated tampers.
2. Place backfill and fill materials evenly adjacent to structures, to required elevations. Take care to prevent wedging action of backfill against structures by carrying the material uniformly around structure to approximately same elevation in each life.

3.4 GRADING

A. Grade areas adjacent to building lines to drain away from structures and to prevent ponding. Finish below the required sub-grade elevations.

3.5 CLEAN-UP

A. Upon completion of the work of this section, place in stockpile areas all excess excavated material, rubbish, trash and debris resulting from operations. Leave the site in a neat and orderly condition.

END OF SECTION 315000

SECTION 320116 – PAVEMENT MILLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. The work shall consist of the removal by planing or milling of existing bituminous paving with a smooth transitional cross grade as directed by the engineer.
B. Removed material shall be satisfactorily and legally disposed of in accordance with the local regulations applicable to the disposal site.

1.3 QUALITY ASSURANCE

A. Conform to all applicable provisions of City of Philadelphia Standard Contract Requirements for Public Works Contracts.

PART 2 - PRODUCTS

NOT USED.

PART 3 - EXECUTION

3.1 GENERAL

A. The equipment used shall be capable of removing paving in one continuous forward motion by planing, grinding or cutting.
B. Limit and depth of cut a shown on the contract drawings, are at the discretion of the Engineer and the Owner reserves the right to increase the width of the area to be planed.
C. All milled areas shall be cleaned by mechanical sweepers or vacuums immediately before and after completion of milling operations in a manner satisfactory to the Engineer and Owner as required for application of a new surface course.

END OF SECTION 320116

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SECTION 321216 - ASPHALT PAVING

PART 1 - GENERAL

1.1 DESCRIPTION

A. This Section includes Hot Mix Asphalt Wearing and Binder Course.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.
B. The following Standard Specifications and Codes shall be considered a part of this specification where such specifications are applicable, and shall include all current changes and revisions:

1. American Society for Testing and Materials.
2. Ordinances and Laws of the Commonwealth of Pennsylvania, County and Municipality within which the work is being performed.
3. Philadelphia Streets Department Standard Specifications.
4. Pennsylvania Department of Transportation.

1.3 DEFINITIONS

A. Hot-Mix Asphalt Paving Terminology: Refer to ASTM D 8 for definitions of terms.
B. PennDOT: Pennsylvania Department of Transportation.

1.4 SUBMITTALS

A. Product data: For each product specified, include technical data and tested physical and performance properties.
B. Job-Mix Designs: Certification, by authorities having jurisdiction, of approval of each job mix proposed for the Work.
C. Material Test Reports: Indicate and interpret test results for compliance of materials with requirements indicated.
D. Material Certificates: Certificates signed by manufacturers certifying that each material complies with requirements.

1.5 QUALITY ASSURANCE

A. Qualifications: Engage an experienced installer, certified in writing by tactile manufacturer as qualified for installation, who has completed asphalt paving similar in material, design, and extent to that indicated for this Project and with a record of successful service performance.
B. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this Project and with a record of successful in-service performance. Firm shall be a registered and approved paving mix manufacturer with authorities having jurisdiction or with the DOT of the state in which Project is located.

C. Regulatory Requirements: Conform to applicable standards of authorities having jurisdiction.
D. Asphalt-Paving Publication: Comply with AI MS-22, "Construction of Hot Mix Asphalt Pavements," unless more stringent requirements are indicated.
E. Paving contractor to have a minimum of ten (10) years of demonstrated successful experience in the installation of asphalt surfaces.
F. Pre-installation Conference: Conduct conference at Project site to comply with requirements in project General and Supplementary Conditions.

1.6 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 surface temperature of 40 degrees F and rising at the time of placement.
2. Asphalt Base Course: Minimum surface temperature 35 degrees F at time of placement.
3. Asphalt Surface Course: Minimum surface temperature of 40 degrees F at time of placement.

PART 2 - PRODUCTS

2.1 ASPHALT MATERIALS

A. Asphalt Cement: ASTM D 3381 for viscosity-graded material. ASTM D 946 for penetration-graded material.
B. Asphalt: ASTM D 3141, Pumping consistency.
C. Tack Coat: ASTM D 977, emulsified asphalt or ASTM D 2397, emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
D. Fog Seal: ASTM D 977, emulsified asphalt or ASTM D 2397, emulsified asphalt, slow setting, factory diluted in water, of suitable grade and consistency for application.
E. Water: Potable.

2.2 MIXES

A. Hot-Mix: Provide dense, hot-laid, hot-mix asphalt plant mixes approved by Pennsylvania Department of Transportation; designed according to PennDOT Standard Specifications for Road and Bridge Construction and complying with the following requirements:

1. Provide mixes with a history of satisfactory performance in geographical area where project is located.
2. Base Course: PennDOT Superpave, Thickness to achieve conditions indicated on plans.
3. Wearing Course: PennDOT Superpave, Thickness to achieve conditions indicated on plans

2.3 AGGREGATE BASE

A. In accordance with PennDOT Publication 408, Section 350.2(a).

2.4 AUXILIARY MATERIALS

A. Herbicide: Commercial chemical for weed control, registered by Environmental Protection Agency (EPA). Provide granular, liquid, or wet table powder form.
B. Sand: ASTM D 1073, Grade Nos. 2 or 3.

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. Completely proof-roll subbase in one direction, repeating proof-rolling in direction perpendicular to first direction. Limit vehicle speed to 3 mph. Notify Engineer in writing of unsatisfactory conditions.

1. Excavate soft spots, and areas of excessive pumping or rutting, as determined by project professional. Replace with compacted subbase as directed. Remedial work required to establish suitable subbase is to be performed by contract at no additional cost to the Owner.
2. Do not begin paving installation until these conditions have been satisfactorily corrected.

3.2 REPAIRS

A. Where it is determined that repairs are required after proof-rolling the contractor shall sawcut an area larger than the required repair area with neat orthogonal and straight lines and remove all unsuitable material.
B. The contractor shall prepare the area with subbase material suitable for placement of full depth asphalt paving.

3.3 SURFACE PREPARATION

A. General: Ensure that prepared substrate surfaces are ready to receive paving. Sweep loose granular particles from surface of unbound-aggregate base course. Do not dislodge or disturb compacted surface of base course.
B. Herbicide Treatment: apply according to manufacturer’s recommended rates and application instructions. Apply to dry, prepared applying paving materials. Mix herbicide with prime coat when formulated by manufacturer for that purpose.
C. Tack Coat: Application of a tack coat shall be in accordance with Section 460 of PennDOT Publication 408 and shall be considered incidental to this item of work.

1. A tack coat shall not be applied to new bituminous base courses. However, a tack coat shall be applied to the new bituminous base course or binder course when, in the opinion of the Engineer, the condition of the surface is unsatisfactory for the direct placement of the succeeding operation.

3.4 AGGREGATE BASE

A. In accordance with PennDOT Publication 408, Section 350.3.

3.5 HOT-MIX ASPHALT PLACEMENT

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. Place hot-mix asphalt base course in number of lifts and thicknesses indicated on the plans. Place hot-mix surface course in single lift. Spread mix at a minimum temperature of 250 degrees F (121 degrees C). Begin mix along centerline of crown for crowned sections and high side of one-way slopes, unless otherwise indicated. Paver machine speed to obtain smooth, continuous surface free of pulls and tears in asphalt-paving mat. Place in consecutive not less than 10 feet (3 m) wide, except where edge strips of a lesser width are required. 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 asphalt surface course. 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 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. Clean contact surfaces and apply tack coat. Offset longitudinal joints in successive courses a minimum of 6 inches (150 mm). Offset transverse joints in successive courses a minimum of 24 inches (600 mm) and as described in AIMS-22 “Construction of Hot Mix Asphalt Pavements”.

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. Complete compaction before mix temperature cools to 185 degrees F (85 degrees C).

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 specified density. Continue rolling until hot-mix asphalt course has been uniformly compacted to the following density:

1. Average Density: 96 percent of reference laboratory density according to ASTM D 1559, but not less than 94 percent nor greater than 100 percent.
2. Finish Rolling: Finish roll paved surfaces to remove roller marks while hot-mix asphalt is still warm.

D. Edges: 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.

E. 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.

F. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and erect barricades to protect paving from traffic until mixture has cooled enough not to become marked.

3.8 INSTALLATION TOLERANCE

A. Thickness: Compact each course to produce the thickness indicated on the plans within the following tolerances:

1. Base Course: Plus or minus 1/2 inch (13 mm);
2. Wearing Course: Plus 1/4 inch (6 mm), no minus.

B. Surface Smoothness: Compact each course to produce a surface smoothness within the following tolerances as determined by using a 10-foot (3-m) straightedge applied transversely or longitudinally to paved areas:

1. Base Course: 1/4 inch (6 mm).
2. Wearing Course: 1/8 inch (3 mm).
3. Crowned Surfaces: Test with crowned template centered and at right angle to crown. Maximum allowable variance from template is 1/4 inch (6 mm).

3.9 FIELD QUALITY CONTROL

A. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
B. Testing Agency: Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
D. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.

1. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
2. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
3. Replace and compact hot-mix asphalt where core tests were taken.

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

3.10 DISPOSAL

A. Except for material indicated to be recycled, remove excavated materials from project site and legally dispose of them. Do not allow excavated materials to accumulate on-site.

END OF SECTION 321216

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SECTION 321216.01 – TENNIS COURT SURFACE COURSE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt materials.
2. Aggregate materials.
3. Asphalt paving surface course.

B. Related Requirement:

1. Section 320116 – Pavement Milling.
2. Section 321216 - Asphalt Paving.

1.2 REFERENCE STANDARDS

A. American Sports Builders Association.
B. Pennsylvania Department of Transportation Publication 408.
C. American Association of State Highway and Transportation Officials:

1. AASHTO M17 - Standard Specification for Mineral Filler for Bituminous Paving Mixtures.
2. AASHTO M29 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.
3. AASHTO M140 - Standard Specification for Emulsified Asphalt.
4. AASHTO M208 - Standard Specification for Cationic Emulsified Asphalt.
5. AASHTO M288 - Standard Specification for Geotextile Specification for Highway Applications.
6. AASHTO M320 - Standard Specification for Performance-Graded Asphalt Binder.
7. AASHTO M324 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
8. AASHTO MP1a - Standard Specification for Performance-Graded Asphalt Binder.

D. Asphalt Institute:

1. AI MS-2 - Mix Design Methods for Asphalt Concrete and Other Hot- Mix Types.
2. AI MS-19 - Basic Asphalt Emulsion Manual.
3. AI SP-2 - Superpave Mix Design.

E. ASTM International:

1. ASTM C1371 - Standard Test Method for Determination of Emittance of Materials Near Room Temperature Using Portable Emissometers.
2. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer.
3. ASTM D242 - Standard Specification for Mineral Filler For Bituminous Paving Mixtures.
4. ASTM D692 - Standard Specification for Coarse Aggregate for Bituminous Paving Mixtures.
5. ASTM D946 - Standard Specification for Penetration-Graded Asphalt Cement for Use in Pavement Construction.
6. ASTM D977 - Standard Specification for Emulsified Asphalt.
7. ASTM D1073 - Standard Specification for Fine Aggregate for Bituminous Paving Mixtures.

8. ASTM D1188 - Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Coated Samples
9. ASTM D2027 - Standard Specification for Cutback Asphalt (Medium-Curing Type).
10. ASTM D2397 - Standard Specification for Cationic Emulsified Asphalt.
11. ASTM D2726 - Standard Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures.
12. ASTM D2950 - Standard Test Method for Density of Bituminous Concrete in Place by Nuclear Methods.
13. ASTM D3381 - Standard Specification for Viscosity-Graded Asphalt Cement for Use in Pavement Construction.
14. ASTM D3515 - Standard Specification for Hot-Mixed, Hot-Laid Bituminous Paving Mixtures.
15. ASTM D3549 - Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens.
16. ASTM D3910 - Standard Practices for Design, Testing, and Construction of Slurry Seal.
17. ASTM D6690 - Standard Specification for Joint and Crack Sealants, Hot Applied, for Concrete and Asphalt Pavements.
18. ASTM E408 - Standard Test Methods for Total Normal Emittance of Surfaces Using Inspection-Meter Techniques.
19. ASTM E903 - Standard Test Method for Solar Absorptance, Reflectance, and Transmittance of Materials Using Integrating Spheres.
20. ASTM E1918 - Standard Test Method for Measuring Solar Reflectance of Horizontal and Low-Sloped Surfaces in the Field.
21. ASTM E1980 - Standard Practice for Calculating Solar Reflectance Index of Horizontal and Low-Sloped Opaque Surfaces.

1.3 SUBMITTALS

A. Product Data:

1. Submit product information for asphalt and aggregate materials.
2. Submit mix design with laboratory test results supporting design.

B. Manufacturer's Certificate: Certify Products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Mixing Plant: Certified by PennDOT.
B. Obtain materials from same source throughout.
C. Perform Work in accordance with PennDOT standards.
D. Maintain one copy of each document on site.

1.5 QUALIFICATIONS

A. Installer: Company specializing in performing work of this section with minimum three years documented experience.

1.6 AMBIENT CONDITIONS

A. Do not place asphalt mixture when ambient conditions do not meet those outlined by PennDOT.

PART 2 - PRODUCTS

2.1 ASPHALT PAVING

A. Performance / Design Criteria:

1. Paving: Design for Sports Courts.

B. Asphalt Materials:

1. Asphalt: In accordance with PennDOT standards. Low Volume, Design Gyration of 50.
2. Primer: AASHTO M140 or M208. MS-2, CMS-2, or HFMS-2s
3. Tack Coat: AASHTO M140 or M208. SS-1, SS-1h, CSS-1, or CSS-1h diluted with an equal amount of water, or agency acceptable product.
4. Reclaimed Asphalt Pavement (RAP): Not permitted for use.
5. Oil: In accordance with PennDOT standards.

C. Aggregate Materials:

1. Coarse Aggregate: ASTM D692; crushed stone, gravel, or blast furnace slag.
2. In accordance with PennDOT Publication 408, Section 410.2(e).
   a. Minimum percent passing the No. 8 sieve of 47% and a maximum percent passing the No. 8 sieve of 67%.
3. Fine Aggregate: ASTM D1073; natural sand or sand manufactured from stone, gravel, or blast furnace slag.

2.2 MIXES

A. Use dry material to avoid foaming. Mix uniformly.
B. Asphalt Paving Mixtures: Designed in accordance with PennDOT standards with maximum zero percent by weight reclaimed asphalt pavement.

1. Surface Course: PG 64S-22, < 0.3 Million ESALs, 9.5 mm FG Mix, 1 ½” Depth.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify utilities indicated under paving are installed with excavations and trenches backfilled and compacted.
B. Verify stabilized asphalt course is dry and ready to support paving and imposed loads.
C. Verify gradients and elevations of base are correct.
D. Verify manhole frames, inlets frames, and handholes are installed in correct position and elevation.

3.2 REPAIRS

A. Where it is determined that repairs are required after proof-rolling the contractor shall sawcut an area larger than the required repair area with neat orthogonal and straight lines and remove all unsuitable material.

B. The contractor shall prepare the area with subbase material suitable for placement of full depth asphalt paving.

3.3 DEMOLITION

A. Saw cut and notch existing paving as indicted on Drawings.
B. Clean existing paving to remove foreign material, excess joint sealant and crack filler from paving surface.
C. Repair surface defects in existing paving to provide uniform surface to receive new paving.

3.4 INSTALLATION

A. Asphalt Paving Overlay

1. Apply tack coat to existing paving surface at rate recommended by geotextile fabric manufacturer.
2. Install geotextile fabric in accordance with manufacturer's instructions to permit asphalt saturation of fabric. Lap fabric edge and end joints 4 inches.
3. Place surface course to 1 ½ inch compacted thickness.
4. Compact overlay by rolling to specified density. Do not displace or extrude paving from position. Hand compact in areas inaccessible to rolling equipment.
5. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

3.5 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.
B. Scheduled Compacted Thickness: Within 1/4 inch.
C. Variation from Indicated Elevation: Within 1/2 inch.

3.6 FIELD QUALITY CONTROL

A. Surface Smoothness: Finished surface of each hot-mix asphalt course will be tested for compliance with smoothness tolerances.
B. Testing Agency: Contractor will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.
C. Thickness: In-place compacted thickness of hot-mix asphalt courses will be determined according to ASTM D 3549.
D. In-Place Density: Samples of uncompacted paving mixtures and compacted pavement will be secured by testing agency according to ASTM D 979.

1. One core sample will be taken for every 1000 sq. yd. or less of installed pavement, with no fewer than 3 cores taken.
2. Field density of in-place compacted pavement may also be determined by nuclear method according to ASTM D 2950 and correlated with ASTM D 1188 or ASTM D 2726.
3. Replace and compact hot-mix asphalt where core tests were taken.

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

3.7 PROTECTION

F. Immediately after placement, protect paving from mechanical injury for until surface temperature is less than 140 degrees F.

END OF SECTION 321216.01

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SECTION 321223 - ASPHALT PAVEMENT COLORCOATING

PART 1 - GENERAL

1.1 SUMMARY

A. Asphalt pavement colorcoating for the tennis court. The Contractor shall furnish all labor, materials and equipment required for the complete leveling/patching and surfacing of all areas indicated on the plans to the satisfaction of the Owner or Owner's Representative.

A. Related Sections:

1. Section 116833 "Athletic Equipment" for mini-pitch, tennis and basketball systems.

1.2 SUBMITTALS

A. Product Data: Provide manufacturer's data on colorcoating.
B. Color Samples: Full range of standard colors for selection by Owner and Landscape Architect.
C. Instructions: Provide manufacturer's application instructions.

