PROJECT MANUAL

COMMUNITY COLLEGE OF PHILADELPHIA

Pavilion and Bonnell Plazas &

17th Street Improvements

1700 Spring Garden Street
Philadelphia, Pennsylvania

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Volume 2
Technical Specifications

Community College of Philadelphia
Pavilion and Bonnell Plazas & 17th Street Improvements - Technical Specifications

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SECTION 024114 – UTILITY DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Demolish all utility structures to the bottom of foundation unless otherwise indicated on the plans.

B. Haul from the site and properly dispose of all rubble. All demolition debris shall be taken to a certified landfill or an approved recycling reclaiming facility approved by the Pennsylvania Department of Environmental Protection. The owner's representatives at the site will monitor the disposal of the demolition debris. Truck tickets shall be submitted weekly to the owner's representatives.

C. Any concrete slabs within the area of demolition to remain are to be broken at 18 inches on center to allow for the percolation of water.

D. Backfill all vaults within the area of demolition that are to remain with stone backfill to 95% Modified Proctor Density conforming to ASTM D1557.

E. Remove all mechanical equipment, electrical equipment, wiring, piping and duct work within the demolition area unless noted otherwise on the Plans. Cap and cut all utilities at the curb line or where indicated on the plans. Bulkhead sewers at the curb line or where indicated on the plans.

F. Excavated soil materials not including debris from demolished utilities, organic material or other unauthorized excavated material are to be reused on site to backfill utility trench excavation to existing, surrounding grade. Haul onto the site stone backfill meeting PennDOT Form 408 Specifications for “2A Modified” material to fill remainder of trench when necessary once utility has been removed. Backfilled utility trenches are to be hand tamped or compacted with construction equipment by traversing over the trenches once brought to existing grade to ensure that minimum settlement occurs.

G. Secure the demolition area with wire fencing and gates.

H. Provide rodent control in accordance with the City of Philadelphia Water Department regulations.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division I Specifications Sections, apply to this section.

B. Other related sections include the following:
   1. Section 312000 “Earth Moving” for excavation and backfill required for utilities to be demolished not included in this section.
   2. Section 024113 “Sitework Demolition” for demolition not included in this section.
   3. Section 331000 “Water Utilities” for cutting and capping of water utilities not included in this section.
   4. Section 333000 “Sanitary Sewerage Utilities” for cutting and capping of water utilities not included in this section.
   5. Division 033000 Section “Concrete” for concrete work required for utility demolition not included in this section.

1.3 QUALITY ASSURANCE

A. Comply with City of Philadelphia Water Department, City of Philadelphia Streets Department, Philadelphia Gas Works, Philadelphia Electric Company, Verizon and any other affected and applicable utility company or provider’s standards and specifications.

1.4 PAVING AND SURFACING

A. It is the Contractor's responsibility to be thoroughly familiar with the Philadelphia Streets Department and Pennsylvania Department of Transportation (PennDOT) standard specifications for paving work, including the following:

   1. Philadelphia Streets Department, Standard Specifications for Paving and Repaving - 1997.
   2. Philadelphia Streets Department, 1997 Standard Construction Items.
   3. PennDOT, Form 408, Specifications - Latest publication.

1.5 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 Owner not less than five business days in advance of proposed utility interruptions.
   2. Do not proceed with utility interruptions without Owner's written permission.

1.6 COORDINATION

A. Coordinate connection to water and sewer main with Philadelphia Water Department.

PART 2 - GENERAL REQUIREMENTS

2.1 The work of demolition includes the complete removal and disposal of all structures and attachments and the removal and disposal offsite of all tanks, pipes, and fixtures unless otherwise specified.

2.2 Utility services will be disconnected and capped by the Contractor. Contractor shall apply for, obtain and pay for all utility discontinuances.

2.3 The Contractor will obtain the license for the removal of all ferrules at the water mains and also obtain a discontinuance permit for all water services. Sewer traps and laterals shall be removed at the curb line and shall be cement-sealed at that point with a vitrified disc to fit the bell opening. This operation shall also require a formal report, in every case, to the Owner or site representative. It shall be the responsibility of the Contractor to verify that the above requirements are met for all the utility connections within the site limits.

2.4 If it is necessary to maintain any power, water, or other utilities during and after demolition, such lines shall be temporarily relocated as necessary and protected in accordance with any applicable code or legal requirements.

2.5 If in the course of the demolition work, asbestos, fuel tanks or other hazardous materials are found, the demolition contractor shall immediately inform the Owner of the location of the hazardous material. The Contractor shall make proper arrangements for the removal and disposal of the hazardous material from the site.

PART 3 - DETAILED REQUIREMENTS

3.1 General - The Contractor shall maintain, protect and be responsible for the safety, stability and integrity of all buildings or structures and improvements situated within the zone of influence of his work. Improvements adjacent to the work shall be protected and made safe from settlement or other damage that may be occasioned by the work under contract.

3.2 Operational Procedures - The Contractor shall make use of such methods of work as are best adapted to preserve the existing improvements, and shall restore and make good any damage which may be done in the course of the construction, irrespective of whether such damage shall be due to negligence or to the inherent character of the work.

3.3 All materials of any nature removed from within the limit of the site except public utility property shall become the property of the Contractor, and shall be removed from the site as it accumulates. No materials, pending sale, shall be permitted at the site. No fires of any kind or burning of debris on the site or adjacent to it shall be permitted.

3.4 DEMOLITION AND REMOVAL OF SITE MECHANICAL SYSTEMS

A. Disconnect and shutoff all mechanical services (sewer, domestic water, gas, steam).

B. Remove all mechanical equipment, including pumps, heat exchangers, pressure vessels, fans, air conditioners, radiators, unit heaters, equipment insulation.

C. Remove all piping, valves, steam traps, accessories and pipe insulation.

D. Remove all ductwork, coils, air terminals (grilles, registers, air diffusers) and louvers.

E. Remove plumbing system including plumbing fixtures, domestic water heater, drainage vent, domestic water and fire protection water piping, valve and accessories and insulation (Asbestos insulation shall be removed by others).

3.5 DEMOLITION AND REMOVAL OF SITE ELECTRICAL AND TELECOMMUNICATION SYSTEMS

A. Disconnect and shutoff electric service including metering equipment and service equipment.

B. Disconnect and remove from the site of distribution equipment, panelboards, power wiring to motor control centers, mechanical and plumbing equipment.

C. Disconnect and remove existing exterior electric boxes, metering equipment, overhead wiring and associated load equipment.

D. Disconnect and remove existing telephone lines.

E. Disconnect and remove conduit and vaults as indicated. Cut and cap electrical and telecommunications conduit at locations indicated.

3.6 DUST, DIRT AND EROSION CONTROL

A. Prevent or control, to the satisfaction of the City of Philadelphia and other governmental regulatory agencies, dust that may result from demolition operations. Use water sprinkling, temporary enclosures and other suitable approved methods to limit dust and dirt from entering the atmosphere. Use approved water control additives when required by excessive dust release.

B. The Contractor will be responsible for furnishing, installing and maintaining all erosion control devices during and until the completion of the demolition contract. Contractor shall rake excessive dirt and debris from the trucks prior to their leaving the site. The adjacent streets and sidewalks shall be broom cleaned and be kept clean of dirt and rubbish at all times.

C. The Contractor shall be notified by the engineer or site representative if the streets and sidewalks are not clean. If the Contractor does not act immediately to remedy the situation and clean the surrounding streets, the engineer or site representative will have the streets cleaned and backcharge the Contractor.

D. Contractor shall maintain stone filters, silt fence and inlets to prevent dirt, soil, rubbish etc., from entering the storm sewers and causing damage to the sewer system.

3.7 PROTECTION OF EXISTING IMPROVEMENTS

A. Contractor shall protect all existing improvements, lights, trees, sidewalks, curbs, storm water piping and stormwater pumping facilities, etc. that are to remain. After completion of the demolition and associated grading, the Contractor shall restore any improvements which were damaged during the course of the work to their original condition.

3.8 UTILITIES

A. Do not commence demolition operations until utility services, including electrical, are properly removed, capped, or protected as indicated or required. All sewers whether shown on the plans or not shown on the plans are to be cut in a neat and workmenlike manner, plugged or capped and sealed with grout or concrete.

B. Contact each utility company, or authority (water, steam, sewer, gas, electricity, telephone) and make arrangements for shutoff and discontinuance of each utility service and pay all required charges.

C. Contact each utility company or authority, in compliance with Pennsylvania Act 38, to verify the location of underground lines and service connections. Notify all utility companies a minimum of seven (7) days before starting demolition and have all utilities marked by the various utility companies (1-800-242-1776).

D. Verify all conditions and utilities in field. Information shown on drawings is taken from best available source but is subject to variation.

3.9 UTILITY CUTTING AND CAPPING

A. All utilities shall be cut and capped at the curb line unless noted otherwise on the Plans.

B. Shut-off, sewer and cap utility services, drain systems and remove in a systematic manner of all components.

C. Determine whether any type of hazardous chemicals, gases, explosives, flammable materials, or similarly dangerous substances have been used in any pipes, tanks or other equipment on the property. When the presence of any such substances is apparent or suspected, testing and purging, if necessary, shall be performed by qualified persons prior to commencing demolition work.

D. Coordinate all work of removal and demolition with the utility companies.

E. Contractor to contact the PA One-Call System (1-800-242-1776) specifying demolition and excavation and have all underground utilities properly marked by the various utility companies prior to commencement of demolition.

3.10 BLASTING

A. No blasting will be permitted.

3.11 FILLING OF VAULTS AND MECHANICAL ROOMS

A. Manholes, vaults and mechanical room

1. No backfill shall be done until the engineer or inspector has approved the condition of the lower level and until all combustible materials, wood and metal have been removed. No material shall be allowed to collect in the manholes, vaults and mechanical rooms during demolition. The Contractor shall pump all water from manholes vaults and mechanical rooms before placing backfill. Bottom of vaults and mechanical rooms shall be broken at two foot intervals to permit the percolation of water.
2. Backfilling stone of manholes vaults and mechanical rooms shall be done with backfill in twelve (12) inch lifts compacted to 95% Modified Proctor Density.

3.12 FILL MATERIAL

A. The area within the limits of the demolition is to be backfilled and graded as shown on the plans. All fill is compacted to 95% Modified Proctor Density.

B. Positive site drainage shall be maintained during the backfilling; no water shall be allowed to pond within an excavated or low area. The demolition contractor shall create sumps where needed and pump the water from the low areas until the backfilling operation is completed.

3.13 TEMPORARY FENCING

A. All material shall be galvanized zinc metal in accordance with ASTM A 641-71a. Wire mesh shall be 9 gauge and shall be 2 ± inches square. Fence shall be 8 feet in height. Line post shall be 2.375 inches O.D. schedule 40. Post spacing shall be 10 feet center to center maximum. Terminal posts and pull posts shall be 2.875 inches O.D. schedule 40. End post or pull posts shall be placed at a minimum spacing of 500 feet. Posts shall have a minimum in ground depth of 3 feet. Post shall be set in concrete with 6 inches of concrete below the post and the width of the concrete shall be a minimum of 12 inches in diameter. The concrete shall have a compressive strength of 2,500 psi. A tension wire shall be installed at the top and the bottom of the fence. The tension wire shall be 6 gauge. Truss braces shall be used at terminal posts and pull posts, a 1 5/8 inch O.D. schedule 40 brace rail shall be used at the top and bottom of the fence; a truss rod and turnbuckle attachment shall be installed between the terminal or end post and each adjacent line post. Gate posts shall be 4 inch O.D. schedule 40. All material i.e. rail tie wire, clips, posts, turnbuckles, rails, tension bars, etc. for a complete fence shall be furnished and installed by the contractor. Gates shall be in accordance with Anchor Fence Inc. specifications or equal.

3.14 BARRICADES AND TRAFFIC

A. All temporary barricades, Traffic control and signs shall be furnished and installed by the demolition contractor.

3.15 RODENT CONTROL

A. Place and maintain rodenticides which shall be effective in preventing the migration of rodents to the areas surrounding demolition and excavation.

B. These rodent control measures shall be in accordance with the "Philadelphia Rat Control Project Guidelines for Rat Eradication and Control in Demolition and Excavations".

C. A copy of these guidelines can be obtained by calling 215-875-5675 or 215-875-5676. This work may also be monitored by the Philadelphia Department of Public Health, Vector Control Services. Payment for this work shall be included in the base bid.

PART 4 - STANDARDS

4.1 All operations shall be performed in accordance with local, county and State regulations, including, but not limited to, the latest edition of:

A. ”American National Standards Institute Safety Requirements for Demolition" (A10.6)

B. City of Philadelphia regulations and ordinances applicable to site preparation, demolition and alterations.

C. Applicable regulations of OSHA relative to demolition work.

D. Environmental Protection Agency and Pennsylvnaia D.E.P. regulations shall be adhered to.

END OF SECTION 024114

SECTION 024119 – SELECTIVE STRUCTURE AND SITE 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. This Section includes the following:

1. Demolition and removal of selected portions of building or structure.
2. Demolition and removal of selected site elements.
3. Abandoning in place and removing below-grade construction.
4. Disconnecting, capping or sealing, abandoning in-place and removing site utilities.
5. Salvaging items for reuse by Owner.

B. Related Sections include the following:

1. Division 01 Section "Summary" for use of premises and phasing, and Owner-occupancy requirements.
2. Division 01 Section "Photographic Documentation" for preconstruction photographs taken before selective demolition operations.
3. Division 01 Section "Temporary Facilities and Controls" for temporary construction and environmental-protection measures for selective demolition operations.
4. Division 01 Section "Cutting and Patching" for cutting and patching procedures.
5. Division 01 Section "Construction Waste Management and Disposal" for disposal of demolished materials.
6. Division 02 Section "Structure Demolition" for demolition of entire buildings, structures, and site improvements.
7. Division 22 Sections for demolishing or relocating site plumbing items.
8. Division 26 Sections for demolishing or relocating site electrical items.
9. Division 31 Section "Site Clearing" for site clearing and removal of above- and below-grade site improvements not part of building demolition.

1.3 DEFINITIONS

A. Remove or Demolish: Remove and legally dispose of items except those indicated to be reinstalled, salvaged or to remain the Owner’s property.

B. Remove and salvage: Items indicated to be removed and salvaged remain the property of the Owner. Remove clean, and store items to protect against damage at Owner’s designated storage area.

C. Remove and reinstall: Remove items indicated; clean, service and otherwise prepare them for reuse. Store and protect against damage. Reinstall items in the same locations or in locations indicated.

D. Existing to remain: Protect construction indicated to remain against damage and soiling during demolition. When permitted by the Architect, items may be removed to a suitable protected storage location during demolition and then cleaned and reinstalled at their original location.

1.4 MATERIALS OWNERSHIP

A. Except for items or materials indicated to be reused, salvaged, reinstalled or otherwise indicated to remain the Owner's property. Demolished materials shall become the Contractor's property and shall be removed from the site with further disposition at the Contractor's option.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.5 SUBMITTALS

A. General: Submit each item in this article according to the Conditions of the Contract and Division 01 Specification Sections, for information only, unless otherwise indicated.

B. Proposed dust control measures.

C. Proposed noise control measures.

D. Schedule of demolition activities indicating the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.
6. Means of protection for items to remain and items in path of waste removal from building.

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

F. Inventory of items to be removed by Owner.

G. Predemolition: Show existing conditions of adjoining construction and site improvements, including finish surfaces that might be misconstrued as damage caused by building demolition

operations. Comply with Division 01 Section "Photographic Documentation." Submit before the Work begins.

H. Landfill Records: Indicate receipt and acceptance of hazardous wastes by a landfill facility licensed to accept hazardous wastes.

I. Record Drawings at project close-out according to Division 01 Section “Project Close-out”.

1. Identify and accurately indicate capped utilities and other subsurface, structural, electrical, or mechanical conditions.

1.6 QUALITY ASSURANCE

A. Demolition firm qualification: Engage an experienced firm that has successfully completed demolition work similar to that indicated for this project.

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

C. Standards: Comply with ANSI A10.6 and NFPA 241.

D. Predemolition Conference: Conduct conference at Project site to comply with requirements in Division 01 Section "Project Management and Coordination." Review methods and procedures related to building demolition including, but not limited to, the following:

1. Inspect and discuss condition of construction to be demolished.
2. Review structural load limitations of existing structures.
3. Review and finalize building demolition schedule and verify availability of demolition personnel, equipment, and facilities needed to make progress and avoid delays.
4. Review and finalize protection requirements.
5. Review procedures for noise control and dust control.
6. Review procedures for protection of adjacent buildings.
7. Review items to be salvaged and returned to Owner.

1.7 PROJECT CONDITIONS

A. Owner assumes no responsibility for buildings and structures to be demolished.

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

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

C. 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 materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect, Engineer, and Owner. Hazardous materials will be removed by Owner under a separate contract.

D. On-site storage or sale of removed items or materials is not permitted.

1.8 COORDINATION

A. Arrange demolition schedule so as not to interfere with Owner's on-site operations and operations of adjacent occupied buildings.

1.9 WARRANTY

A. Existing Special Warranty: Remove, replace, patch and repair materials and surfaces damaged during demolition by methods and with materials so as not to void existing warranties.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

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

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

C. 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. Comply with Division 01 Section "Photographic Documentation."

D. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during building demolition operations.

E. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

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

3.2 PREPARATION

A. Existing Utilities: Refer to Divisions 22 and 26 Sections for shutting off, disconnecting, removing, and sealing or capping utilities. Do not start demolition work until utility disconnecting and sealing have been completed and verified in writing.

B. Locate, identify, disconnect, and seal or cap off indicated utilities serving buildings and structures to be demolished.

1. Owner will arrange to shut off indicated utilities when requested by Contractor.
2. Arrange to shut off indicated utilities with utility companies.
3. If removal, relocation, or abandonment of utility services will affect adjacent occupied buildings, then provide temporary utilities that bypass buildings and structures to be demolished and that maintain continuity of service to other buildings and structures.
4. Cut off pipe or conduit a minimum of 24 inches below grade. Cap, valve, or plug and seal remaining portion of pipe or conduit after bypassing according to requirements of authorities having jurisdiction.

C. Temporary Shoring: Provide and maintain interior and exterior shoring, bracing, or structural support to preserve stability and prevent unexpected movement or collapse of construction being demolished.

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

D. Salvaged Items: Comply with the following:

1. Clean salvaged items of dirt and demolition debris.
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 storage area designated by Owner.
5. Protect items from damage during transport and storage.

E. Drain, purge or otherwise remove, collect, and dispose of chemicals, gases, explosives, acids, flammable or other dangerous materials before proceeding with demolition work.

3.3 PROTECTION

A. Existing Facilities: Protect adjacent walkways, loading docks, building entries, and other building facilities during demolition operations. Maintain exits from existing buildings.

B. Existing Utilities: Maintain utility services to remain and protect from damage during demolition operations.

1. Do not interrupt existing utilities serving adjacent occupied or operating facilities unless authorized in writing by Owner and authorities having jurisdiction.
2. Provide temporary services during interruptions to existing utilities, as acceptable to Owner and authorities having jurisdiction.

a. Provide at least 72 hours notice to occupants of affected buildings if shutdown of service is required during changeover.

C. Temporary Protection: Erect temporary protection, such as walks, fences, railings, canopies, and covered passageways, where required by authorities having jurisdiction and as indicated. Comply with requirements in Division 01 Section "Temporary Facilities and Controls."

1. Protect adjacent buildings and facilities from damage due to demolition activities.
2. Protect existing site improvements, appurtenances, and landscaping to remain.
3. Erect a plainly visible fence around drip line of individual trees or around perimeter drip line of groups of trees to remain.
4. Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.
5. Provide protection to ensure safe passage of people around building demolition area and to and from occupied portions of adjacent buildings and structures.
6. Protect walls, windows, roofs, and other adjacent exterior construction that are to remain and that are exposed to building demolition operations.
7. Erect and maintain dustproof partitions and temporary enclosures to limit dust, noise, and dirt migration to occupied portions of adjacent buildings.

D. Remove temporary barriers and protections where hazards no longer exist. Where open excavations or other hazardous conditions remain, leave temporary barriers and protections in place.

3.4 POLLUTION CONTROLS

A. Use water sprinkling, temporary enclosures and other suitable approved methods to limit the spread of dust and dirt. Comply with governing environmental protection regulations. Use approved water control additives when required by excessive dust release. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

B. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.

C. Clean adjacent structures and improvements of dust, dirt and debris caused by demolition. Return adjacent areas to condition existing before the start of demolition.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove indicated existing buildings and site improvements completely as indicated in the Drawings. Use methods required to complete the Work within limitations of governing regulations.

B. Engineering Surveys: During demolition, perform surveys to detect hazards that may result from building demolition activities.

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

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

D. Explosives: Use of explosives is not permitted.

E. Make use of such methods of work as are best adapted to preserve the existing improvements.

3.6 DEMOLITION BY MECHANICAL MEANS

A. Proceed with demolition of structural framing members systematically, from higher to lower level. Complete building demolition operations above each floor or tier before disturbing supporting members on the next lower level.

B. Remove debris from elevated portions of the building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.

1. Remove structural framing members and lower to ground by method suitable to minimize ground impact and dust generation.

C. Salvage: Items to be salvaged are indicated on Drawings.

D. Demolition to Grade: As indicated on the Drawings, structures shall be torn down completely, in a systematic manner, from top of the structure to the elevation noted on plan. All wood, organic material, rubbish, metal, steel and debris shall be removed from the site.

E. Below-Grade Construction: Demolish foundation walls and other below-grade construction as indicated on the Drawings.

1. Remove below-grade construction, including basements, foundation walls, and footings, completely or to depths indicated on Drawings. Piping: Disconnect piping at unions, flanges, valves, or fittings. Piping: Disconnect piping at unions, flanges, valves, or fittings.
2. All wood, organic material, rubbish, metal, steel and debris encountered below grade shall be removed from the site.

F. Existing Utilities: Demolish and remove existing utilities and below-grade utility structures as indicated on the Drawings.

1. Piping: Disconnect piping at unions, flanges, valves, or fittings.
2. Wiring Ducts: Disassemble into unit lengths and remove plug-in and disconnecting devices.

3.7 DEMOLITION AND REMOVAL FROM SITE OF MECHANICAL SYSTEMS

A. Disconnect and shutoff all mechanical services (sewer, domestic water, gas, steam) as indicated on the Drawings.

B. Remove all mechanical equipment, including pumps, heat exchangers, pressure vessels, fans, air conditioners, radiators, unit heaters and equipment insulation and indicated on the drawings.

C. Remove all piping, valves, steam traps, accessories and pipe insulation as indicated on the Drawings.

D. Remove all ductwork, coils, air terminals and louvers as indicated on the drawings.

E. Removal of plumbing system including plumbing fixtures, domestic water heater, drainage vent, domestic water and fire protection water piping, valve and accessories and insulation (Asbestos insulation shall be removed by others).

3.8 DEMOLITION AND REMOVAL FROM SITE OF ELECTRICAL SYSTEMS

A. Disconnect and shutoff electric service including metering equipment and service equipment as indicated on the Drawings.

B. Disconnect and remove from the site distribution equipment, panel boards and power wiring to motor control centers as indicated on the Drawings.

C. Disconnect and remove existing exterior electric boxes, metering equipment, overhead wiring and associated load equipment as indicated on the Drawings.

D. Disconnect and remove existing telephone lines as indicated on the Drawings.

3.9 SEQUENCE

A. Demolition shall be restricted to horizontal operations, the demolition to be progressing from top to bottom, one level at a time.

B. Masonry walls shall be demolished in small sections. No walls above the elevation of the first level shall be thrown, but a clamshell bucket may be used to demolish the walls piecemeal. No windows or door frames shall be removed until the demolition work has progressed to their elevation in the walls.

C. No wall section more than one story in height shall be permitted to stand alone without lateral bracing, unless such wall was originally designed and constructed to stand to a greater height without such lateral support and is in a condition to be self supporting. All walls shall be left in a stable condition at the end of each shift.

3.10 SITE RESTORATION

A. Below-Grade Areas: Rough grade below-grade areas ready for further excavation or new construction.

B. Below-Grade Areas: Completely fill below-grade areas and voids resulting from building demolition operations with satisfactory soil materials according to backfill requirements in Division 31 Section "Earth Moving."

C. Site Grading: Uniformly rough grade area of demolished construction to a smooth surface, free from irregular surface changes. Provide a smooth transition between adjacent existing grades and new grades.

D. After completion of the demolition and associated grading, the Contractor shall restore any improvements which were damaged during the course of the work to their original condition.

3.11 REPAIRS

A. Promptly repair damage to adjacent buildings caused by demolition operations.

3.12 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site. See Division 01 Section "Construction Waste Management and Disposal" for recycling and disposal of demolition waste.

B. Remove demolition waste materials from Project site and legally dispose of them in an EPA-approved landfill acceptable to authorities having jurisdiction.

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.