1.3 QUALIFICATIONS

A. Applicator: Company specializing in performing the work of this section with minimum two years' experience.

1.4 TEST MATERIALS

A. The Owner reserves the right to sample materials both as delivered to the job site in unopened drums and after dilution and mixing prior to application. Such testing shall be by an independent laboratory of the Owner's choice to assure that the materials meet the standards set by this specification.

1.5 ENVIRONMENTAL REQUIREMENTS

A. Do not apply colorcoating when ambient air temperature is less than 50 degrees F, nor during fog, rain, or other unsuitable conditions. Do not apply when surface temperature is below 40 degrees F or in excess of 140 degrees F.

B. Surfacing system shall be asbestos free.

1.6 SUBSTITUTIONS

A. Under provisions of Division One Specification Sections.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: California Products Corporation, Plexipave, 150 Dascomb Rd., Andover, MA 01810, (978) 623-9980, https://www.californiasportssurfaces.com/, or approved equal.

2.2 MATERIALS

A. Acrylic Patching System: Shall be court patch binder conforming to manufacturer's specifications.

B. Crack Filler: Shall be a fortified acrylic type filler for use in fine cracks (less than 3/16" wide) conforming to manufacturer's specifications.

C. Acrylic Resurfacer: Shall be a 100% acrylic emulsion binder conforming to manufacturer's specifications.

D. Finish Coating: Shall be a reinforced acrylic finish coating conforming to manufacturer's specifications, color: TBD

E. Line Paint: acrylic latex, color: White

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that tennis court surface is ready to receive work.

C. Beginning of colorcoating application means acceptance of existing conditions.

3.2 PREPARATION

A. Surface Preparation

1. The asphalt paving surface shall be thoroughly cleaned, removing all loose dirt, oil, grease, leaves, and drippings and scrub with a detergent and water. Remove all traces of detergent.

B. Holes and Cracks

1. Where asphalt paving surface cracks occur, they shall be milled to remove all asphalt humps, cleared of all debris, dirt, and vegetation, sprayed with an approved soil sterilant, and filled with court patch binder as recommended by colorcoating manufacturer. Hairline fissures will not be considered as surface cracks.
2. Where open joints or cracks occur (more than 3/8 inch wide and less than 1 inch wide), they shall be milled to remove all debris, dirt, and vegetation. Spray with an approved soil sterilant, backfill with crushed stone, and seal with bituminous paving.
3. Where open joints or cracks occur (1 inch wide or greater), they shall be milled to remove all debris, dirt, and vegetation. Spray with an approved soil sterilant, backfill with No. 8 coarse aggregate, and seal with 1 1/2" of bituminous paving.

C. Depressions

1. Depressions holding enough water to cover a five cent piece shall be filled with court patch binder patching mix, as recommended by the surface colorcoating manufacturer.

D. Curing

1. New asphalt concrete surface should be allowed to cure a minimum of 10 to 14 days prior to application of colorcoating.

E. Sports Courts

1. Install tennis system according to specification section 116833 “Athletic Equipment”, and manufacturer’s instructions.

3.3 APPLICATION

A. General

1. All areas to be colorcoated shall be clean, free from sand, clay, grease, dust, salt, or other foreign matters. The Contractor shall obtain the Owner’s approval, prior to applying any surface treatment. The storage of materials, mixing, and surface preparation shall be in accordance with the manufacturer’s instructions.
2. The Contractor shall arrange for a representative of the surfacing material manufacturer to be present at the start of the work, to check installation conditions, and to instruct the applicators as to proper methods and procedures, and also as may be necessary during the course of the work, to insure a satisfactorily completed installation.
3. The application shall be done by thoroughly experienced and skillful workmen, in strict accordance with the manufacturer’s instructions.

B. Filler Coat

1. Filler coat (acrylic resurfacer) shall be applied to the clean underlying surface in one application to obtain a total quantity of not less than 15-20 yards per gallon based on the material prior to any dilution. Apply filler coat as recommended by the surface colorcoating manufacturer.
2. Allow filler coat to dry thoroughly. Scrape off all ridges and rough spots prior to any subsequent application of acrylic resurfacer or color surface system.

C. Finish Coating

1. The Contractor shall apply two (2) coats of Fortified Plexipave reinforced acrylic finish coating.
2. Each finish coat shall be applied at a rate of 0.4 - 0.5 gallons per square yard. Allow each coat to dry thoroughly prior to any subsequent applications of color surface system.
3. Apply the second coat at a 90 degree angel to the previous coat.
4. The finished surface shall have a uniform appearance and be free of ridges and tool marks.

3.4 PROTECTION

A. Protect finished application under provisions of Section 01500.

B. Do not permit traffic over pavement for 24 hours.

END OF SECTION

SECTION 321400 – UNIT PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this Section.

1.2 SECTION INCLUDES

A. Extent of work is shown on Drawings and includes but is not limited to:

1. Furnish and install precast concrete unit pavers on bituminous setting bed with sand joints.

2. Furnish and install brick unit pavers on mortar setting bed with grout joints.

1.3 RELATED SECTIONS

A. Section 033000 – Cast-in-Place Concrete

B. Section 044800 - Site Stone Masonry

C. Section 321216 - Asphalt Paving

1.4 REFERENCES

A. The following apply to work in this Section:

1. ASTM: Specifications of the American Society for Testing and Materials latest editions. Modifications specified herein shall govern where conflicts with ASTM standards occur.

1.5 SUBMITTALS

A. Submit prior to delivery of materials to site.

B. Product Data: Submit manufacturer's product data and installation instructions for each material and product used.

C. Samples: Submit two representative samples of each material specified indicating visual characteristics and finish. Include wider range if variation of finish is anticipated.

1. Sand joint material, 1/2 lb. bag.

2. Concrete unit pavers including all colors specified for project.

3. Brick unit pavers including all colors specified for project.

4. Cementitious materials. Include brand, type, and name of manufacturer.

5. Setting bed mortar mixes. Include description of type and proportions of

ingredients.

D. Samples for Initial Selection:

1. For pigmented grout and sealant material and other items involving color selection. Include sample of manufacturers full range of colors. Selected product may be a standard color or a custom blended color.

E. Shop Drawings:

1. Provide shop drawings for unit pavement utilizing field measurements.

2. Indicate layout, pertinent dimensions, junction with other materials, and jointing methods.

F. Test Reports:

1. Provide sieve analysis of setting bed and joint materials.

1.6 QUALITY ASSURANCE

A. Comply with governing codes and regulations. Provide products of acceptable manufacturers that have been in satisfactory use in similar service for three years. Use experienced installers. Deliver, handle, and store materials in accordance with manufacturer's instructions.

B. Weather Restrictions: Bituminous-set pavers can be used in all climatic conditions. However, the bituminous setting bed material should not be placed when the temperature is below 40 °F.

C. Construction Tolerance:

1. Unit pavement: Unit-to-unit offset tolerance of 1/32 inch from flush and 1/8 inch in 10 feet from level or required slope.

D. Field-Constructed Mock-ups: Provide sample panel of each type of unit paving as specified herein. Build mock-ups in place at the sites and obtain Owner’s and Landscape Architect's acceptance of visual qualities of sample panels before commencing work. Replace unsatisfactory mock-up work until acceptance is obtained. Mock-up may be used as part of the work if conforming to specified requirements and accepted by Owner and Landscape Architect. Accepted mock-up establishes minimum standard of quality and workmanship for paver work.

1. Concrete unit paver mock-up: Build 6’ x 6’ panel of the pavement using unit pavers, setting and jointing materials.

2. Brick paver mock-up: Build a 1’-5 1/8” x 6’ band of the pavement using brick pavers, setting and jointing materials.

3. If initial mock-ups are rejected, build additional mock-ups to arrive at desired features. Retain all mock-ups until acceptable mock-up is selected by Owner and Landscape Architect. Retain and protect acceptable mock-ups during construction as standard for judging work. Do not alter, move, damage or destroy mock-up until work is complete.

4. Acceptable mock-ups may become part of the permanent installation.

1.7 DELIVERY STORAGE AND HANDLING

A. Deliver, store, handle and protect all materials from damage.

B. Handle pavers to prevent chipping, breakage, soiling, or other damage.

C. Store pavers and curbs on wood skids or pallets, covered with non-staining, waterproof membrane. Place and stack skids and pavers to distribute weight evenly and to prevent breakage and cracking.

1.8 PROJECT CONDITIONS

A. Protection of Stone Masonry: Cover partially completed stone masonry when construction is not in progress to protect from inclement weather.

B. Stain Prevention: Immediately remove mortar to prevent staining the exposed surfaces of stone masonry and all adjacent surfaces.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace stone masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7 days after completing cleaning.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

PART 2 - PRODUCTS

2.1 PRECAST CONCRETE UNIT PAVERS

A. Supplier: Hanover Architectural Products, 5000 Hanover Road, Hanover PA 17331, 717-637-0500.

B. Product: Prest Paver.

C. Size: 35-7/8” x 35-7/8”.

D. Thickness: 2-1/2”

E. Color Matrix# & Finish:

1. Color A: Matrix #M1078, Finish: Tudor

2. Color B: Matrix #M1428, Finish: #13

3. Color C: #M3588, Finish: #21

F. (10) extra pavers of each color to be provided as attic stock, to be palletized and delivered to location as determined by Owner.

2.2 BRICK UNIT PAVERS

A. Supplier: Church Brick, 118 Burlington Road, Bordentown, NJ 08505, 609-298-0090

B. Product: Glen-Gery, Cushwa series paver

C. Size: 4” x 8”

D. Height: 2-1/4”

E. Finish: 53-DD

2.3 BITUMINUOUS SETTING MATERIALS

A. Primer for Base: ASTM D2028/D2028M, cutback asphalt, grade as recommended by unit paver manufacturer.

B. Fine Aggregate for Setting Bed: ASTM D1073, No. 2 or No. 3.

C. Asphalt Cement: ASTM D3381/D3381M, Viscosity Grade AC-10 or Grade AC-20.

D. Neoprene-Modified Asphalt Adhesive: Paving manufacturer's standard adhesive consisting of oxidized asphalt combined with 2 percent neoprene and 10 percent long-fibered mineral fibers containing no asbestos. To be utilized if field conditions require.

E. Sand for Joints: Fine, sharp, washed, natural sand or crushed stone with 100 percent passing No. 16 sieve and no more than 10 percent passing No. 200 sieve.

F. Provide sand of color needed to produce required joint color.

2.4 BITUMINOUS SETTING-BED MIX

A. Mix bituminous setting-bed materials at an asphalt plant in approximate proportion, by weight, of 7 percent asphalt cement to 93 percent fine aggregate unless otherwise indicated. Heat mixture to 300 deg F.

2.5 ROLLED ASPHALT LEVELING COURSE

A. Asphalt mix: Superpave Binder Course – refer to section 321216.

2.6 GROUT

A. Preblended, standard cement grout mix conforming to ANSI A118.6, sanded. Color as selected by Landscape Architect from manufacturers full range.

2.7 MORTAR MIXES

A. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

B. Mortar for Unit Pavers: Comply with ASTM C 270, Proportion Specification. Provide Type S unless another type is indicated.

C. Water: Potable, clean and free from deleterious acids, alkalies, and organic matter.

D. Mixing: Combine and thoroughly mix pre-blended dry materials to water in a mechanical batch mixer; comply with ASTM C270 proportion specification and manufacturer's instructions for mixing time and water content, unless otherwise indicated.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify substrate is level, smooth, capable of supporting pavers and imposed loads, and ready to receive Work of this section.

B. Verify that concrete substrate has cured at least 28 days and attained 75 percent design strength.

C. Vacuum clean concrete substrates to remove dirt, dust, debris and loose particles.

D. Verify that gradients and elevations of substrate are correct.

E. Stake out lines of work and seek approval of Owner and Landscape Architect.

3.2 INSTALLATION OF PAVERS ON BITUMINOUS SETTING BED

A. Place bituminous setting bed.

1. Use control bars to control the depth of the bituminous setting bed. Place bituminous between control bars and strike off. Fill low spots with more bituminous material to produce smooth, even, firm setting bed.

2. Screed setting bed with power roller to nominal depth of 3/4" while still hot.

B. Apply coat of neoprene-modified asphalt adhesive if required by field conditions.

C. Set pavers with a joint width of 1/8" minimum and 1/4" maximum.

1. Maintain proper joint alignment and pattern as indicated on Drawings.

2. Protect newly laid pavers with plywood panels placed over pavers where installers stand.

3. Cut pavers as required and as shown on Drawings.

4. Roll pavers if necessary to achieve additional leveling, before installing joint filler, after heat has built-up in the surface from several days of hot weather.

D. Sweep joint filler into joints. Spread dry sand and fill joints immediately after vibrating pavers into leveling course. Vibrate pavers and add sand until joints are completely filled, then remove excess sand. Leave a slight surplus of sand on the surface for joint filling.

E. Do not allow traffic on installed pavers until sand has been vibrated into joints.

F. Repeat joint-filling process 30 days later

G. Remove and replace pavers that are loose, out of line or grade, chipped, broken, stained or otherwise damaged or if units do not match adjoining units as intended or present a tripping hazard. Provide new units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.

H. Do not allow traffic on installed pavers until jointing material has been installed.

I. Repeat joint-filling process 30 days later.

J. Remove and replace pavers that are loose, out of line or grade, chipped, broken, stained or otherwise damaged or if units do not match adjoining units as intended or present a tripping hazard. Provide new units and install in same manner as original units, with same joint treatment to eliminate evidence of replacement.

3.3 MORTAR SETTING-BED APPLICATIONS

A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Mix and place only that amount of mortar bed that can be covered with brick pavers before initial set. Before placing brick, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.

C. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch- thick bond coat to mortar bed or to back of each paver with a flat trowel.

D. Tamp or beat brick paver with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver or step in a single operation before initial set of mortar; do not return to areas already set or disturb bricks for purposes of realigning finished surfaces or adjusting joints.

E. Spaced Joint Widths: Provide 3/8-inch nominal joint width with variations not exceeding plus or minus 1/16 inch.

F. Grouted Joints: Grout paver joints complying with ANSI A118.6.

G. Grout joints as soon as possible after initial set of setting bed.

1. Force grout into joints, taking care not to smear grout on adjoining surfaces.

2. Clean brick as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.

3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.

H. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

3.4 PROTECTION OF FINISHED WORK

A. Do not permit construction traffic over unprotected paver surface.

3.5 CLEAN UP

A. Maintain the site in an orderly condition during the progress of work. Promptly remove debris and trash. Leave the site in a neat, orderly condition, broom clean.

END OF SECTION

SECTION 321500 – SITE MASONRY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes

1. Brick veneer for site walls and piers.

2. Cast stone coping for brick veneered site walls and piers.

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials:

1. ASTM A666 - Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar.

1.4 PERFORMANCE REQUIREMENTS

A. American Society for Testing and Materials:

1. Design anchor attachment to masonry units with a factor of safety of 5:1.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated including, but not limited to:

1. Cementitious materials. Include brand, type, and name of manufacturer.

2. Setting bed mortar mixes. Include description of type and proportions of ingredients.

3. Joint sealants and backer rods.

4. Anchors, clips, dowels, pins and other metal accessories.

5. Shims and setting buttons; plastic or nylon.

B. Samples for Initial Selection

1. For colored sealant, jointing materials and other items involving color selection. Include sample of manufacturers full range of standard colors.

2. Brick: Three (3) units for each type of product specified.

3. Cast stone: one (1) 12” x 12” x 1.5” units depicting the full color range.

C. Samples for Verification

1. Setting Bed Materials

2. Jointing Materials

D. Shop Drawings for Walls and Steps:

1. Show sizes, dimensions, profiles, finishes, jointing, anchoring system and other necessary information required to convey full scope of work.

2. Include adjacent Work, including but not limited to, paving, adjoining work, and soil or fill conditions at specified finished grades.

3. Utilize same designations or naming as indicated on the Drawings for site features such as walls and seat walls.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: A qualified installer who employs experienced masons and fitters.

B. Source Limitations: Obtain each variety of masonry unit, regardless of finish, from one source with resources to provide materials of consistent quality in appearance and physical properties.

C. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color for exposed masonry, from single manufacturer for each cementitious component and from single source or producer for each aggregate.

D. Mockups: Build mockups to demonstrate aesthetic effects and set quality standards for materials and execution.

1. Locations of mockups to be submitted for approval by Landscape Architect. Preferred mockup location for veneered wall and stairs to be adjoining to evaluate intersections and connections of work and associated concrete backup.

2. Build mockups for each type of site masonry including, but not limited to,

a. Brick veneered wall.

b. Cast stone wall and pier cap.

3. Consult Landscape Architect prior to constructing mockups.

4. Protect accepted mockups from the elements with weather-resistant membrane.

5. Approval of mockups is for color, texture, blending of masonry units; relationship of sealant or grout color to masonry unit color; tooling of joints; and aesthetic qualities of workmanship.

a. Jointing grout and sealant shall be fully cured prior to review for accurate color representation.

b. Approval of mockups is also for other material and construction qualities Landscape Architect specifically approves in writing.

c. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Landscape Architect specifically approves such deviations in writing.

6. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store masonry units on elevated platforms in a dry location. If units are not stored in an enclosed location, cover tops and sides of stacks with waterproof sheeting, securely tied. If units become wet, do not install until they are dry.

B. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

C. Store aggregates where grading and other required characteristics can be maintained and contamination avoided.

D. Deliver preblended, dry mortar mix in moisture-resistant containers designed for lifting and emptying into dispensing silo. Store preblended, dry mortar mix in delivery containers on elevated platforms, under cover, and in a dry location or in a metal dispensing silo with weatherproof cover.

E. Store masonry accessories, including metal items, to prevent corrosion and accumulation of dirt and oil.

1.8 PROJECT CONDITIONS

A. Protection of Masonry: Cover partially completed masonry when construction is not in progress to protect from inclement weather.