C. Do not burn demolished materials.

3.13 CLEANING

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

PART 4 - STANDARDS

4.1 All operations shall be performed in accordance with local, county and State regulations, including, but not limited to, the latest edition of:

A. "American National Standards Institute Safety Requirements for Demolition" (A10.6).

B. City of Philadelphia regulations and ordinances applicable to site preparation, demolition and alterations.

C. Applicable regulations of OSHA relative to demolition work.

D. Environmental Protection Agency and Pennsylvania D.E.P. regulations.

END OF SECTION 024119

SECTION 033000 – CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete formwork.

B. Foundations, concrete stairs

C. Light Pole Piers, Concrete curbs

D. Concrete reinforcement.

E. Joint devices associated with concrete work.

F. Miscellaneous concrete elements, including equipment pads.

G. Concrete curing.

1.02 RELATED REQUIREMENTS

A. Section 321313 Concrete Paving

1.03 REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute International; 2006.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2002).

C. ACI 301 - Specifications for Structural Concrete for Buildings; American Concrete Institute International; 2005.

D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007).

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

F. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).

G. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2008.

H. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute International; 2004.

I. ASTM A 185/A 185M - Standard Specification for Steel Welded Wire Reinforcement, Plain, for Concrete; 2007.

J. ASTM A 615/A 615M - Standard Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement; 2009b.

K. ASTM A 775/A 775M - Standard Specification for Epoxy-Coated Steel Reinforcing Bars; 2007b.

L. ASTM C 33 - Standard Specification for Concrete Aggregates; 2008.

M. ASTM C 39/C 39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2009a.

N. ASTM C 143/C 143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2009.

O. ASTM C 150 - Standard Specification for Portland Cement; 2007.

P. ASTM C 171 - Standard Specification for Sheet Materials for Curing Concrete; 2007.

Q. ASTM C 173/C 173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2009.

R. ASTM C 260 - Standard Specification for Air-Entraining Admixtures for Concrete; 2006.

S. ASTM C 309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2007.

T. ASTM C 494/C 494M - Standard Specification for Chemical Admixtures for Concrete; 2008a.

U. ASTM C 618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2008a.

V. ASTM C 881/C 881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2002.

W. ASTM C 1240 - Standard Specification for Silica Fume Used in Cementitious Mixtures; 2005.

X. ASTM D 1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Nonextruding and Resilient Bituminous Types); 2004 (Reapproved 2008).

Y. ASTM D 3963/D 3963M - Standard Specification for Fabrication and Jobsite Handling of Epoxy Coated Reinforcing Steel Bars; 2001 (Reapproved 2007).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements.

1.05 QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

PART 2 PRODUCTS

2.01 FORMWORK

A. Formwork Design and Construction: Comply with guidelines of ACI 347 to provide formwork that will produce concrete complying with tolerances of ACI 117.

B. Form Materials: Contractor's choice of standard products with sufficient strength to withstand hydrostatic head without distortion in excess of permitted tolerances.
   1. Form Facing for Exposed Finish Concrete: Contractor's choice of materials that will provide smooth, stain-free final appearance.
   2. Form Coating: Release agent that will not adversely affect concrete.
   3. Form Ties: Cone snap type that will leave no metal within 1-1/2 inches of concrete surface.

2.02 REINFORCEMENT

A. Reinforcing Steel: ASTM A 615/A 615M Grade 60 (420).
   1. Type: Deformed billet-steel bars.
   2. Finish: Epoxy coated in accordance with ASTM A 775/A 775M, unless otherwise indicated.

B. Steel Welded Wire Reinforcement: ASTM A 185/A 185M, plain type.
   1. Form: Flat Sheets.
   2. Mesh Size and Wire Gage: As indicated on drawings.

C. Reinforcement Accessories:
   1. Tie Wire: Annealed, minimum 16 gage.
   2. Chairs, Bolsters, Bar Supports, Spacers: Sized and shaped for adequate support of reinforcement during concrete placement.
   3. Provide plastic coated steel components for placement within 1-1/2 inches of weathering surfaces.

2.03 CONCRETE MATERIALS

A. Cement: ASTM C 150, Type I - Normal Portland type.
   1. Acquire all cement for entire project from same source.

B. Fine and Coarse Aggregates: ASTM C 33.
   1. Acquire all aggregates for entire project from same source.

C. Fly Ash: ASTM C 618, Class F.

D. Silica Fume: ASTM C 1240, proportioned in accordance with ACI 211.1.

E. Water: Clean and not detrimental to concrete.

2.04 CHEMICAL ADMIXTURES

A. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

B. Air Entrainment Admixture: ASTM C 260.

C. Water Reducing Admixture: ASTM C 494/C 494M Type A.

2.05 ACCESSORY MATERIALS

A. Moisture-Retaining Cover: ASTM C 171; regular curing paper, white curing paper, clear polyethylene, white polyethylene, or white burlap-polyethylene sheet.

B. Liquid Curing Compound: ASTM C 309, Type 1, clear or translucent.

2.06 BONDING AND JOINTING PRODUCTS

A. Epoxy Bonding System: Complying with ASTM C 881/C 881M and of Type required for specific application.

B. Waterstops: Bentonite and butyl rubber, complying with NSF 61.
   1. Configuration: As indicated on drawings.
   2. Size: As indicated on drawings.

C. Reglets: Formed steel sheet, galvanized, with temporary filler to prevent concrete intrusion during placement.
   1. Size: As indicated on drawings.

D. Joint Filler: Nonextruding, resilient asphalt impregnated fiberboard or felt, complying with ASTM D 1751, 1/2 inch thick and 4 inches deep; tongue and groove profile.

E. Slab Construction Joint Devices: Combination keyed joint form and screed, galvanized steel, with minimum 1 inch diameter holes for conduit or rebars to pass through at 6 inches on center; ribbed steel stakes for setting.
   1. Provide removable plastic cap strip that forms wedge-shaped joint for sealant installation.
   2. Height: To suit slab thickness.

2.07 CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.
   1. Replace as much Portland cement as possible with fly ash, ground granulated blast furnace slag, silica fume, or rice hull ash as is consistent with ACI recommendations.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, as specified in ACI 301.
   1. For trial mixtures method, employ independent testing agency acceptable to Engineer for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates

recommended by manufacturer.

D. Normal Weight Concrete:

2. Compressive Strength, when tested in accordance with ASTM C 39/C 39M at 14 days: 4,000 psi.
   3. Fly Ash Content: Maximum 15 percent of cementitious materials by weight.
   4. Mico Silica/Silica Fume Content: Maximum 5 percent of cementitious materials by weight.
   5. Cement Content: Minimum 564 lb per cubic yard.
   6. Water-Cement Ratio: Maximum 40 percent by weight.
   7. Total Air Content: 4 percent, determined in accordance with ASTM C 173/C 173M.
   8. Maximum Slump: 3 inches.
   9. Maximum Aggregate Size: 1 inch.

2.08 MIXING

A. On Project Site: Mix in drum type batch mixer, complying with ASTM C 685. Mix each batch not less than 1-1/2 minutes and not more than 5 minutes.

PART 3 EXECUTION

3.01 PREPARATION

A. Formwork: Comply with requirements of ACI 301. Design and fabricate forms to support all applied loads until concrete is cured, and for easy removal without damage to concrete.

B. Verify that forms are clean and free of rust before applying release agent.

C. Coordinate placement of embedded items with erection of concrete formwork and placement of form accessories.

D. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.
   1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.

E. Where new concrete with integral waterproofing is to be bonded to previously placed concrete, prepare surfaces to be treated in accordance with waterproofing manufacturer's instructions. Saturate cold joint surface with clean water, and remove excess water before application of coat of waterproofing admixture slurry. Apply slurry coat uniformly with semi-stiff bristle brush at rate recommended by waterproofing manufacturer.

F. In locations where new concrete is doweled to existing work, drill holes in existing concrete, insert steel dowels and pack solid with non-shrink grout.

3.02 INSTALLING REINFORCEMENT

A. Fabricate and handle epoxy-coated reinforcing in accordance with ASTM D 3963/D 3963M.

B. Comply with requirements of ACI 301. Clean reinforcement of loose rust and mill scale, and accurately position, support, and secure in place to achieve not less than minimum concrete coverage required for protection.

C. Install welded wire reinforcement in maximum possible lengths, and offset end laps in both directions. Splice laps with tie wire.

3.03 PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

D. Separate slabs on grade from vertical surfaces with joint filler.

E. Place joint filler in floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

F. Extend joint filler from bottom of slab to within ½ inch of finished slab surface. Conform to Section 079005 for finish joint sealer requirements.

G. Install joint devices in accordance with manufacturer's instructions.

H. Install construction joint devices in coordination with floor slab pattern placement sequence. Set top to required elevations. Secure to resist movement by wet concrete.

I. Apply sealants in joint devices in accordance with Section 079005.

J. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

K. Place concrete continuously between predetermined expansion, control and construction joints.

L. Do not interrupt successive placement; do not permit cold joints to occur.

M. Place floor slabs in saw cut pattern indicated.

N. Saw cut joints within 24 hours after placing. Use 3/16 inch thick blade, cut into ¼ depth of slab thickness.

O. Screed floors level, maintaining surface flatness of maximum ¼ inch in 10 ft.

3.04 CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:
   1. Cork Floated Finish: Immediately after form removal, apply grout with trowel or firm rubber float; compress grout with low-speed grinder, and apply final texture with cork float.

D. Concrete Slabs: Finish to requirements of ACI 302.1R, and as follows:
   1. Other Surfaces to Be Left Exposed: "Steel trowel" as described in ACI 302.1R, minimizing burnish marks and other appearance defects.

3.05 CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot or cold temperatures, and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.
   1. Normal concrete: Not less than 7 days.

C. Surfaces Not in Contact with Forms:
   1. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than three days by water ponding, water-saturated sand, water-fog spray, or saturated burlap.
   2. Final Curing: Begin after initial curing but before surface is dry.
      a. Moisture-Retaining Cover: Seal in place with waterproof tape or adhesive.
      b. Curing Compound: Apply in two coats at right angles, using application rate recommended by manufacturer.

3.06 FIELD QUALITY CONTROL

A. See drawings for this Scope of Work.

3.07 DEFECTIVE CONCRETE

A. Test Results: The testing agency shall report test results in writing to Engineer and Contractor within 24 hours of test.

B. Defective Concrete: Concrete not conforming to required lines, details, dimensions, tolerances or specified requirements.

C. Repair or replacement of defective concrete will be determined by the Engineer. The cost of additional testing shall be borne by Contractor when defective concrete is identified.

D. Do not patch, fill, touch-up, repair, or replace exposed concrete except upon express direction of Engineer for each individual area.

END OF SECTION

SECTION 042000 - UNIT MASONRY FOR SITE WORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes unit masonry for the seat walls and ground signage consisting of the following:

1. Face brick.
2. Mortar and grout.
3. Ties and anchors.
4. Illuminated, fabricated channel dimensional characters.
5. Split-face concrete masonry units to match existing.

B. Products furnished, but not installed, under this Section include the following:

1. Mortar for cast stone units installed under other Division 04 Sections.
2. Anchor sections of adjustable masonry anchors for connecting to concrete frame, installed under Division 03 Section "Site Concrete."

1.2 SUBMITTALS

A. Product Data: For each different masonry unit, accessory, and other manufactured product specified.

B. Samples for Verification: For the following:

1. Full-size units for each different exposed masonry unit required, showing the full range of exposed colors, textures, and dimensions to be expected in the completed construction.
2. Accessories embedded in the masonry.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Dimensional Characters: Half-size Sample of each type of dimensional character.
2. Exposed Accessories: Half-size Sample of each accessory type.

D. Shop Drawings: For dimensional letter signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by others, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign at least half size.

4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.
6. Show method and clearance for replacement of light fixture(s).

E. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

F. Material Test Reports: From a qualified testing agency indicating and interpreting test results of the following for compliance with requirements indicated:

1. Each type of masonry unit required. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances
2. Mortar complying with property requirements of ASTM C 270.

G. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements:

1. Each type of masonry unit required. Include size-variation data for brick, verifying that actual range of sizes falls within specified tolerances
2. Each cement product required for mortar and grout, including name of manufacturer, brand, type, and weight slips at time of de livery.
3. Each type and size of anchor, tie, and m et.al. accessory.

1.3 QUALITY ASSURANCE

A. Masonry Standard: Comply with requirements of "Specifications for Masonry Structures, ACI 530.1-02/ASCE 6-02/TSM 602-02" published by the American Concrete Institute, except when more stringent requirements are specified and as modified by the requirements of these Contract Documents.

1. Revise ACI 530.1/ASCE 6/TSM 602 to exclude Article 1.5; Subparagraphs 1.1 C.1 through Subparagraphs 3.3 E.1 through 5.

B. Installer Qualifications: Engage an experienced installer who has 10 years experience as a journeymen mason, and who has completed masonry similar in material, design, and extent to that indicated for this Project and with a record of successful in-service performance.

1. A minimum of one skilled journeyman mason shall be present at all times during masonry erection and shall personally direct the work.

C. Source Limitations for Masonry Units: Obtain exposed masonry units of a uniform texture and color, or a uniform blend within the ranges accepted for these characteristics, through one source from a single manufacturer for each product required.

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

E. Mockups: Before installing unit masonry, build mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and qualities of materials and execution. Final approval of masonry unit color and texture and mortar color and texture will be made based on acceptance of mock-up. Build mockups to comply with the following requirements, using materials indicated for the completed Work.

1. Locate mockup in the locations as directed by Architect.
2. Build one mock-up for each type of exposed masonry material to be provided.
3. Build a single mockup containing the following types of masonry approximately 96 inches long by 48 inches high by full thickness, including face and backup wythes and accessories. Include a sealant-filled joint at least 16 inches (400 mm) long in the mockup.

    a. Typical exterior masonry-veneer seating wall complete with back-up, ties, sealant and cast stone cap.

1.4 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.5 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.

1.6 PROJECT CONDITIONS

A. Protection of Masonry: During construction, cover tops of walls, projections, and sills with waterproof sheeting at end of each day's work. Cover partially completed masonry when construction is not in progress.

B. Do not apply uniform loads for at least 12 hours and concentrated loads for at least three (3) days after building masonry walls or columns.

C. Stain Prevention: Prevent grout, mortar, and soil from staining the face of masonry to be left exposed or painted. Immediately remove grout, mortar, and soil that come in contact with such masonry.

1. Protect base of walls from rain-splashed mud and from mortar splatter by coverings spread on ground and over wall surface.
2. Protect sills, ledges, and projections from mortar droppings.
3. Turn scaffold boards near the wall on edge at the end of each day to prevent rain from splashing mortar and dirt onto completed masonry.

D. Cold-Weather Requirements: Do not use frozen materials or m aterials mixed or coated with ice or frost. Do not build on frozen substrates. Remove and replace unit masonry damaged by frost or by freezing conditions. Comply with cold-weather construction requirements contained in Part 1.8 of ACI 530.1/ASCE 6/TMS 602.

1. Do not lay masonry units that are wet or frozen.
2. Remove masonry damaged by freezing conditions.

E. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F (4 deg C) and above and will remain so until masonry has dried, bu t not less than 7 days after completing cleaning.

F. Hot-Weather Requirements: Protect unit masonry work when temperature and humidity conditions produce excessive evaporation of water from mortar and grout. Comply with cold-weather construction requirements contained in Part 1.8 D. of ACI 530.1/ASCE 6/TMS 602. Provide artificial shade and wind breaks and use cooled materials as required

1. When ambient temperature exceeds 100 deg F (38 deg C), or 90 deg F (32 deg C) with a wind velocity greater than 8 mph (13 km/h), do not spread mortar beds more than 48 inches (1200 mm) ahead of masonry. Set masonry units within one minute of spreading mortar.

1.7 WARRANTY

A. Dimensional Letter Signage Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:
   a. Deterioration of finishes beyond normal weathering.
   b. Separation or delamination of sheet materials and components.

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

1.8 SPECIAL INSPECTIONS

A. The Owner will engage the services of a qualified Special Inspector for this project. The Special Inspector will provide and/or coordinate inspection and testing requirements as necessary in accordance with the provisions of Chapter 17 of the Building Code of New York State, Division of these Specifications, and the Statement of Special Inspections.

1. In absence of other indications of non-compliance with requirements, masonry shall be considered satisfactory if results from field quality control tests comply with minimum requirements indicated.

B. Testing Agency shall submit copies of reports to Special Inspector, Engineer, Architect, Construction Manager, and Contractor on same day that tests are made. Include date of testing, weather conditions, building location and test location referenced to column lines, proportions, composition, and compressive strength.

PART 2 - PRODUCTS

2.1 BRICK

A. General: Provide shapes indicated and as follows for each form of brick required:

1. Provide units without cores or frogs and with exposed surfaces finished for ends of sills and caps and for similar applications that would otherwise expose unfinished brick surfaces.

B. Provide special shapes for applications requiring brick of size, form, color, and texture on exposed surfaces that cannot be produced by sawing.

1. Provide special shapes for applications where stretcher units cannot accommodate special conditions, including those at corners, movement joints, bond beams, sashes, and lintels.
2. Provide special shapes for applications where shapes produced by sawing would result in sawed surfaces being exposed to view.

C. Face Brick.

1. Manufacturer, Style and Color: Glen-Gery Brick, Tuscan Series, Golden Dawn color.
2. Size: 3-5/8 inches wide (92 mm) by 2-1/4 inches (57 mm) high by 7-5/8 inches (191 mm) long.
3. Application: Use where brick is exposed, unless otherwise indicated.

2.2 MORTAR AND GROUT MATERIALS

A. Portland Cement: ASTM C 150, Type I or II, except Type III may be used for cold-weather construction. Provide natural color cement Hydrated Lime: ASTM C 207, Type S.
1. For brickwork, and setting cast stone trim units, provide natural color or white cement as required to produce required mortar color.

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

C. Portland Cement-Lime Mix: Packaged blend of portland cement complying with ASTM C 150, Type I or Type III, and hydrated lime complying with ASTM C 207.

D. Masonry Cement: Not permitted.

E. Aggregate for Mortar: ASTM C 144; except for joints less than 1/4 inch (6.5 mm) thick, use aggregate graded with 100 percent passing the No. 16 (1.18-mm) sieve.

1. For colored mortar, provide natural sand or ground marble, granite, or other sound stone; of color necessary to produce required mortar color.

F. Aggregate for Grout: ASTM C 404.

G. Mortar Pigments: Natural and synthetic iron oxides, compounded for mortar mixes. Use only pigments with a record of satisfactory performance in masonry mortars.

H. Water: Potable

2.3 STEEL MATERIALS, GENERAL REINFORCEMENT

A. Recycled Steel: Reinforcing bar, rods, steel wire, welded wire fabric, anchors and ties, and miscellaneous steel accessories shall contain a minimum of 35% (combined) post-industrial (preconsumer)/ post-consumer recycled content (the percentage of recycled content is based on the weight of the component materials).

2.4 TIES AND ANCHORS

A. General: Provide ties and anchors, specified in subsequent articles, made from materials that comply with this Article, unless otherwise indicated.

B. Mill Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 641 (ASTM A 641M), Class 1 coating.

C. Hot-Dip Galvanized Carbon-Steel Wire: ASTM A 82; with ASTM A 153, Class B-2 coating.

D. Steel Sheet, Galvanized after Fabrication: ASTM A 366/A 366M cold-rolled, carbon-steel sheet hot-dip galvanized after fabrication to comply with ASTM A 153.

E. Steel Plates, Shapes, and Bars: ASTM A 36/A 36M.

2.5 ANCHORS FOR CONNECTING TO CONCRETE

A. General: Provide two-piece assemblies that allow vertical or horizontal adjustment but resist tension and compression forces perpendicular to plane of w all.

1. Anchor Section: Dovetail anchor section formed from minimum 0.0966-inch- (2.5-mm-) thick, steel sheet, galvanized after fabrication.
2. Tie Section: Triangular-shaped wire tie, sized to extend within 1 inch (25 mm) of masonry face, made from 0.1875-inch- (4.8-mm-) hot-dip galvanized steel wire.
3. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. D/A 100 slots with D/A 720 tie; Dur-O-Wal, Inc.
   b. 305 slots with 315 tie; Hohmann & Barnard, Inc.
   c. 100 slots with 103 series tie; Heckman Building Products, Inc.
   d. 500 series slots with 506 series tie; National Wire Products Industries

2.6 MISCELLANEOUS ANCHORS

A. Anchor Bolts: Steel bolts complying with ASTM A 307, Grade A (ASTM F 568, Property Class 4.6); with ASTM A 563 (ASTM A 563M) hex nuts and, where indicated, flat washers; hot-dip galvanized to comply with ASTM A 153, Class C; of diameter and length indicated and in the following configurations:

   1. Headed bolts.

B. Postinstalled Anchors: Anchors as described below, with capability to sustain, without failure, load imposed within factors of safety indicated, as determined by testing per ASTM E 488, conducted by a qualified independent testing agency.

   1. Type: Chemical anchors.
   2. Type: Expansion anchors.
   3. Corrosion Protection(Indoor): Carbon-steel components zinc plated to comply with ASTM B 633, Class Fe/Zn 5 (5 m icrons) for Class SC 1 service condition (mild).
   4. Corrosion Protection: Stainless-steel components complying with ASTM F 593 and ASTM F 594, Alloy Group 1 or 2 (ASTM F 738M and ASTM F 836M, Alloy Group 1 or 4) for bolts and nuts; ASTM A 666 or ASTM A 276, Type 304 or 316, for anchors.
   5. For Post-installed Anchors in Concrete: Capability to sustain, without failure, a load equal to four times the loads imposed.
   6. For Post-installed Anchors in Grouted Masonry Units: Capability to sustain, without failure, a load equal to six times the loads imposed

2.7 MISCELLANEOUS MASONRY ACCESSORIES

A. Compressible Filler: Pre-molded filler strips com plying with ASTM D 1056, Grade 2A1; compressible up to 35 percent; of width and thickness indicated; formulated from neoprene.

B. Bond-Breaker Strips: Asphalt-saturated, organic roofing felt complying with ASTM D 226, Type I (No. 15 asphalt felt).

2.8 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup (0.14-L) dry measure tetrasodium polyphosphate and 1/2-cup (0.14-L) dry measure laundry detergent dissolved in 1 gal. (4 L) of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.9 MASONRY CLEANERS

A. Job-Mixed Detergent Solution: Solution of 1/2-cup dry measure tetrasodium polyphosphate and 1/2-cup dry measure laundry detergent dissolved in 1 gal. of water.

B. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cleaner manufacturer and manufacturer of masonry units being cleaned.

2.10 MORTAR AND GROUT MIXES

A. General: Do not use admixtures, including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures, unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.

B. 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.

C. Colored Mortar for Brickwork and Setting Cast Stone Units: Produce mortar to match selected color, and approved mock-up, by using selected ingredients. Do not alter specified proportions without Architect's approval.

1. Use naturally colored aggregates to produce required mortar color to greatest extent possible, before adding pigments.
2. Pigments: W here mortar pigments are used, do not exceed a pigment-to-cement ratio of 1:10 by weight.
3. Color: Match building precast color.

D. Mortar for Unit Masonry: Comply with ASTM C 270, Proportion Specification.

1. Limit cementitious materials in mortar to portland cement and lime.
2. For masonry below grade, in contact with earth, and where indicated, use Type M.

3. For exterior above-grade load-bearing and exterior above-grade non-load-bearing walls, use Type N.
4. For cast stone units, use Type N.
5. Provide grout with a slump of 8 to 11 inches as measured according to ASTM C 143.

2.11 PERFORMANCE REQUIREMENTS FOR SIGNAGE

A. Thermal Movements: For exterior fabricated channel dimensional characters, allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.12 DIMENSIONAL CHARACTERS

A. Fabricated Channel Characters: Metal face and side returns, formed free from warp and distortion; with uniform faces, sharp corners, and precisely formed lines and profiles; internally braced for stability and for securing fasteners; and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
2. ASI Sign Systems, Inc.
3. Nelson-Harkins Industries.
4. Steel Art Company.
5. Metallic Arts.
6. APCO Graphics, Inc.

B. Illuminated Characters: Backlighted character construction with LED lighting including transformers, insulators, and other accessories for operability, with provision for servicing and concealing connections to building electrical system. Use tight or sealed joint construction to prevent unintentional light leakage. Space lamps apart from each other and away from character surfaces as needed to illuminate evenly.

1. Power: 120 V, 60 Hz, 1 phase, 15 A
2. Weeps: Provide weep holes to drain water at lowest part of exterior characters.

C. Character Material: Sheet or plate stainless steel.

D. Material Thickness: 0.050 inch (1.27 mm) thick for face and 0.031 inch (0.79 mm) thick for returns.

E. Character Height and Depth: As indicated on Drawings.

F. Finishes: Integral Stainless-Steel Finish: [No. 4] [No. 8] [Match Architect's sample] [As selected by Architect from full range of industry finishes].