B. Stain Prevention: Immediately remove mortar and soil to prevent them from staining the exposed surfaces of masonry.

1. Protect base of walls from rain-splashed mud and mortar splatter by coverings spread on the ground and over the wall surface.

2. Protect all exposed surfaces from mortar droppings, including adjacent constructions such as exposed aggregate concrete pavement or any other adjacent surface.

C. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace masonry damaged by frost or freezing conditions. Comply with cold-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until masonry has dried, but not less than 7

days after completing cleaning. Protect all exposed surfaces from mortar droppings, including adjacent constructions such as exposed aggregate concrete pavement or any other adjacent surface.

D. Hot-Weather Requirements: Comply with hot-weather construction requirements contained in ACI 530.1/ASCE 6/TMS 60

1.9 COORDINATION

A. Advise installers of other work about specific requirements for placement of reinforcement, veneer anchors, and similar items to be built into masonry.

B. Verify field measurements prior to fabrication. Notify Landscape Architect of any discrepancies prior to fabrication.

1.10 WARRANTY

A. Unless stated otherwise in these Specifications, warranty shall state that all work is in accord with drawings and Specifications, as amended by any changes thereto authorized by the Landscape Architect, free from defects in materials and workmanship for a period of five (5) years from date of acceptance of the work by the Owner or failure of system to meet performance requirements. Contractor shall agree to repair or replace defective materials and workmanship during the guarantee period at no additional cost to the Owner.

1. Defective materials and workmanship are hereby defined to include evidence of abnormal deterioration, aging, structural failure of components resulting from exposure to normal load and forces, failure of operating parts to function normally, sealant failures, deterioration or discoloration of finishes in excess of normal aging, and failure to fulfill other specified performance.

PART 2 - PRODUCTS

2.1 BRICK VENEER

A. Defective Material: Referenced standards may allow a certain percentage of units to contain chips, cracks, or other defects exceeding limits stated in the standard. Do not use units where such defects will be exposed in the completed Work.

B. Basis of Design Product: Glen-Gery Cushwa Series, molded face brick, available from Church Brick, 118 Burlington Road, Bordentown, NJ 08505, www.churchbrick.com.

1. Color: “53-DD” and “50-DD”. Blending rate TBD

2. Modular Size: 3-5/8inches deep, 2-1/4 inches high, 7-5/8 inches long

2.2 ARCHITECTURAL CAST STONE

A. Custom engineered and fabricated, reinforced wet-cast cast stone, smooth finish, no visible aggregate, in sizes and shapes as indicated on Drawings. Comply with ASTM C1364.

1. Basis-of-Design Product: Sun Precast Co., Inc, 4051 Ridge Road, Beaver Springs, PA 17812

a. Seatwall Coping: powdered pigment applied to replicate Scofield Lithochrome A-26 Brick Red
b. Pier Cap: to be selected from manufacturer's full range of colors.

B. Physical properties

1. Compressive strength: ASTM C1194, 6,500 psi minimum at 28 days.

2. Absorption: ASTM C1195, 5% maximum by the cold water method or 10% maximum by the boiling water method at 28 days.

3. Air content: 4 to 6 percent air entrainment except do not add to zero-slump concrete mixes.

4. Freeze-Thaw: ASTM C1364, less than 5% after 300 cycles of freezing and thawing.

5. Linear shrinkage: ASTM C426. Shrinkage shall not exceed 0.065%.

6. Cement/aggregate ratio: 1:3 to 1:5, as needed to achieve desired finish.

C. Color and Finish

1. All surfaces exposed to view shall have a fine-grained texture similar to natural limestone.

a. No air voids larger than 1/32 inches.

b. Density of air voids shall be less than three occurrences per square inch and shall not be visible under direct daylight at a distance of five feet.

2. Color variation in accordance with ASTM D2244.

3. Chips in cast stone units cannot be visible in direct daylight from a distance of 10 feet.

2.3 MORTAR AND GROUT MATERIALS

A. Use colored aggregate mortar for exposed grout joints. Color as selected by Landscape Architect from manufacturer's full range.

2.4 MORTAR MIXES

A. Preblended, Dry Mortar Mix: Furnish dry mortar ingredients in form of a preblended mix. Measure quantities by weight to ensure accurate proportions, and thoroughly blend ingredients before delivering to Project site.

B. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification. Provide Type N unless another type is indicated.

C. Water: Potable, clean and free from deleterious acids, alkalies, and organic matter.

D. Mixing: Combine and thoroughly mix pre-blended dry materials to water in a mechanical batch mixer; comply with ASTM C270 proportion specification and manufacturer's instructions for mixing time and water content, unless otherwise indicated.

2.5 ANCHORS AND FASTENERS

A. Anchor Material: Stainless steel, ASTM A 666, Type 304. Sizes and configurations: As required for vertical and horizontal support of masonry units and applicable loads.

B. Dowels and Pins Material: Stainless steel, ASTM A 276, Type 304

2.6 TIES AND ANCHORS

A. General: Ties and anchors shall extend at least 1-1/2 inches into veneer but with at least a 5/8-inch cover on outside face.

B. Materials: Provide ties and anchors specified in this article that are made from materials that comply with the following unless otherwise indicated:

1. Stainless-Steel Wire: ASTM A 580/A 580M, Type 304.

2. Stainless-Steel Sheet: ASTM A 240/A 240M or ASTM A 666, Type 304.

C. Corrugated Wall Ties: Metal strips not less than 7/8-inch wide by 18 gauge by 7-inches long.

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Backer Rod for Sealant Joints: Flexible, closed cell, non-gassing, polyethylene, rope-like joint backing material of appropriate diameter for specified joint size as indicated on the Drawings to resist pressure during sealant tooling. Backer rod shall not stain or adhere to sealant materials and shall be fully compatible with sealant compounds.

B. Sealant for Joints: In compliance with manufacturer's instructions, provide Sonneborn Sonolastic NP 2, or approved comparable product. Landscape Architect shall select color from the full range of standard colors. Intent is to match pointing mortar.

C. Weep/Vent Products: Use the following unless otherwise indicated:

1. Round Plastic Weep/Vent Tubing: Medium-density polyethylene, 3/8-inch OD by length required to extend from exterior face of masonry unit to cavity behind.

D. Setting Shims: Plastic or vulcanized neoprene.

E. Setting Buttons: Resilient plastic buttons.

2.8 MISCELLANEOUS MATERIALS

A. 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 D 4751.

3. Permittivity: 0.02 per second, minimum; ASTM D 4491.

4. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.

B. Drainage Geotextile: Nonwoven needle-punched geotextile fabric, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent; complying with AASHTO M 288 and the following, measured per test methods referenced:

1. Survivability: Class 2, AASHTO M 288.

2. Apparent Opening Size: No. 40 sieve, maximum; ASTM D 4751.

3. Permittivity: 0.5 per second, minimum; ASTM D 4491.

4. UV Stability: 50 percent after 500 hours' exposure, ASTM D 4355.

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

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive masonry, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Examine substrate to verify that dovetail slots, inserts, reinforcement, veneer anchors, flashing, and other items installed in substrates and required for or extending into masonry are correctly installed.

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

D. Beginning installation means acceptance of existing conditions.

3.2 PREPARATION

A. Clean dirty or stained surfaces by removing soil, stains, and foreign materials before setting. Clean by thoroughly scrubbing with fiber brushes and then drenching with clear water. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 INSTALLATION, GENERAL

A. Use full-size units without cutting if possible. If cutting is required to provide a continuous pattern or to fit adjoining construction, cut units with motor-driven saws; provide clean, sharp, unchipped edges. Allow units to dry before laying unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed. Sort masonry units before it is placed to remove units that do not comply with requirements relating to aesthetic effects, physical properties, or fabrication, or that is otherwise unsuitable for intended use.

B. Arrange as indicated on Drawings.

C. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

D. Set masonry units to comply with requirements indicated on Drawings. Install supports, fasteners, and other attachments indicated or necessary to secure masonry units in place. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

E. Maintain uniform joint widths except for variations due to different unit sizes and where minor variations are required to maintain bond alignment, if any. Set walls with joints not less than 1/4 inch at narrowest points or more than 1/2 inch at widest points.

F. Provide sealant joints of widths and at locations indicated.

1. Keep sealant joints free of mortar and other rigid materials.

G. Place weep holes in joints where moisture may accumulate.

1. Use specified product herein to form weep holes.

2. Space weep holes as indicated on Drawings.

3.4 CONSTRUCTION TOLERANCES

A. Variation from Plumb: For vertical lines and surfaces, do not exceed 1/4 inch in 10 feet or more.

B. Variation from Level: For joints and lines of coping, horizontal grooves, and other conspicuous lines, do not exceed 1/4 inch in 20 feet or more.

C. Measure variation from level, plumb, and position shown in plan as variation of the average plane of the face of each unit from level, plumb, or dimensioned plane.

D. Variation in Mortar-Joint Thickness: Do not vary from joint size range indicated.

3.5 LAYING MASONRY WALLS

A. Lay out walls in advance for accurate spacing of surface bond patterns with uniform joint thicknesses and for accurate location of openings, movement-type joints, returns, and offsets. Avoid using less-than-half-size units, particularly at corners, jambs, and, where possible, at other locations.

B. Bond Pattern for Exposed Masonry: Unless otherwise indicated, lay exposed masonry in running bond; do not use units with less than nominal 4-inch horizontal face dimensions at corners or ends.

C. Built-in Work: As construction progresses, build in items specified in this and other Sections. Fill in solidly with masonry around built-in items.

3.6 INSTALLATION OF ANCHORED MASONRY

A. Set masonry unit in full bed of mortar unless otherwise indicated. Build anchors into mortar joints as unit is set.

B. Space anchors as indicated, but not more than 18 inches o.c. vertically and horizontally. Install additional anchors within 12 inches of openings and at intervals, not exceeding 24 inches, around perimeter.

C. Rake out joints for sealant to depth of not less than dimension indicated on Drawings before setting mortar has hardened. Rake joints to uniform depths with square bottoms and clean sides.

3.7 ERECTION TOLERANCES

A. Variation in Line: Do not exceed 1/8 inch in 96 inches.

B. Variation in Joint Width: Do not vary joint thickness more than 1/16 inch or 1/4 inch of nominal joint width, whichever is less.

C. Variation in Surface Plane: Do not exceed 1/8 inch in 10 feet maximum from level or slope Variation in Plane between Adjacent Units: Do not exceed 1/32-inch difference between planes of adjacent units.

3.8 WALL JOINTING

A. Prepare joint surfaces for sealant by removing mortar from joint before it sets and brush clean dust and mortar particles from joint prior to application of sealant.

B. Tape-off joints to protect the adjacent surface from contact with the sealant and to create a crisp line. Tool joints, with a smooth jointing tool to produce a concave joint profile set just below the face of the masonry unit.

3.9 ADJUSTING AND CLEANING

A. Remove and replace masonry units of the following description:

1. Broken, chipped, stained, or otherwise damaged masonry unit. Unit may not be repaired.

2. Defective joints.

3. Masonry units not matching approved samples and mockups.

4. Masonry units not complying with other requirements indicated.

B. Replace in a manner that results in masonry units matching approved samples and mockups, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean masonry units as work progresses. Remove mortar fins and smears and sealant before tooling joints.

D. Final Cleaning: After mortar is thoroughly set and cured, clean masonry units as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.

2. Test cleaning methods on mockup; leave one-half of panel uncleaned for comparison purposes. Obtain Landscape Architect's approval of sample cleaning before cleaning masonry units.

3. Clean masonry units by bucket and brush hand-cleaning method described in BIA Technical Note No. 20 Revised II, using job-mixed detergent solution.

3.10 MORTAR SETTING-BED APPLICATIONS

A. Saturate concrete subbase with clean water several hours before placing setting bed. Remove surface water about one hour before placing setting bed.

B. Mix and place only that amount of mortar bed that can be covered with bluestone before initial set. Before placing bluestone, cut back, bevel edge, and remove and discard setting-bed material that has reached initial set.

C. Place pavers before initial set of cement occurs. Immediately before placing pavers on mortar bed, apply uniform 1/16-inch- thick bond coat to mortar bed or to back of each paver with a flat trowel.

D. Tamp or beat bluestone with a wooden block or rubber mallet to obtain full contact with setting bed and to bring finished surfaces within indicated tolerances. Set each paver or step in a single operation before initial set of mortar; do not return to areas already set or disturb bluestone for purposes of realigning finished surfaces or adjusting joints.

E. Spaced Joint Widths: Provide 3/8-inch nominal joint width with variations not exceeding plus or minus 1/16 inch.

F. Grouted Joints: Grout paver joints complying with ANSI A108.10.

G. Grout joints as soon as possible after initial set of setting bed.

1. Force grout into joints, taking care not to smear grout on adjoining surfaces.

2. Clean bluestone as grouting progresses by dry brushing or rubbing with dry burlap to remove smears before tooling joints.

3. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness unless otherwise indicated.

4. If tooling squeezes grout from joints, remove excess grout and smears by dry brushing or rubbing with dry burlap and tool joints again to produce a uniform appearance.

H. Cure grout by maintaining in a damp condition for seven days unless otherwise recommended by grout or liquid-latex manufacturer.

3.11 PROTECTION OF FINISHED WORK

A. Do not permit construction traffic over unprotected paver surface.

3.12 CLEAN UP

A. Maintain the site in an orderly condition during the progress of work. Promptly remove debris and trash. Leave the site in a neat, orderly condition, broom clean.

END OF SECTION

SECTION 321613.13 - CAST-IN-PLACE CONCRETE CURB AND GUTTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK

A. This Section includes construction of City of Philadelphia Type B Curb.

PART 2 - PRODUCTS

2.1 CAST-IN-PLACE CONCRETE CURB

A. Concrete: Class A, in accordance with PennDOT Publication 408, Section 704.
B. Expansion Joint Material: PennDOT Publication 408, Section 705.1.
C. Cure: PennDOT Publication 408, Section 711.2 (a).

2.2 AGGREGATE BASE

A. In accordance with PennDOT Publication 408, Section 350.2(a).

PART 3 - EXECUTION

3.1 CAST-IN-PLACE CONCRETE CURB

A. In accordance with PennDOT Publication 408, Section 630.3 with the following additions:
    1. Concrete may be placed in the forms in one lift provided there are sufficient workmen and equipment on the project to thoroughly consolidate the concrete.
    2. Cure shall be applied to the top of the curb before any marked dehydration of the concrete surface occurs. The forms shall be removed within 24 hours and all exposed concrete surfaces cured.
    3. When directed, the Contractor shall provide additional protection by covering the curb with salt hay at expense of the contractor.

END OF SECTION 32 16 13.13

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SECTION 321623 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SCOPE OF WORK

A. This Section includes construction of Concrete Sidewalks on aggregate subbase.

PART 2 - PRODUCTS

2.1 CONCRETE PAVING

A. Concrete: Class A, in accordance with PennDOT Publication 408, Section 704.
B. Aggregate: PennDOT Publication 408, Section 703.2 for Type C or better Number 2A material.
C. Cure: PennDOT Publication 408, Section 711.2 (a).
D. Joint Material: PennDOT Publication 408, Section 705.1.

2.2 AGGREGATE BASE

A. In accordance with PennDOT Publication 408, Section 350.2(a).

PART 3 - EXECUTION

3.1 CONCRETE PAVING

A. In accordance with PennDOT Publication 408, Section 676.3. The thickness of the sidewalk paving and aggregate shall be as defined in the construction plans.

3.2 AGGREGATE BASE

A. In accordance with PennDOT Publication 408, Section 350.3.

END OF SECTION 32 16 23

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SECTION 321723 - PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This section includes specifications for proposed permanent pavement markings.

1.2 SUBMITTALS

A. The Contractor shall submit to the Owner, catalog cut sheet(s) defining the proposed pavement marking material to be utilized for each color of pavement marking paint.

1.3 PROJECT CONDITIONS

A. Pavement-Marking Paint: Proceed with pavement marking only on a clean, dry surfaces and at a minimum ambient or surface temperature of 40 degrees F for oil base materials, 50 degrees F for water-based materials, and not exceeding 90 degrees F.
B. Surface Preparation: The surface shall be clean and free of dirt, grease, oil, or other contaminants which could interfere with adhesion and as further detailed and outlined in the PennDOT Standard Specifications for Road and Bridge Construction, latest edition.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Epoxy Pavement Marking Paint:
    1. Shall be materials as referenced in the latest edition of PennDOT Publication 408, section 964.

PART 3 - EXECUTION

3.1 PERMANENT PAVEMENT MARKINGS

A. Allow new asphalt paving to age a minimum of 48 hours before painting. New concrete pavement shall age a minimum of 30 days before painting, unless otherwise approved by the Owner.
B. Sweep and clean surface to eliminate loose material and dust prior to application.
C. Apply paint material at manufacturer’s recommended rates to provide a minimum wet film thickness of 15 mils and dry film thickness of 10 mils.
D. Paint shall be applied in 2 coats to a clean, dry surface using template or a striping machine. Stripes shall be of uniform width of 4 inches wide, unless otherwise noted on the drawing(s). Other markings shall be provided as on the proposed drawing(s) and as required per Philadelphia Department of Streets and PennDOT Standards.

END OF SECTION 32 17 23

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SECTION 323113 – CHAIN-LINK FENCING AND GATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. Section Includes:

1. Chain-link fences and gates.

B. Related Sections:
1. Division 2 Section “Earthwork”.
2. Division 2 Section “Tree Protection and Trimming”.
3. Division 2 Section “Asphalt Paving”.
4. Division 2 Section “Site Concrete”.