G. Mounting: Projecting studs or brackets as reviewed and approved by Architect from shop drawing submittals.

1. Hold characters at manufacturer's/fabricators recommended distance from wall surface . Distance shall allow for access to light fixtures for maintenance

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

1. For the record, prepare written report, endorsed by Installer, listing conditions detrimental to performance.
2. Verify that foundations are within tolerances specified.
3. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Before installation, examine rough-in and built-in construction to verify actual locations of piping connections.

3.2 INSTALLATION, GENERAL

A. For cold-weather construction comply with requirements contained in ACI 530.1-05.

B. Build chases and recesses to accommodate items specified in this Section and in other Sections of the Specifications.

C. Leave openings for equipment to be installed before completing masonry. After installing equipment, complete masonry to match the construction immediately adjacent to the opening.

D. Cut masonry units with motor-driven saws to provide clean, sharp, un-chipped edges. Cut units as required to provide a continuous pattern and to fit adjoining construction. W here possible, use full-size units without cutting. Allow units cut with water-cooled saws to dry before placing, unless wetting of units is specified. Install cut units with cut surfaces and, where possible, cut edges concealed.

E. Select and arrange units for exposed unit masonry to produce a uniform blend of colors and textures.

1. Mix units from several pallets or cubes as they are placed.

F. Wetting of Brick: W et brick before laying if the initial rate of absorption exceeds 30 g/30 sq. in. (30 g/194 sq. cm) per minute when tested per ASTM C 67. Allow units to absorb water so they are damp but not wet at the time of laying.

3.3 CONSTRUCTION TOLERANCES

A. Comply with tolerances in ACI 530.1/ASCE 6/TMS 602 and the following:.

B. For conspicuous vertical lines, such as external corners, door jambs, reveals, and expansion and control joints, do not vary from plumb by more than 1/4 inch in 20 feet (6 mm in 6 m), nor 1/2 inch(12 mm) maximum.

C. For vertical alignment of exposed head joints, do not vary from plumb by more than 1/4 inch in 10feet (6 mm in 3 m), nor 1/2 inch (12 mm) maximum.

D. For conspicuous horizontal lines, such as exposed lintels, sills, parapets, wall caps and reveals, the following tolerances will apply.

1. Variation from Plumb: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet(6 mm in 6 m) or more.
2. Variation from Level: Do not exceed 1/8 inch in 10 fee t (3 mm in 3 m), 1/4 inch in 20 feet (6mm in 6 m), or 3/8 inch (9 mm) maximum.
3. Variation in Joint Width: Do not vary joint thickness m ore than 1/8 inch in 36 inches (3 mm in 900 mm) or one-fourth of nominal joint width, whichever is less.
4. Variation in Plane between Adjacent Surfaces (Lipping): Do not exceed 1/16-inch (1.5-mm) difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

E. For exposed bed joints, do not vary from thickness indicated by more than plus or minus 1/8 inch(3 mm), with a maximum thickness limited to 1/2 inch (12 mm). Do not vary from bed-joint thickness of adjacent courses by more than 1/8 inch (3 mm).

F. For exposed head joints, do not vary from thickness indicated by more than plus or minus 1/8 inch(3 mm). Do not vary from adjacent bed-joint and head-joint thicknesses by more than 1/8 inch (3mm).

3.4 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: Lay exposed masonry in running bond pattern unless otherwise indicated; do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

C. Lay concealed masonry with all units in a wythe in running bond or bonded by lapping not less than2 inches (50 mm). Bond and interlock each course of each wythe at corners. Do not use units with less than nominal 4-inch (100-mm) horizontal face dimensions at corners or jambs.

D. Stopping and Resuming W ork: In each course, rack back one-half-u nit length for one-half running bond or one-third-unit length for one-third running bond; do not tooth. Clean exposed

surfaces of set masonry, wet clay masonry units lightly if required, and remove loose masonry units and mortar before laying fresh masonry.

E. Built-in Work: As construction progresses, build in items specified under this and other Sections of the Specifications. Fill in solidly with masonry around built-in items.

F. Fill space between hollow-metal frames and masonry solidly with mortar, unless otherwise indicated.

3.5 MORTAR BEDDING AND JOINTING

A. Lay hollow masonry units as follows:

1. With full mortar coverage on horizontal and vertical face shells.
2. Bed webs in mortar in starting course on footings and in all courses of piers, columns, and pilasters, and where adjacent to cells or cavities to be filled with grout.
3. For starting course on footings where cells are not grouted, spread out full mortar bed, including areas under cells

B. Lay solid brick-size masonry units with completely filled bed and head joints; butter ends with sufficient mortar to fill head joints and shove into place. Do not deeply furrow bed joints or slush head joints.

C. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than the joint thickness, unless otherwise indicated.

3.6 ANCHORING MASONRY TO STRUCTURAL MEMBERS

A. Anchor masonry to structural members where masonry abuts or faces structural members to comply with the following:

1. Provide an open space not less than 1 inch (25 mm) in width between masonry and structural member, unless otherwise indicated. Keep open space free of mortar or other rigid materials.
2. Anchor masonry to structural members with flexible anchors embedded in masonry joints and attached to structure.
3. Space anchors as indicated, but not more than 16 inches (406 mm) o.c. vertically and 16 inches (406 mm) o.c. horizontally, with not less than 1 anchor for each 1.77 sq. ft. (0.16 sq. m) of wall area.

3.7 CONTROL AND EXPANSION JOINTS

A. General: Install vertical control and expansion joints at one side of all doorways and at wall locations maximum 25 ft. o.c., and where indicated. Build-in related items as masonry progresses. Do not form a continuous span through movement joints unless provisions are made to prevent in-plane restraint of wall or partition movement.

B. Form expansion joints in brick made from clay or shale by building in joint fillers not less than 3/8 inch (10 mm) for installation of sealant and backer rod specified in Division 7 Section "Joint Sealants." Keep joint free and clear of mortar

C. Build in horizontal, pressure-relieving joints where indicated; construct joints by either leaving an air space or inserting a compressible filler of width required for installing sealant and backer rod specified in Division 7 Section "Joint Sealants."

3.8 FIELD QUALITY CONTROL

A. Inspectors: Owner will engage qualified certified testing agency to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

1. Retesting of materials failing to meet specified requirements shall be done at Contractor's expense.

B. Testing Frequency: Tests and Evaluations listed in this Article will be performed during construction for each 5000 sq. ft. (465 sq. m) of wall area or portion thereof:

C. Mortar Test (Property Specification): For each mix provided, per ASTM C 780 . Test mortar for mortar air content and compressive strength.

3.9 REPAIRING, POINTING, AND CLEANING

A. Remove and replace masonry units that are loose, chipped, broken, stained, or otherwise damaged or that do not match adjoining units. Install new units to match adjoining units; install in fresh mortar, pointed to eliminate evidence of replacement.

B. Pointing: During the tooling of joints, enlarge voids and holes, except weep holes, and completely fill with mortar. Point up joints, including corners, openings, and adjacent construction, to provide a neat, uniform appearance. Prepare joints for sealant application.

C. In-Progress Cleaning: Clean unit masonry as work progresses by dry brushing to remove mortar fins andInspectors: Owner will engage qualified independent inspectors to perform inspections and prepare reports. Allow inspectors access to scaffolding and work areas, as needed to perform inspections.

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

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample wall panel; leave one-half of panel uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of masonry.
3. Protect adjacent stone and non-masonry surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.

4. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing the surfaces thoroughly with clear water.
5. Clean brick masonry with a proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 042000

SECTION 047200 - CAST STONE

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:
   1. Cast stone wall caps.

B. B. Related Sections Include the Following:
   1. Division 04 Section "Unit Masonry for Sitework" for mortar and grout.

1.2 DEFINITIONS

A. Cast Stone: Architectural precast concrete building units intended to simulate natural cut stone.

B. Arris: The sharp edge of a Cast Stone Units

1.3 SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for cast stone units.

B. Material Safety Data Sheets (MSDS) highlighting VOC limits.

C. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions details of reinforcement and anchorages, if any; and indication of finished faces.
   1. Include elevations showing layout of units and locations of joints and anchors.

D. Samples for Initial Selection: For colored mortar, showing the full range of colors available.

E. Samples for Verification:
   1. For each mortar color required, showing the full range expected in the finished construction. Make samples using the same sand and mortar ingredients to be used on Project. Label samples to indicate type and amount of colorant used.
   2. For each color and texture of cast stone required, 10-inches (250 mm) square in size.

F. Full-Size Samples: For each type of cast stone unit required. Make available for Architect's review at Project site before installing cast stone.
   1. Approved Samples may be installed in the Work.

G. Qualification Data: For firms and persons specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include lists of completed projects with project names and addresses, names and addresses of architects and owners, and other information specified.
   1. Include copies of material test reports for completed projects, indicating compliance of cast stone with ASTM C 1364.

H. Material Test Reports: From a qualified testing agency indicating and interpreting test results for compliance of cast stone with requirements indicated.

I. Certification that the materials incorporated in this Work are free from hazardous contaminates.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A firm experienced in manufacturing cast stone units similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to manufacture required units.

B. Testing Agency Qualifications: An independent testing agency qualified according to ASTM E 329 to conduct the testing indicated, as documented according to ASTM E 548.

C. Source Limitations for Cast Stone: Obtain cast stone units through one source from a single manufacturer.

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

1.5 DELIVERY, STORAGE, AND HANDLING

A. Pack, handle, and ship cast stone units in suitable packs or pallets.
   1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units, if required, using dollies with wood supports.
   2. Store cast stone units on wood skids or pallets with non-staining, waterproof covers. Arrange to distribute weight evenly and to prevent dam age to units. Ventilate under covers to prevent condensation.

B. Store installation materials on elevated platforms, under cover, and in a dry location.

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

1.6 COORDINATION

A. A. Coordinate production and delivery of cast stone with unit masonry work to minimize the need for on-site storage and to avoid delaying the Work.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. Continental Cast Stone East
   2. Haddonstone (USA) Ltd.
   3. Stone Legends Inc.

4. Stromberg Architectural Inc
5. Sun Precast Co., Inc

2.2 CAST STONE MATERIALS

A. General: Comply with ASTM C 1364 and the following:
   1. Portland Cement: ASTM C 150, Type I, containing not more than 0.60 percent total alkali when tested according to ASTM C 114.
   2. Coarse Aggregates: Granite, quartz, or limestone complying with ASTM C 33; gradation as needed to produce required textures.
   3. Fine Aggregates: Manufactured or natural sands complying with ASTM C 33, gradation as needed to produce required textures.
   4. Air-Entraining Admixture: ASTM C 260, certified by the manufacturer to be compatible with other admixtures used.
   5. Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 5 to 7 percent.

B. Reinforcement: Deformed steel bars complying with ASTM A 615/A 615M.
   1. Epoxy Coating: ASTM A 775/A 775M.
   2. Galvanized Coating: ASTM A 767/A 767M.

C. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A 276 or ASTM A 666, Type 304.

2.3 CAST STONE UNITS

A. Provide cast stone units produced through a wet cast process.

B. Provide cast stone units complying with ASTM C 1364.
   1. Provide units that are resistant to freezing and thawing as determined by laboratory testing according to ASTM C 666, Procedure A, as modified by ASTM C 1364.

C. Reinforce units as indicated and as required by ASTM C 1364. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches (38 mm) of material.

D. Fabricate units with sharp arris and details accurately reproduced with indicated texture on all exposed surfaces, unless otherwise indicated.
   1. Slope exposed horizontal surfaces at least 1:12, unless otherwise indicated.
   2. Provide raised fillets at backs of sills and at ends indicated to be built into jambs.
   3. Provide drips on projecting elements, unless otherwise indicated.

E. Cure and finish units as follows:
   1. Cure units in totally enclosed curing room under dense fog and water spray at 95 percent relative humidity for 24 hours.
   2. Yard cure units until the sum of the mean daily temperatures for each day equals or exceeds 350 deg F.
   3. Acid etch units to remove cement film from surfaces indicated to be finished.

F. Color and Texture: Match color and texture of adjacent building’s precast concrete panels and trim.

2.4 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from stainless steel complying with ASTM A 276 or ASTM A 666, Type 304.

B. Dowels: Round stainless-steel bars com plying with ASTM A 276, Type 304, 1/2-inch (12-mm) diameter.

C. Job-Mixed Detergent Solution: Solution of ½ cup (125 mL) of dry-measure tetrasodium polyphosphate and ½ cup (125 mL) of dry-measure laundry detergent dissolved in 1 gal. (4 L) of water.

2.6 SOURCE QUALITY CONTROL

A. Employ an independent testing agency to sample and test cast stone units according to ASTM C 1364.
   1. Include testing for freezing and thawing resistance.

PART 3 – EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of cast stone.

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

3.2 INSTALLATION

A. Set cast stone as indicated on Contract Drawings. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place. Set units accurately in locations indicated with edges and faces aligned according to established relationships and indicated tolerances.

B. Drench units with clear water just before setting.

C. Set units in full bed of mortar with full head joints, unless otherwise indicated. Build anchors and ties into mortar joints as units are set.
   1. Fill dowel holes and anchor slots with mortar.
   2. Leave head joints open in wall caps and other units with exposed horizontal surfaces. Keep joints clear of mortar, and rake out to receive sealant.

D. Rake out joints for pointing with mortar to depths of not less than 3/4 inch (19 mm). Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

E. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch (10 mm). Compact each layer thoroughly and allow to becom e thumbprint hard before applying next layer.

F. Tool exposed joints slightly concave when thumbprint hard, using a jointer larger than joint thickness, unless otherwise indicated.

G. Provide expansion, control, and pressure-relieving joints of widths and at locations indicated.
1. Sealing joints is specified in Division 7 Section "Joint Sealants."
2. Keep joints free of mortar and other rigid materials.

3.3 INSTALLATION TOLERANCES

A. Variation from Plum b: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m) or 1/4 inch in 20 feet (6 mm in 6 m) or more.

B. Variation from Level: Do not exceed 1/8 inch in 10 feet (3 mm in 3 m), 1/4 inch in 20 feet (6 mm in 6 m), or 3/8 inch (9 mm) maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches (3 mm in 900m mm) or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not exceed 1/16-inch (1.5-mm) difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.4 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if m ethods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, com plying with other requirements, and showing no evidence of replacement.
In-Progress Cleaning: Clean cast stone as work progresses. Remove mortar fins and smears before tooling joints.

C. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:
1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent, polyethylene film, or waterproof masking tape.
3. Wet wall surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
4. Clean cast stone by bucket and brush hand-cleaning method described in BIA Technical. Notes No. 20 Revised II, using job-mixed detergent solution.

END OF SECTION 047200

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. Benches
   2. Table and Chair Units
   3. Trash and Recycling Cans

B. Related Requirements:

   1. Division 03 Section "Cast-in-Place Concrete".
   2. Division 31 Section "Earth Moving" for excavation for installing concrete footings.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Product Schedule: For site furnishings. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For site furnishings to include in maintenance manuals.

PART 2 - PRODUCTS

2.1 BENCH

A. Products: Stay Bench by Landscape Forms, Inc.

   1. Backed bench; 2 dividers; no arms

2. Powdercoat finish; Color, steel.

3. Mounting: Surface and Embedded, see Drawings for location.

4. Surface Mounted: See manufacturer's installation instructions.

2.2 TABLE WITH ATTACHED SEATS

A. Products: Mingle by Landscape Forms, Inc.

1. Seats Style: Backed

2. Seat Number: 5 and 6 seat units, see Drawings for locations

3. Table Top: Catena, Powdercoat finish

4. Powdercoat finish; Color, steel.

5. Surface mounted. See manufacturer's installation instructions.

2.3 TRASH AND RECYCLING CANS

A. Products: Select by Landscape Forms, Inc.

1. Powdercoat finish; Color, steel.

2. Coordinate with Owner regarding single, double, or triple unit

3. Coordinate with Owner regarding number and location of units.

PART 3 - Specify body and doors as all solid, all perforated or combination of solid and perforated. When specifying combination, provide solid or perforated choice for the body and for each door. Specify opening style(s): multi-use, newspaper slot or 5" diameter. Specify powdercoat color(s) for body, door, opening trim and signage plate. Specify standard or custom signage wording and with or without lock for each door.

PART 4 - EXECUTION

4.1 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.

4.2 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 and/or positioned at locations indicated on Drawings.

END OF SECTION 129300

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SECTION 260519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

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. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

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

1. American Insulated Wire Corp.; a Leviton Company.
2. General Cable Corporation.

3. Cablec Continental Cable Company.
4. Southwire Company.

B. Copper Conductors: Comply with NEMA WC 70.

C. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. AFC Cable Systems, Inc.
2. Hubbell Power Systems, Inc.
3. O-Z/Gedney; EGS Electrical Group LLC.
4. 3M; Electrical Products Division.
5. Thomas & Betts Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper: Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

B. Branch Circuits: Copper. Solid or stranded for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

C. Wire smaller than No. 12 AWG shall not be used for lighting or power circuits.

3.2 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

A. Exposed Branch Circuits, Including in Crawlspaces: Type THHN-THWN, single conductors in raceway.

B. Branch Circuits Concealed in Accessible Ceilings, Walls, and Partitions: Type THHN-THWN, single conductors in raceway.

C. Branch Circuits Concealed in Concrete Masonry, Above Inaccessible Ceilings, Below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. Conceal cables in finished walls, ceilings, and floors, unless otherwise indicated.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.

D. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.

3.4 CONNECTIONS

A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.

D. Copper conductors #10 AWG and smaller shall be terminated and spliced with wire nut connectors. The nylon self-insulated type shall be used to isolate the termination from other metal parts and equipment.

END OF SECTION 260519

SECTION 260526 - GROUNDING AND BONDING 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. This Section includes methods and materials for grounding systems and equipment**,** plus the following special applications**:**
   1. Underground distribution grounding.
   2. All feeders and branch circuits.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel; 3/4 inch by10 feet (19 mm by 3 m).

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Install solid conductor for No. 10 AWG and smaller, and stranded conductors for No. 8 AWG and larger, unless otherwise indicated.

B. Conductor Terminations and Connections:
1. Underground Connections: Exothermic welded connectors, except at test wells and as otherwise indicated.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Handholes: Install a driven ground rod through handhole floor, close to wall, and set rod depth so 4 inches (100 mm) will extend above finished floor. If necessary, install ground rod before manhole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into manhole through a waterproof sleeve in manhole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches (50 mm) above to 6 inches (150 mm) below concrete. Seal floor opening with waterproof, nonshrink grout.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors with all feeders and branch circuits.

B. Metal Poles Supporting Outdoor Lighting Fixtures: Install grounding electrode and a separate insulated equipment grounding conductor in addition to grounding conductor installed with branch-circuit conductors.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Ground Rods: Drive rods until tops are 6 inches (150 mm) below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

C. Test Wells: Ground rod driven through drilled hole in bottom of handhole. Handholes are specified in Division 26 Section "Underground Ducts and Raceways for Electrical Systems," and shall be at least 12 inches (300 mm) deep, with cover.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal**,** at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Measure ground resistance not less than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage and without chemical treatment or other artificial means of reducing natural ground resistance.
    b. Perform tests by fall-of-potential method according to IEEE 81.

B. Report measured ground resistances that exceed the following values:
1. Manhole Grounds: 10 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

END OF SECTION 260526

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. This Section includes the following:

1. Conduit, ducts, and duct accessories for direct-buried duct banks**,** and in single duct runs.
2. Handholes and boxes.

1.3 DEFINITION

A. RNC: Rigid nonmetallic conduit.

B. RSC: Rigid steel Conduit.

1.4 SUBMITTALS

A. Product Data: For the following:

1. Duct-bank materials, including separators and miscellaneous components.
2. Ducts and conduits and their accessories, including elbows, end bells, bends, fittings, and solvent cement.
3. Accessories for manholes, handholes, boxes**,** and other utility structures.
4. Warning tape.

1.5 QUALITY ASSURANCE

A. Comply with ANSI C2.

B. Comply with NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver ducts to Project site with ends capped. Store nonmetallic ducts with supports to prevent bending, warping, and deforming.

B. Store precast concrete and other factory-fabricated underground utility structures at Project site as recommended by manufacturer to prevent physical damage. Arrange so identification markings are visible.

C. Lift and support precast concrete units only at designated lifting or supporting points.

1.7 PROJECT 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/or Owner in writing no fewer than 10 days in advance of proposed interruption of electrical service.
2. Do not proceed with interruption of electrical service without Construction Manager's and/or Owner's written permission.

1.8 COORDINATION

A. Coordinate layout and installation of ducts, manholes, handholes, and boxes with final arrangement of other utilities, site grading, and surface features as determined in the field.

PART 2 - PRODUCTS

2.1 CONDUIT

A. RSC: Galvanized. Comply with ANSI C80.1.

B. RNC: NEMA TC 2, Type EPC-40-PVC, UL 651, with matching fittings by same manufacturer as the conduit, complying with NEMA TC 3 and UL 514B.

2.2 NONMETALLIC DUCTS AND DUCT ACCESSORIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Lamson & Sessions; Carlon Electrical Products.
2. Manhattan/CDT; a division of Cable Design Technologies.
3. Spiraduct/AFC Cable Systems, Inc.

2.3 HANDHOLES AND BOXES OTHER THAN PRECAST CONCRETE

A. Description: Comply with SCTE 77.

1. Color: Gray
2. Configuration: Units shall be designed for flush burial and have open, unless otherwise indicated.

3. Cover: Weatherproof, secured by tamper-resistant locking devices and having structural load rating consistent with enclosure.
4. Cover Finish: Nonskid finish shall have a minimum coefficient of friction of 0.50.
5. Cover Legend: Molded lettering, "ELECTRIC".
6. Duct Entrance Provisions: Duct-terminating fittings shall mate with entering ducts for secure, fixed installation in enclosure wall.
7. Handholes 12 inches wide by 24 inches long (300 mm wide by 600 mm long) and larger shall have factory-installed inserts for cable racks and pulling-in irons.

B. Polymer Concrete Handholes and Boxes with Polymer Concrete Cover: Molded of sand and aggregate, bound together with a polymer resin, and reinforced with steel or fiberglass or a combination of the two.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armorcast Products Company.
b. Carson Industries LLC.
c. CDR Systems Corporation.
d. NewBasis.

PART 3 - EXECUTION

3.1 UNDERGROUND DUCT APPLICATION

A. Ducts for Electrical Feeders 600 V and Less: RNC**,** NEMA Type EPC-40 PVC, in concrete-encased duct bank, unless otherwise indicated.

B. Ducts for Electrical Feeders 600 V and Less: RNC**,** NEMA Type EPC-40 PVC, in direct-buried duct bank, unless otherwise indicated.

C. Ducts for Electrical Branch Circuits: RNC, NEMA Type EPC-40 PVC, in direct-buried duct bank, unless otherwise indicated.

D. Underground Ducts for Telephone, Communications, or Data Utility Service Cables: RNC, NEMA Type EPC-40 PVC, in concrete-encased duct bank, unless otherwise indicated.

3.2 EARTHWORK

A. Excavation and Backfill: Comply with Division 31 Section "Earth Moving," but do not use heavy-duty, hydraulic-operated, compaction equipment.

B. Restore surface features at areas disturbed by excavation and reestablish original grades, unless otherwise indicated. Replace removed sod immediately after backfilling is completed.

C. 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 Division 32 Sections "Turfs and Grasses" and "Plants."

D. Cut and patch existing pavement in the path of underground ducts and utility structures according to Division 01 Section "Cutting and Patching."

3.3 DUCT INSTALLATION

A. Slope: Pitch ducts a minimum slope of 1:300 down toward manholes and handholes and away from buildings and equipment. Slope ducts from a high point in runs between two manholes to drain in both directions.

B. Curves and Bends: Use 5-degree angle couplings for small changes in direction. Use manufactured long sweep bends with a minimum radius of 48 inches (1220 mm) both horizontally and vertically, at other locations, unless otherwise indicated.

C. Joints: Use solvent-cemented joints in ducts and fittings and make watertight according to manufacturer's written instructions. Stagger couplings so those of adjacent ducts do not lie in same plane.

D. Sealing: Provide temporary closure at terminations of ducts that have cables pulled. Seal spare ducts at terminations. Use sealing compound and plugs to withstand at least 15-psig (1.03-MPa) hydrostatic pressure.