1.3 REFERENCES

A. The following apply to work in this Section:
1. ASTM: Specifications of the American Society for Testing and Materials latest editions. Modifications specified herein shall govern where conflicts with ASTM standards occur.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design chain-link fences and gates, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements, meeting PPR standard requirements, and design criteria indicated.

B. Structural Performance: Chain-link fence and gate framework shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.

1. Minimum Post Size: Refer to Drawings.
2. Minimum Post Size and Maximum Spacing: Refer to Drawings.
   a. Fence Height: Refer to Drawings.
   b. Material Group: IA, ASTM F 1043, Schedule 40 steel pipe.

1.5 SUBMITTALS

A. Product Data: Submit product literature or tear sheets with name of product and manufacturer. Fence and gate posts, rails, fittings, and locks. Confirm that gate locking mechanism works with PPR preferred locking system.

1. Chain-link fences.

B. Product Test Reports: For framing strength according to ASTM F 1043.

C. Field quality-control reports.

D. Warranty: Sample of warranty.

1.6 QUALITY ASSURANCE

A. Contractor shall have had experience with at least two (2) other projects of similar scope and complexity and shall perform work with personnel totally familiar with playground, chain link fence installation and construction techniques under the supervision of an experienced foreperson.

B. Manufacturer: Company specializing in the manufacture of chain link fences with minimum three (3) years experience.

1.7 REGULATORY REQUIREMENTS

A. Comply with all rules, regulations, laws and ordinances of local, state and federal authorities having jurisdiction. Provide labor, materials, equipment and services necessary to make work comply with such requirements without additional cost to Owner.

1. Coordinate work with utility companies. Notify Pennsylvania One Call System, Inc. 1-800-242-1776 not less than three working days prior to beginning work.

B. Investigate the conditions of public thoroughfares and roads as to availability, clearances, loads, limits, restrictions and other limitations affecting transportation to and ingress and egress at the site.

1. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction.

C. Conform to applicable code for disposal of debris.

D. Procure and pay for permits and licenses required for work.

1.8 DELIVERY STORAGE AND HANDLING

A. Deliver, store, handle and protect all materials from damage.

1.9 PROJECT CONDITIONS

A. Field Measurements: Verify layout information for chain-link fences and gates shown on Drawings in relation to property survey and existing structures. Verify dimensions by field measurements.

B. Should any work performed under this Section expose previously unknown conditions, immediately report the discovery to Architect. However, during this time use any measures necessary to maintain adequate safety conditions.

1. Should Contractor, in the course of work, find any discrepancies between Drawings and physical conditions or any omissions or errors in Drawings, inform Architect immediately in writing for clarification. Work done after such discovery, unless authorized by Owner, shall be at Contractor's risk.

1.10 WARRANTY

A. Warranty: Manufacturer's standard form in which Installer agrees to repair or replace components of chain-link fences and gates that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CHAIN-LINK FENCE FABRIC

A. General: Provide fabric in one-piece heights measured between top and bottom of outer edge of selvage knuckle or twist. Comply with CLFMI Product Manual and with requirements indicated.

B. Manufacturer: Master Halco – 3010 Lyndon B Johnson Freeway, Dallas TX, www.masterhalco.com, or approved equal.

C. Fence fabric mesh size, gauge per Drawings.

1. Thermally fused vinyl coated steel chain link fence ASTM F668- Type 2B with a galvanized steel core in accordance with ASTM A-641-71A. Color Black.

2.2 FENCE FRAMING

A. Posts and Rails: Comply with ASTM F 1043 for framing, including rails, braces, and line; terminal; and corner posts. Provide members with minimum dimensions and wall thickness according to ASTM F 1043 based on Drawings. Coating to match chain link fence fabric. Color Black.

2.3 FITTINGS

A. General: Comply with ASTM F 626. Provide coating to match chain link fence fabric.

B. Post Caps: Provide for each post.

1. Provide line post caps with loop to receive top rail.

C. Rail and Brace Ends: For each corner and end post.

D. Rail Fittings: Provide the following:

1. Top Rail Sleeves: Round-steel tubing not less than 6 inches long.
2. Rail Clamps: Line and corner boulevard clamps for connecting intermediate and bottom rails in the fence line-to-line posts.

E. Tension and Brace Bands: Pressed steel.

F. Tension Bars: Steel, length not less than 2 inches shorter than full height of chain-link fabric. Provide one bar for each gate and end post, and two for each corner and pull post, unless fabric is integrally woven into post.

G. Truss Rod Assemblies: Hot-dip galvanized rod and turnbuckle or other means of adjustment.

H. Tie Wires, Clips, and Fasteners: According to ASTM F 626.

1. Standard Round Wire Ties: For attaching chain-link fabric to posts, rails, and frames, complying with the following:

a. Hot-Dip Galvanized Steel: 0.106-inch diameter wire; galvanized coating thickness matching coating thickness of chain-link fence fabric.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for site clearing, earthwork, pavement work, and other conditions affecting performance of the Work.

1. Do not begin installation before final grading is completed unless otherwise permitted by Architect.

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

3.2 PREPARATION

A. Stake locations of fence lines, gates, and terminal posts. Do not exceed intervals of 500 feet or line of sight between stakes. Indicate locations of utilities, lawn sprinkler system, underground structures, benchmarks, and property monuments.

3.3 INSTALLATION, GENERAL

A. Install chain-link fencing to comply with ASTM F 567 and more stringent requirements indicated.

3.4 CHAIN-LINK FENCE INSTALLATION

A. Post Excavation: Drill or hand-excavate holes for posts to diameters and spacings indicated, in firm, undisturbed soil.

B. Post Setting: Set posts in concrete at indicated spacing into firm, undisturbed soil.

1. Verify that posts are set plumb, aligned, and at correct height and spacing, and hold in position during setting with concrete or mechanical devices.
2. Concrete Fill: Place concrete around posts to dimensions indicated and vibrate or tamp for consolidation. Protect aboveground portion of posts from concrete splatter.

C. Terminal Posts: Locate terminal end, and corner posts per ASTM F 567

D. Line Posts: Space line posts per Drawings.

E. Post Bracing and Intermediate Rails: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Diagonally brace terminal posts to adjacent line posts with truss rods and turnbuckles. Install braces at end and gate posts and at both sides of corner and pull posts.

1. Locate horizontal braces at mid-height of fabric 72 inches or higher, on fences with top rail. Install so posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch diameter hog rings of same material and finish as fabric wire, spaced per Drawings. Install tension wire in locations indicated before stretching fabric. Provide horizontal tension wire at the following locations:

1. Extended along top and bottom of fence fabric. Install top tension wire through post cap loops. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.

G. Top Rail: Install according to ASTM F 567, maintaining plumb position and alignment of fencing. Run rail continuously through line post caps and terminating into rail end attached to posts or post caps fabricated to receive rail at terminal posts. Provide expansion couplings as recommended in writing by fencing manufacturer.

H. Intermediate and Bottom Rails: Install and secure to posts with fittings.

I. Chain-Link Fabric: Apply fabric to outside of enclosing framework. Leave 2 inches between finish grade or surface and bottom selvage unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Anchor to framework so fabric remains under tension after pulling force is released.

J. Tie Wires: Use wire of proper length to firmly secure fabric to line posts and rails. Attach wire at one end to chain-link fabric, wrap wire around post a minimum of 180 degrees, and attach other end to chain-link fabric per ASTM F 626. Bend ends of wire to minimize hazard to individuals and clothing. Each end of wire tie shall be wrapped around fabric at least 540 degrees.

1. Maximum Spacing: Tie fabric to line posts at dimension indicated on Drawings.

3.5 CLEAN UP

A. Maintain the site in an orderly condition during the progress of work. Promptly remove debris and trash. Leave the site in a neat, orderly condition, broom clean.

END OF SECTION

SECTION 329100 - PLANTING PREPARATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section

1.2 SECTION INCLUDES

A. The scope of work includes all labor, materials, tools, supplies, equipment, facilities, transportation and services necessary for, and incidental to performing all operations in connection with furnishing, delivery, and installation of Planting Soils. Scope of work includes, but is not limited to, sourcing, purchase, delivery and installation of Planting Soil and soil amendments and clean up and disposal of all excess and surplus material.

B. The specific soil types in this section include:

1. Planting Soil for plant beds.

1.3 RELATED REQUIREMENTS

A. Section 312000 Earthwork

B. Section 329300 Plants

1.4 REFERENCE STANDARDS

A. In the event that the requirements of any of the referenced standards and specifications herein conflict with each other the more stringent requirement shall prevail. Where reference is made to one of the standards, the revision in effect at the time of bid opening shall apply.

B. American Society for Testing Materials (ASTM):
1. ASTM C33 – Gradation Requirements for Coarse Aggregates.
2. ASTM C602 Standard Specification for Agricultural Liming Materials.
3. ASTM D422 – Standard Test Method for Particle Size Analysis of Soils.
4. ASTM D698 – Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
5. ASTM D3385 – Standard Test Method for Infiltration Rate of Soils in Field Using Double-Ring Infiltrometer.
6. ASTM D4972 – Standard Test Method for pH of Soils.
7. ASTM D5298 – Standard Specification for Topsoil Used for Landscaping Purposes.
8. ASTM D7481 – Standard Test Methods for Determining Loose and Tapped Bulk Densities of Powders using a Graduated Cylinder.
9. ASTM F1632 – Standard Test Method for Particle Size Analysis and Sand Shape Grading of Golf Course Putting Green and Sports Field Rootzone Mixes.
10. ASTM F1647 – Standard Test Methods for Organic Matter Content of Athletic Field Rootzone Mixes.
11. ASTM F1815 – Standard Test Methods for Saturated Hydraulic Conductivity, Water Retention, Porosity, and Bulk Density of Athletic Field Rootzones.

C. Other Standards:
1. U.S. Department of Agriculture (USDA), Natural Resources Conservation Service, Soil Texture Calculator.
2. USDA, Natural Resources Conservation Service, 2003. National Soil Survey Handbook, title 430-VI, current edition.
3. USDA Soil Survey Laboratory Methods Manual, Soil Survey Investigations Report, current edition.
4. Environmental Protection Agency (EPA) Section 503 Regulations.
5. Department of Environmental Protection (DEP), Pennsylvania Bulletin, Management of Fill, Clean Fill Policy, current edition.
6. U.S. Composting Council (USCC), Test Methods for the Examination of Composting and Compost (TMECC), current edition.
7. USCC, Landscape Architecture / Design Specifications for Compost Use, Planting Bed Establishment with Compost.
8. Association of Official Analytical Chemists (AOAC), Official Methods of Analysis, current edition.
9. Soil Science Society of America (SSSA), Methods of Soil Analysis, current edition.

1.5 DEFINITIONS

A. Bulk Density: is an indicator of soil compaction calculated as the dry weight of soil by its volume typically expressed in g/cm3.

B. Coarse Sand: sharp natural or manufactured fine aggregate and further defined in this specification.

C. Compacted soil: soil where the density of the soil is greater that the threshold for root limiting, and further defined in this specification.

D. Compost: Well decomposed stable organic material as defined by the US Composting Council and further defined in this specification.

E. Planting Soil: Planting soil shall harvested from fields or development sites or manufactured uniformly mixed individual soil components (Topsoil, Sand, Compost) or existing mineral soil at the locations of proposed planting meeting the criteria specified herein.

F. Topsoil: Naturally produced and harvested soil from the A horizon or upper layers or the soil as further defined in this specification.

G. Salvaged Topsoil: Topsoil stripped from the Project Site and prepared for reuse at the Project Site.

1.6 SUBMITTALS

A. Submit a list of materials to be provided for work under this Section including the name and address of the materials producer and the location from which the materials are to be obtained.

B. Submit dated certificates or letters, signed by the materials producer, stating that materials meet or exceed the specified requirements.

C. For each type of manufactured product, submit data and certificates that the product meets the specification requirements, signed by the product manufacturer, and complying with testing requirements and referenced standards and specific requested testing.

D. Laboratory soil testing requirements:
   1. Samples of soil(s) to be submitted to an approved soil testing laboratory for testing in accordance with specifications herein. Submit the soil testing laboratory for review and approval prior to commencing with any soil testing.
   2. Test results shall be submitted to the Landscape Architect for approval in conjunction with soil amendment products in accordance with soil testing laboratory recommendations.
   3. Submit soil test reports including test results for each criteria listed within the Products section herein for:
      a. Individual Components for Soil Mixes: Topsoil, Compost and Sand.
      b. Soil Mixes Using Individual Components.
      c. Test reports for Individual Components and Soil Mixes must be submitted concurrently.
      d. The source of supply for Individual Components for Soil Mixes and Soil Mixes Using Individual Components must be indicated on the test report submittals.
   4. Test reports must be the same material to be supplied and must be current within the period of time defined as follows unless approved otherwise by the Landscape Architect:
      a. Topsoil: no more than 6 months old.
      b. Salvaged Topsoil: no more than 6 months old.
      c. Compost: no more than 3 months old.
      d. Sand: no more than 6 months old.
      e. Planting Soil: test data must be no more than 1 month old.
      f. Sample test results shall be considered valid until the time of construction and for the material supplied.
   5. If tests fail to meet the specifications, obtain other sources of material, retest and resubmit until accepted by the Landscape Architect.
   6. Soils shall not contain any traces of hydrocarbons, petroleum products, chemically prohibited substances, or any other elements considered to be toxic to any vegetation that is used. Clean fill certification shall be submitted by the manufacturer.
   7. All soil testing will be at the expense of the Contractor.

E. Physical samples:
   1. All samples must be submitted simultaneously with the laboratory test reports. Samples are required for the following:
      a. Salvaged Topsoil
      b. Manufactured Planting Soil
   2. Provide one (1) one-gallon sample in a resealable plastic bag to the Landscape Architect.

1.7 On-site verification soil testing requirements:

A. Landscape Architect may require Compaction Testing:
   1. Maintain an up-to-date written report of compaction test results. Test compaction every 12-inch lift of soil for every 300 square feet of soil installed for each planting area designated on the Drawings. The Landscape Architect may review the written report at any time to confirm conformance with the specification. Submit final report at the completion of soil installation.
   2. Maintain at the site at all times a soil cone penetrometer with pressure dial and a soil moisture meter to check soil compaction and soil moisture.
      a. Penetrometer shall be AgraTronix Soil Compaction Meter or approved equal.
      b. Moisture meter shall be “general digital soil moisture meter”.

B. Should any verification test results indicate soil material is not consistent with the approved submittals or requirements specified herein, the Contractor shall remove the installed soil and re-install soil at the Contractors expense until the Contract Document requirements are met.

1.8 Accompany each delivery of soil mixes, bulk materials, fertilizers and soil amendments provide the appropriate certificates and delivery tickets to the Landscape Architect. The soil supplier must be

indicated on delivery tickets for all soil mix deliveries and the supplier must match the approved submittals.

1.9 Quality Assurance

A. All materials, methods of construction, and workmanship shall conform to applicable requirements of ASTM, PTM, PennDOT Standard Specifications and AASHTO Standards, PADEP Clean Fill Guidance, unless otherwise specified.

B. Soil Testing Laboratory Qualifications: The laboratory shall be an independent laboratory, recognized by the State Department of Agriculture. The testing laboratory must have experience in performing agronomic testing including physical and chemical properties of soil. Tests shall be made in strict compliance with the standards of the Association of Official Analytical Chemists and follow standards from the NRCS Soils Manual and ASTM testing methods applicable to the specific tests requested. Laboratory shall have staff fully qualified to review test results, and to make recommendations to amend samples based on what is planned to grow in the soil. American Association for Laboratory Accreditation (A2LA) certification is preferred.
   1. Compost that participates in the US Composting Council's Seal of Testing Assurance (STA) Program and tested through an STA program lab, using appropriate test methods from the TMECC (Test Methods for the Examination of Compost and Composting) is preferred. Test data shall be presented on a Compost Technical Data Sheet.

C. Any fill or topsoil sources, disposal areas, or temporary offsite storage locations shall be subject to review and approval by the Landscape Architect and the University.

D. Installer Qualifications: The installer shall be a firm having at least five (5) years of experience of a scope similar to that required for the work.
   1. Installer Field Supervision: When any soil work is in progress, installer shall maintain, on-site, an experienced full-time supervisor.
   2. Installer's field supervisor shall have a minimum of five (5) years experience as a field supervisor installing soil, shall be trained and proficient in the use of field surveying equipment to establish grades.

1.10 Delivery, Storage, and Handling

A. Preparation, amendment, and mixing of soils shall be performed at the soil supplier location.

B. Weather: Do not mix, deliver, place or grade soils when frozen or with moisture above field capacity. Soils shall not be handled, hauled, placed, or compacted when wet or frozen. Soil shall only be handled when the moisture content is between the specified ranges in percent water by volume.

C. Protect soil and soil stockpiles, including the stockpiles at the soil blender's yard, from wind, rain and washing that can erode soil or separate fines and coarse material, and contamination by chemicals, dust and debris that may be detrimental to plants or soil drainage. Once spread, soils shall be protected with staked erosion control blankets.

D. All manufactured packaged products and material shall be delivered to the site in unopened containers and stored in a dry enclosed space suitable for the material and meeting all environmental regulations. Biological additives shall be protected from extreme cold and heat. All products shall be freshly manufactured and dated for the year in which the products are to be used.

E. Do not dump or store bulk materials near structures, utilities, walkways and pavements, or on existing turf areas or plants.

F. 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.

G. None of the soil materials shall be delivered to the site until sample certifications are approved by the Landscape Architect, however, such approval does not constitute final acceptance. Certification submittal shall include recommended soil amendment products if proposed to modify the soils. Any approval of soils made conditional upon utilizing one or more amendments shall be understood to afford to the Landscape Architect the right for further testing and refusal of materials that do not meet these Specifications.