E. Pulling Cord: Install 100 lbf (445 N) test nylon cord in ducts, including spares.

F. Direct-Buried Duct Banks:

1. Support ducts on duct separators coordinated with duct size, duct spacing, and outdoor temperature.
2. Space separators close enough to prevent sagging and deforming of ducts, with not less than 5 spacers per 20 feet (6 m) of duct. Secure separators to earth and to ducts to prevent displacement during backfill and yet permit linear duct movement due to expansion and contraction as temperature changes. Stagger spacers approximately 6 inches (150 mm) between tiers.
3. Excavate trench bottom to provide firm and uniform support for duct bank. Prepare trench bottoms as specified in Division 31 Section "Earth Moving" and Division 26 Section "Common Work Results for Electrical for pipes less than 6 inches (150 mm) in nominal diameter.
4. Install backfill as specified in Division 31 Section "Earth Moving" and Division 26 Section "Common Work Results for Electrical.
5. After installing first tier of ducts, 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 (100 mm) over ducts 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 as specified in Division 31 Section "Earth Moving."
6. Install ducts with a minimum of 3 inches (75 mm) between ducts for like services and 12 inches (300 mm) between power and signal ducts.
7. Depth: Install top of duct bank at least 36 inches (900 mm) below finished grade, unless otherwise indicated.

8. Set elevation of bottom of duct bank below the frost line.
9. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
10. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches (75 mm) of concrete.
    b. For equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches (1500 mm) from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.4 INSTALLATION OF CONCRETE MANHOLES, HANDHOLES, AND BOXES

A. Precast Concrete Handhole and Manhole Installation:

1. Comply with ASTM C 891, unless otherwise indicated.
2. Install units level and plumb and with orientation and depth coordinated with connecting ducts to minimize bends and deflections required for proper entrances.
3. Unless otherwise indicated, support units on a six inch level bed of crushed stone or gravel, graded from 1-inch (25-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

B. Elevations:
1. Handhole Covers: In paved areas and trafficways, set surface flush with finished grade.

3.5 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 ducts to minimize bends and deflections required for proper entrances. Use box extension if required to match depths of ducts, and seal joint between box and extension as recommended by the manufacturer.

B. Unless otherwise indicated, support units on a six inch level bed of crushed stone or gravel, graded from 1/2-inch (12.7-mm) sieve to No. 4 (4.75-mm) sieve and compacted to same density as adjacent undisturbed earth.

C. Elevation: In paved areas and trafficways, set so cover surface will be flush with finished grade. Set covers of other handholes 1 inch (25 mm) above finished grade.

D. 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 the enclosure.

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

F. For enclosures installed in asphalt paving or concrete 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 six inches of crushed stone.

1. Concrete: 3000 psi (20 kPa), 28-day strength, complying with Division 03 Section "Cast-in-Place Concrete," with a troweled finish.

3.6 GROUNDING

A. Ground underground ducts and utility structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

3.7 CLEANING

A. Pull leather-washer-type duct cleaner, with graduated washer sizes, through full length of ducts. Follow with rubber duct swab for final cleaning and to assist in spreading lubricant throughout ducts.

END OF SECTION 260543

SECTION 262726 - WIRING DEVICES

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. This Section includes the following:

1. Receptacles, receptacles with integral GFCI, and associated device plates.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. TVSS: Transient voltage surge suppressor.

F. UTP: Unshielded twisted pair.

1.4 SUBMITTALS

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

1.5 QUALITY ASSURANCE

A. Source Limitations: Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:
   1. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
   2. Leviton Mfg. Company Inc. (Leviton).
   3. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

2.2 GFCI RECEPTACLES

A. General Description: Straight blade, feed - through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Duplex GFCI Convenience Receptacles, 125 V, 20 A:
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Pass & Seymour; 2084.
      b. Hubbell
      c. Leviton

2.3 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
   1. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in "wet locations."

B. Wet-Location, Weatherproof Cover Plates: NEMA 250, complying with type 3R weather-resistant, die-cast aluminum with lockable cover.

2.4 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

   1. Wiring Devices Connected to Normal Power System: Almond or Black or Brown or Ivory White or As selected by Architect unless otherwise indicated or required by NFPA 70 or device listing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.
5. Install switches on lock set side of doorways.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.
4. Existing Conductors:

    a. Cut back and pigtail, or replace all damaged conductors.
    b. Straighten conductors that remain and remove corrosion and foreign matter.
    c. Pigtailing existing conductors is permitted provided the outlet box is large enough.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.
3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. Tighten unused terminal screws on the device.
8. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Receptacle Orientation:

1. Install ground pin of vertically mounted receptacles up, and on horizontally mounted receptacles to the right.

F. Device Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

3.2 LOCATION OF DEVICES

A. The approximate schematic location of devices is given on the drawings. The exact location shall be determined at the building as the work progresses. Refer to Architectural plans for any special details, elevations, and reflective ceiling plan. Verify door swings at job site. In no case shall switches be located behind door swings. Any switch so located shall be changed. Field verify equipment locations and adjust device and outlet locations to avoid inaccessibility. Relocate inaccessible outlets.

B. The Architect and the Owner reserve the right to change the location of any outlet, before it has been installed.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.
   1. Test Instruments: Use instruments that comply with UL 1436.
   2. Test Instrument for Convenience Receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

   1. Line Voltage: Acceptable range is 105 to 132 V.
   2. Percent Voltage Drop under 15-A Load: A value of 5 percent or higher is not acceptable.
   3. Ground Impedance: Values of up to 2 ohms are acceptable.
   4. GFCI Trip: Test for tripping values specified in UL 1436 and UL 943.
   5. Using the test plug, verify that the device and its outlet box are securely mounted.
   6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

END OF SECTION 262726

SECTION 265600 - EXTERIOR LIGHTING

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. This Section includes the following:

1. Exterior luminaires with lamps and ballasts.
2. Poles and accessories.
3. Luminaire lowering devices.

1.3 DEFINITIONS

A. CRI: Color-rendering index.

B. Luminaire: Complete lighting fixture, including ballast housing if provided.

C. Pole: Luminaire support structure, including tower used for large area illumination.

D. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports, lowering devices, and supporting structure, applied as stated in AASHTO LTS-4.

B. Live Load: Single load of 500 lbf (2224 N), distributed as stated in AASHTO LTS-4.

C. Ice Load: Load of 3 lbf/sq. ft. (143.6 Pa), applied as stated in AASHTO LTS-4.

D. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.

1.5 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.
4. Luminaire materials.
5. Photometric data based on laboratory tests of each luminaire type, complete with indicated lamps, ballasts, and accessories.

    a. For indicated luminaires, photometric data shall be certified by a qualified independent testing agency. Photometric data for remaining luminaires shall be certified by manufacturer.
    b. Photometric data shall be certified by manufacturer's laboratory with a current accreditation under the National Voluntary Laboratory Accreditation Program for Energy Efficient Lighting Products.

6. Ballasts, including energy-efficiency data.
7. Lamps, including life, output, and energy-efficiency data.
8. Materials, dimensions, and finishes of poles.
9. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
10. Anchor bolts for poles.
11. Manufactured pole foundations.

B. Shop Drawings:

1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
2. Design calculations, certified by a qualified professional engineer, indicating strength of screw foundations and soil conditions on which they are based.
3. Wiring Diagrams: Power and control wiring.

C. Samples for Verification: For products designated for sample submission in Lighting Fixture Schedule. Each sample shall include lamps and ballasts.

D. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.

E. Qualification Data: For agencies providing photometric data for lighting fixtures.

F. Field quality-control test reports.

G. Operation and Maintenance Data: For luminaries, poles and luminaire lowering devices to include in emergency, operation, and maintenance manuals.

H. Warranty: Special warranty specified in this Section.

I. LED Lamps information:
1. Certified photometric report (per IESNA LM-79) from an approved Department of Energy lab to validate photometric performance.

2. Lumen depreciation data for the LED luminaire supported by the LED chip manufacturer's IESNA LM-80 test data. Submit IESNA LM-80 testing reports.
3. Photometric IES file for LED luminaires in electronic format.
4. Product label documenting Energy Star compliance.
5. Design Lights Consortium label indicating the consistency and life of the LED.
6. Data on LED driver including dimensions, remote mounting distance (as applicable), energy consumption, and quantity of fixtures to be run from single individual driver.
7. Product data documenting LED fixture CRI and color temperature. Minimum CRI shall be equal to or greater than 85.
8. Information regarding all dimming accessories necessary to adequately dim LED fixture.
9. Documentation from LED lamp manufacturer that all lamps are from the same manufacturer and BIN number. Color consistency between bins shall meet IESNA recommendations.

1.6 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by an independent agency, with the experience and capability to conduct the testing indicated, that is an NRTL as defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with IEEE C2, "National Electrical Safety Code."

D. Comply with NFPA 70.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty Period for Luminaires, Poles, Metal Corrosion, Color Retention: Two years from date of Substantial Completion.
2. Warranty Period for Lamps: Replace lamps and fuses that fail within 12 months from date of Substantial Completion.

B. Special Warranty for LED Lamps: Manufacturer's standard form, made out to Owner and signed by lamp manufacturer agreeing to replace lamps that fail in materials or workmanship, f.o.b. the nearest shipping point to Project site, within specified warranty period indicated below.

1. Warranty Period: Five year(s) from date of Substantial Completion.

1.9 EXTRA MATERIALS

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

1. Lamps: 5 for every 10 of each type and rating installed. Furnish at least one of each type.
2. Glass and Plastic Lenses, Covers, and Other Optical Parts: 5 for every 100 of each type and rating installed. Furnish at least one of each type.
3. Globes and Guards: 5 for every 100 of each type and rating installed. Furnish at least one of each type.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Lighting fixtures shall be provided from the manufacturers listed in the Lighting Fixture Schedule.

B. Where more than one manufacturer is listed the first manufacturer is the basis of design. Alternate manufacturers are listed as potential sources of product equal to the basis of design. Listing of alternate manufacturers does not guarantee that an equal product is available as a standard product offering. A custom or modified version of a standard product, provided by one of the alternate manufacturers and a level of quality established by the standard series shown, will be reviewed for approval. Product will be accepted if technical specifications as well as aesthetic qualities meet or exceed those of the specified manufacturer. The architect reserves the right to reject or modify the proposed fixture from the alternate manufacturer as needed to match the specifications of the fixture chosen as the basis of design.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit relamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during relamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field. Provide where indicated in schedule.

J. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

K. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

2.3 LED FIXTURES AND LAMPS

A. Manufacturers: All LED lamps to be by the same manufacturer.

1. Philips
2. Cree
3. Nichia
4. Samsung
5. Osram

B. LED lamps shall be EnergyStar listed.

C. LED lamps shall possess a minimum CRI of 85 and a CCT as specified on the Lighting Fixture Schedule.

D. LED lamps shall possess less than a 100 kelvin temperature shift over the life of the product. Confirmation of color consistency shall be noted in manufacturer's published data.

E. Dimming shall be integral to all fixtures indicated as dimmable on the Lighting Fixture Schedule. Dimming shall be flicker free and controllable between 100% and 10% light output. Dimmers that are not integral to the fixture shall not be acceptable.

F. LED fixture manufacturer shall indicate a defined ambient temperature maximum for thermal management of LEDs. Ambient temperature maximum shall be 40 degree C or higher at minimum.

G. All LED lamps for fixture type shall be provided by the same LED lamp manufacturer and BIN number. Color consistency between bins shall be equal to or less than 5 SDCM – Standard Deviation of Color Matching.

H. White LED lamps shall be supplied in all fixtures. Color mixing of LED lamps to produce white light is not acceptable.

I. Heat sinks serving LED fixtures shall be secured to fixture using a frame system. Use of spring clips to support the weight of the heat sink is not acceptable.

J. Fixtures shall be UL listed.

K. LED fixtures shall be tested for conformance under IESNA LM-79 and LM-80. Results shall be documented in the submittals. LM-80 results shall indicate a minimum 70% lumen output at 50,000 hours.

2.4 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

A. Structural Characteristics: Comply with AASHTO LTS-4.

1. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.
2. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

B. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.

C. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor Bolts, Leveling Nuts, Bolt Caps, and Washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
3. Anchor-Bolt Template: Plywood or steel.

D. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 03 Section "Cast-in-Place Concrete."

E. Power-Installed Screw Foundations: Factory fabricated by pole manufacturer, with structural steel complying with ASTM A 36/A 36M and hot-dip galvanized according to ASTM A 123/A 123M; and with top-plate and mounting bolts to match pole base flange and strength required to support pole, luminaire, and accessories.

F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.

2.5 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429, Alloy 6063-T6 with access handhole in pole wall.

B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.

1. Shape: as indicated on fixture schedule.
2. Mounting Provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.
1. Finish: match luminaire.

F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

G. Aluminum Finish: Comply with NAAMM's "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

1. Finish designations prefixed by AA comply with the system established by the Aluminum Association for designating aluminum finishes.
2. Natural Satin Finish: Provide fine, directional, medium satin polish (AA-M32); buff complying with AA-M20; and seal aluminum surfaces with clear, hard-coat wax.
3. Class I, Clear Anodic Finish: AA-M32C22A41 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, clear coating 0.018 mm or thicker) complying with AAMA 611.

4. Class I, Color Anodic Finish: AA-M32C22A42/A44 (Mechanical Finish: medium satin; Chemical Finish: etched, medium matte; Anodic Coating: Architectural Class I, integrally colored or electrolytically deposited color coating 0.018 mm or thicker) complying with AAMA 611.
5. Color to match luminaire or as selected by architect from manufacturers complete list of standard and optional available colors.

2.6 DECORATIVE POLES

A. Pole Material:

1. Cast aluminum.

B. Mounting Provisions:

1. Bolted to concrete foundation.

C. Fixture Brackets:

1. Cast aluminum.

D. Pole Finish: match luminaire or as selected by architect from manufacturers complete list of standard and optional available colors.

2.7 POLE ACCESSORIES

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for ground-fault circuit-interrupter type.

1. Recessed, 18 inches (300 mm) above finished grade.
2. Nonmetallic polycarbonate plastic or reinforced fiberglass cover, color to match pole, that when mounted results in NEMA 250, Type 3R enclosure.
3. With cord opening.
4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

C. Decorative accessories, supplied by decorative pole manufacturer, include the following:

1. Banner Arms: Aluminum.

2.8 REQUIREMENTS FOR INDIVIDUAL EXTERIOR LIGHTING DEVICES

A. See lighting fixture schedule included as part of contract drawings for requirements for individual fixtures.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming.

3.2 POLE INSTALLATION

A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following minimum horizontal distances of poles from surface and underground features, unless otherwise indicated on Drawings:

1. Fire Hydrants and Storm Drainage Piping: 60 inches (1520 mm).
2. Water, Gas, Electric, Communication, and Sewer Lines: 10 feet (3 m).

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 03 Section "Cast-in-Place Concrete."

D. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

E. Raise and set poles using web fabric slings (not chain or cable).

3.3 BOLLARD LUMINAIRE INSTALLATION

A. Align units for optimum directional alignment of light distribution.

B. Install on concrete base with top above finished grade or surface at bollard location. Cast conduit into base, and shape base to match shape of bollard base. Finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.4 INSTALLATION OF INDIVIDUAL GROUND-MOUNTING LUMINAIRES

A. Install on concrete base with top as indicated above finished grade or surface at luminaire location. Cast conduit into base, and finish by troweling and rubbing smooth. Concrete materials, installation, and finishing are specified in Division 03 Section "Cast-in-Place Concrete."

3.5 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Underground Ducts and Raceways for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.6 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole, unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.7 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

C. Illumination Tests:

1. Measure light intensities at night. Use photometers with calibration referenced to NIST standards. Comply with the following IESNA testing guide(s):

a. IESNA LM-50, "Photometric Measurements of Roadway Lighting Installations."
b. IESNA LM-64, "Photometric Measurements of Parking Areas."

D. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

3.8 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain luminaire lowering devices.

END OF SECTION 265600

SECTION 311000 - SITE CLEARING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Protecting existing trees, shrubs, groundcovers, plants and grass to remain.
2. Removing existing trees, shrubs, groundcovers, plants and grass.
3. Clearing and grubbing.
4. Stripping and stockpiling topsoil.
5. Removing above- and below-grade site improvements.
6. Disconnecting and capping or sealing site utilities.
7. Temporary erosion and sedimentation control measures.

1.2 MATERIAL OWNERSHIP

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

1.3 PROJECT CONDITIONS

A. Traffic: Minimize interference with adjoining roads, streets, walks, and other adjacent occupied or used facilities during site-clearing operations.

1. Do not close or obstruct streets, walks, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction.
2. Provide alternate routes around closed or obstructed traffic ways if required by authorities having jurisdiction.

B. Salvable Improvements: Carefully remove items indicated to be salvaged and store on Owner's premises where indicated.

C. Utility Locator Service: Notify utility locator service for area where Project is located before site clearing.

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

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. Satisfactory Soil Materials: Requirements for satisfactory soil materials are specified in Division 31 Section "Earthmoving."

1. Obtain approved borrow soil materials off-site when satisfactory soil materials are not available on-site.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect and maintain benchmarks and survey control points from disturbance during construction.

B. Locate and clearly flag trees and vegetation to remain or to be relocated. No heavy equipment traffic will be allowed within the drip line of all vegetation to remain.

C. Protect existing site improvements to remain from damage during construction.

1. Restore damaged improvements to their original condition, as acceptable to Owner.
2. Protect improvements on adjoining properties.

3.2 TEMPORARY EROSION AND SEDIMENTATION CONTROL

A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and walkways, according to sediment and erosion control Drawings.

B. Inspect, repair, and maintain erosion and sedimentation control measures during construction until permanent vegetation has been established.

C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

3.3 TREE PROTECTION

A. Erect and maintain temporary fencing around tree protection zones before starting site clearing. Remove fence when construction is complete.

B. Do not excavate within tree protection zones, unless otherwise indicated.

C. Repair or replace trees and vegetation indicated to remain that are damaged by construction operations, in a manner approved by Architect.

3.4 UTILITIES

A. Locate, identify, disconnect, and seal or cap off utilities indicated to be removed.

1. Arrange with utility companies to shut off indicated utilities.

B. 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 Architect not less than two days in advance of proposed utility interruptions.
2. Do not proceed with utility interruptions without Architect's written permission.

C. Removal of underground utilities is included in Division 2 Sections covering site utilities.

3.5 CLEARING AND GRUBBING

A. 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 not exceeding a loose depth of 8 inches, and compact each layer to a density equal to adjacent original ground.

3.6 TOPSOIL STRIPPING

A. Remove sod and grass before stripping topsoil.

B. Strip topsoil to whatever depths are encountered in a manner to prevent intermingling with underlying subsoil or other waste materials.

C. Stockpile topsoil materials away from edge of excavations without intermixing with subsoil. Grade and shape stockpiles to drain surface water. Cover to prevent windblown dust.

3.7 SITE IMPROVEMENTS

A. Remove existing above- and below-grade improvements as indicated and as necessary to facilitate new construction.

3.8 DISPOSAL

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

1. Separate recyclable materials produced during site clearing from other nonrecyclable materials. Store or stockpile without intermixing with other materials and transport them to recycling facilities.

2. Burning is not permitted on property.
3. The disposal of all debris and excess material shall be conducted in strict accordance with all applicable codes and ordinances.

END OF SECTION 311000

SECTION 312000 – EARTH MOVING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes the following:

1. Preparing subgrades for slabs-on-grade, walks, pavements, lawns and grasses and exterior plants.
2. Excavating and backfilling for buildings and structures.
3. Excavating and backfilling for utility trenches.
4. Dewatering of excavations and drainage control during earthwork operations as required.
5. Disposal of all excavated materials not used as fill on the site.

1.2 DEFINITIONS

A. Backfill: Soil material used to fill an excavation.

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

B. Bedding Course: Course placed over the excavated subgrade in a trench before laying pipe.

C. Borrow Soil: Satisfactory soil imported from off-site for use as fill or backfill.

D. Excavation: Removal of material encountered above subgrade elevations and to lines and dimensions indicated.

1. Authorized Additional Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions as directed by the Owner. Authorized additional excavation and replacement material will be paid for according to Contract provisions changes in the Work.
2. Unauthorized Excavation: Excavation below subgrade elevations or beyond indicated lines and dimensions without direction by the Owner. Unauthorized excavation, as well as remedial work directed by Owner, shall be without additional compensation.

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

F. Structures: Buildings, footings, foundations, retaining walls, slabs, tanks, curbs, mechanical and electrical appurtenances, or other man-made stationary features constructed above or below the ground surface.

G. Subgrade: Surface or elevation remaining after completing excavation, or top surface of a fill or backfill immediately below subbase, drainage fill, or topsoil materials.

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

1.3 PROJECT CONDITIONS

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

1.4 QUALITY ASSURANCE

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

1.5 GEOTECHNICAL REPORT

A. A Geotechnical Report for this project was prepared by Hunt Engineering Company and is titled 'Geotechnical Engineering Report' and dated June 30, 2008. For copies of this report please contact the Owner. All recommendations affecting the work of this section as called for in the Geotechnical Report shall be followed unless specifically directed otherwise by the Geotechnical Engineer.

PART 2 - PRODUCTS

2.1 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations. Refer to the Geotechnical Study for further information regarding acceptable fill materials.

B. Satisfactory Soils: Consists of the fill that will be required to bring the existing site up to the final rough grades as shown on the Drawings for the new construction. The following shall be used as satisfactory fill:

1. Earth fill: Earth fill shall consist of materials derived from on-site excavation. The maximum particle size should not exceed eight (8) inches unless it is demonstrated that oversized fragments can be broken down by the compaction equipment. The fill should contain no organic inclusions, frozen material, ice, snow, or any deleterious material which by decay or other means might cause settlement.
2. Rock fill: Rock fill shall consist of material derived from on-site rock excavation or off-site borrow which are reduced to a maximum size of 18 inches except otherwise specified in the Contract. The use of oversized rock fill shall be permitted only upon the written authorization of the Soils Engineer.
3. Satisfactory borrow materials that can be used for any additional fill that may be required shall be only those complying with ASTM D2487 Classification GW, GP, GM, SM, SW,

and SP and have a natural moisture content within 3% of the optimum as determined by ASTM D1557. The respective borrow sources should be sampled and approved by the independent testing laboratory engaged by the Owner.

C. Unsatisfactory Soils: Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH, and PT according to ASTM D 2487 and A-2-6, A-2-7, A-4, A-5, A-6, and A-7 according to AASHTO M 145, or a combination of these groups.

1. Unsatisfactory soils also include satisfactory soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

2.2 BACKFILL

A. Backfilling shall consist of filling excavated areas below finish grade, as required to bring subgrades to proper elevations.

B. New backfill material which the contractor shall furnish under this Section shall be of bank run sand and gravel, free from rubbish, debris, sod, roots or artificial material. It shall comply with the following gradation requirements:

U.S. Sieve Size	Percent Fines by Weight
4 in.	100
No. 4	30-65
No. 40	5-35
No. 200	0-8

C. Material excavated from or already stored on the site may be accepted if it meets the above gradation and/or the compaction requirements as verified by laboratory tests. Acceptability of the material will be determined at the job site, by the independent testing laboratory. Classification of soils shall be as per ASTM D-2487.

2.3 BACKFILL MATERIAL

A. All of the above materials shall be free of debris, waste, frozen materials, vegetable and other deleterious matter and contain less than 20% by weight material passing the NO. 200 sieve.

2.4 ACCESSORIES

A. Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility.

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Preparation of subgrade for earthwork operations including removal of vegetation, topsoil, debris, obstructions, and deleterious materials from ground surface is specified in Division 31 Section "Site Clearing."

C. Protect and maintain erosion and sedimentation controls, which are specified in Division 31 Section "Site Clearing," during earthwork operations.

3.2 CONTRACTOR'S REVIEW

A. The Earthwork Contractor shall do the following:

1. Study the contract drawings and Specifications with regard to the work as shown and required under this Section so as to insure its completeness.
2. Examine conditions in which this work is to be performed and notify the Owner if any exist which are detrimental to the proper and expeditious performance of the work. Starting on the work shall constitute acceptance of the conditions to perform the work as specified.
3. Verify dimensions taken at the job site affecting the work. Bring field dimensions which are at variance to the attention of the Owner. Obtain decision regarding corrective measures before the start of work.
4. Cooperate in the coordination and scheduling of the work of this Section with the work of other Sections so as not to delay job progress.

3.3 EARTHWORK CONTRACTOR'S RESPONSIBILITIES:

A. Prior to the commencement of work, the Contractor shall have examined all drawings and Specifications, shall have visited the site, consulted the records of adjacent construction and of existing utilities and their connections, and noted conditions and limitations which may influence the work of this Section.

B. The Contractor shall be totally responsible for safety measures taken by him during the progress of the work.

C. The Contractor shall retain, at his own expense, the services of a soils consultant to advise on all construction techniques involved in the work, including the design, checking and approval of temporary bracing, shoring, underpinning and other items pertinent to the work, and on construction methods for solution of problems which may be encountered during the course of the work. The Contractor's soil consultant shall consult him on construction methods which will reduce the risk of settlement and/or damage to surrounding structures, utilities and facilities on the Owner's property and on property adjoining the site of the work. The soil consultant shall be a licensed registered professional engineer in soils and foundations in Pennsylvania and shall certify that the site earthwork is in accordance with specifications of this section.

D. The Contractor shall maintain general natural drainage of the property during earthwork operations. Should flooding of work areas occur, remove all water.