PART 2 - PRODUCTS

2.1 Individual Components for Soil Mixes

A. Topsoil

1. Topsoil definition: Topsoil shall be a harvested from the Project Site or fields or development sites and shall be loose, friable mineral particles resulting from natural soil formation from the A, E and upper B horizons, or “solum” where most plant roots grow. Manufactured soils where sand, composted organic material, chemical additives or similar elements has been blended to meet the requirements of Topsoil is not acceptable. The soil shall be free of construction and trash debris, rocks, hydrocarbons, petroleum materials, herbicides, or other harmful contaminants that would impact plant growth.
   a. Topsoil shall comply with the following parameters:
      i) Organic matter (ASTM F1647, Method A): 1.5% minimum (by dry weight).
      ii) pH (1 soil : 1 water): 5.0 - 7.0.
   b. Stockpiled Existing Topsoil at the site meeting the above criteria may be acceptable.

B. Organic Amendment / Compost

1. Compost is as defined by the “US Composting Council Landscape Architecture / Design Specifications for Compost Use, Planting Bed Establishment with Compost”. Compost shall be a well decomposed, stable, weed free organic matter source. It shall be derived from: agricultural, food, or industrial residuals; leaf litter and yard trimmings; or source-separated waste. The product shall contain no substances toxic to plants and shall be reasonably free (< 1% by dry weight) of man-made foreign matter. The compost will possess no objectionable odors and shall not resemble the raw material from which it was derived.
2. Compost shall comply with the following parameters:
   a. pH: 6.0 - 8.0.
   b. Soluble salt content (electrical conductivity, 1 soil : 2 water): maximum 5 dS/m (mmhos/cm).
   c. Compost derived from stabilized mushroom soil compost may possess a maximum EC of 10 dS/m (1:2), if the maturity testing is a minimum of 95% and ammonia (NH4) content is a maximum of 250 ppm.
   d. Moisture content %, wet weight basis: 30 – 60.
   e. Organic Matter Content, % dry weight basis: 30 – 65.
   f. Particle size, dry weight basis: 98% pass through 1/2 inch screen.
   g. Stability carbon dioxide evolution rate: mg CO2-C/ g OM/ day ≤ 3.
   h. Maturity, seed emergence and seedling vigor, % relative to positive control: minimum 80%.
   i. Physical contaminants (inerts), %, dry weight basis: <0.5%.
   j. Chemical contaminants, mg/kg (ppm): meet or exceed US EPA Class A standard, 40CFR § 503.13, Tables 3 levels.

k. Biological contaminants select pathogens fecal coliform bacteria, or salmonella, meet or exceed US EPA Class A standard, 40 CFR § 503.32(a) level requirements.

C. Coarse Sand

1. Sharp natural or manufactured fine aggregate shall be hard and durable and free of limestone (calcareous sand), shale and slate particles and free of harmful contaminants that would impact plant growth complying with the following parameters:
   a. pH shall be lower than 7.0.
   b. Sieve analysis:

Sieve	Percent passing (by mass)
3/8 inch (9.5 mm)	100
No 4 (4.75 mm)	95-100
No 8 (2.36 mm)	80-100
No 16 (1.18 mm)	50-85
No 30 (.60 mm)	25-75
No 50 (.30 mm)	5-40
No 100 (.15 mm)	2-20
No 200 (0.75 mm)	2-15

   c. Particle analysis must be per USDA classification, Sand.
      Sand (2 - 0.05 mm): ≥88%
      Silt (0.05 - 0.002 mm): ≤9%
      Clay (< 0.002 mm): ≤3%

D. Chemical Amendments

1. Lime, ASTM C 602, agricultural limestone containing a minimum 80 percent calcium carbonate equivalent and as follows:
   a. Class: Class T, with a minimum 99 percent passing through No. 8 sieve and a minimum 75 percent passing through No. 60 sieve.
   b. Provide lime in form of dolomitic limestone.

2.2 Soil Mixes Using Individual Components

A. Definition

1. Manufactured uniformly mixed individual soil components (Salvaged Topsoil, Topsoil, Sand, Compost) meeting the criteria specified herein. Provide Soils at the locations indicated on the Drawings complying with the following parameters.

B. Planting Soil, Plant Beds

1. Planting soil shall be manufactured from uniformly mixed individual soil components (Salvaged Topsoil, Sand, Compost) or existing mineral soil at the locations of proposed planting meeting the criteria specified herein.
2. Provide Planting Soil at the locations indicated on the Drawings complying with the following parameters:
   a. Particle analysis must be per USDA classification for loam, sandy loam, sandy clay loam, or silt loam within the following parameters using ASTM D422:
      Sand: 45 - 55%
      Silt: no more than 30%
      Clay: no more than 20%
      Gravel content larger than 2mm shall be less than 12%.

b. pH (1 soil : 1 water): 6.0 - 7.2.
c. Organic matter (ASTM F1647, Method A): 3 - 6% (by dry weight).
d. Hydraulic conductivity (ASTM F1815) at 85% Proctor (ASTM D698): 1.0 in/hr +/- 0.5 in/hr
e. Soluble salt content (electrical conductivity, 1 soil : 2 water): maximum 1.60 mmho/cm. Sodium (Na) salinity shall not exceed 700 ppm.
f. Cation Exchange Capacity (CEC): >15 meq/100g.
g. Nutrient analysis including macronutrients and micronutrients (Mehlich-3) with soil fertility interpretation and recommendations relevant to the specified plant species.
h. Compost shall not be added at more than 30% by volume.

C. Erosion Control Mat
1. Straw Blanket
a. For use on 4:1 to 3:1 slopes with moderate runoff conditions: utilize ECS-1 Single Net Straw Rolled Erosion Control Blanket, East Coast Erosion Blankets, 443 Bricker Road, Bernville, PA 19506, 800-582-4005, www.erosionblankets.com, or approved equal.
b. Matting containing non-degradable plastic mesh is prohibited.
2. Straw Mulch:
a. For use on slopes less than or equal 4:1 with minimal runoff conditions: utilize mildew-free and seed-free salt hay with a nonasphaltic liquid tackifier.

D. Amendments

1. At the time of final grading, add fertilizer if required to the Planting Soil at rates recommended by the testing results for the species of plants to be grown.

PART 3 - EXECUTION

3.1 SITE EXAMINATION

A. Prior to installation of soil, examine site to confirm that existing conditions are satisfactory for the work of this section to proceed. The Landscape Architect shall approve the condition of the subgrade and the previously installed subgrade preparation and the installation of subsurface drainage.

1. Confirm that the subgrade is at the proper elevation and compacted as required. Subgrade elevations shall slope toward the under drain lines as shown on the Drawings.
a. Subgrade definition: surface or elevation of subsoil remaining after completing excavation, or top surface of a fill or backfill, before placing Planting Soil.
2. Confirm that all surface areas to be filled with Soil are free of construction debris, refuse, compressible or biodegradable materials, stones greater than 2 inches diameter, soil crusting films of silt or clay that reduces or stops drainage from the Soil into the subsoil; and/or standing water. Remove unsuitable material from the site.
a. Debris definition: Elements including, but not limited to, concrete, concrete masonry, wood, excavated rock and rock fragments, rubble, overburden soils, abandoned utility structures, trash, refuse and litter.
3. Confirm that no adverse drainage conditions are present.
4. Confirm that no conditions are present which are detrimental to plant growth.

B. If unsatisfactory conditions are encountered, notify the Landscape Architect immediately to determine corrective action before proceeding.

3.2 SOIL INSTALLATION

A. All equipment utilized to install or grade Soils shall be wide track or balloon tire machines rated with a ground pressure of 4 psi or less. All grading and soil delivery equipment shall have buckets equipped with 6 inch long teeth to scarify any soil that becomes compacted.

B. In areas of soil installation above existing subsoil, scarify the subgrade material prior to installing Soil.

1. Scarify the subsoil of the subgrade to a depth of 3 – 6 inches with the teeth of the back hoe or loader bucket, tiller or other suitable device.
2. Immediately install the Planting Soil. Protect the loosened area from traffic. DO NOT allow the loosened subgrade to become compacted.
3. In the event that the loosened area becomes overly compacted, loosen the area again prior to installing the Planting Soil.

C. Install the Planting Soil in 6 inch lifts to the required depths. Minimum depth of planting soil in plant beds is 12 inches or as shown on the Drawings.

1. Apply compacting forces to each lift as required to attain the required compaction. Scarify the top of each lift prior to adding more Planting Soil by dragging the teeth of a loader bucket or backhoe across the soil surface to roughen the surface.
2. Approved compaction equipment includes a smooth drum roller or plate compactor. Typically one to three passes per lift will achieve the desired compaction. Contractor to test desired compaction methodology with actual soil to be installed to confirm installation method and material properties are compatible and will achieve the specified compaction rates.
3. Provide adequate equipment to achieve consistent and uniform compaction of the Soils. Use the smallest equipment that can reasonably perform the task of spreading and compaction. Use the same equipment and methods of compaction for the entire project area once soil, installation methodology, and compaction critieria have been coordinated and confirmed.

D. Do not pass motorized equipment over previously installed and compacted soil except as authorized below.

1. Light weight equipment such as trenching machines or motorized wheel barrows is permitted to pass over finished soil work.
2. If work after the installation and compaction of soil compacts the soil to levels greater than the above requirements, follow the requirements of Over Compaction Reduction herein.

E. Phase work such that equipment to deliver or grade soil does not have to operate over previously installed Planting Soil. Work in rows of lifts the width of the extension of the bucket on the loader. Install all lifts in one row before proceeding to the next. Work out from the furthest part of each bed from the soil delivery point to the edge of each bed area.

F. Where travel over installed soil is unavoidable, limit paths of traffic to reduce the impact of compaction in Planting Soil. Each time equipment passes over the installed soil it shall reverse out of the area along the same path with the teeth of the bucket dropped to scarify the soil. Comply with Over Compaction Reduction herein in the event that soil becomes over compacted. Access over finished grade soils shall be restricted. If access is required across placed soils, Contractor shall be required to rework compacted soil areas prior to fine grading to the full depth of the placed soils as directed by the Landscape Architect.

G. The depths and grades shown on the Drawings are the final grades after settlement and shrinkage of the compost material. The Contractor shall install the Planting Soil at a higher level to anticipate this reduction of Soil volume. A minimum settlement of approximately 10 - 15% of the soil depth is expected. All grade increases are assumed to be as measured prior to addition of surface Compost till layer, or mulch.

H. Maintain moisture conditions within the Soil during installation or modification to allow for satisfactory compaction.

1. Volumetric soil moisture level during installation shall be above permanent wilt point and below field capacity for each type of soil texture within the following ranges.

Soil texture	Permanent wilting point	Field capacity
Sand, Loamy sand, Sandy loam	5-8%	12-18%
Loam, Sandy clay, Sandy clay loam	14-25%	27-36%
Clay loam, Silt loam	11-22%	31-36%
Silty clay, Silty clay loam	22-27%	38-41%

2. The Contractor shall confirm the soil moisture levels with a moisture meter (Digital Soil Moisture Meter, DSMM500 by General Specialty Tools and Instruments, or approved equivalent). Suspend operations if the Soil becomes wet. Apply water if the soil is overly dry.

I. Installing Planting Soil with soil or mulch blowers or soil slingers is not permitted.

3.3 SOIL COMPACTION REQUIREMENTS FOR PLANT BEDS AND LAWN

A. The following are threshold levels of compaction as determined by each method for the subsoil surface and full profile of Planting Soil, testing each lift of Soil with a penetrometer. The same penetrometer and moisture meter shall be used to test installed soil throughout the work.

1. Acceptable Compaction
   a. Standard Proctor Method – 75-85%.
   b. Penetration Resistance Method – about 75-250 psi.
   c. Soil below 75 psi soil becomes increasingly unstable and will settle excessively.
2. Unacceptable Compaction
   a. Standard Proctor Method – Above 85%.
   b. Penetration Resistance Method – Approximately above 300 psi
3. Prior to testing the soil with the penetrometer check the soil moisture. Penetrometer readings are impacted by soil moisture and excessively wet or dry soils will read significantly lower or higher than soils at optimum moisture.
4. The penetrometer readings shall be within 20% plus or minus of the specified levels.
5. Where the Standard Proctor Method is utilized, the following Bulk Density levels based on 75% minimum and 85% maximum standard Proctor indicate acceptable compaction.

Soil Texture	Bulk Density (g/cm^3)	
	Max.	Min.
Loamy Sand	1.80	1.65
Sandy Loam	1.65	1.45
Sandy Clay Loam	1.55	1.35
Loam	1.50	1.30
Silt Loam	1.45	1.25

3.4 OVER COMPACTION REDUCTION

A. Compacted soil: soil where the density of the soil, at each lift for the full profile, is greater that the threshold for root limiting, and further defined in this specification.

B. Any soil that becomes compacted to a density greater than the specified density shall be dug up and reinstalled. This requirement includes compaction caused by other sub-contractors after the Planting Soil is installed and approved.

C. Surface roto tilling shall not be considered adequate to reduce over compaction at levels 6 inches or greater below finished grade.

3.5 INSTALLATION OF CHEMICAL ADDITIVES

A. Following the installation of each soil and prior to fine grading and installation of the Compost till layer, apply chemical additives as recommended by the soil test, and appropriate to the soil and specific plants to be installed.

B. Types, application rates and methods of application shall be approved by the Landscape Architect prior to any applications.

3.6 FINE GRADING

A. Fine grading: The final grading of the soil to achieve exact contours and positive drainage, often accomplished by hand rakes or drag rakes other suitable devices, and further defined in this specification, and further defined in this specification.

B. The Landscape Architect shall approve all rough grading prior to the installation of Compost, fine grading

C. Grade the finish surface of all planted areas to meet the grades shown on the Drawings, allowing the finished grades to remain higher than the grades on the grading plan, as defined in paragraph Soil Installation, to anticipate settlement over the first year.

D. Utilize hand equipment, small garden tractors with rakes, or small garden tractors with buckets with teeth for fine grading to keep surface rough without further compaction. Do not use the flat bottom of a loader bucket to fine grade, as it will cause the finished grade to become overly smooth and or slightly compressed.

E. Provide for positive drainage from all areas toward the existing inlets, drainage structures and or the edges of planting beds. Adjust grades as directed to reflect actual constructed field conditions of paving, wall and inlet elevations. Notify the Landscape Architect in the event that conditions make it impossible to achieve positive drainage.

F. Provide smooth, rounded transitions between slopes of different gradients and direction. Modify the grade so that the finish grade before adding mulch and after settlement is one or two inches below all paving surfaces or as directed by the Drawings.

3.7 INSTALLATION OF IN-SITU COMPOST AMENDMENT

A. After Planting Soil is installed in planting bed areas, spread 2 – 3 inches of Compost over the beds and roto till into the top 4 - 6 inches of the Planting Soil. This step will raise grades slightly above the grades required in Fine Grading herein. This specification anticipates that the raise in grade due to

this tilling will settle within a few months after installation as Compost breaks down. Additional settlement as defined in paragraph “Soil Installation” must still be accounted for in the setting of final grades.

B. Soil Tilling: Loosening the surface of the soil to the depths specified with a rotary tine tilling machine, roto tiller, (or spade tiller), and further defined in this specification.

3.8 PROTECTION

A. Protect areas of in-place soil from additional compaction, disturbance, and contamination. Prohibit the following practices within these areas except as required to perform planting operations:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Vehicle traffic.
4. Foot traffic.
5. Erection of sheds or structures.
6. Impoundment of water.
7. Excavation or other digging unless otherwise indicated.

B. If planting soil or subgrade is overcompacted, disturbed, or contaminated by foreign or deleterious materials or liquids, remove the planting soil and contamination; restore the subgrade as directed by the Landscape Architect and replace contaminated planting soil with new planting soil.

3.9 CLEANING

A. Protect areas adjacent to planting-soil preparation and placement areas from contamination. Keep adjacent paving and construction clean and work area in an orderly condition.

B. Remove surplus soil and waste material including excess subsoil, unsuitable materials, trash, and debris and legally dispose of them off Owner's property unless otherwise indicated.

END OF SECTION

SECTION 329300 – PLANTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Plants.
2. Nursery visits and plant selection.
3. Tree stabilization.
4. Maintenance and warranty.

B. Related Sections:

1. Division 32 Section “Soil Preparation”.
2. Division 32 Section “Lawn”.

1.3 SUSTAINABILITY REQUIREMENTS

A. LEED 2009 Core & Shell:

1. Recycled content.
2. Regional materials.

1.4 REFERENCES

A. ASNS: “American Standard for Nursery Stock,” latest edition, published by the American Nursery and Landscape Association.

B. NAA: “National Arborist Association Standards for Pruning”, latest edition, published by the National Arborist Association.

C. ANSI: “American National Standards Institute”, latest edition.

1.5 DEFINITIONS

A. Balled and Burlapped Stock: Plants dug with firm, natural balls of earth in which they were grown, with ball size not less than diameter and depth recommended by ANSI Z60.1 for type and size of plant required; wrapped with burlap, tied, rigidly supported, and drum laced with twine with the root flare visible at the surface of the ball as recommended by ANSI Z60.1.

B. 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.

C. Finish Grade: Elevation of finished surface of 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. Caliper: Diameter of a trunk as measured by a diameter tape at a height 6 inches above the root flair for trees up to, and including, 4-inch size at this height; and as measured at a height of 12 inches above the root flair for trees larger than 4-inch size.

G. Root-Ball Depth: Measured from bottom of trunk flare to the bottom of root ball.

H. Root-Ball Width: Measured horizontally across the root ball with an approximately circular form or the least dimension for non-round root balls, not necessarily centered on the tree trunk, but within tolerance according to ANSI Z60.1.