E. The Contractor shall lay out the work completely and in accordance with the drawings and the reference points. Safeguard all reference stakes, points and bench marks and replace same if disturbed or removed by negligence or without prior approval. Cooperate in protecting temporary stakes during the progress of the work.

F. The Contractor shall maintain and protect newly graded areas from the actions of the elements. Any settlement or washing that occurs prior to acceptance of the work, shall be repaired and grades re-established to the required elevations and slopes.

G. The Contractor shall execute the work with promptness and diligence, but excavation or filling shall not be done when filling the ground is frozen or too wet for proper compaction as determined by the independent soils engineer. Claims for extra payment resulting from weather conditions will not be considered.

H. The Contractor shall remove all excavated material that is either unacceptable for fill on this project or is excess material.

1. Any or all of this material that the Owner wishes to keep, including all topsoil, shall be moved by the Contractor to a storage site designated by the Owner.
2. Any and all of this material that the Owner does not want to keep shall be removed and disposed of off site by the Contractor.

I. The Contractor shall stock pile excavated and fill materials in areas designated by the Owner.

J. The Contractor shall keep all roads, public and private, free of dirt, mud, snow, ice and debris resulting from this work.

K. Where fill, backfill, or subbase materials must be conditioned to reach optimum moisture content, apply water uniformly to prevent free water from appearing on surface during or subsequent to compaction operations.

L. The contractor shall carefully maintain bench marks, monuments and other reference points; if disturbed or destroyed, replace as directed by the Professional.

M. The Contractor shall dispose of, off the site, by legal means, all trash generated by the execution of the work. The Contractor shall have sole responsibility for keeping streets and approach

areas broom clean to the satisfaction of the Owner and Municipal Authorities having jurisdiction.

N. The Contractor shall not burn rubbish.

O. The Contractor shall not use any explosive, except for rock excavation when approved by the Owner and the Municipality.

P. The Contractor shall barricade all open excavations occurring as part of this work and post with warning lights.

Q. The Contractor shall adhere to PennDOT traffic control specifications for work in State Right of Ways.

3.4 EXCAVATION

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

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

B. The Contractor shall do excavation of every description of any material, to lines and rough grades noted on the drawings.

C. Excavation in Rock Area: If rock is encountered in the cut areas, the rock shall be undercut two (2) feet below subgrade level and the excavation shall be filled with suitable fill material compacted to specification elsewhere mentioned.

3.5 EXCAVATION FOR STRUCTURES

A. Excavate to indicated elevations and dimensions within a tolerance of plus or minus 1 inch. If applicable, extend excavations a sufficient distance from structures for placing and removing concrete formwork, for installing services and other construction, and for inspections.

1. Excavations for Footings and Foundations: Do not disturb bottom of excavation. Excavate by hand to final grade just before placing concrete reinforcement. Trim bottoms to required lines and grades to leave solid base to receive other work.

3.6 EXCAVATION FOR WALKS AND PAVEMENTS

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

3.7 EXCAVATION FOR UTILITY TRENCHES

A. Excavate trenches to indicated gradients, lines, depths, and elevations.

B. Excavate trenches to uniform widths to provide the following clearance on each side of pipe or conduit. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe or conduit, unless otherwise indicated.

1. Clearance: As indicated in Drawings.

C. Trench Bottoms: Excavate and shape trench bottoms to provide uniform bearing and support of pipes and conduit. Shape subgrade to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits. Remove projecting stones and sharp objects along trench subgrade.

1. Where rock is encountered, carry excavation 6 inches below required elevation and backfill with a 6 inch layer of crushed stone or gravel prior to installation of pipe.
2. For pipes and equipment 6 inches or larger in nominal size, shape bottom of trench to fit bottom of pipe for 90 degrees (bottom 1/4 of the circumference). Fill depressions with tamped sand backfill. At each pipe joint, dig bell holes to relieve pipe bell of loads and to ensure continuous bearing of pipe barrel on bearing surface.

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

E. Excavated soil will be considered acceptable material for backfilling, only if it conforms to the backfill material requirements specified herein.

3.8 SUBGRADE INSPECTION

A. Proof-roll subgrade below the building slabs and pavements with heavy pneumatic-tired equipment to identify soft pockets and areas of excess yielding. Do not proof-roll wet or saturated subgrades.

B. Reconstruct subgrades damaged by freezing temperatures, frost, rain, accumulated water, or construction activities, as directed by Owner, without additional compensation.

3.9 UNAUTHORIZED EXCAVATION

A. No allowance shall be made or paid for additional earth excavation removed accidentally, or for the Contractor's convenience, beyond the elevations indicated on the drawings or specified herein. If, through error, the excavation is carried beyond the required depths, or through lack of protection excavation is rendered unfit for bearing, the Contractor shall at his own expense bring the excavation to the required levels and compaction levels as specified herein and to the satisfaction of the Professional.

B. Excavation of earth or rock beyond indicated or authorized limits shall be refilled with select fill material compacted to 95% Modified Proctor density or concrete as may be required by Engineer, at the Contractor's expense.

3.10 ROCK EXCAVATION

A. Should any rock be encountered that will require excavation, such excavation shall meet the requirements of the following:

1. Rock excavation in open excavation includes removal and disposal of materials and obstructions encountered which cannot be dislodged and excavated with modern track-mounted heavy-duty excavating equipment without drilling, blasting or ripping. Rock excavation equipment is defined as Caterpillar Model No. 973 or No. 977K, or equivalent track-mounted loader, rated at not less than 170HP flywheel power and developing 40,000 lb. break-out force (measured in accordance with SAE J732C).
2. Rock excavation in trenches and pits includes removal and disposal of materials and obstructions encountered which cannot be excavated with a 1.0 cubic yard (heaped) capacity, 42" wide bucket on track-mounted power excavator equivalent to Caterpillar Model 215, rated at not less than 90HP flywheel power and 30,000 lb. drawbar pull. Trenches in excess of 10'-0" in width and pits in excess of 30'-0" in either length or width are classified as open excavation.
3. Typical of materials classified as rock are boulders 1/2 cu. yd. or more in volume, solid rock, rock in ledges, and rock hard cementitious aggregate deposits.
4. The use of explosives for rock excavation shall only be permitted when approved by the Owner and the Municipality.
5. Intermittent drilling, blasting or ripping performed to increase production and not necessary to permit excavation or material encountered will be classified as earth excavation.
6. Do not perform rock excavation work until material to be excavated has been cross-sectioned and classified by the Professional. The contractor shall include a unit price of any rock excavation in his bid and he shall be paid an additional amount for this excavation based on the unit price and the payment lines indicated below.

3.11 STORAGE OF SOIL MATERIALS

A. Stockpile borrow soil materials and excavated satisfactory soil materials without intermixing. Place, grade, and shape stockpiles to drain surface water. Cover to prevent windblown dust.

1. Stockpile soil materials away from edge of excavations. Do not store within drip line of remaining trees.

3.12 UTILITY TRENCH BACKFILL

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

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

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings. Concrete is specified in Division 3 Section.

D. Provide 4-inch-thick, concrete-base slab support for piping or conduit less than 24 inches below surface of roadways. After installing and testing, completely encase piping or conduit in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe or conduit.

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

F. Place and compact final backfill of satisfactory soil to final subgrade elevation.

G. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.13 SOIL FILL

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

B. Fill Placement: No fill shall be placed in any area until such areas have been inspected and approved. The gradation and distribution of materials throughout the compacted fill section shall be such that the fill will be free from lenses, pockets, streaks and layers of material differing substantially in texture or gradation form the surrounding material of the same class. Successive loads of materials shall be dumped at locations on the fill as directed or approved by the inspector.

C. Place and compact fill material in layers to required elevations as follows:

1. Under grass and planted areas, use satisfactory soil material.
2. Under walks and pavements, use satisfactory soil material.
3. Under steps and ramps, use satisfactory soil material.
4. Under building slabs, use satisfactory soil material.
5. Under footings and foundations, satisfactory soil material.

3.14 SOIL MOISTURE

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.

1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.15 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches in loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight according to ASTM D 1557:

1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
2. Under walkways, scarify and recompact top 6 inches (150 mm) below subgrade and compact each layer of backfill or fill soil material at 92 percent.
3. Under lawn or unpaved areas, scarify and recompact top 6 inches below subgrade and compact each layer of backfill or fill soil material at 90 percent.
4. For utility trenches, compact each layer of initial and final backfill soil material at 90 percent.

3.16 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.

B. Site Grading: Slope grades to direct water away from buildings and to prevent ponding. Finish subgrades to required elevations within the following tolerances:

1. Lawn or Unpaved Areas: Plus or minus 1 inch.
2. Walks: Plus or minus 1/2 inch.
3. Pavements: Plus or minus 1/2 inch.

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

3.17 DISKING AND SCARIFYING

A. Each layer of soil fill shall be disked if required to break down oversized clods, to mix non-uniform materials, to secure a relatively uniform moisture content, or to insure uniform density and proper compaction.

3.18 SURFACE DRAINAGE

A. Surface Drainage: Fill surface slopes shall be maintained to facilitate surface runoff away from load bearing fill and to prevent ponding of surface water. During periods of anticipated inclement weather, the surface of the fill shall be graded and sealed as directed by the Engineer to preclude percolation of surface water. If ponding of surface water does occur it shall be removed by pumping, ditching or as otherwise directed by the Engineer.

B. The Contractor shall construct temporary earth berms along the top edges of embankments to intercept runoff water. It shall be the Contractor's responsibility to protect its work area from runoff and erosion by whatever means deemed suitable at no extra cost to the Owner.

3.19 OVERFILLS AND UNDERCUTS

A. In the event the Contractor places more borrow than is required and thereby causes a waste of excavation, the amount of such waste, unless authorized, will be deducted from the volume of borrow as measured in the borrow area.

3.20 SLOPES

A. Cut slopes shall be shaped, top-soiled where specified, seeded and mulched as the work progresses in accordance with the following sequence unless otherwise directed by the Owner.

1. Slopes whose vertical height is more than 10 feet, shall be seeded in two approximately equal increments of height.
2. Slopes whose vertical height is 10 feet or less may be seeded in one operation.

B. The dressing, preparing, and seeding of slopes shall be performed immediately following the completion of each increment of height stated and immediately following the suspension of grading operations in which the suspension is to have a duration greater than 15 days.

C. Fill slopes shall be shaped, top-soiled where specified, seeded and mulched in accordance with the procedure herein before described except that extra care shall be taken to protect previously seeded area from spill over materials placed in the upper lifts of the embankment.

D. In the event the Contractor places more borrow than is required and thereby causes a waste of excavation, the amount of such waste, unless authorized, will be deducted from the volume of borrow as measured in the borrow area.

3.21 PUMPING AND DEWATERING

A. Pumping shall be at the expense of the Contractor. The pumping work shall include adequate pumps, hoses, strainers and other appurtenances, fuel, power, trench drains, pumps and sheeting required in connection with pumping, as well as labor and maintenance.

3.22 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent geotechnical engineering testing agency to perform field quality-control testing.

B. Allow testing agency to inspect and test subgrades and each fill or backfill layer. Proceed with subsequent earthwork only after test results for previously completed work comply with requirements.

C. Footing Subgrade: At footing subgrades, at least one test of each soil stratum will be performed to verify design bearing capacities. Subsequent verification and approval of other footing subgrades may be based on a visual comparison of subgrade with tested subgrade when approved by Owner.

D. Testing agency will test compaction of soils in place according to ASTM D 1556, ASTM D 2167, ASTM D 2922, and ASTM D 2937, as applicable.

E. When testing agency reports that subgrades, fills, or backfills have not achieved degree of compaction specified, scarify and moisten or aerate, or remove and replace soil to depth required; recompact and retest until specified compaction is obtained.

3.23 TEMPORARY SHORING AND BRACING

A. Temporary shoring and bracing shall be provided where required to maintain excavation banks in a safe and stable condition or where required for the protection of adjoining structures. Shoring and bracing shall consist of sound timbers or rolled structural shapes of the required dimensions. Shoring and bracing shall safely support the property to be protected. All temporary protection shall be removed when no longer required and/or directed by the Professional.

3.24 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing.

1. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.25 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION 312000

SECTION 312319 - DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes construction dewatering.

1.2 PERFORMANCE REQUIREMENTS

A. Dewatering Performance: Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control ground-water flow into excavations and permit construction to proceed on dry, stable subgrades.

1.3 SUBMITTALS

A. Shop Drawings for Information: For dewatering system. Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water.

1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with water disposal requirements of authorities having jurisdiction.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by dewatering operations.

1. Prevent surface water and subsurface or ground water from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.

3.2 INSTALLATION

A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.

B. Before excavating below ground-water level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers, and structures have been constructed and fill materials have been placed, or until dewatering is no longer required.

C. Provide an adequate system to lower and control ground water to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers, and other excavations.

1. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.

D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations.

1. Maintain piezometric water level a minimum of 24 inches below surface of excavation.

E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.

F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to Owner.

1. Remove dewatering system from Project site on completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36 inches (900 mm) below overlying construction.

G. Damages: Promptly repair damages to adjacent facilities caused by dewatering operations.

END OF SECTION 312319

SECTION 312500 – EROSION AND SEDIMENTATION CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Bidding Requirements, Conditions of the Contract and General and Requirements Specifications Sections, apply to work of this section.

1.2 DESCRIPTION

A. Erosion and Sedimentation Control includes but is not limited to dust control and movement of soil into sewer system and onto highways. This work shall be in accordance with recommendations as published by the U.S. Department of Agriculture Soil Conservation Services through their local offices; and as herein specified.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Crushed stone as specified on plan detail.

B. Filter Fabric as specified on plan detail.

C. Silt Fence as specified on plan detail.

D. Inlet protection as specified on plan detail.

PART 3 - EXECUTION

3.1 GENERAL

A. Install tire cleaner and place silt fences along the low ends of site. Broom dirt from roadways on a weekly basis and after each storm occurrence. Replace tire cleaner as required. Inspect sedimentation control measures after each storm for damages. Repair or replace silt fence as required. Never keep ground uncovered more than ten (10) days.

B. Prevent earthwork from entering sewer pipes and inlet. Place silt fence around inlets. Put temporary bulkheads on sewer pipes.

C. Keep earthwork sufficiently moist to prevent wind erosion.

END OF SECTION 312500

SECTION 315000 - EXCAVATION SUPPORT AND PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes temporary excavation support and protection systems.

B. Related Sections include the following.

1. Division 01 Section "Construction Facilities and Temporary Controls."
2. Division 31 Section "Earth Moving" for excavating and backfilling.

1.2 PERFORMANCE REQUIREMENTS

A. Design, furnish, install, monitor, and maintain excavation support and protection system capable of supporting excavation sidewalls and of resisting soil and hydrostatic pressure and superimposed and construction loads.

1. Provide professional engineering services needed to assume engineering responsibility, including preparation of Shop Drawings and a comprehensive engineering analysis by a qualified professional engineer.
2. Work includes removing excavation support and protection systems when no longer needed.
3. Prevent surface water from entering excavations by grading, dikes, or other means.
4. Install excavation support and protection systems without damaging existing buildings, pavements, and other improvements adjacent to excavation.

1.3 SUBMITTALS

A. Shop Drawings for Information: Prepared by or under the supervision of a qualified professional engineer for excavation support and protection systems.

1. Include Shop Drawings signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 PROJECT CONDITIONS

A. Survey adjacent structures and improvements, employing a qualified professional engineer or land surveyor; establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations.

1. During installation of excavation support and protection systems, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations and positions for comparison with original elevations and positions. Promptly notify Owner if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent construction.

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

C. Project Site Information: A geotechnical report has been prepared for this Project and is available for information only. The report is not part of the Contract Documents. The opinions expressed in this report are those of the geotechnical engineer and represent interpretations of the subsoil conditions, tests, and results of analyses conducted by the geotechnical engineer. Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor.

1. Make additional test borings and conduct other exploratory operations as necessary.
2. The geotechnical report is referenced elsewhere in the Project Manual.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide materials that are either new or in serviceable condition.

B. Structural Steel: ASTM A 36/A 36M, ASTM A 690/A 690M, or ASTM A 992/A 992M.

C. Steel Sheet Piling: ASTM A 328/A 328M, ASTM A 572/A 572M, or ASTM A 690/A 690M; with continuous interlocks.

D. Wood Lagging: Lumber, mixed hardwood, nominal rough thickness of 3 inches.

E. Cast-in-Place Concrete: ACI 301, of compressive strength required for application.

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

PART 3 - EXECUTION

3.1 PREPARATION

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during excavation support and protection system operations.

B. Install excavation support and protection systems to ensure minimum interference with roads, streets, walks, and other adjacent occupied and used facilities.

C. Monitor excavation support and protection systems daily during excavation progress and for as long as excavation remains open. Promptly correct bulges, breakage, or other evidence of movement to ensure that excavation support and protection systems remain stable.

D. Promptly repair damages to adjacent facilities caused by installing excavation support and protection systems.

E. Locate excavation support and protection systems clear of permanent construction and to permit forming and finishing of concrete surfaces.

3.2 REMOVAL AND REPAIRS

A. Remove excavation support and protection systems when construction has progressed sufficiently to support excavation and bear soil and hydrostatic pressures. Remove in stages to avoid disturbing underlying soils or damaging structures, pavements, facilities, and utilities.

1. Remove excavation support and protection systems to a minimum depth of 48 inches below overlying construction and abandon remainder.
2. Repair or replace, as approved by Owner, adjacent work damaged or displaced by removing excavation support and protection systems.

B. Leave excavation support and protection systems permanently in place.

END OF SECTION 315000

SECTION 320116 - PAVEMENT MILLING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including Bidding Requirements, Conditions of the Contract and General Requirements Specifications Sections, apply to work of this Section.

1.2 DESCRIPTION

A. Removal of existing bituminous pavement surface by milling operation, with specified equipment to the depth indicated on the plans.

PART 2 - MATERIALS

A. None.

PART 3 - EXECUTION

3.1 Equipment

Use a milling machine designed and built for this type of work. Provide a machine with an effective automatic grade and slope control system and has the capability to mill concrete patches.

3.2 Milling

Mill so the finished surface is free from gouges, grooves and ridges and is in accordance with the surface tolerances requirements of PennDOT Form 408 Section 401.3(k), or as directed. To facilitate traffic control pick-up and move milled material, immediately after milling operations. Use care to remove the existing bituminous material around structures and pads and utilities within the work area. Repair and replace, to the satisfaction of the Owner, facilities which are damaged by the milling operation. Control the rate of milling to avoid tearing the mat, resulting in chunky and non-uniformly milled material. Keep the milled pavement surface free from all loose materials and dust.

3.3 Disposition of milled material

Satisfactorily dispose of the milled material.

PART 4 - MEASURE AND PAYMENT

On a square yard basis or as otherwise indicated in the Contract.

END OF SECTION 320116

SECTION 321100 – BASE COURSES

PART 1 - GENERAL

1.1 STIPULATIONS

The specification section "General Conditions and "Special Requirements" form a part of this section by this reference thereto and shall have the same force and affect as if printed herewith in full.

1.2 RELATED DOCUMENTS

Drawings and general provisions of Contract, including Bidding Requirements, Conditions of the Contract and General Requirements Specifications Sections, apply to work of this Section.

1.3 DESCRIPTION OF WORK

This work is the construction of compacted aggregate on a prepared select backfilled subgrade area and includes the preparation of subgrade, as specified in PennDOT State Highway Standard Specifications, Form 408 Section 210, and the American Association of State Highway Officials (AASHO).

1.4 TESTING

Contractor shall take elevations on a 50-foot grid maximum to determine if the sub base is to grade and on a 50-foot grid maximum to determine if the granular base course is to grade.

1.5 QUALITY CONTROL AND RELATED WORK

Section numbers referenced herein, or as per PennDOT Specifications.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Base course shall be a compacted stone of the depth indicated on the drawings meeting the requirements of Section 703.2 of PennDOT Specifications except where otherwise indicated. Coarse aggregate shall be a mix of AASHTO No. 3 and PennDOT No.2A stones. The percentage of No. 2A stone shall be between 15% and 30 % of the total weight. The material shall be mixed thoroughly to provide and even gradation and shall deliver a stone base without voids once properly compacted. Fine Aggregate, if required to choke the coarse aggregate, shall be AASHTO No. 10.

B. Prepared subgrade. When backfill is required to bring the subgrade to proper elevation, the Contractor shall use Type C or better No. 2A or No. OGS material per PennDOT Form 408 Specifications.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Equipment:

1. Spreaders: Use adjustable, self-propelled mechanical spreaders capable of accurately placing and spreading base material without segregation.

2. Compaction Equipment: As per PennDOT Standard Specifications.

B. General:

1. Prepare the subgrade prior to placing the base course. Do not place base material on soft, muddy, or frozen areas. Before placing base, satisfactorily correct irregularities or soft areas in the prepared area.
2. Correct unsatisfactory base conditions developing ahead of the paving operations by reshaping, and recompacting, or by replacement, if directed.

C. Placement:

1. Spreading Coarse Material:

a. The coarse material shall be spread uniformly by approved mechanical stone spreaders to the full width of the base unless otherwise specified for part-width construction. Spreaders shall be adjusted to spread the loose material to obtain a layer of the required depth after compaction. In areas inaccessible to spreading equipment, the material may be spread directly from trucks provided the distribution is satisfactory to the engineer. All segregated material shall be removed and replaced with well-graded material. The coarse material shall not be spread for a distance of more than an average day's work ahead of choking and compacting.
b. After each layer of material has been spread, it shall be checked with approved templates and straightedges, and all irregularities shall be satisfactorily corrected prior to rolling.

2. Compacting Coarse Material:

a. The coarse material shall be rolled and thoroughly compacted with an approved 3-wheel roller as specified in PennDOT form 408, Section 108.05(c) 3.a. The rolling shall begin at the sides and progress to the center, except on superelevated curves where the rolling shall begin on the low side and progress to the high side.
b. The rolling shall be parallel with the centerline of the roadway, uniformly lapping each preceding track, covering the entire surface with the rear wheels and continuing until the material does not creep or wave ahead of the roller wheels.

3. Application of Fine Material:

    a. If in the opinion of the Engineer, excessive voids are present in the stone base after the coarse material has been satisfactorily rolled and compacted, fine material, suitably conditioned to assure thorough filling of the voids in the coarse material, shall be spread uniformly over the surface with approved mechanical equipment. In areas inaccessible to spreading equipment, the engineer may permit manual spreading which shall be performed in a sweeping motion with a square-pointed shovel, alternately in opposite directions, until the voids are completely filled. Immediately following this operation, the fine material shall be broomed and rolled until the voids in the coarse material are completely filled and the base coarse is thoroughly compacted and firmly set. Brooms attached to the roller in an approved manner, and hand brooms, shall be used to uniformly spread the fines over the surface and insure the filling of all voids in the coarse material. Dumping the fine material directly upon the surface of the coarse material will not be permitted. All excess fines forming in piles or cakes upon the surface shall be loosened and scattered.

    b. The spreading and rolling of fine material shall be carried out in sections of not less than 150 feet nor more than 1000 feet in length, unless otherwise approved by the engineer. Each section shall be completely bound and compacted before beginning another.

4. Compacting and Bonding:

    a. The rolling and brooming of the surface shall be continued during the process of spreading the fine material. Rolling shall begin at the sides, and shall progress as specified for rolling the coarse material.

    b. The entire surface shall be covered with the rear wheels, additional fines shall be applied where necessary to fill voids, and the rolling continued until the base course is thoroughly compacted and firmly set.

    c. After the completion of the application and rolling of fines, the surface of single-layer construction, or the surface of each layer of multi-layer construction, shall be sprinkled with water and rolled. All excess fines forming in piles or cakes upon the surface shall be loosened and scattered by sweeping exercising care that the fine material is not removed below the top of the coarse aggregate. On the surface of single-layer construction or the top layer of multi-layer construction the sprinkling and rolling shall be continued and additional fines applied where necessary until all voids are filled and until a slight wave of grout forms in front of the roller wheels. Brooms attached to the roller, and hand brooms, shall be used to distribute the grout uniformly into the unfilled voids. After the wave of grout has been produced over the entire section of the base course, this portion shall be let to dry. The surface shall be sprinkled and re-rolled on succeeding days as required to bond it thoroughly and to secure a satisfactory surface.

d. The quantity of fines and water used shall be determined by the engineer and shall be sufficient to produce a smooth, hard monolithic surface.

e. Diagonal and cross-rolling shall be performed as specified or directed.

f. Sprinklers for this work shall be of a size and design approved by the engineer and shall be mounted on a motor-driven chassis equipped with pneumatic tires. Other methods of sprinkling may be used, if approved.

D. Maintenance and Traffic:

a. The contractor shall maintain the completed base course, until the placement of the surface course, in accordance with the requirements of Section 104.04(c).

b. No traffic shall be allowed on the base course other than necessary local traffic and that developing from the operation of essential construction equipment, unless otherwise directed by the engineer. Any defects which may develop in the construction of the base course or any damage caused by the operation of local or job traffic is the responsibility of the contractor and shall be immediately repaired or replaced at no expense to the Department.

c. Base course opened to traffic by authority of the engineer, in writing, shall be maintained and protected by the contractor as specified in Section 107.10 and 107.15.

E. Compaction and Density:

a. Compact the uniformly spread material to not less than 100% of the maximum dry-weight density, which will be determined in accordance with PTM No. 106, Method B. The in-place density will be determined, in accordance with PTM No. 112 or PTM No. 402, where directed, for each 3,000 square yards, or less, of each layer of completed base. When the material is too coarse to use these methods, determine compaction based on non-movement of the material under the compaction equipment. Proceed with compaction gradually from sides to center, with each succeeding pass uniformly overlapping the previous pass. Continue until the entire area is satisfactorily shaped and compacted.

b. Surface Tolerance shall be within 1/2 inch of finished grade.

c. Test for Depth: Carefully dig one test hole to the full depth of the competed base, where directed, for each 3,000 square yards or less of completed subbase.

d. The Engineer will measure the depth of the finished subbase.

e. Where base is 1/2 inch or more deficient from the depth indicated, remove the base and satisfactorily replace at no additional cost.

f. After the depth has been measured, backfill test holes with acceptable material and compact.

END OF SECTION 321100

SECTION 321216 – ASPHALT PAVING

PART 1 - GENERAL

1.1 STIPULATIONS

A. The specifications section "General Conditions" and "Special Requirements" form a part of this section by this reference thereto and shall have the same force and affect as if printed herewith in full.

1.2 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including Bidding Requirements, Conditions of the Contract and General Requirements Specifications Sections, apply to work of this Section.

1.3 DESCRIPTION OF WORK:

A. This work is the construction of plant-mixed bituminous concrete courses on a prepared surface.

B. Extent of work is shown on drawings including:
1. Bituminous binder course - 1-1/2 inch thick unless otherwise indicated.
2. Bituminous wearing surface - 1 inch thick compacted unless otherwise indicated.

C. Prepared aggregate base is specified in Section 321100.

1.4 QUALITY ASSURANCE:

A. PennDOT State Highway Administration form 408 Standard Specifications. Comply with Section 420 type 1D-2A Bituminous Pavements and Section 321100.

PART 2 - PRODUCTS

2.1 GENERAL

A. Materials and methods of construction shall conform to applicable requirements of the Pennsylvania Department of Transportation Specifications, form 408, latest edition unless otherwise noted and shall consist of:

1. Bituminous Concrete Binder Course - 1-1/2 inch thick compacted or as shown on the drawings.
2. Bituminous Wearing Surface - 1 inch thick or as shown on the drawings.

PART 3 - EXECUTION

3.1 CONSTRUCTION

A. Comply with PennDOT Section 401.

B. Finished paving shall be true and even, free of low spots or bumps. All areas must drain to established drainage points. No puddles will be permitted.

END OF SECTION 321216

SECTION 321313 - CONCRETE PAVING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including Bidding Requirements, Conditions of the Contract and General Requirements Specifications Sections, apply to work of this Section.

1.2 DESCRIPTION OF WORK

A. This section includes the following:
1. Construction of cement walks on 4-inch stone aggregate subbase.
2. Construction of an 8-inch thick cement concrete pad on a 4-inch stone aggregate base.
3. Construction of a 8-inch depth concrete driveway paving on a 4-inch aggregate subbase on geotextile fabric in accordance with the City of Philadelphia Streets Department specifications and details.

1.3 QUALITY ASSURANCE

Comply with PennDOT State Highway Administration Standard Specifications, Section 676.1 Cement Concrete.

PART 2 - PRODUCTS

2.1 MATERIALS (PER PennDOT STANDARD SPECIFICATIONS)

A. Cement Concrete – Class AA Section 704.1 PennDOT Specifications.

B. Aggregate. Shall be stone gravel or slag meeting the requirements of Section 703.3 of PDT 408 for Type C or better AASHTO No. 57 Material.

C. Premoulded Expansion Joint Filler – Section 705.1 PennDOT Specifications.

D. Concrete Curing Compound – Section 711.2 (a) PennDOT Specifications.

E. Curing and Protecting Covers.

F. Protective Coating for Cement Concrete Pavement.

PART 3 - EXECUTION

3.1 GENERAL

Install concrete work in compliance with PennDOT Standard Specifications.

3.2 CONSTRUCTION

A. Preparation of Foundation: Form the foundation at a depth of 8" below and parallel with the finished surface of the sidewalk. When directed, remove and replace unsuitable material with acceptable material. Thoroughly compact the foundation, finish to a firm, even surface; moisten if required.

B. Placing Aggregate for Bed: Spread aggregate on the prepared foundation to form a thoroughly compacted bed 4 inches deep.

C. Forms: Use acceptable wood or metal forms extending the full depth of concrete.

D. Concrete: As specified in the applicable parts of Standard Specifications. Place concrete 4 inches deep. Strike off, finish, and test, as specified except that manual operations are allowed and a light broom finish applied. Form outside edges and joints with a 1/4-inch radius edging tool. Form transverse dummy joints at 5-foot intervals, approximately 1/8 inch wide and at least 1 inch deep.

E. Concrete shall be protected and cured for a period of not less than 72 hours after completion by the use of an approved membrane curing compound; or by double thickness burlap or cotton mats kept wet throughout the curing period; or by the use of waterproof mats. All types of mats shall be properly weighted down to prevent access of air to the concrete.

F. Concrete driveway construction shall be in accordance with Section 11.8.3 and 11.8.4 of the City of Philadelphia Standard Specifications for Paving and Repaving 1967.

G. Expansion Joints: Place 1/2 inch premoulded, expansion joint material for the full depth of the sidewalk, opposite expansion joints in adjacent curb, between the sidewalk and curb, and between the sidewalk and rigid structures.

H. Removal of Forms: Do not remove side forms until at least 12 hours after placing concrete. After removal of forms, fill minor honeycombed areas with mortar. As directed, remove and replace defective major honeycombed areas.

I. Backfilling: After the concrete has cured for at least 72 hours, backfill spaces adjacent to the sidewalk, using acceptable embankment material, as specified in PennDOT Standard Specifications.

END OF SECTION 321313

SECTION 321413 - PRECAST CONCRETE UNIT PAVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete Pavers

B. Bedding and Joint Sand.

C. Aggregate Base

D. Edge Restraints

1.2 RELATED SECTIONS

A. Section 312000 Earth Moving

B. Section 321313 Concrete Paving

1.3 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including the General and Supplementary General Requirements, apply to this Section.

1.4 REFERENCES

A. American Society of Testing and Materials (ASTM) (latest edition):

1. C 33 Specification for Concrete Aggregates.
2. C 136 Method for Sieve Analysis for Fine and Coarse Aggregate.
3. C 140 Sampling and Testing Concrete Masonry Units.
4. C 144 Standard Specifications for Aggregate for Masonry Mortar.
5. C 936 Specifications for Solid Interlocking Concrete Paving Units.
6. C 979 Specification for Pigments for Integrally Colored Concrete.
7. D 698 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 5.5 lb (24.4 N) Rammer and 12 in. (305 mm) drop.
8. D 1557 Test Methods for Moisture Density Relations of Soil and Soil Aggregate Mixtures Using a 10-lb (44.5 N) Rammer and 18 in. (457 mm) drop.

1.5 QUALITY ASSURANCE

A. Installation shall be by a contractor and crew with at least one year of experience in placing interlocking concrete pavers on projects of similar nature or dollar cost.

B. The Contractor shall conform to all local, state/provincial licensing and bonding requirements.

1.6 SUBMITTALS

A. Shop or product drawings and product data shall be submitted.

B. Full size samples of concrete paving units shall be submitted to indicate Color and shape selections.

C. Sieve analyses for grading of bedding and joint sand shall be submitted.

D. Test results shall be submitted from an independent testing laboratory for compliance of paving unit requirements to ASTM C 936 or other applicable requirements.

E. The layout, pattern, and relationship of paving joints to fixtures and project formed details shall be indicated.

1.7 MOCK-UPS

A. A 7 ft. x 7 ft. (2m x 2m) paver area shall be installed as described in Article 3.2.

B. This area will be used to determine the amount that the pavers settle into bedding sand after compaction, joint sizes, lines, laying pattern(s), color(s), and texture of the project.

C. This area shall be the standard from which the work will be judged.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Concrete pavers shall be delivered to the site in steel banded, plastic banded, or plastic wrapped cubes capable of transfer by fork lift or clamp lift. The pavers shall be unloaded at the job site in such a manner that no damage occurs to the product.

B. Bedding and joint sand shall be covered with a secure waterproof covering to prevent exposure to rainfall or removal by wind.

C. Delivery and paving schedules shall be coordinated in order to minimize interference with normal use of buildings adjacent to paving.

1.9 ENVIRONMENTAL CONDITIONS

A. Do not install sand or pavers during heavy rain or snowfall.

B. Do not install sand and pavers over frozen base materials.

C. Do not install frozen sand.

PART 2 MATERIALS

2.1 CONCRETE PAVERS

A. Supplied by:

EP Henry

www.ephenry.com

800-444-3679

B. Product name(s)/shape(s), color(s), overall dimensions, and thickness of the paver(s) specified as follows:

Product name: Eco Brick Stone

Product shape(s): Width: 8", Height 2-3/8"; Length: 4"

Product color(s), Dakota Blend

C. Pavers shall meet the minimum material and physical properties set forth in ASTM C 936, Standard Specification for Interlocking Concrete Paving Units. Efflorescence shall not be a cause for rejection.

1. Average compressive strength 8000 psi (55MPa) with no individual unit under 7,200 psi (50 MPa).
2. Average absorption of 5% with no unit greater than 7% when tested according to ASTM C 140.
3. Resistance to 50 freeze-thaw cycles, when tested according to ASTM C 67, with no breakage greater than 1.0% loss in dry weight of any individual unit. This test method shall be conducted not more than 12 months prior to delivery of units.

D. Pigment in concrete pavers shall conform to ASTM C 979. ACI Report No. 212.3R provides guidance on the use of pigments.

2.2 GRANULAR BASE

The granular base material shall consist of select granular fill material.

2.3 BEDDING AND JOINT SAND

A. The bedding and joint sand shall be clean, non-plastic, and free from deleterious or foreign matter. It can be natural or manufactured from crushed rock. Do not use limestone screenings or stone dust that do not conform to the grading requirements in Table 3. When concrete pavers are subject to vehicular traffic, the sands shall be as hard as practically available.

B. The bedding sand shall conform to the grading requirements of ASTM C 33 as shown in Table 1.

TABLE 1
BEDDING SAND
GRADING REQUIREMENTS

ASTM C 33	
Sieve Size	Percent Passing
3/8 in. (9.5 mm)	100
No. 4 (4.75 mm)	95 to 100
No. 8 (2.36 mm)	85 to 100
No. 16 (1.18 mm)	50 to 85
No. 30 (600 µm)	25 to 60
No. 50 (300 µm)	10 to 30

No. 100 (150 µm)	2 to 10

C. The joint sand shall conform to the grading requirements of ASTM C 144 as shown in Table 2 below:

TABLE 2
JOINT SAND
GRADING REQUIREMENTS

ASTM C 144		
	Natural Sand	Manufactured Sand
Sieve Size	Percent Passing	Percent Passing
No. 4 (4.75 mm)	100	100
No. 8 (2.36 mm)	95 – 100	95 to 100
No. 16 (1.18 mm)	70 – 100	70 to 100
No. 30 (600 µm)	40 – 75	40 to 75
No. 50 (300 µm)	10 – 35	20 to 40
No. 100 (150 µm)	2 – 15	10 to 25
No. 200 (75 µm)	0	0 to 10

2.5 EDGE RESTRAINTS

Edge restraints shall be used along all unrestrained paver edges and supported on a minimum of 6 in. (150mm) of aggregate base.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subgrade preparation, compacted density and elevations conform to the specifications.

B. Verify that geotextiles, if applicable, have been placed according to specifications and drawings.

C. Verify that aggregate base materials, thickness, compaction, surface tolerances and elevations conform to the specifications.

D. Verify the proper installation of the concrete curbing, in terms of location, elevation, and adherence to the specifications.

E. Verify that the base is dry, uniform, even and ready to support sand, pavers and imposed loads.

F. Beginning of bedding sand and paver installation shall signify acceptance of base and edge restraints.

3.2 CONCRETE PAVING BASE

A. Install concrete paving base as specified in Section 321313.

3.3 GRANULAR BASE INSTALLATION

A. After proper construction of the edge restraints for the concrete pavement as per Section 3.4, and upon approval by the Consultant, aggregate base shall be placed in uniform lifts not exceeding 6 in. (150 mm) loose thickness. Each lift shall be compacted to at least 100 percent Standard Proctor Maximum Dry Density.

B. The granular base shall be trimmed to within 0 to 3/8 in. (0 to 10 mm) of the specified grade. The surface of the prepared base shall not deviate by more than 3/8 in. (10 mm) from the bottom edge of a 10 ft. (3 m) long straight edge laid in any direction.

C. The upper surface of the base shall be sufficiently well graded and compacted to prevent infiltration of the bedding sand into the base both during construction and throughout its service life. Segregated areas of the granular base shall be blended by the application of crushed fines that have been watered and compacted into the surface.

D. Before commencing the placing of the sand bedding course and the placement of the interlocking concrete pavers, the base shall be inspected by the Owner or the Consultant.

3.4 EDGE RESTRAINTS

A. Adequate edge restraint shall be provided along the perimeter of all paving as specified. The face of the edge restraint, where it abuts pavers, shall be vertical down to the subbase.

B. All concrete edge restraints shall be constructed to dimensions and level specified and shall be supported on a compacted subbase not less than 6 in (150 mm) thick.

C. Concrete used for the construction of edge restraints shall be air-entrained and have a compressive strength as specified. All concrete shall be in accordance with ASTM C 94 requirements.

3.5 PAVER INSTALLATION

A. Spread the bedding sand evenly over the base course and screed to a nominal 1 in. (25 mm) thickness, not exceeding 1 ½ in. (40 mm) thickness. The screeded sand should not be disturbed. Sufficient sand shall be placed in order to stay ahead of the laid pavers. Do not use the bedding sand to fill depressions in the base surface.

Screed sand shall be fully protected against incidental compaction, including compaction by rain. Any screeded sand which is incidentally compacted prior to laying of the paving unit, shall be removed and brought back to profile in a loose condition. Neither pedestrian nor vehicular traffic shall be permitted on the screeded sand.

The Contractor shall screed the bedding sand using either an approved mechanical spreader (e.g.: an asphalt paver) or by the use of screed rails and boards.

B. Initiation of paver placement shall be deemed to represent acceptance of the pavers.

C. Pavers shall be free of foreign material before installation.

D. Pavers shall be inspected for color distribution and all chipped, damaged or discolored pavers shall be replaced.

E. The pavers shall be laid in the pattern(s) as shown on the drawings. String lines or chalk lines on bedding sand should be used to hold all pattern lines true.

F. Joints between the pavers on average shall be between 1/16 in. and 1/8 in. (2 mm to 4 mm) wide. In order to maintain the desired pattern, joint spacing must be consistent. This spacing must also be provided for the first row abutting the edge restraint.

G. Gaps at the edges of the paved area shall be filled with cut pavers.

H. Pavers to be placed along the edge shall be cut with a double blade paver splitter or masonry saw.

I. Upon completion of cutting, the area must be swept clean of all debris to facilitate inspection and to ensure pavers are not damaged during compaction. (Debris or sand particles left on pavers which are being compacted can cause point loading which may chip, scrape or break the paver.)

J. After sweeping and prior to compaction, the paved area must be inspected by the owner or consultant to ensure satisfactory color blending. Pavers can be moved easily at this time to achieve good color distribution.

K. Low amplitude, high frequency plate compactor shall be used to compact the pavers into the sand. The compactor shall transmit an effective force not less than 75 kN per square metre (1600 Lb/ft^2) of plate area. The frequency of vibration shall be within the range of 75 to 100 Hz. Use Table 3 below to select size of compaction equipment:

TABLE 3
PAVER THICKNESS AND REQUIRED MINIMUM

COMPACTION FORCE

Paver Thickness	Compaction Force
2 3/8 in. (60 mm)	3000 lbs [13 kN]
2 3/4 in. (70 mm) & 3 1/8 in. (80 mm)	5000 lbs [22 kN]

L. The pavers shall be compacted to achieve consolidation of the sand bedding and brought to level and profile by not less than three passes. Initial compaction should proceed as closely as possible following the installation of the paving units and prior to the acceptance of any traffic or application of sweeping sand.

M. Any units that are structurally damaged during compaction shall be immediately removed and replaced.

N. Dry joint sand shall be swept into the joints until the joints are full. This will require at least two or three passes with the compactor. Do not compact within 3 ft. (1 m) of the unrestrained edges of the paving units.

O. All work to within 3 ft. (1 m) of the laying face must be left fully compacted with sand-filled joints at the completion of each day.

P. Excess joint sand shall be swept off when the job is complete.

3.06 FIELD QUALITY CONTROL

A. Final elevations shall be checked for conformance to the drawings after removal of excess joint sand.

B. All surface and pavement structures shall be true to the lines and levels, grades, thickness and cross sections shown on the drawings. All pavements shall be finished to lines and levels to ensure positive drainage at all drainage outlets and channels. In no case shall the cross-fall of any portion of pavement be less than 2 percent. The final surface elevations shall not deviate more than 3/8 in. (10 mm) under a 10 ft. (3 m) long straight edge.

C. The surface elevation of pavers shall be 1/8 to 1/4 in. (3 to 6 mm) above adjacent drainage inlets, concrete collars or channels.

D. Finished paver surfaces shall be protected from damage by adjacent construction activities.

END OF SECTION

SECTION 321613 - CONCRETE CURBS AND GUTTERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Bidding Requirements, Conditions of the Contract and General Requirements Specifications Sections, apply to work of this Section.

1.2 DESCRIPTION:

A. The extent of the concrete curb work is shown on the drawings.

B. Lines and grades are shown on drawings.

1.3 QUALITY ASSURANCE:

Comply with details shown on the drawings and applicable PennDOT Specifications.

PART 2 - PRODUCTS

2.1 MATERIAL

A. Cement Concrete - Class A Section 704.1 PennDOT Specifications.

B. Premolded Expansion Joint Filler - Section 705.1 PennDOT Specifications.

C. Concrete Curing Compound - Section 711.2(a) PennDOT Specifications.

PART 3 - EXECUTION

3.1 CONSTRUCTION: As shown on the Standard Drawings as specified in the applicable parts of Standard Specifications, and as follows:

A. Excavation: Excavate to the required depth, then compact the material upon which the curb is to be constructed to a firm, even surface.

B. Forms: Use acceptable metal forms, except on sharp curves and short tangent sections, where wood forms may be used. Use forms which will not discolor the concrete.

C. Placing and Finishing Concrete: Place the concrete in the forms in layers not exceeding 5 inches in depth and spade sufficiently to eliminate voids. A vibrator may be used. Provide drainage openings through the curb, at the elevation and of the size required, where indicated or directed.

Smoothly and evenly finish the top surface of the curb, using a wood float. While the concrete is still plastic, round the edge of the face and back of the curb. Place depressed curbs for drives or handicapped ramps, where indicated or directed. 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.

D. Joints: The curbing shall be constructed in uniform lengths or blocks of 10 feet, except where closures necessitate a reduction in length, and the blocks shall be separated during construction by 1/8 inch thick sheet steel templates cut to conform to the size of the curbing. These templates shall be set and maintained accurately in a position at right angles to the alignment and finished surface of the curb and shall be withdrawn to within 6 inches of the top of the curb at initial set and completely withdrawn as concrete approaches hard set.

Tool the edges of construction joints to a 1/4-inch radius.

Place 1/4 inch premolded expansion joint material, cut to the cross sectional area of the curb, at 30 foot intervals, at points of curve at structures, and at the end of the work day.

E. Removal of Forms: Do not remove forms until such time it will not be detrimental to the concrete. Correct irregular surfaces by rubbing with a carborundum stone. Brush finishing or plastering will not be permitted. Fill minor defects with mortar.

F. Backfilling and Embankment: As soon as possible after the removal of forms, backfill the voids in front and back of the curb, using acceptable embankment material.

Complete embankments in back of raised curbs, as indicated, except carefully compact the embankment by means of mechanical tampers, or rollers, if permitted, not exceeding 8 tons.

Dispose of unsuitable and surplus material.

END OF SECTION 321613

SECTION 321723 – PAVEMENT MARKINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

Drawings and general provisions of Contract, including Bidding Requirements, Conditions of the Contract and General Requirements Specifications Sections, apply to work of this Section.

1.2 DESCRIPTION

A. Painting of parking stalls.

B. Pavement markings.

PART 2 - MATERIALS

2.1 PAINT

A. Paint for pavement markings within 17th Street shall conform to Streets Department specification Division 20-0820 Painted Pavement and Markings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Use painting machine able to apply a 4" wide paint strip in either a solid or broken pattern.

B. Rollers or brushes will not be allowed to apply 4" wide stripping.

C. Paint shall be applied to a nominal thickness of 15 mils $\pm$ 1 mil.

D. Pavement shall be satisfactorily clean and dry prior to the application of the paint.

END OF SECTION 321723

SECTION 329200 – FINISH GRADING AND SEEDING

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.

A. Erosion & Sediment Pollution Control Program Manual, Pennsylvania Department of Environmental Protection, Bureau of Soil and Water Conservation, latest edition

B. Commonwealth of Pennsylvania Department of Transportation (PennDOT) Specifications, Publication 408, latest edition.

C. American Society for Testing and Materials (ASTM).

1.2 DESCRIPTION OF WORK

A. The work of this section consists of providing labor, materials, tools, equipment and services necessary to furnish and install all planting as indicated on the drawings and specified herein. The work generally includes:

1. Finish grading.

2. Planting soil preparation including amendments.

3. The establishment of lawns.

4. Protection, maintenance, guarantee and replacement of lawns.

5. Seeding (permanent).

6. Repair of existing lawns disturbed by construction.

1.3 QUALITY ASSURANCE

A. Perform all work in accordance with the Pennsylvania Department of Transportation specifications, latest edition as modified by these specifications.

B. Analysis and Standards: Package standard products with manufacturer have certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

1. Prior to the start of any seeding activity, the Contractor shall have the existing soil tested by an approved soils testing laboratory. Copies of the soil test results shall be furnished to the Owner's Representative before seeding is started.

2. All turf and landscape areas compacted due to project will be corrected through excavation, rototilling, aeration or other approved means to the satisfaction of the Owner's Representative.

C. Installer Qualifications: A qualified landscape installer whose work has resulted in successful lawn establishment.

1. Installer's Field Supervision: Require Installer to maintain an experienced full-time supervisor on Project site when planting is in progress.

1.4 SUBMITTALS

A. Certification: Submit certificates of inspection as required by governmental authorities. Submit manufacturer's or vendor's certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements.

B. Submit seed manufacturer's or vendor's certified statement for each grass seed mixture required, stating botanical and common name, percentage by weight, and percentages of purity, germination, and weed seed for each grass seed species. Submit all original seed tags to the Owner's Representative.

C. Maintenance Instructions: Submit typewritten instructions recommending procedures to be established by the Owner for continued maintenance of after the contract maintenance period, including watering requirements, fertilizing, weeding, etc. Submit prior to expiration of required maintenance period(s).

D. Furnish topsoil analysis results made by a qualified independent soil-testing agency stating percentages of organic matter, inorganic matter (silt, clay and sand), deleterious material, pH, and mineral and plant-nutrient content of topsoil. Analysis results shall make recommendations on amendments based on the specified seeding varieties and other plant materials as shown on the drawings. Submit topsoil analysis results to the Owner's Representative before seeding is started.

1.5 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site. Fertilizers and seed shall be delivered and stored in original unopened packages, kept dry and not opened until needed for use. Damaged or faulty packages shall not be used.

B. Topsoil shall not be muddy or frozen.

1.6 JOB CONDITIONS

A. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify the Owner's Representative before planting.

B. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required.

1.7 SEQUENCING AND SCHEDULING

A. Coordinate installation of seeding during normal planting seasons.

B. Prior to the start of seeding activity, the Contractor shall have the existing soil and stockpiled topsoil tested by an approved soils testing laboratory.

C. Restore lawn areas, existing and proposed, that have been disturbed by construction.

PART 2 - PRODUCTS

2.1 PLANTING SOIL

A. Standard
1. Planting Soil shall comply with ASTM D 5268 topsoil, with pH range of 5.5 to 7, and a minimum of 6 percent organic material content.