I. 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.

J. Stem Girdling Roots: Roots that encircle the stems (trunks) of trees below the soil surface.

1.6 PRE-INSTALLATION MEETINGS

A. Pre-installation Conference: Conduct conference at Project site. Review methods and procedures related to transplanting, plant installation, and coordination including, but are not limited to, the following:

1. Construction schedule. Verify availability of materials, personnel, equipment, and unimpeded access needed to make progress and avoid delays.
2. Tree and plant protection.
3. Tree maintenance.
4. Arborist or horticulturist responsibilities.

1.7 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Plant Materials: Include quantities, sizes, quality, and sources for plant materials.

B. Samples for Verification: For each of the following:

1. Mulch: 1-gallon re-sealable plastic bag of each mulch type required; labeled with composition of materials and source of mulch. Each Sample shall be typical of the lot of material to be furnished; provide an accurate representation of color, texture, and organic makeup.

C. Qualification Data: For qualified landscape Installer. Include list of similar projects completed by Installer demonstrating Installer's capabilities and experience. Include project names, addresses, and year completed, and include names and addresses of owners' contact persons.

D. Product Certificates: For each type of manufactured product, from manufacturer, and complying with the following:

1. Manufacturer's certified analysis of standard products.
2. Analysis of other materials by a recognized laboratory made according to methods established by the Association of Official Analytical Chemists, where applicable.

E. Maintenance Instructions: Recommended procedures to be established by Owner for maintenance of plants during a calendar year. Submit before start of required maintenance periods.

F. Warranty: Sample of special warranty.

G. Existing Conditions: Documentation of existing plants indicated to be transplanted, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

1. Use sufficiently detailed color photographs or video recordings. Color shall accurately depict hue condition of foliage and bark.
2. Include drawings and notations to indicate specific wounds and damage conditions of each plant designated to be transplanted.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: A qualified landscape Installer whose work has resulted in successful establishment of plants.

1. Experience: Five (5) years' experience in landscape installation in project of similar complexity.
2. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when work is in progress.
3. Pesticide Applicator: State licensed, commercial.

B. Measurements: Measure according to ANSI Z60.1. Do not prune to obtain required sizes.

1. Trees: Measure with branches and trunks in their normal position. Take height measurements from or near the top of the root flare for field-grown stock and container grown stock. Measure main body of tree for height and spread. Take caliper measurements 6 inches above the root flare for trees up to 4-inch caliper size, and 12 inches above the root flare for larger sizes.
2. Other Plants: Measure with stems, petioles, and foliage in their normal position.

C. Tree Tagging and Nursery Visits: Landscape Architect and Owner, with Contractor present will select plant material at nursery. Trees must be field grown and in-the-ground at time of selection. Representative samples for shrubs and herbaceous plants will be observed and selected at the nursery and serve as the basis of review and additional plants delivered to the site. The Contractor shall source specified plants and coordinate nursery visits.

1. Plants shall be selected from a nursery supply that is at least three times the quantity specified.
2. Tree selection shall occur at least two (2) months prior to delivery to site. Caliper size at time of planting shall meet specified size unless otherwise approved by Owner.

D. Pre-installation Conference: Conduct conference at Project site.

E. 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 in such a manner as to destroy their natural shape.

F. Plant Material Observation: Landscape Architect or Owner 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. Owner 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 delivery of planting materials seven (7) business days in advance of delivery to site.

G. Completely cover foliage when transporting trees while they are in foliage.

H. Handle plants by root ball. Do not drop plants.

I. Move plants after preparations for planting have been completed and install immediately. If planting is delayed more than six hours after moving, set plants in their appropriate aspect (sun, filtered sun, or shade), protect from weather and mechanical damage, and keep roots moist.

1. Heal in, ball and burlap, or pot plants as required if transplant location is not immediately available due to sequencing of construction.

1.9 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.

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. Store bulbs, corms, and tubers in a dry place at 60 to 65 deg F until planting.

F. 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. Set balled stock on ground and cover ball with mulch or other acceptable material.
2. Do not remove container-grown stock from containers before time of planting.
3. 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.

G. Immediately remove rejected plants from site.

1.10 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. Planting Restrictions: Plant during the following periods as specified weather permitting. Coordinate planting periods with maintenance periods to provide required maintenance from date of Planting Completion. Do not work soil when muddy or excessively wet or frozen.

1. Spring Planting: March 1 through June 15.
2. Fall Planting: September 15 through October 15.
3. Plant trees know to be fall hazards only in the Spring.

C. 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.

D. Coordination with 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.

1.11 WARRANTY

A. Warranty: Installer agrees to repair or replace plantings and accessories that fail in materials, workmanship, or growth within specified warranty period. Failures include, but are not limited to, the following:

1. 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.
2. Structural failures including plantings falling or blowing over.
3. Faulty performance of tree stabilization.
4. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

B. Warranty Periods from Date of Planting Completion:

1. Trees: Twenty-four (24) months.
2. Shrubs, Ground Covers, Perennials, Ornamental Grasses, Bulbs and Other Plants: Twelve (12) months.
3. Annuals: Three (3) months.

C. Include the following remedial actions as a minimum:

1. Immediately remove dead plants and replace unless required to plant in the succeeding planting season.
2. Replace plants that are more than 25 percent dead or in an unhealthy condition at end of warranty period.
3. A limit of one replacement of each plant will be required, except for losses or replacements due to failure to comply with requirements.
4. Provide extended warranty for period equal to original warranty period, for replaced plant material upon initial replacement. The warranty shall terminate upon successive replacement.

1.12 MAINTENANCE SERVICE

A. Initial Maintenance Service for Ground Cover and Other Plants: 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.

1. Maintenance Period: Six (6) months from date of Planting Completion.

PART 2 - PRODUCTS

2.1 PLANT MATERIAL

A. General: Furnish nursery-grown plants true to genus, species, variety, cultivar, stem form, shearing, and other features indicated in Plant Schedule or Plant Legend shown on Drawings and complying with ANSI Z60.1; and with healthy root systems developed by transplanting or root pruning. Provide well-shaped, fully branched, healthy, vigorous stock, densely foliated when in leaf and free of disease, pests, eggs, larvae, and defects such as knots, sun scald, injuries, abrasions, and disfigurement.

1. Trees with damaged, crooked, or multiple leaders; tight vertical branches where bark is squeezed between two branches or between branch and trunk ("included bark"); crossing trunks; cut-off limbs more than 1 inch in diameter; or with stem girdling roots will be rejected.
2. Collected Stock: Do not use plants harvested from the wild, from native stands, from an established landscape planting, or not grown in a nursery unless otherwise indicated.

B. Provide plants of sizes, grades, and ball or container sizes complying with ANSI Z60.1 for types and form of plants required. Plants of a larger size may be used if acceptable to Owner, with a proportionate increase in size of roots or balls.

C. Root-Ball Depth: Furnish trees and shrubs with root balls measured from top of root ball, which shall begin at root flare according to ANSI Z60.1. Root flare shall be visible before planting.

D. Labeling: Label each plant of each variety, size, and caliper with a securely attached, waterproof tag bearing legible designation of common name and full scientific name, including genus and species. Include nomenclature for hybrid, variety, or cultivar, if applicable for the plant as shown on Drawings.

2.2 MULCHES

A. Organic Mulch: Free from deleterious materials and suitable as a top dressing of trees and shrubs, consisting of one of the following:

1. Type: Triple-ground bark.
2. Size Range: 3 inches maximum, 1/2 inch minimum.
3. Color: Natural. Dyed mulch is prohibited.

B. Erosion Control

1. Products: Subject to compliance with requirements, available products that may be incorporated into the Work include the following short-term 100% biodegradable products, or approved comparable product:

2. Erosion Control Blanket:
   a. American Excelsior Company, 850 Avenue H East, Arlington, TX 76011, 800-777-7645, www.americanecelsior.com.
      i) Curlex NetFree for slopes 6:1 to 3:1.
      ii) Curlex I FibreNet for slopes 3:1 to 2:1.
   b. North American Green, 5401 St. Wendel-Cynthiana Road, Poseyville, IN 47633, 800-772-2040, www.nagreen.com.
      i) BioNet S75BN for slopes 6:1 to 3:1.
      ii) BioNet S150BN for slopes 3:1 to 2:1.
   c. Nedia Enterprises, Inc., 22187 Vantage Pointe Place, Ashburn, VA 20148, 888-725-6999, www.nedia.com.
      i) S300B for slopes 6:1 to 3:1.
      ii) S400B for slopes 3:1 to 2:1.

3. Fasteners for securing Erosion Control Blanket:
   a. American Excelsior Company, 850 Avenue H East, Arlington, TX 76011, 800-777-7645, www.americanecelsior.com.
      i) E-staple fastener, 6-inch.
   b. North American Green, 5401 St. Wendel-Cynthiana Road, Poseyville, IN 47633, 800-772-2040, www.nagreen.com.
      i) BioStake fastener, 6-inch.

2.3 PESTICIDES

A. General: Pesticide registered and approved by EPA, acceptable to authorities having jurisdiction, and of type recommended by manufacturer for each specific problem and as required for Project conditions and application. Do not use restricted pesticides unless authorized in writing by authorities having jurisdiction.

B. Pre-Emergent and Post-Emergent Herbicides (Selective and Non-Selective) shall only be used with written authorization by the Owner.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas to receive plants for compliance with requirements and conditions affecting installation and performance.

1. Verify that no foreign or deleterious material or liquid such as paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, or acid has been deposited in soil within a planting area.
2. Do not mix or place soils and soil amendments in frozen, wet, or muddy conditions.
3. Suspend soil spreading, grading, and tilling operations during periods of excessive soil moisture until the moisture content reaches acceptable levels to attain the required results.
4. Uniformly moisten excessively dry soil that is not workable and which is too dusty.

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

C. If contamination by foreign or deleterious material or liquid is present in soil within a planting area, remove the soil and contamination as directed by Owner and replace with new planting soil.

3.2 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities and turf areas and existing plants from damage caused by planting operations.

B. Install erosion-control measures to prevent erosion or displacement of soils and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways.

C. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Owner's acceptance of layout before excavating or planting. Make minor adjustments as required.

D. Wrap trees and shrubs with burlap fabric over trunks, branches, stems, twigs, and foliage to protect from wind and other damage during digging, handling, and transportation.

E. Lay out individual transplant locations and areas for multiple plantings. Stake locations, outline areas, adjust locations when requested, and obtain Owner's acceptance of layout before transplanting. Make minor adjustments as required.

3.3 PLANTING AREA ESTABLISHMENT

A. Finish Grading: Grade planting areas to a smooth, uniform surface plane with loose, uniformly fine texture. Roll and rake, remove ridges, and fill depressions to meet finish grades.

B. Before planting, obtain Owner's acceptance of finish grading; restore planting areas if eroded or otherwise disturbed after finish grading.

3.4 EXCAVATION FOR TREES

A. Planting Pits and Trenches: Install in accordance with the Drawings. Excavate circular planting pits with sides sloping inward at a 45-degree angle. Excavations with vertical sides are not acceptable. Scarify sides of planting pit smeared or smoothed during excavation.

1. Do not excavate deeper than depth of the root ball, measured from the root flare to the bottom of the root ball.
2. If area under the plant was initially dug too deep, add soil to raise it to the correct level and tamp the added soil to prevent settling.
3. Maintain required angles of repose of adjacent materials as shown on the Drawings. Do not excavate subgrades of adjacent paving, structures, hardscapes, or other new or existing improvements.
4. Maintain supervision of excavations during working hours.
5. Keep excavations covered or otherwise protected when unattended by Installer's personnel.

B. Obstructions: Notify Owner if unexpected rock or obstructions detrimental to trees or shrubs are encountered in excavations.

C. Drainage: Notify Owner if subsoil conditions evidence unexpected water seepage or retention in tree or shrub planting pits.

3.5 TREE AND SHRUB PLANTING

A. Before planting, verify that root flare is visible at top of root ball according to ANSI Z60.1. If root flare is not visible, remove soil in a level manner from the root ball to where the top-most root emerges from the trunk. After soil removal to expose the root flare, verify that root ball still meets size requirements.

B. Remove stem girdling roots and kinked roots. Remove injured roots by cutting cleanly; do not break.

C. Set balled and burlapped stock plumb and in center of planting pit or trench with root flare above adjacent finish grades per Drawings.

1. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. When planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
2. Continue backfilling process. Water again after placing and tamping final layer of soil.

D. Set container-grown stock plumb and in center of planting pit or trench with root flare above adjacent finish grades per Drawings.

1. Carefully remove root ball from container without damaging root ball or plant.
2. Backfill around root ball in layers, tamping to settle soil and eliminate voids and air pockets. For large shrubs, when planting pit is approximately one-half filled, water thoroughly before placing remainder of backfill. Repeat watering until no more water is absorbed.
3. Continue backfilling process. Water again after placing and tamping final layer of soil.

E. When planting on slopes, set the plant so the root flare on the uphill side is flush with the surrounding soil on the slope; the edge of the root ball on the downhill side will be above the surrounding soil. Apply enough soil to cover the downhill side of the root ball.

3.6 TREE AND SHRUB PRUNING

A. Remove only dead, dying, or broken branches. Do not prune for shape.

B. Prune, thin, and shape trees and shrubs only as directed by Owner.

C. Do not apply pruning paint to wounds.

3.7 GROUND COVER AND HERBACEOUS PLANTING

A. Set out and space ground cover and herbaceous plants other than trees and shrubs as indicated in even rows with triangular spacing unless indicated otherwise on the Drawings.

B. Work soil around roots to eliminate air pockets.

C. Water thoroughly after planting, taking care not to cover plant crowns with wet soil.

3.8 PLANTING AREA MULCHING

A. Mulch backfilled surfaces of planting areas and other areas indicated.

1. Trees in Lawn Areas: Apply organic mulch ring to thickness indicated, in radius per Drawings around trunks.
2. Organic Mulch in Plant Bed Areas: Apply thickness indicated of organic mulch over whole surface of planting area, and finish level with adjacent finish grades.

3.9 PLANT MAINTENANCE

A. Maintain plantings by watering, weeding, mulching, restoring planting saucers, adjusting and repairing tree-stabilization devices, resetting to proper grades or vertical position, and performing other operations as required to establish healthy, viable plantings.

B. Fill in as necessary soil subsidence that may occur because of settling or other processes. Replace mulch materials damaged or lost in areas of subsidence.

C. Apply treatments as required to keep plant materials, planted areas, and soils free of pests and pathogens or disease. Use integrated past management practices whenever possible to minimize the use of pesticides and reduce hazards. Treatments include physical controls such as hosing off foliage, mechanical controls such as traps, and biological control agents.

3.10 PESTICIDE APPLICATION

A. Apply pesticides and other chemical products and biological control agents in accordance with requirements of authorities having jurisdiction and manufacturer's written recommendations. Coordinate applications with Owner's operations and others in proximity to the Work. Obtain Owner approval before application is performed.

B. Post-Emergent Herbicides (Selective and Non-Selective): Apply only as necessary to treat already-germinated weeds and in accordance with manufacturer's written recommendations.

C. Notification signage must be posted at every entrance in a highly visible location at least five (5) days in advance of application and maintained five (5) business days following application, or as recommended by the manufacturers instructions, whereby it is then removed from the site.

1. Notification Signage shall be brightly colored, laminated and at least 8.5” by 11” format including the following information:
   a. Date of Notification.
   b. Date of Application.
   c. Name of Chemical.
   d. Reason for Chemical Application.
   e. Information informing as to the precautions that must be taken including humans and pets.

3.11 CLEANUP AND PROTECTION

A. Do not allow soil and debris created by turf work onto permeable unit paving areas. Promptly clean up any soil or debris on impervious paving areas, such as concrete sidewalk or roadway paving. Clean wheels of vehicles before leaving site to avoid tracking soil onto roads, walks, or other paved areas.

B. Protect plants from damage due to landscape operations and operations of other contractors and trades. Maintain protection during installation and maintenance periods. Treat, repair, or replace damaged plantings.

C. After installation and before Planting Completion, remove nursery tags, nursery stakes, tie tape, labels, wire, burlap, and other debris from plant material, planting areas, and Project site.

3.12 DISPOSAL

A. Remove surplus soil and waste material including excess subsoil, unsuitable soil, trash, and debris and legally dispose of them off Owner's property.

END OF SECTION

SECTION 331416 - SITE WATER UTILITY DISTRIBUTION PIPING

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. This Section includes water-distribution piping and related appurtenances for site work to be picked up by the general site contractor 5’ from the face of all buildings.

B. All work shall conform to the requirements of Philadelphia Water, Philadelphia Fire Marshall, and any other regulatory authorities having jurisdiction.

C. All water main work and water service connections under this contract shall be governed by and done in accordance with the most recent revision or amendment to the Standard Specifications and Standard Details of the Philadelphia Water Department.

D. All work on water service connections shall be done by, or under the direction of, a licensed Master Plumber.

E. Section Includes:
   1. Pipe and fittings for Site water line, including domestic water line and fire water line.
   2. Tapping sleeves and valves.
   3. Valves and boxes.
   4. Fire hydrants and yard hydrants.
   5. Reduced-pressure backflow preventers.
   6. Pipe support systems.
   7. Bedding and cover materials.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

B. Related Requirements:
   1. Section 033053 – Site Cast-in-Place Concrete: Concrete for thrust restraints.
   2. Section 310000 – Earthwork.
   3. Section 312316.13 – Trenching: Execution requirements for trenching.
   4. Section 331419 – Valves and Hydrants for Water Utility Service.

1.3 REFERENCES

A. Philadelphia Water Department (PWD)
   1. Standard Details
   2. Standard Specifications

B. Factory Mutual (FM)
   1. Approval Guide

C. Underwriters Laboratories (UL)
1. Fire Protection Equipment Directory
2. UL 1285 - Pipe and Couplings, Polyvinyl Chloride (PVC), for Underground Fire Service
3. UL 262 - Gate Valves for Fire-Protection Service
4. UL 246 - Hydrants for Fire-Protection Service

D. National Sanitation Foundation (NSF)
1. NSF 14 - Plastics Piping System Components and Related Materials
2. NSF 61 - Drinking Water System Components - Health Effects

E. National Fire Protection Association (NFPA)
1. NFPA 70 - National Electrical Code
2. NFPA 24 - Hydraulic Fluid Power Systems - Methods to Improve Sealing Reliability (new standard)
3. NFPA 1963 - Screw Threads and Gaskets for Fire Hose Connections (revision of ANSI/NFPA 1963-1993)

F. American Water Works Association (AWWA)
1. C151 Ductile-Iron Pipe, Centrifugally Cast, for Water (revision of ANSI/AWWA C151/A21.51-91)
2. C104 - Cement-Mortar Lining for Ductile-Iron Pipe and Fittings for Water
3. C150 - Thickness Design of Ductile-Iron Pipe
4. C110 - Ductile-Iron and Gray-Iron Fittings, 3 in through 48 in (75 mm through 1200 mm), for Water and Other Liquids
5. C153 - Ductile-Iron Compact Fittings, 3 in. through 24 in. (76 mm Through 610 mm) and 54 in. through 64 in. (1,400 mm Through 1,600 mm), for Water Service
6. C900 - Polyvinyl Chloride (PVC) Pressure Pipe, 4 Inch through 12 Inch for Water Distribution
7. C500 - Gate Valves for Water and Sewage Systems
8. C111 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings
9. C550 - Protective Epoxy Interior Coatings for Valves and Hydrants
10. C509 - Resilient-Seated Gate Valves for Water Supply Service
11. C800 - Underground Service Line Valves and Fittings
12. C702 - Cold Water Meters - Compound Type
13. C502 - Hydrants, Dry Barrel Fire
14. C600 - Installation of Ductile-Iron Water Mains and Their Appurtenances
15. C605 - Water Treatment - Underground Installation of Polyvinyl Chloride PVC Pressure Pipe and Fittings for Water
16. C651 - Disinfecting Water Mains

G. American Society for Testing and Materials (ASTM)
1. B88 - Standard Specification for Seamless Copper Water Tube
2. B813 - Standard Specification for Liquid and Paste Fluxes for Soldering Applications of Copper and Copper Alloy Tube
3. B32 - Standard Specification for Solder Metal
4. D2241 - Standard Specification for Poly(Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series)
5. D3139 - Standard Specification for Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
6. F645 - Standard Guide for Selection, Design, and Installation of Thermoplastic Water Pressure Piping Systems

H. American Society of Mechanical Engineers (ASME)

1. B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings R(1994)
2. B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings

I. Manufacturer’s Standardization Society (MSS)

1.4 SUBMITTALS

A. Product Data for the following:
   1. Valves, Corporation Stops, Curb Boxes, Curb Stops, Valve Boxes
   2. Backflow preventers and assemblies, including enclosure
   3. Meter Pits
   4. Fire Hydrants

B. Wiring Diagrams: Power, signal, and control wiring.
C. Field quality-control test reports.
D. Operation and Maintenance Data for the following:
   1. Valves;
   2. Backflow preventers;
   3. Protective enclosures; and,

1.5 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with requirements of the regulatory authorities having jurisdiction; including tapping of water mains, backflow prevention, installation, testing, and disinfection. Comply with standards of the regulatory authorities having jurisdiction for fire-suppression water-service piping, including materials, hose threads, installation, and testing.
B. Piping materials shall bear label, stamp, or other markings of specified testing agency.
C. Electrical Components, Devices, and Accessories: UL listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to the regulatory authorities having jurisdiction and marked for intended use.
D. Comply with FM's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
E. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
F. NSF Compliance: Comply with NSF 14 for plastic potable-water-service piping. Comply with NSF 61 for materials for water-service piping and specialties for domestic water.
G. Suppliers of materials must be pre-qualified in accordance with Water Department Quality Certification Standards QC-1 for Precast Concrete Products, QC-2 for Gray/Ductile Iron Castings, QC-3 for Ready-Mixed Concrete, QC-4 for Welded Steel Inlet Frames and Grates, QC-5 for Standard Pressure Fire Hydrants, QC-6 for Reinforced Concrete Pipe, QC-7 for Filter Media Products, QC-8 for Ductile Iron Pipe and Fittings, QC-9 for Vitrified Clay Pipe and Fittings, QC-10 for Standard Pressure Gate valves (3” to 12”) & (16” & Larger), QC-11 for Standard Pressure

Butterfly Valves (3” to 20”) & (24” & Larger), QC-12 for Resilient-Seated Gates Valves (3” to 12” Dia. & 16” Dia. to 48”), and QC-13 for Thermoplastic Pipe and Fittings.

1.6 PROJECT CONDITIONS

A. Existing Utilities: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
   1. Notify the engineer and the Owner not less than 2 days in advance of proposed utility interruptions; and,
   2. Do not proceed with utility interruptions without written permission from the engineer or the Owner.

1.7 COORDINATION & FEES

A. The Contractor shall be responsible for obtaining and payment of all tap and construction permit fees associated with this section.
B. The Contractor shall install water lines and appurtenances as shown on the drawings. Including, but not limited to, any taps, vault, and backflow prevention. The Contractor shall install plugging and marking apparatus as necessary to protect his work. Water meters are furnished and installed by the Philadelphia Water Department. The cost is covered in the fee charged for a water permit. Contractor is to coordinate with Philadelphia Water for meter installation.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS, APPLICATION

A. Ductile-Iron Pipe
   1. Ductile iron pipe shall conform to the requirements of AWWA C151, class 350, and shall have a cement-mortar lining of standard thickness in accordance with AWWA C104; pipe thickness shall be in accordance with AWWA C150; pipe shall have push-on joints in accordance with AWWA C110. Additional fittings shall be mechanical-joint ductile-iron compact fittings in accordance with AWWA C153 or standard size in accordance with AWWA C110.
   2. Cast into, stamp or paint on each pipe: the manufacturer's mark; casting number; year of cast; "DI"; class of pipe. Markings shall be clear and legible.

B. Copper Tubing
   1. Comply with ASTM B88.
   2. Type: K, annealed.
   3. Fitting: Cast copper; ASME B16.18
   4. Joints: Compression connection.

2.2 VALVES

A. Cast-Iron, Gate Valves:

1. Nonrising-Stem, Metal-Seated Gate Valves: AWWA C500, UL 262, FM-approved, gray- or ductile-iron body and bonnet; with cast-iron or bronze double-disc gate, bronze gate rings, bronze stem, and stem nut.
    a. Minimum Working Pressure: 200 psi (1380 kPa).
    b. End Connections: Mechanical joint, per (AWWA C 111).
    c. Interior Coating: Complying with AWWA C550.
    d. Nut: 2 inches square, complying with AWWA C500.
2. Nonrising-Stem, Resilient-Seated Gate Valves: AWWA C509, UL 262, FM-approved, gray- or ductile-iron body and bonnet; with bronze or gray- or ductile-iron gate, resilient seats, bronze stem, and stem nut.
    a. Minimum Working Pressure: 200 psig (1380 kPa).
    b. End Connections: Mechanical joint, per ANSI A21.11 (AWWA C111).
    c. Interior Coating: Complying with AWWA C550.
    d. Nut: 2-inch square, complying with AWWA C500.

B. Tapping-Sleeve Assemblies: Conform to the requirements of MSS SP-60. Tapping sleeves may be cast-iron, ductile-iron or stainless-steel, two-piece bolted sleeve with flanged outlet for new branch connection.
C. Valve Boxes: Comply with AWWA M44 for cast-iron valve boxes. Include top section, adjustable extension of length required for depth of burial of valve, lid with lettering "WATER," bottom section with base of size to fit over valve, and approximately 5-inch diameter barrel.
D. Operating Wrenches: Steel tee-handle, stem of length to operate deepest buried valve, and 2-inch square socket matching valve operating nut, placed in sprinkler room.

2.3 WATER SERVICE CONNECTIONS

A. Service-Saddle Assemblies: Comply with AWWA C800.
B. Corporation Valve: Comply with AWWA C800, bronze body, threaded inlet and outlet matching service piping material.
C. Buffalo type curb boxes or approved equal
D. Curb Stops: Comply with AWWA C800, bronze body, with inlet and outlet matching service piping material.
E. Copper service pipe in accordance with ASTM B 88, Type K, annealed (temper O50 or O60).

2.4 METER PIT

A. Meter pits and accessories shall be tested and registered with the quality certification staff in accordance with the quality certification standard QC-1 for precast concrete products.
B. Meter pit shall be designed for H-20 loading.
C. All precast segments shall be keyed and their joints watertight.
D. Precast Concrete Meter Pit:

1. Precast manufacturers shall be certified in accordance with QC-1 by the Department Quality Certification Staff.
2. Concrete shall consist of Portland Cement which conforms to ASTM C150 and aggregates which conform to C33. The minimum compressive strength shall be 4,000 psi.
3. Reinforcing steel shall conform to ASTM A615 grade 60 for bars or ASTM A185 for welded wire fabric.

2.5 BACKFLOW-PREVENTION DEVICES

A. Comply with regulatory authorities having jurisdiction requirements and as shown on the Drawings.

B. Enclosure:
1. Provide manufactured backflow prevention assembly enclosure meeting the requirements of the backflow preventer and ASSE 1060.
2. Enclosure shall be installed on a Concrete Pad meeting the manufacturer's instructions and meeting the requirements of Section 321600, Concrete Curbs, Sidewalks, and Pavement.

2.6 FIRE HYDRANTS

A. Manufacturer:
1. Furnish center compression locks manufactured by the Center Compression Lock Co. Inc., PO Box 3609, 2502 Edgemont Street, Philadelphia, PA 19125, (215) 739-1727, or approved equal.
2. Furnish materials according to City of Philadelphia standards.

B. Furnish standard pressure fire hydrant in accordance with Philadelphia Standard Specification W-14 for furnishing Philadelphia Standard Fire Hydrants and the Philadelphia Standard Details for Water Mains. Furnish retainer glands for all joints.

C. The bonnets of hydrants shall be color coded as follows:

Main Size	Hydrant Bonnet Color
6" - 8"	Orange
10" - 12"	Green
16" & Larger	Red

D. The hydrant bonnets shall be painted with Rust-Oleum 7600 series of VOC industrial enamels. The following is a list of Rust-Oleum's color name and number for each color:

Color	Rust-Oleum Color Name	Number
Orange	Equipment Orange	7656
Green	Safety Green	7633
Red	Fire Hydrant Red	7665

PART 3 - EXECUTION

3.1 TRENCHING

A. Comply with requirements of Section 312316.13, Trenching.

3.2 VALVES

A. General Application: Use mechanical joint valves for NPS 2-inch and larger underground installation. Use threaded or flanged-end valves for installation in vaults.
B. Set Valve boxes to grade, true and plumb with valve operating nut centered in box.

3.3 PIPE AND FITTING INSTALLATION

A. Water-Main Connection: Verify with regulatory authorities having jurisdiction that size of tap and location shown on drawings is acceptable. Make tap conforming to requirements of regulatory authorities having jurisdiction and Manufacturers Standardization Society (MSS) standards.
B. Install each service pipe with the material specified, or as directed by the Project Manager.
C. Comply with NFPA 24 for fire-service-main piping materials and installation.
D. Install ductile-iron, water-service piping according to AWWA C600 and AWWA M41.
E. All piping shall be installed with a minimum of 4 feet of cover, or 12 inches below level of max frost penetration, or as required by regulatory authorities having jurisdiction, whichever is deeper. If pipe is installed in a cut section prior to completion of grading operations, pipe shall be installed so that minimum required cover will exist upon completion of grading operations.
F. Install underground piping with restrained joints at horizontal and vertical changes in direction. Use restrained-joint piping, thrust blocks, anchors, tie-rods and clamps, and other supports.
G. Pipe Bedding: Pipe bedding material shall be installed if required by regulatory authorities having jurisdiction water authority or engineer. No pipe shall be laid resting on a rock, blocking or unyielding objects.
H. Location with Sewers: Separate trenches shall be provided for water lines and sewer lines, with lines separated by a minimum of 10 feet horizontally. Water mains that cross sewers shall have a minimum vertical separation of 18 inches).
I. Tap water main for installation of ferrule. Use a single piece of service pipe between ferrule or swing joint and curb stop. Connect new service to water distribution pipe. Where adapter is required between curb stop and water distribution pipe, length of adapter may not exceed two feet without written approval from Project Manager for each such connection.

3.4 ANCHORAGE INSTALLATION

A. Install anchorages for tees, plugs and caps, bends, crosses, valves, and hydrant branches. Include anchorages for the following piping systems:
   1. Gasketed-Joint, Ductile-Iron, Water-Service Piping: According to AWWA C600;
   2. Gasketed-Joint, PVC Water-Service Piping: According to AWWA M23;
   3. Fire-Service-Main Piping: According to NFPA 24; and,
   4. Apply full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.5 BACKFLOW-PREVENTER INSTALLATION

A. Comply with regulatory authorities having jurisdiction, including water authority requirements.
B. Do not install bypass piping around backflow preventers.

3.6 QUALITY CONTROL

A. Piping Tests: Conduct piping tests before joints are covered and after thrust blocks have hardened sufficiently. Fill pipeline 24 hours before testing and apply test pressure to stabilize system. Use only potable water.
B. Hydrostatic Tests:
   1. The Contractor shall test all pipelines and appurtenances with water at test pressure of 150 psi or 1.5 times working pressure, whichever is greater. Test pressure must be maintained for at least 2 hours. All leakage apparent after testing must be repaired immediately. a. The work will not be finally accepted until leakage shall prove to be less than 10 gallons per 24 hours per mile of pipe at test pressure; and,
   2. Fire Water System tests shall be in full conformity with the requirements of all applicable codes, NFPA standards, and other authorities having jurisdiction.
      a. All new underground mains and lead-ins shall be flushed thoroughly before connection is made to internal system piping. The site utility subcontractor shall be responsible for disposal of the test water drained from the test outlets.
      b. The trench shall be backfilled between joints before testing to prevent movement of pipe.
      c. Test shall be made by the site utility subcontractor in the presence of the regulatory authority having jurisdiction and/or the Owner’s representative.
      d. The site utility subcontractor shall prepare reports of testing activities and submit 2 copies to the General Contractor.

3.7 IDENTIFICATION

A. Install continuous underground detectable warning tape in accordance with Section 312000 – Earth Moving, or a 14-gauge solid copper tracer wire prior to backfilling of trench for underground PVC water-service piping. Locate below finished grade, directly over piping.

3.8 CLEANING

A. Clean and disinfect water-distribution piping as follows:

1. Purge new water-distribution piping systems and parts of existing systems that have been altered, extended, or repaired before use;
2. Use purging and disinfecting procedure prescribed by authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in NFPA 24 for flushing of piping. Flush piping system with clean, potable water until dirty water does not appear at points of outlet;
3. Use purging and disinfecting procedure prescribed by regulatory authorities having jurisdiction or, if method is not prescribed by authorities having jurisdiction, use procedure described in AWWA C651 or as described below; and,
    a. Fill system or part of system with water/chlorine solution containing at least 50 ppm of chlorine; isolate and allow to stand for 24 hours.
    b. Drain system or part of system of previous solution and refill with water/chlorine solution containing at least 200 ppm of chlorine; isolate and allow to stand for 3 hours.
    c. After standing time, flush system with clean, potable water until no chlorine remains in water coming from system.
    d. Submit water samples in sterile bottles to authorities having jurisdiction. Repeat procedure if biological examination shows evidence of contamination
4. The site utility subcontractor shall prepare reports of purging and disinfecting activities and submit 2 copies to the General Contractor.

END OF SECTION 331416

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SECTION 334009 - CONNECTIONS TO EXISTING STRUCTURES

PART 1 - GENERAL

1.1 SUMMARY OF WORK

A. The Work described in this Section shall include all materials, labor, equipment and incidentals required to make connections to structures from stormwater conduit piping as shown on the drawings. All orifice, underdrain, distribution, or other piping that connects to a structure shall have the connection constructed per these Specifications.

1.2 REFERENCES

A. ASTM C 109, Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-inch or 50 mm Cube Specimens).
B. ASTM D 638, Test Method for Tensile Properties of Plastics.
C. ASTM D 695, Test Method for Compressive Properties of Rigid Plastics.

1.3 SUBMITTALS

A. Before starting this work, submit for approval of Owner/Authorized Representative, manufacturer’s literature describing Epoxy Mortar Gel and Epoxy Bonding Agent. Literature must address each requirement (e.g. Compressive Strength per ASTM C109) as specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. The following products are acceptable as Epoxy Mortar Gel, provided they continue to meet all requirements:

1. Meta Bond HM Gel, as manufactured by American Meta Seal Company, 509 Washington Avenue, Carlstadt, NJ 07072.
2. Sikadur 31 Hi-Mod Gel, as manufactured by Sika Corporation, Box 297, Lyndhurst, NJ 07071.
3. Thermal-Chem Mortar Resin Gel (Product No. 304), as manufactured by Thermal-Chem, Inc., 1400 Louis Avenue, Elkgrove, IL 60007.
4. Approved equivalent product.

B. The following products are acceptable as Epoxy Bonding Agent, provided they continue to meet all requirements.

1. Meta Bond HM, or Meta Bond HM Gel, as manufactured by American Meta Seal Company.
2. Sikastix 370, Sikadur Hi-Mod, or Sikadur 31 Hi-Mod Gel, as manufactured by Sika Corporation.
3. Thermal-Chem Mortar Resin (Product No. 3), or Thermal-Chem Mortar Resin Gel (Product No. 34), as manufactured by Thermal-Chem, Inc.
4. Approved equivalent product.