B. Sources
1. Existing, in-place or stockpiled surface topsoil. Based on the standard and properties described, verify suitability of existing surface topsoil to produce viable planting soil. Mix topsoil with amendments and fertilizers in quantities as recommended by the topsoil analysis to obtain planting soil adequate to support lawns and other vegetation types as shown on the drawings.
2. Topsoil off-site sources. Obtain topsoil displaced from naturally well-drained sites where topsoil occurs at least 4 inches deep; do not obtain from agricultural land, bogs or marshes. Based on the standard and properties described, verify suitability of off-site topsoil to produce viable planting soil. Mix topsoil with amendments and fertilizers in quantities as recommended by the topsoil analysis to obtain planting soil adequate to support lawns and other vegetation types as shown on the drawings.

C. Properties
1. Screened and free of stones 1 inch or larger in any dimension; free of roots, plants, sod, clods, clay lumps, pockets of coarse sand, paint, paint washout, concrete slurry, concrete layers or chunks, cement, plaster, building debris, oils, gasoline, diesel fuel, paint thinner, turpentine, tar, roofing compound, acid, and other extraneous materials harmful to plant growth
2. Free of obnoxious weeds and invasive plants including quackgrass, Johnsongrass, poison ivy, nutsedge, nimblewill, Canada thistle, bindweed, bentgrass, wild garlic, ground ivy, perennial sorrel, and bromegrass; not infested with nematodes, grubs, other pests, pest eggs, or other undesirable organisms and disease-causing plant pathogens
3. Friable and with sufficient structure to give good tilth and aeration. Continuous, air-filled, pore-space content on a volume/volume basis shall be at least 15 percent when moisture is present at field capacity. Soil shall have a field capacity of at least 15 percent on a dry weight basis.

D. Topsoil Analysis
1. Furnish topsoil analysis by a qualified soil-testing laboratory stating percentages of organic matter, inorganic matter (silt, clay and sand), deleterious material, pH and mineral and plant-nutrient content of topsoil.

2. Analysis report shall state suitability of topsoil for growth of lawns and other plant materials shown on the drawings. State recommended quantities of lime, nitrogen, phosphorus, potash and other nutrients and necessary to amend the topsoil and make it suitable for growth of lawns and other plant materials shown on the drawings

E. Amendments
1. Add soil amendments to topsoil as recommended by the topsoil analysis to produce a satisfactory planting soil.

2.2 SOIL AMENDMENTS

A. Lime: In accordance with the soil test recommendations, lime shall be natural dolomitic limestone containing not less than 85% of total carbonates with a minimum of 30% magnesium carbonates, ground so that not less than 90% passes a 20-mesh sieve and not less than 50% passes a 100-mesh sieve.

B. Organic Matter: If required by the soil test, organic matter shall be polymer dewatered recycled composted leaf and/or bark mulch.

C. Peat Humus: Decomposed peat free of disease and fungus with no identifiable fibers and with pH range suitable for intended use.

D. Bonemeal: Commercial, raw, finely ground; 4% nitrogen and 20% phosphoric acid.

E. Superphosphate: Soluble mixture of treated minerals; 20% available phosphoric acid.

F. Sand: Clean, washed sand, free of toxic materials and in accordance with ASTM C33-81.

G. Manure: Well rotted, unleached stable or cattle manure containing not more than 25% by volume of straw, sawdust or other bedding materials and containing no chemicals or ingredients harmful to plants.

H. Commercial Fertilizer: Complete high grade fertilizer of neutral character, with some elements derived from organic sources and conforming to the requirements of all federal, state, and local laws. Provide proper fertilizer to remedy deficiencies found in the soil tests. Provide nitrogen, phosphorous, and potassium in amounts recommended in soil reports from a qualified soil-testing agency.

2.3 GRASS

A. Grass Seed: Provide blue tag Pennsylvania certified fresh, clean, new-crop seed complying with tolerance for purity and germination established by Official Seed Analysts of North America. Provide seed mixture composed of grass species, proportions and minimum percentages of purity, germination, and maximum percentage of weed seed, as specified. Mixture shall not contain more than .05% weed or crop seed or more than 1.5% inert matter.

B. Permanent Seeding Mixture:

1. Full Sun: Kentucky bluegrass (Poa pratensis), a minimum of three cultivars.
2. Sun and Partial Shade: Proportioned by weight as follows:

a. 50 percent Kentucky bluegrass (Poa pratensis).
b. 30 percent chewings red fescue (Festuca rubra variety).
c. 10 percent perennial ryegrass (Lolium perenne).
d. 10 percent redtop (Agrostis alba).

3. Shade: Proportioned by weight as follows:

a. 50 percent chewings red fescue (Festuca rubra variety).
b. 35 percent rough bluegrass (Poa trivialis).
c. 15 percent redtop (Agrostis alba).

4. Application Rate: 6 lbs. per 1,000 square feet total – In two operations at right angles to each other using a suitable mechanical seeder or sowing by hand for smaller areas.

5. Apply seed and fiber mulch separately.

C. Wood Cellulose Fiber Mulch: Provide specially prepared wood cellulose processed into a uniform fibrous physical state. Wood cellulose to be dyed green or contain a green dye in the package that will provide an appropriate color to facilitate visual inspection of the uniformly spread slurry. The fiber mulch, including dye, shall contain no germination or growth inhibiting factors. The mulch material shall be manufactured and processed in such a manner that the wood cellulose fiber mulch will remain in uniform suspension in water under agitation and will blend with other additives to form homogeneous slurry. The mulch material shall form a blotter-like ground cover, on application, having moisture absorption and percolation properties and shall cover and hold grass seed in contact with the soil without inhibiting the growth of the grass seedlings.

D. The mulch material shall contain no elements or compounds at concentration levels that will be phyto-toxic. Wood cellulose fiber must conform to the following physical requirements: fiber length to approximately 10 mm., diameter approximately 1 mm., pH range of 4.0 to 8.5, ash content of 1.6% maximum and water holding capacity of 90% minimum.

1. Application rate: Net dry weight of 1500 lbs per acre. The wood cellulose fiber shall be mixed with water, and the mixture shall contain a maximum of 50 lbs. of wood cellulose fiber per 100 gallons of water. In areas where erosion may be a problem, use an organic tackifier such as CON-TACK™ or approved equal in accordance with manufacturer's instructions.

2. When seeding occurs after acceptable seeding dates, over-winter protection shall consist of applying five bales clean straw per 1,000 sq. ft. and anchor mulch by commercial mulch netting or 20 lbs. per 1,000 sq. ft. cellulose fiber. Asphalt emulsion anchoring is not acceptable.

E. Anti-Erosion Mulch (Used only for winter application): Provide clean, seed-free salt hay or threshed straw of wheat, rye, oats, or barley.

2.4 MISCELLANEOUS LANDSCAPE MATERIALS

A. Herbicide: "Round Up" or equal. No spraying shall be done without first submitting a spray program to the Owner's Representative for approval. After approval, application will only be permitted by licensed individuals.

PART 3 - EXECUTION

3.1 FINISH GRADING

A. Exercise extreme caution in excavation operations, so as not to disturb or damage any subsurface utilities or other existing or proposed site improvements, including existing lawns.

B. Perform all excavation operations in accordance with Pennsylvania Department of Environmental protection standards.

C. Limit finish grading to areas that will be planted in the immediate future.

D. Perform all finish grading necessary to bring the site to required finished elevations. Finish grading consists of preparing subgrade and spreading planting soil ready for seeding work.

E. If general area is hard pan, subgrade shall first be rototilled or chisel-plowed at least 6 inches deep to permit proper loosening and preparation of ground.

F. Subgrade must be loosened and graded by harrowing, disking, or dragging, as dictated by the condition of the subgrade. The entire subgrade must then be raked and all stones over 1", grade stakes, rubbish, and general debris removed. Hand rake to a smooth, even surface. Area must be fine graded to a smooth, even surface with loose, uniformly fine texture. Drag areas, remove ridges and fill depressions as required to meet finish grades.

G. Planting soil shall be dumped in piles, uniformly spaced or otherwise distributed by approved equipment. The piles shall be spread with a blade grader, or by any other approved method, to a minimum depth of 6 inches to permit 1 inch of settlement. Correct any surface irregularities to prevent formation of low spots and pockets that would retain water.

H. Planting soil shall not be placed when the subgrade is frozen, excessively wet, or extremely dry and no planting soil shall be handled when in a frozen or muddy condition. During all operations following planting soil spreading, the surface must be kept free from stones over 1" and any other materials which would be detrimental to seeding or maintenance of the lawn.

I. After completion and approval of finish grading, remove any excess planting soil from site, unless otherwise directed, and leave finish graded area clean and well raked, ready for lawn work.

3.2 SOIL PREPARATION FOR SEEDED AREAS

A. Prior to applying planting soil amendments, roll area with a water filled roller. Correct any surface irregularities to prevent formation of low spots.

B. Add specified planting soil amendments to top surface of existing soil and mix thoroughly into the soil. Apply lime, if required by soil test, at the rate recommended. Wait at least one full week after lime has been spread before applying fertilizer.

C. Apply starter fertilizer uniformly, at rates determined by the soil tests for new lawns. Delay application of fertilizer if lawn planting will not follow within a few days.

D. Apply organic matter as required by soil test.

E. Moisten prepared lawn areas before planting if soil is dry. Water thoroughly and allow surface moisture to dry before planting lawns. Do not create a muddy soil condition.

F. Subgrade must be loosened and graded by harrowing, disking, or dragging, as dictated by the condition of the subgrade. The entire subgrade must then be raked and all stones over 1", grade stakes, rubbish, and general debris removed. Hand rake to a smooth, even surface. Area must be fine graded to a smooth, even surface with loose, uniformly fine texture. Drag areas, remove ridges and fill depressions as required to meet finish grades.

3.3 SEEDING NEW LAWNS

A. Do not use wet seed or seed that is moldy or otherwise damaged in transit or storage. Do not seed in adverse weather or on wet or frozen ground.

B. Do seeding between April 1 and May 15 or between September 1 and October 15, unless otherwise permitted by the Owner's Representative.

C. As soon as the ground has been properly prepared, sow grass seed at the rate specified, in two operations at right angles to each other, using a suitable mechanical seeder or sowing by hand for small areas. Establish seed to soil contact.

D. Unless seeder covers the seed with soil as it sows, rake to obtain a light covering of soil over the seed after sowing and roll and cross-roll very lightly with an empty water roller and water with a fine spray. Do not seed when wind exceeds 5 miles per hour.

E. After seed application, protect seeded area with wood cellulose fiber mulch. Wood cellulose fiber mulch shall be applied at a net dry weight of 1,500 lbs. per acre. The wood cellulose fiber shall be mixed with water, and the mixture shall contain a maximum of 50 lbs. of wood cellulose fiber per 100 gallons of water. In areas where erosion may be a problem, use a 'tackerfier' such as CON-TACK or approved equal in accordance with manufacturers specifications.

F. After seeding, keep seed/soil moist. Water daily for proper germination.

G. When seeding occurs after acceptable seeding dates, over-winter protection shall consist of applying five bales of straw per 1,000 sq. ft. and anchor mulch by commercial mulch netting or 20 lbs. per 1,000 sq. ft. cellulose fiber. Asphalt emulsion anchoring is not acceptable.

3.4 RECONDITIONING EXISTING LAWNS

A. Recondition existing lawn areas damaged by Contractor's operations including storage of materials and equipment and movement of vehicles. Also recondition existing lawn areas where minor regrading is required.

B. Provide fertilizer, seed, and soil amendments as specified for new lawns, and as required, to provide a satisfactorily reconditioned lawn.

C. Provide new planting soil, as required, to fill low spots and meet finish grades.

D. Cultivate bare, eroded and compacted areas thoroughly to provide a satisfactory planting bed.

E. Remove diseased and unsatisfactory lawn areas off site; do not bury into soil. Remove topsoil containing foreign materials resulting from Contractor's operations, including oil drippings, stone, gravel, and other loose building materials.

F. Where substantial lawn remains, but is thin, mow, rake, aerate if compacted, fill low spots, remove humps, and cultivate soil, fertilize, and seed. Remove weeds before seeding, of if extensive, apply selective chemical weed killers as required. Apply a seedbed mulch, if required, to maintain moist condition.

G. Water newly planted lawn areas and keep moist until new grass is established.

3.5 CLEANUP AND PROTECTION

A. During finish grading, seeding and landscape work, keep pavements clean and work area in an orderly condition.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.

3.6 SATISFACTORY LAWNS

A. Satisfactory Seeded Lawn: At end of maintenance period, a healthy, uniform, close stand of grass has been established, free of weeds and surface irregularities, with coverage exceeding 90 percent over any 10 sq. ft. and bare spots not exceeding 5 by 5 inches.

B. Reestablish lawns that do not comply with requirements and continue maintenance until lawns are satisfactory.

3.7 MAINTENANCE

A. Begin maintenance immediately after planting. Maintain lawn for a minimum of three (3) months during the growing season.

B. Mow grass at regular intervals to maintain at a maximum height of 2½ inches; three (3) mowings required. Do not cut more than 1/3 of grass blade at any one mowing.

C. Neatly trim edges and hand clip where necessary.

D. Immediately remove clippings after mowing and trimming.

E. Water to prevent grass and soil from drying out.

F. Roll surface to remove mirror depressions or irregularities.

G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instruction.

H. Immediately reseed areas showing bare spots.

I. Provide maintenance log detailing the dates which mowings occurred.

3.8 FINAL INSPECTION AND ACCEPTANCE OF LAWNS

A. Notice, by the contractor, shall be given in writing as to when maintenance of the lawn areas by the contractor is to be discontinued. Maintenance shall cease in accordance with the time periods presented in these specifications, providing all lawn areas are properly established healthy and uniform, free of washouts, depressions, bare spots, weeds, and large off-color areas. Final inspection of seeded lawns shall follow and written approval given, by the Owner's representative, if acceptable. Any lawn area under this contract that is not in satisfactory condition, as determined by the Owner's Representative, shall be reworked as soon as conditions permit. All reworked lawn areas shall be maintained as previously specified in maintenance until final inspection and acceptance occurs. Contractor is responsible for furnishing and maintaining an established lawn in all areas designated on the plans for new lawn as well as areas of existing lawn (within and outside the limit of construction) disturbed by construction activities

END OF SECTION 329200

SECTION 329300 – PLANTS AND PLANTING

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 DESCRIPTION OF WORK

A. The work of this section consists of providing labor, materials, tools, equipment and services necessary to furnish and install all planting as indicated on the drawings and specified herein. The work generally includes:

1. Plant bed preparation.
2. The search, selection, transportation and planting of nursery plants and the establishment of plant beds and edging of beds.
3. Protection, maintenance, guarantee and replacement of plant material and mulched beds.

B. The contractor shall become familiar with the site and local conditions under which the work is to be performed and shall correlated his observations with the requirements of the proposed drawings and specifications.

C. Related Work: Section 329200 “Finish Grading and Seeding.” This section includes planting soil specifications.

1.3 SUBMITTALS

A. Certification: Submit certificates of inspection as required by governmental authorities. Submit manufacturer’s or vendor’s certified analysis for soil amendments and fertilizer materials. Submit other data substantiating that materials comply with specified requirements.

B. Nursery supplier: Submit in writing 30 days after the Award of the Contract, the names and addresses of the nursery(ies) that will be supplying plants.

C. Planting Schedule: Submit in writing the proposed planting schedule, indicating dates for each type of landscape work during normal seasons for such work in area of site. Correlate with specified maintenance periods to provide maintenance from date of substantial completion. Once accepted, revise dates only as approved in writing, after documentation of reason for delays.

D. Maintenance Instructions: Submit typewritten instructions recommending procedures to be established by Owner for continued maintenance after contract work is complete including

watering requirements, fertilizing, pruning, etc. Submit prior to expiration of required maintenance period(s).

1.4 QUALITY ASSURANCE

A. Submit to the Architect within 30 days of Award of the contract, a letter indicating the source of plants for approval.

B. Perform all work in accordance with the Pennsylvania Department of Transportation Specifications, latest edition as modified by these specifications.

C. General: Ship landscape materials with certificates of inspection required by governing authorities. Comply with regulations applicable to landscape materials, in character and value.

D. If specified landscape material is not obtainable, submit proof of non-availability to Owner's Representative, together with proposal for use of equivalent material in character and value.

E. Analysis and Standards: Package standard products with manufacturer's certified analysis. For other materials, provide analysis by recognized laboratory made in accordance with methods established by the Association of Official Agriculture Chemists, wherever applicable.

F. Trees, Shrubs and Plants: Provide trees, shrubs and plants of quantity, size, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of the current ANSI Z60.1 "American Standard for Nursery Stock". Provide healthy, vigorous stock, grown in Zones 5 and 6 recognized nursery in accordance with good horticultural practice and free of disease, insects, eggs, larvae and defects such as knots, sun-scald, injuries, abrasions, or disfigurement.

G. Label trees and shrubs of each variety with a securely attached waterproof tag bearing legible designation of botanical and common name.

H. Where formal arrangements or consecutive order of trees, shrubs or bulbs are shown, select stock for uniform height, spread and branching (trees only) and label with numbers to assure symmetry in planting.

I. Inspection: At the option and cost of the Contractor, provide trees for inspection and tagging by the Owner's Representative at the nursery. Ship only those with the Owner's Representative's tag. Alternatively, trees may be inspected at the site before planting. Regardless of whether the trees have been tagged at the nursery, the Owner's Representative retains right to further inspect trees and shrubs prior to planting for genus, species, variety, size, condition of balls and root systems, insects, injuries and latent defects, and to reject unsatisfactory or defective material. Remove rejected trees or shrubs immediately from project site.

J. Provide trees and shrubs of size shown or specified. Trees and shrubs of larger size may be used with approval of the Owner's Representative. Undersized plants are unacceptable.

K. Planting soil shall be provided as needed for planting work as specified in Section 329200 "Finish Grading and Seeding."

1.5 DELIVERY, STORAGE AND HANDLING

A. Packaged Materials: Deliver packaged materials in containers showing weight, analysis and name of manufacturer. Protect materials from deterioration during delivery, and while stored at site.

B. Trees and Shrubs: Provide freshly dug trees and shrubs. Do not prune prior to delivery unless otherwise approved by the Owner's Representative. Do not bend or bind-tie trees or shrubs in such manner as to damage bark, break branches or destroy natural shape. Provide protective covering during delivery. Do not drop balled and burlapped stock during delivery.

C. Deliver trees and shrubs after preparations for planting have been completed and plant immediately. If planting is delayed more than 6 hours after delivery, set trees and shrubs in shade and heel in, protect from weather and mechanical damage, and keep roots moist by covering with mulch, burlap or other acceptable means of retaining moisture. Water heeled-in plants each day as necessary to maintain moist condition.

D. Do not remove container grown stock from containers until planting time.

E. Notify the Owner's Representative of the delivery schedule at least 48 hours in advance so the plants may be inspected upon arrival at the job site. Remove unacceptable plants from the job immediately.

1.6 JOB CONDITIONS

A. Utilities: Determine location of underground utilities and perform work in a manner which will avoid possible damage. Hand excavate, as required. Mark utility locations prior to digging. Trees may have to be shifted because of utility conflict; contact Owner's Representative prior to planting in alternate location. Contractor to coordinate with Owner's Representative regarding existing subsurface improvements/structures and utilities.

B. Excavation: When conditions detrimental to plant growth are encountered, such as rubble fill, adverse drainage conditions, or obstructions, notify Owner's Representative before planting.

C. Optional Tree Guying and Staking: The guying and staking of trees is not required as scope of work items of this contract. At the Contractor's option he/she may elect to install these items without any additional cost to the Owner. Should the Contractor elect to guy and stake trees, methods and materials shall be as herein specified. Do not wrap trees.

1.7 SEQUENCING AND SCHEDULING

A. Proceed with and complete landscape work as rapidly as portions of site become available, working within seasonal limitations for each kind of landscape work required.

B. Restore all existing lawn areas that have been disturbed by construction.

C. Planting Time: Plant or install materials during normal planting seasons for each type of landscape work required. Correlate planting with specified maintenance periods to provide maintenance from date of substantial completion.

1. General:

a. Dig deciduous material after the leaves fall or during the period just prior to leafing, weather permitting.
b. Dig needled evergreen material no sooner than after new growth hardens.
c. Dig broadleaf evergreen material in spring prior to development of new growth.

2. Planting Dates:

a. Plant deciduous plants in the fall after the leaves fall and while the ground temperatures are above 45 degrees F. In the spring plant between the time the ground becomes workable and before new growth starts.
b. Plant needled evergreens between the time that the new growth has hardened and while the ground temperatures are above 45 degrees F (late summer/early fall) or prior to the development of new growth (spring).
c. Plant broadleafed evergreens prior to the development of new growth (spring).
d. Plant bulbs as soon as they become available in the fall and before November 15.

1.8 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 shall comply with such requirements without additional cost to Owner. The contractor shall obtain a street tree permit using the Philadelphia Parks and Recreation application located at the following website:

http://www.phila.gov/ParksandRecreation/programsandactivities/Applications/Tree_Request_Form.pdf

B. Procure and pay for permits and licenses required for work of this section.

PART 2 - PRODUCTS

2.1 GENERAL PRODUCTS

A. Planting soil as specified in Section 329200 “Finish Grading and Seeding.”

B. Peat Heat Humus as specified in Section 329200 “Finish Grading and Seeding.”

C. Organic matter as specified in Section 329200 “Finish Grading and Seeding.”

D. Mulch: Organic mulch free from deleterious materials and suitable for top dressing of trees, shrubs or plants and consisting of the following:

1. Bark mulch (Premium shredded hardwood Bark). Only bark mulch that has not been subjected to any conditions that would cause it to lose any of its value as mulch, and free from twigs, leaves, wood shavings, sawdust, toxic substances and foreign materials shall be used.

E. Sand as specified in Section 329200 "Finish Grading and Seeding."

F. Manure as specified in Section 329200 "Finish Grading and Seeding."

G. Commercial Fertilizer as specified in Section 329200 "Finish Grading and Seeding."

2.2 PLANTING SOIL

A. See Section 329200 Finish Grading and Seeding for planting soil specification.

B. For pit and trench type backfill, mix planting soil prior to backfilling, and stockpile at site.

C. For planting beds, mix planting soil either prior to planting or apply on surface of topsoil and mix thoroughly to specified depth before planting.

2.3 PLANTS

A. Quality: Provide trees, shrubs, and other plants of size, genus, species and variety shown and scheduled for landscape work and complying with recommendations and requirements of the current ANSI Z60.1 "American Standard for Nursery Stock", grown in zones 5 and 6.

B. Deciduous Trees: Provide balled and burlapped (B&B) trees of height and caliper scheduled or shown and with branching configuration and rootball recommended by ANSI Z60.1 for type and species required. Provide single stem trees except where special forms are shown or listed. Plants must be locally grown.

C. Deciduous Shrubs: Provide balled and burlapped (B&B) shrubs of the height or spread shown or listed and with not less than minimum number of canes and rootball required by ANSI Z60.1 for type and size of shrub required. Plants must be locally grown.

D. Evergreens: Provide balled and burlapped (B&B) evergreens of sizes shown or listed. Dimensions indicate minimum spread for spreading and semi-spreading type evergreens and height for other types, such as globe, dwarf, cone, pyramidal, broad up-right, and columnar. Provide normal quality evergreens with well-balanced form complying with requirements for other size relationships to the primary dimension shown. Rootball to conform with ANSI Z60.1 Standards. Plants must be locally grown.

E. Container grown plant materials will be acceptable upon written approval by the Owner's Representative, subject to specified limitations for container grown stock.

F. Bulbs: Provide double nosed, DNII bulbs free of disease, fungus and soft spots.

2.4 MISCELLANEOUS LANDSCAPE MATERIALS

A. Landscape Fabric: Water permeable filtration fabric of fiberglass or polypropylene fabric manufactured by Reemay, Inc. or approved equivalent. Submit sample for approval.

B. Herbicide: Herbicide as specified in Section 329200 "Finish Grading & Seeding."

C. Stakes and Guys: Staking and guying is a Contractor option, however trees must be straight and plumb at end of specified warranty period. Do not wrap trees.

PART 3 - EXECUTION

3.1 PREPARATION - GENERAL

A. Exercise extreme caution in excavation and planting backfilling operations, so as not to disturb or damage any subsurface utilities or other existing or proposed site improvements.

B. Lay out individual tree and shrub locations and areas for multiple plantings. Stake locations and outline plant beds and secure Owner's Representatives acceptance before start of planting work. Make adjustments as may be requested.

C. Contractor must examine subgrade, verify soil density, verify topsoil quality, verify elevations, observe conditions under which work is to be performed, and notify Owner's Representative of any unsatisfactory or adverse conditions such as, but not limited to percolation from plant pits. Do not proceed with work until unsatisfactory conditions have been corrected.

3.2 PREPARATION OF PLANTING PITS AND BEDS

A. Strip existing lawn and remove soils to a minimum depth 6" or as shown on details. All unwanted vegetation shall be completely removed and hauled to a site designated by the Owner or sprayed with Roundup.

B. Loosen subgrade of planting bed areas to a minimum depth of 6" using a cultimulcher or similar equipment. Remove stones over 1" in any dimension, and sticks, stones, rubbish and other extraneous matter.

C. Backfill for planting pits and beds shall be planting soil. Poor soils, gravel, hardpan or other soil injurious to plants shall not be used as backfill. Spread planting soil to minimum depth required to meet lines, grades and elevations shown, after light rolling and natural settlement. Place approximately 1/2 of total amount of planting soil required. Work into top of loosened subgrade to create a transition layer, then place remainder of the planting soil.

D. If an impervious, hard pan layer remains in the bottom of the pit or planting bed after excavation, the pit or bed shall be excavated to a depth of the hardpan or 36 inches below the bottom of the rootball. The pit or bed then shall receive a 6" layer of AASHTO 67 stone, covered with straw, roofing paper, or similar material. Remainder of the pit shall be backfilled with planting soil.

E. Add specified commercial fertilizer and specified soil amendments to surface of plant mix and mix thoroughly into top 6".

F. All plant beds are to be tested for percolation. Where excavation for planting pits, pockets and beds will not drain in a reasonable period of time (24 hours) and will affect the health of the plant, notify the Owner's Representative and provide under drains connected to a positive outfall. Under drainage will be paid on a unit price basis and will be reviewed and approved by a local expert, who has been selected by the Owner's Representative prior to installation.

3.3 EDGING OF PLANTING BEDS

A. If not edged by walls or other hardscape, spade edge along all plant beds including trees saucers. Stake layout of bed or edge and secure Owner's Representative's approval prior to edging. Edge at an angle, utilizing the spade to form sharp, defined, smooth bed lines. Maintain a constant 12" mulched area from the base of the plant to the edge of the lawn area. Consistent mulch depth must be maintained as shown on drawings.

B. Remove and dispose of off-site all debris resulting from the edging process.

C. Chemical or herbicidal edging techniques are forbidden.

3.4 EXCAVATION FOR TREES AND SHRUBS

A. Excavate pits as shown on details. Remove sticks, roots, rubbish, building materials or any materials resulting from previous demolition and any other extraneous matter. Loosen 6" of subsoil in bottom of excavation. If the pit, bed or trench does not properly percolate, then provide positive drainage as directed by the Owner's Representative as additional work.

B. Dispose of excess subsoil removed from planting excavations off site.

C. Fill excavations for trees and shrubs with water and allow to percolate out before planting.

3.5 PLANTING TREES AND SHRUBS

A. Place plants as shown or scheduled. Plant all shrubs in planting beds using equilateral spacing unless otherwise indicated on drawings.

B. Set balled and burlapped (B&B) stock on layer of loosened subsoil, plumb and in center of pit or trench with top of ball at same elevation as adjacent finished landscape grades. Remove burlap or wire cages from sides of balls; retain on bottoms. When set, place additional backfill (planting soil) around base and sides of ball, and work each layer to settle backfill (planting soil) and eliminate voids and air pockets. When excavation is approximately 2/3-full, water thoroughly before placing remainder of backfill. Adjust for any settling that may take place. Repeat watering until no more is absorbed. Water again after placing final layer of backfill (planting soil). All plants shall, after planting, bear the same relation to the surface grade as it did in the nursery.

C. Set container grown stock as specified for balled and burlapped stock on layer of loosened subsoil, except cut cans on two sides with an approved can cutter being careful not to sever roots. Remove bottoms of cans after partial backfilling so as not to damage rootballs.

D. Set top of backfill to allow for mulching. Provide a small mound of soil formed around the edge of each tree pit to form a shallow saucer.

E. Mulch pits and planted areas. Provide not less than following thickness of mulch and work into top of backfill and finish level with adjacent finish grades. Mulch depth as shown on drawings must be a settled thickness amount. Make sure no mulch covers plant crowns, and do not place mulch against plant trunks or stems.

F. For Trees and Shrubs: Provide 3" thickness of mulch after settlement.

G. Seek approval from Owner's Representative prior to pruning. Prune, thin out and shape trees and shrubs in accordance with standard horticultural practice. Prune trees to retain required height and spread. Unless otherwise directed by Owner's Representative do not cut tree leaders, and remove only injured or dead branches from flowering trees, if any. Prune shrubs to retain natural character.

H. Remove and replace excessively pruned or misformed stock resulting from improper pruning.

I. Fertilize.

3.6 PLANTING GROUND COVERS

A. Space plants as shown or scheduled. Plant all beds using equilateral spacing unless otherwise indicated on drawings.

B. Dig as shown on detail to allow for spreading of roots. Backfill with planting soil and work soil around roots to eliminate air pockets and leave a slight saucer indentation around plants to hold water. Water thoroughly after planting, taking care not to cover crowns of plants with wet soils.

C. Mulch areas between plants, place not less than 2" settled mulch thickness.

3.7 MAINTENANCE

A. Begin maintenance immediately after planting.

B. Maintain trees, shrubs and other plants until final acceptance.

C. Maintain trees, shrubs and other plants by pruning, cultivating, watering and weeding as required for healthy growth. Restore planting saucers. Reset trees and shrubs to proper grades or vertical position as required. Spray as required to keep trees and shrubs free of insects and disease.

1. Weeding: Weed control shall be by mechanical means. Herbicide use is acceptable with Owner approval.

D. At the end of the maintenance/guarantee period the Contractor shall remove all tree staking (installed by the Contractor's option) and related appurtenances and dispose of off site.

3.8 PLANTING GUARANTEE AND REPLACEMENT

A. Guarantee: Guarantee plants for the entire maintenance period, one (1) year after the date of substantial completion. Plants shall be alive and in satisfactory growth at the end of the guarantee period.

B. Any plants under this contract that is dead or not growing satisfactorily during the maintenance period, as determined by the Owner's Representative, shall be removed by the Contractor within ten days of notice or the Owner will remove the plants and bill the Contractor accordingly. Replacement plants shall be planting during the next normal planting season, as soon as weather permits. All replacements shall be of the same kind and size as specified in the plant list. They shall be furnished and planted as specified under planting; the cost shall be borne by the Contractor except for replacements needed as a result of vandalism or acts of neglect on the part of others.

C. Contractor shall maintain a written log of all plants that had died, including location and date of plant that was determined to be dead, date of removal, and date of replanting. Logs shall be submitted to the Owner's Representative for approval prior to acceptance of replanted plants. Replanted plants shall not be accepted without written log.

3.9 CLEANUP AND PROTECTION

A. During landscape work, keep pavements clean and work area in an orderly condition.

B. Protect landscape work and materials from damage due to landscape operations, operations by other contractors and trades and trespassers. Maintain protection during installation and maintenance periods. Treat, repair or replace damaged landscape work as directed.

3.10 FINAL INSPECTION AND ACCEPTANCE OF PLANTING

A. At the end of the maintenance/guarantee period, the Owner's Representative, upon written request of the Contractor submitted at least ten (10) days prior to anticipated inspection date, will inspect the work to determine acceptance. The condition of the work will be noted and a determination made regarding any continued maintenance.

B. After inspection, the Contractor shall be notified in writing by the Owner's Representative of acceptance of work, subject to guarantee, or, if there are any deficiencies, of the requirements for completion of the work. All work remaining to be done shall be subject to subsequent inspection before acceptance.

END OF SECTION 329300

SECTION 334000 - STORM DRAINAGE UTILITIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

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

1.2 SUMMARY

A. This Section includes but is not limited to gravity-flow, non-pressure storm drainage outside the building, with the following components:

1. Excavation and backfilling.
2. Installation of piping and fittings.
3. Installation of manholes, inlets, catch basins, cleanouts, vaults, swales and ditches.
4. Connection to existing utility lines.
5. Testing and related appurtenances.

B. Related Sections include the following:

1. Division 31 Section “Earthwork” for excavation and backfill required for sewage systems not included in this section.
2. Division 03 Section “Concrete” for concrete work required for storm sewer systems not included in this section.
3. Division 22 Section – Plumbing for interior building systems including conductors, horizontal branches, and connections to roof and deck drains not included in this section.

1.3 QUALITY ASSURANCE

A. City of Philadelphia Water Department specification for sewers and stormwater conduit.

1.4 REQUIREMENTS, TESTS AND INSPECTION

A. All materials shall be tested for conformance to the current specifications, and in accordance with the current standard test methods, of technical societies, institutes, associations of Federal and State specifications, as called for in these specifications, in the Special Specifications of the Contract or as called for by the Engineer. Current specifications and current standard test methods are defined as the latest editions, amendments of revisions that are current at the time of receipt of bids.

B. The City of Philadelphia Water Department will inspect the tap connection of new stormwater sewers to the City of Philadelphia Sewers. Contractor to pay the cost of the City of Philadelphia inspection.

C. Manufacturer's Qualifications: All materials shall be obtained from firms regularly engaged in manufacture of stormwater conduit and sewers system's products of types, materials, and sizes required, whose products have been in satisfactory use of similar service for not less than 5 years.

D. Installer's Qualifications: Firm with at least 3 years of successful installation experience on projects with storm sewage work similar to that required for project.

E. Codes and Standards - Plumbing Code Compliance: Comply with applicable portion of City of Philadelphia Standard Plumbing Code pertaining to selection and installation of storm and sewage system's materials and products.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer’s technical product data and installation instructions for storm sewage materials and products.

B. Record Drawings: At project closeout, submit record drawings of installed stormwater conduit and sewage piping and products, in accordance with requirements of Division 01.

C. Maintenance Data: Submit maintenance data and parts lists for stormwater conduit and sewage system materials and products. Include this date, product data, shop drawings, and record drawings in maintenance manual; in accordance with requirements of Division 01.

D. Field quality-control test reports.

1.6 DELIVERY, STORAGE, AND HANDLING

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

B. Handle manholes according to manufacturer's written rigging instructions.

C. Handle catch basins and stormwater inlets according to manufacturer's written rigging instructions.

PART 2 - PRODUCTS

2.1 PIPES AND PIPE FITTINGS

A. General: Provide pipes as shown on the drawings, of weight/class indicated. Provide pipe fittings and accessories of same material and weight/class as pipes, with joining method as indicated.

2.2 PIPING MATERIALS

A. Reinforced Concrete Pipe and Fittings

1. Circular reinforced concrete pipe used in the construction of stormwater conduits, including wye branches, bends and fittings, shall conform to ASTM C 76 Standard Specification for Reinforced Concrete Culvert, Storm Drain and Sewer Pipe, Class III, Wall B. Quadrant reinforcing of the pipe will not be permitted.
2. All reinforced concrete pipe used in the construction of stormwater conduits shall have rubber gasket joints. The joints and the gasket material shall conform to ASTM C 443 Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets. The joint shall consist of a bell or groove on one end of a unit of pipe and a spigot or tongue on the adjacent end of the joining pipe.

B. Ductile-Iron Culvert Pipe and Fittings

1. Pipe: ASTM A 716, for push-on joints. Manufactured and tested per ANSI A21.51 (AWWA C151). Pipe 12 inches in diameter and smaller shall be thickness class 56. Pipe larger than 12 inches in diameter shall be thickness Class 54, unless specified otherwise on the Plans.
2. Standard Fittings: AWWA C110, ductile or gray iron, for push-on joints.
3. Compact Fittings: AWWA C153, for push-on joints.
4. Gaskets: AWWA C111, rubber.

C. Corrugated Metal Pipe and Fittings

1. Corrugated-Steel Pipe and Fittings: ASTM A 760/A 760M, Type I with fittings of similar form and construction as pipe.
2. Special-Joint Bands: Corrugated steel with O-ring seals.
3. Standard-Joint Bands: Corrugated steel.
4. Perforations: AASTHO M36, Class 2 Perforations.

2.3 NONPRESSURE-TYPE PIPE COUPLINGS

A. Comply with ASTM C 1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground nonpressure piping. Include ends of same sizes as piping to be joined and corrosion-resistant-metal tension band and tightening mechanism on each end.

2.4 CLEANOUTS

1. Cleanouts shall be per plan.

2.5 TRENCH DRAINS

1. Trench Drains shall be per plan and installed per manufacturer’s recommendations.

2.6 MANHOLES

A. General:

1. Manholes shall precast reinforced concrete manhole sections.
2. Manholes shall be constructed with steps and/or ladder bars from the invert of the sewer or stormwater conduit to the top of the manhole.
3. Manholes built into sanitary sewers or combined sewers shall be fitted with cast iron frames and closed covers. Manholes built into stormwater conduits shall be fitted with cast iron frames and solid or vented covers.

B. Precast Concrete Manholes:

1. Precast reinforced concrete manhole sections, including grade rings, eccentric cones, riser sections and base sections, shall comply with ASTM C478 Standard Specification for Precast Reinforced Concrete Manhole Sections, and shall be tested and registered with the Quality Certification Staff in accordance with the Quality Certification Standard QC-1 to Precast Concrete Products. In addition, manufacturers must be certified in accordance with QC-1 by the Quality Certification Staff and shop drawings must be approved by the Water Department Design Branch.
2. Precast reinforced concrete manholes built into sanitary, combined and intercepting sewers shall have rubber gasket joints which shall conform to ASTM C443 Standard Specification for Joints for Circular Concrete Sewer and Culvert Pipe, Using Rubber Gaskets. Precast reinforced concrete manholes built into stormwater conduits shall have rubber gasket joints or mortar joints.
3. Resilient Connectors shall be used to insert pipe into precast reinforced concrete manholes that are built into any intercepting sewers. Resilient Connectors shall meet the requirements of ASTM C923 Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures and Pipes.
4. The mortar shall meet the requirements of Section 2.04.H, paragraph 3.In addition to the requirements specified in ASTM C478, the concrete mix shall meet the following: The minimum compressive strength shall be 4,000 psi. The water-cement ration shall be 0.45. The minimum cement content shall be 564 lb/cu yd. The cement shall be Portland Cement Type I IA, II, IIA III or IIIA. The slump shall be 3 inches maximum and 1 inch minimum. The air content shall be 6 $\pm$ %. Air-Entraining Admixtures must meet the requirements of ASTM C260 Standard Specification for Air-Entraining Admixtures for Concrete. Coarse aggregate shall be No. 67 or No. 57.

C. Ladders, Bars and Steps:

1. Aluminum for manhole steps shall be manufactured and tested in accordance with ASTM B221 Standard Supplications for Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes and Tubes, Alloy 6061 T6. Embedded ends of aluminum steps shall have 2 coats of bitumastic.
2. The plastic encasement shall be manufactured and tested in accordance with ASTM D2146 Standard Specification for Proplyene Plastic Molding and Extrusion Materials. Type 11-49108-D.

D. Manhole Frames and Covers:

1. Manhole frames and covers shall be tested and registered with the Quality Certification Staff in Accordance with the Quality Certification Standard QC-2 for Gray Iron Castings. In addition, manufacturers must be certified in accordance with QC-2 by the Quality

Certification Staff and shop drawings must be approved by the Water Department Design Branch.

2. Manhole frames and covers shall be made of Class 30B gray iron which is tested in accordance with ASTM A48 Standard Specification for Gray Iron Castings. The name of the foundry and the heat and lot number shall be cast into the frame and into the exterior side of the cover.
3. Manholes frames and covers shall be thoroughly cleaned. All projections and roughness shall be ground smooth. The bearing surfaces of the frame and cover shall not rock or jam. Frames and covers shall not be painted.

2.7 PRECAST CONCRETE VAULT

1. Precast, Reinforced Concrete Vaults shall be per plan.

2.8 INLETS

A. General:

1. Inlets shall precast reinforced concrete.
2. All inlet catch basins shall have traps, unless otherwise shown on the plans, which may be placed in wall as indicated on the Drawings.
3. The use of 90 degree bends in the pipe connection between the inlet and the sewer is prohibited.

B. Precast Concrete Inlets:

1. Precast reinforced concrete catch basins shall comply with ASTM C913 Standard Specification for Precast Concrete Water and Wastewater Structures and shall be tested and registered according to the Quality Certification Standard QC-1 for Precast Concrete Products.
2. In addition to the requirements specified in ASTM C913, the concrete mix shall meet the following: The minimum compressive strength shall be 4,000 psi. The water-cement ratio shall be 0.45. The minimum cement content shall be 564 lb./cu.yd. The cement shall be Portland Cement Type I, IA, II, IIA, III or IIIA. The slump shall be 3 inches maximum and 1 inch minimum. The air content shall be 6% plus or minus 1%. Admixtures, other than air-entraining, must be approved prior to use. Coarse aggregate shall be No. 67 or 57.
3. The reinforcing shall be as described in ASTM C913. The welded wire fabric used for reinforcing shall be the sheet type.
4. Precast reinforced concrete inlet adjustment risers Grate inlets shall conform to ASTM C913.

C. Inlet Grates and Frames:

1. Inlet grates and frames shall conform to PennDOT Standard Drawing No. R.C. 34 Cast Iron Type M and C inlets.

PART 3 - EXECUTION

3.1 EARTHWORK

A. Excavation, trenching, and backfilling are specified in Division 31 Section "Earthwork."

3.2 INSTALLATION OF PIPE AND PIPE FITTINGS

A. General: Install piping in accordance with governing authorities having jurisdiction, except where more stringent requirements are indicated.

B. Inspect piping before installation to detect apparent defects. Mark defective materials with white paint and promptly remove from site.

C. Lay piping beginning at the low point of the system, true to grades and alignment indicated, with unbroken continuity of invert.

D. Place bell ends and groove ends of piping facing upstream.

E. The width of trenches for sewers shall be as shown on the Plans.

F. Care shall be taken in placing the pipe into the trench to prevent damaging the joints or joint-material and to prevent disturbing the trench.

G. The manufacturer’s recommendations for pipe assembly must be closely followed. Care must be taken to clean the mating surfaces of the joints before jointing. The jointing surfaces shall be lubricated as recommended by the manufacturer. The pipe ends shall be aligned and assembled by hand, bar or the use of a come-along. In all instances the ends of the pipe must be protected against damage.

H. Protection of Pipes: The mouth of the pipes, in the trenches, shall be carefully protected from rock falls or damage from any other source. In addition, the mouth of the pipes shall be provided with means to prevent earth or any other substance from entering.

I. Length of Pipes: All pipes used in the construction of sewers, stormwater conduits and other connects shall be the maximum length produced, except where shorter lengths are required for closures, curved sewers or to secure proper locations for laterals or inlet connections.

J. Provisions of Lateral Connections:

1. Unless otherwise specified, provisions shall be made for lateral connections on each side of the sewer and/or stormwater conduit in accordance with zoning requirements, or with existing or preceeding building developments.
2. Laterals shall be constructed to have a direct fall between the building and or inlet and the connection at the sewer.

K. All pipe shall be placed on a stone or concrete cradle as shown on the plans. Pipe with less than 2 feet of cover shall be encased in concrete, minimum thickness 4 inches.

L. Connections: Laterals shall be connected to the sewer pipe with factory manufactured wye branches. Pipe 10" and less shall be connected to sewer with a pipe saddle connection, unless indicated otherwise in the plans.

M. Installing Pipe Fittings:

1. After the pipes are placed in the trench, they shall be prepared for coupling by thoroughly cleaning and then lubricating the joint. For pipes manufactured to accept "O" ring gaskets, the groove and the "O" ring gasket shall be lubricated as recommended by the manufacturer. The gasket shall be placed in the groove and the tension shall be equalized by inserting a suitable tool under the gasket and running it around the pipe 3 times.
2. For pipes manufactured to accept fin type gaskets, the inside surface of the bell or groove and the gasket shall be lubricated as recommended by the manufacturer.
3. After the joint is lubricated, the pipes shall be coupled immediately. The pipes shall be pulled up tightly by using a winch, come-along or other appropriate method. A visual check shall be made to see that the pipe is properly connected.

N. Factory manufactured wye branches or pipe saddles shall be used to connect laterals to the City of Philadelphia sewer main. Field fabricated wye branches and connections are not permitted.

3.3 TAP CONNECTION

A. Make connections to existing conduits and underground structures, so that finished work will conform as nearly as practicable to requirements specified for new work.

B. Use commercially manufactured wyes for branch connections. Field cutting into conduits will not be permitted. Spring flows into existing lines and encase entire wye, plus 6" overlap, with not less than 6" of 3000 psi 28-day compressive strength concrete.

C. Branch connections made from one side into existing 12" to 21" conduit shall have a wye sprung into the existing line, and entire wye encased with not less than 6" of 3000 psi 28-day compressive strength concrete.

1. For branch connections from side into existing 24" or larger conduit or to underground structures, cut opening into unit sufficiently large to allow 3" of concrete to be packed around entire connection. Cut ends of connection passing through conduit or structure wall to conform to shape of and be flush with inside wall, unless otherwise indicated. On outside of conduit structure wall, encase entering connection in 6" of concrete for a minimum length of 12" to provide additional support or collar from connection to undisturbed ground.

2. Provide concrete which will attain a minimum 28-day compressive strength of 3000 psi, unless otherwise noted.

3. Use an epoxy bonding compound as interface between new and existing concrete and conduit material.

4. Take care while making tap connections to prevent concrete or debris from entering existing conduit or structure. Remove debris, concrete or other extraneous material which may accumulate.

3.4 INSTALLATION OF INLETS

A. After excavation has been completed, level off the area where the base section will be located. Provide a 3/4" crushed stone bed to obtain a level and solid foundation. Do not use wood, brick or other materials to shim the base section.

B. When installing a two piece catch basin remove all foreign materials such as dirt, mud and stones from the joint surfaces. Apply a bitumen-type sealing compound to seal the joint. The sealing compound shall be approved by the Water Department Design Branch prior to application.

C. Seal all lifting holes and the adjustment area around the trap with non-shrink, non-metallic mortar. The mortar shall not contain gas-forming agents and shall be tested in accordance with ASTM C827 Standard Test Method for Early Volume Change of Cementious Mixtures, C191 Standard Test Method for Time Setting of Hydraulic Cement by Vicat Needle and C 109 Standard Test Method for Compressive Strength of Hydraulic Cement Mortars. The change in volume shall be 0 or shall increase slightly. The time of set shall be 45 minutes minimum. The minimum compressive strength shall be 6000 psi at 28 days.

D. Backfill shall be deposited in layers of 8 inches or less and tamped. Compaction of the backfill through puddling is not allowed.

3.5 CLEANOUT INSTALLATION

A. Install cleanouts and riser extensions from sewer pipes to cleanouts at grade. Use ductile-iron soil pipe fittings in sewer pipes at branches for cleanouts and ductile-iron soil pipe for riser extensions to cleanouts. Install piping so cleanouts open in direction of flow in sewer pipe.

B. Set cleanout frames and covers in earth in cast-in-place-concrete block as indicated in the Drawings. Set with tops 1 inch above surrounding grade.

C. Set cleanout frames and covers in concrete pavement with tops flush with pavement surface.

3.6 ROOF DRAIN CONNECTIONS

A. Connect roof drains to storm drains. Grout joints between ductile iron pipe and P.V.C. pipes thoroughly with cement mortar to make watertight joint or provided concrete collar.

3.7 CLOSING ABANDONED UTILITIES

A. Close open ends of abandoned underground utilities which are indicated to remain in place. Provide sufficiently strong closures to withstand hydrostatic or earth pressure which may result after ends of abandoned utilities have been closed.

1. Close open ends of concrete or masonry utilities with no less than 8" thick brick masonry bulkheads.

2. Close open end of conduits with threaded metal caps, plastic plugs, or other acceptable methods suitable for size and type of material being closed. Wood plugs are not acceptable.

3.8 FIELD QUALITY CONTROL

A. Inspect interior of piping to determine whether line displacement or other damage has occurred. Inspect after approximately 24 inches of backfill is in place, and again at completion of Project.

1. Submit separate reports for each system inspection.
2. Defects requiring correction include the following:

    a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    c. Crushed, broken, cracked, or otherwise damaged piping.
    d. Infiltration: Water leakage into piping.
    e. Exfiltration: Water leakage from or around piping.

3. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
4. Reinspect and repeat procedure until results are satisfactory.

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

1. Do not enclose, cover, or put into service before inspection and approval.
2. Test completed piping systems according to authorities having jurisdiction.
3. Schedule tests and inspections by authorities having jurisdiction with at least 24 hours' advance notice.
4. Submit separate report for each test.
5. Gravity-Flow Storm Drainage Piping: Test according to requirements of authorities having jurisdiction, UNI-B-6, and the following:

    a. Exception: Piping with soil tight joints unless required by authorities having jurisdiction.
    b. Option: Test plastic piping according to ASTM F 1417.
    c. Option: Test concrete piping according to ASTM C 924.

C. Leaks and loss in test pressure constitute defects that must be repaired.

D. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

3.9 CLEANING AND RESTORATION

A. Clean interior of piping of dirt and superfluous materials.

B. The work area shall be restored to its original or better condition. Restoration includes, but is not limited to repairs or replacement of footway and curbing that is cracked or broken by the Contractor and replacing brick in brick footways.

END OF SECTION 334000