2.2 MATERIALS

A. Epoxy Mortar Gel shall:

1. Be a 100% solids formulation.
2. Have a Tensile Strength per ASTM D 638 not less than 3000 psi after 7 days at 73□F.
3. Have a Tensile Elongation per ASTM D 638 not over 7%.
4. Have a Compressive Strength per ASTM D 695 not less than 3000 psi after 24 hours at 73 degrees F, and not less than 6000 psi after 7 days at 73 degrees F.

B. Sand shall:

1. Be oven-dry silica sand.
2. Have at least 70% by weight pass #20 sieve.
3. Have not over 35% by weight pass #40 sieve.

C. Epoxy Bonding Agent shall meet the requirements for Epoxy Mortar Gel.

2.3 MIXES

A. Epoxy Mortar shall consist of Epoxy Mortar Gel and Sand mixed at a 1:1 ratio by loose volume.

PART 3 - EXECUTION

3.1 MAKING CONNECTION

A. Make hole(s) in existing structure as necessary to permit connection. Core through existing concrete structures and cut reinforcing as necessary. Remove all dirt, laitance, and other loose or undesirable material from mating surfaces. Check hole(s) for fit.

B. Comply fully with manufacturer’s instructions. Coat mating surfaces with Epoxy Bonding Agent and set pipe. Seal all openings with Epoxy Mortar. Support pipe securely to prevent movement and protect for at least 24 hours.

END OF SECTION 334009

SECTION 400581.26 – FREEZE PROOF YARD HYDRANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Non-freeze yard hydrants.
B. Related Requirements:

1. Section 331416 - Site Water Service Distribution Piping: Piping, trenching, backfilling, and compaction requirements.

1.2 RELATED DOCUMENTS

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

1.3 REFERENCE STANDARDS

A. List reference standards included within text of this Section, with designations, numbers, and complete document titles.
B. NSF International:

1. NSF 61 - Drinking Water System Components - Health Effects.
2. NSF 372 - Drinking Water System Components - Lead Content.

C. American Water Works Association (AWWA)

1. AWWA C651 - Disinfecting Water Mains

1.4 SUBMITTALS

A. Section 013300 - Submittal Procedures: Requirements for submittals.
B. Product Data: Submit manufacturer information regarding component materials, fittings, assembly and parts diagram, and accessories.
C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
D. Manufacturer Instructions: Submit detailed instructions on installation requirements, including storage and handling procedures.
E. Field Quality-Control Submittals: Indicate results of Contractor-furnished tests and inspections.
F. Qualifications Statement:

1. Submit qualifications for manufacturer.

1.5 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for submittals.
B. Project Record Documents: Record actual locations of non-freeze yard hydrants.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Requirements for maintenance materials.
B. Tools: Furnish two Control Keys Owner.

1.7 QUALITY ASSURANCE

A. Materials in Contact with Potable Water: Certified according to NSF 61 and NSF 372.
B. Perform Work according to City of Philadelphia standards.
C. Maintain copies of each standard affecting Work of this Section on Site.

1.8 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this Section with minimum three years' experience.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.
B. Delivery:
    1. Seal hydrant ends to prevent entry of foreign matter.
    2. Inspection: Accept materials on Site in manufacturer's original packaging and inspect for damage.
C. Store materials according to manufacturer instructions.
D. Protection:
    1. Protect materials from moisture and dust by storing in clean, dry location remote from construction operations areas.
    2. Provide additional protection according to manufacturer instructions.

PART 2 - PRODUCTS

2.1 NON-FREEZE YARD HYDRANTS

A. Manufacturers:

1. Acceptable Manufacturers:
   a. Zurn
   b. Josam
   c. Watts
   d. Wade
2. Furnish materials according to City of Philadelphia standards.

B. Description:

1. Type: Non-freeze.
2. Barrel: Automatic drain after use.
3. Recessed box with hinged latching cover.

C. Operation:

1. Drain Valve: Actuated when main valve is in CLOSED position.

D. Connections:

1. Hose Connection: One each, 3/4-inch hose connections.
2. Drain Port: 1/8 inch.
3. Inlet:
   a. Size: 3/4 inch.
   b. Type: Threaded.

E. Accessories:

1. Control Keys to prevent unauthorized use.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation examination.
B. Identify required lines, levels, contours, and datum locations.
C. Verify that elevations prior to excavation and installation of non-freeze yard hydrants are as indicated on Drawings.

3.2 PREPARATION

A. Section 017000 - Execution and Closeout Requirements: Requirements for installation preparation.
B. Locate, identify, and protect from damage utilities to remain.

C. Do not interrupt existing utilities without permission and without making arrangements to provide temporary utility services.

1. Notify Architect/Engineer not less than three days in advance of proposed utility interruption.
2. Do not proceed without written permission from Architect/Engineer.

3.3 INSTALLATION

A. Perform trench excavation, backfilling, and compaction as specified in Section 331417 - Site Water Service Utility Laterals.
B. Install non-freeze yard hydrants in conjunction with pipe laying.
C. Provide support blocking and drainage gravel while installing non-freeze yard hydrants; do not block drain hole.
D. Orientation:
E. Set valves and hydrants plumb.

1. Set non-freeze yard hydrants with outlets as indicated on Drawings.

F. After main-line pressure testing, flush non-freeze yard hydrants and check for proper drainage.
G. Disinfection of Water Piping System: In accordance with the most recent amendment to the Standard Specifications and Standard Details of the Philadelphia Water Department and the Standard Specification for Disinfecting Water Mains, W-22 and AWWA C651.

3.4 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting and testing.

PART 4 - Testing:

4.1 Pressure test non-freeze yard hydrants with water mains as in accordance with City of Philadelphia Standards.

END OF SECTION 400581.26

SECTION 015639 –TEMPORARY TREE AND PLANT PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

1. Drawings and general provisions of the Contract, including General Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

2. Section includes general protection and pruning of existing trees and plants that are affected by execution of the Work, whether temporary or permanent construction.

3. Related Sections:

1. Division 01 Section “Construction Waste Management”
2. Division 01 Section “Field Engineering” for field engineering and surveying.
3. Division 32 Section “Soil Preparation”
4. Division 32 Section “Plants”

1.3 DEFINITIONS

4. Caliper: Diameter of a trunk measured by a diameter tape at 6 inches above the ground for trees up to, and including, 6-inch size; and breast height (DBH) for trees larger than 6-inch size.

5. Plant-Protection Zone: Area surrounding individual trees, groups of trees, shrubs, or other vegetation to be protected during construction, and indicated on Drawings.

6. Tree-Protection Zone: Area surrounding individual trees or groups of trees to be protected during construction, and indicated on Drawings.

7. Vegetation: Trees, shrubs, groundcovers, grass, and other plants.

1.4 SUBMITTALS

8. Product Data: For each type of product indicated.

9. Samples for Verification: For each type of the following:

1. Protection-Zone Fencing: Manufacturer’s cut sheets
2. Protection-Zone Signage: Manufacturer’s cut sheets.
3. Organic Mulch: One (1) gallon of organic mulch; in sealed plastic bags labeled with composition of materials by percentage of weight and source of mulch.

10. Tree Pruning Schedule: Written schedule detailing scope and extent of pruning of trees to remain that interfere with or are affected by construction.

4. Species and size of tree.

5. Location on site plan. Include unique identifier for each.
6. Reason for pruning.
7. Description of pruning to be performed.

11. Qualification Data: For qualified arborist and tree service firm.

12. Certification: From arborist, certifying that trees indicated to remain have been protected during construction according to recognized standards and that trees were promptly and properly treated and repaired when damaged.

13. Maintenance Recommendations: From arborist, for care and protection of trees affected by construction during and after completing the Work.

14. Existing Conditions: Documentation of existing trees and plantings indicated to remain, which establishes preconstruction conditions that might be misconstrued as damage caused by construction activities.

8. Use sufficiently detailed photographs or video.
9. Include plans and notations to indicate specific wounds and damage conditions of each tree or other plants designated to remain.

1.5 QUALITY ASSURANCE

15. Arborist Qualifications: Certified Arborist as certified by ISA.

16. Tree Service Firm Qualifications: An experienced tree service firm that has successfully completed temporary tree and plant protection work similar to that required for this Project and that will assign an experienced, qualified arborist to Project site during execution of the Work.

17. Pre-installation Conference: Conduct conference at Project site.

1. Review methods and procedures related to temporary tree and plant protection including, but not limited to, the following:
   a. Construction schedule. Verify availability of materials, personnel, and equipment needed to make progress and avoid delays.
   b. Enforcing requirements for protection zones.
   c. Arborist’s responsibilities.
   d. Field quality control.

1.6 PROJECT CONDITIONS

18. The following practices are prohibited within protection zones:

1. Storage of construction materials, debris, or excavated material.
2. Parking vehicles or equipment.
3. Foot traffic.
4. Erection of sheds or structures.
5. Impoundment of water.
6. Excavation or other digging unless otherwise indicated.
7. Attachment of signs to or wrapping materials around trees or plants unless otherwise indicated.

19. Do not direct vehicle or equipment exhaust toward protection zones.

20. Prohibit heat sources, flames, ignition sources, and smoking within or near protection zones and organic mulch.

21. Protection fencing must be approved by the Owner's Representative prior to commencing with any demolition or construction work.

22. Install protection fencing before installing erosion and sedimentation controls. Trenched silt fence is prohibited within plant protection zones. Utilize tubular sediment control device, such as Filtrexx® Sediment Control or similar product in accordance with the manufacturers instructions, in lieu of silt fencing. Trenching is prohibited within plant protection zones.

23. Flows of water redirected from construction areas or generated by construction activity are prohibited from entering or crossing plant protection zones. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

24. Work within the plant protection zone must be approved by and supervised by Owner's Representative.

25. The Owner's Representative may require additional protection fencing or relocation of fencing as work progresses.

26. Bring any unforeseen site conditions, such as structural roots, that will impact new construction to the attention of the Architect and Owner's Representative. Do not proceed with work without written authorization.

27. Arborist may require crown pruning to compensate for root loss caused by damaging or cutting of the root system. Provide subsequent maintenance during contract period as recommended by arborist.

PART 2 - GENERAL

2.1 MATERIALS

28. Topsoil: Refer to 329100 'Planting Preparation'.

29. Organic Mulch: Free from deleterious materials and suitable as a top dressing for trees and shrubs, consisting of one of the following:

1. Type: Shredded hardwood.
2. Size Range: 3 inches (76 mm) maximum, ½ inch (13 mm) minimum.
3. Color: Natural.

30. Protection-Zone Fencing: Fencing fixed in position and meeting the following requirements.

31. Tree Protection-Zone Fencing: Orange high density polyethylene plastic fence with 3 ½" x 1 ½" openings. Height: 4 feet.Provide steel posts as shown on Drawings.

D. Protection-Zone Signage: Shop-fabricated, rigid plastic or metal sheet with attachment holes prepunched and reinforced; legibly printed with nonfading lettering and as follows:

4. Size and Text: As shown on Drawings.
5. Lettering: 3-inch high minimum, white characters on red background.

PART 3 - EXECUTION

3.1 EXAMINATION

32. Erosion and Sedimentation Control: Examine the site to verify that temporary erosion- and sedimentation-control measures are in place. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross protection zones.

33. For the record, prepare written report, endorsed by arborist, listing conditions detrimental to tree and plant protection.

3.2 PREPARATION

34. Protect tree root systems from damage caused by runoff or spillage of noxious materials while mixing, placing, or storing construction materials. Protect root systems from ponding, eroding, or excessive wetting caused by dewatering operations.

3.3 TREE- AND PLANT-PROTECTION ZONES

35. Protection-Zone Fencing: Install protection-zone fencing along edges of protection zones before materials or equipment are brought on the site and construction operations begin in a manner that will prevent people from easily entering protected area except by entrance gates. Construct fencing so as not to obstruct safe passage or visibility at vehicle intersections where fencing is located adjacent to pedestrian walkways or in close proximity to street intersections, drives, or other vehicular circulation.

1. Chain-Link Fencing: Install to comply with ASTM F 567 and with manufacturer's written instructions.
2. Posts: Post shall not be driven into ground due to potential disturbance to graves below. Where a post is located on existing paving or concrete to remain, provide appropriate means of post support acceptable to Landscape Architect. Do not drive posts through roots of trees to remain; utilize a weighted base in lieu of driving posts into the ground where roots are encountered.

36. Protection-Zone Signage: Install protection-zone signage in visibly prominent locations in a manner approved by Architect. Install one sign spaced approximately every 35 feet on protection-zone fencing, but no fewer than four signs with each facing a different direction.

37. Maintain protection zones free of weeds and trash.

38. Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

39. Maintain protection-zone fencing and signage in good condition as acceptable to Architect and remove when construction operations are complete and equipment has been removed from the site.

3. Do not remove protection-zone fencing, even temporarily, to allow deliveries or equipment access through the protection zone.
4. Temporary access is permitted subject to preapproval in writing by arborist if a root buffer effective against soil compaction is constructed as directed by arborist. Maintain root buffer so long as access is permitted.

3.4 EXCAVATION

40. General: Excavate at edge of protection zones and for trenches indicated within protection zones according to requirements in Section 312000 “Earth Moving.”

41. Trenching near Trees: Where utility trenches are required within protection zones, hand excavate and/or air-spade under or around tree roots or tunnel under the roots by drilling, auger boring, or pipe jacking. Do not cut main lateral tree roots or taproots; cut only smaller roots that interfere with installation of utilities. Cut roots as required for root pruning.

42. Do not allow exposed roots to dry out before placing permanent backfill. Provide temporary earth cover or pack with peat moss and wrap with burlap. Water and maintain in a moist condition. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

3.5 ROOT PRUNING

43. Prune roots that are affected by temporary and permanent construction. Prune roots as follows:

1. Cut roots manually by digging a trench and cutting exposed roots with sharp pruning instruments; do not break, tear, chop, or slant the cuts. Do not use a backhoe or other equipment that rips, tears, or pulls roots.
2. Cut Ends: Do not coat cut ends of roots with an emulsified asphalt or similar coatings.
3. Temporarily support and protect roots from damage until they are covered with soil.
4. Cover exposed roots with burlap and water regularly.
5. Backfill as soon as possible according to requirements in Section 312000 “Earth Moving.”

44. Root Pruning at Edge of Protection Zone: Prune roots 6 inches inside of the protection zone, by cleanly cutting all roots to the depth of the required excavation.

45. Root Pruning within Protection Zone: Clear and excavate by hand to the depth of the required excavation to minimize damage to root systems. Use narrow-tine spading forks, comb soil to expose roots, and cleanly cut roots as close to excavation as possible.

3.6 CROWN PRUNING

46. Prune branches that are affected by temporary and permanent construction. Prune branches as follows:

1. Prune trees as indicated on the Drawings. Provide subsequent maintenance during Contract period as recommended by arborist.
2. Pruning Standards: Prune trees according to ANSI A300 (Part 1) and the following:
   a. Type of Pruning: Cleaning, Thinning, and/or Reduction.
   b. Specialty Pruning: Restoration.
3. Cut branches with sharp pruning instruments; do not break or chop.
4. Do not apply pruning paint to wounds

47. Chip removed branches and dispose of off-site.

3.7 REGRADING

48. Lowering Grade: Where new finish grade is indicated below existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

49. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

1. Root Pruning: Prune tree roots exposed by lowering the grade. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots as required for root pruning.

50. Raising Grade: Where new finish grade is indicated above existing grade around trees, slope grade beyond the protection zone. Maintain existing grades within the protection zone.

51. Minor Fill within Protection Zone: Where existing grade is 2 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single uncompacted layer and hand grade to required finish elevations.

3.8 FIELD QUALITY CONTROL

52. Inspections: Engage a qualified arborist to direct plant-protection measures in the vicinity of trees, shrubs, and other vegetation indicated to remain and to prepare inspection reports.

3.9 REPAIR AND REPLACEMENT

53. General: Repair or replace trees, shrubs, and other vegetation indicated to remain or be relocated that are damaged by construction operations, in a manner approved by Architect.

1. Submit details of proposed root cutting and tree and shrub repairs.
2. Have arborist perform the root cutting, branch pruning, and damage repair of trees and shrubs.
3. Treat damaged trunks, limbs, and roots according to arborist’s written instructions.
4. Perform repairs within 24 hours.
5. Replace vegetation that cannot be repaired and restored to full-growth status, as determined by Architect.

54. Trees: Remove and replace trees indicated to remain that are more than 25 percent dead or in an unhealthy condition before the end of the corrections period or are damaged during construction operations that Landscape Architect determines are incapable of restoring to normal growth pattern.

6. Provide new trees of same size and species as those being replaced for each tree that measures 6 inches or smaller in caliper size.
7. Provide two new trees of 4-inch caliper size for each tree being replaced that measure between 6-inch caliper and 8-inch caliper in size at a location directed by the Owner or Owner’s Representative.
8. Provide 6-inch caliper size for each tree being replaced that measure greater than 8-inch caliper in size at a location directed by the Owner or Owner’s Representative. Quantity of trees shall equal the total diameter at breast height (DBH) size of the tree removed unless directed otherwise by the Owner. For example, a 32-inch DBH shall require five new trees.
9. Species: Species selected by Landscape Architect.

10. Plant and maintain new trees as specified in Section 32 93 00 ‘Plants’.

55. Soil Aeration: Where directed by Landscape Architect, aerate surface soil compacted during construction. Aerate to extent as directed by Landscape Architect beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with approved Compost.

3.10 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove excess excavated material, displaced trees, trash and debris, and legally dispose of them off Owner’s property.

END OF SECTION