SECTION 02000
SITE WORK

PART 1 - GENERAL

1.01 DESCRIPTION

A. These general site work requirements apply to all site work operations. Refer to Specification sections for specific product and execution requirements.

1.02 QUALITY ASSURANCE

A. Comply with all applicable local, state, and federal requirements regarding materials, methods of work, and disposal of excess and waste materials.

B. Obtain and pay for all required inspections, permits, and fees. Provide notices required by governmental authorities.

1.03 PROJECT CONDITIONS

A. Locate and identify existing underground and overhead services and utilities within contract limit work areas. Provide adequate means of protection of utilities and services designated to remain. Repair utilities damaged during site work operations at Contractor's expense.

B. Arrange for disconnection disconnect and seal or cap all utilities and services designated to be removed before start of site work operations. Perform all work in accordance with the requirements of the applicable utility company or agency involved.

C. When uncharted or incorrectly charted underground piping or other utilities and services are encountered during site work operations, notify the Engineer and the applicable utility company immediately to obtain procedure directions. Cooperate with the applicable utility company in maintaining active services in operation.

D. Locate, protect, and maintain benchmarks, monuments, control points and project engineering reference points. Reestablish disturbed or destroyed items at Contractor's expense.

E. Perform site work operations and the removal of debris and waste materials to assure minimum interference with streets, walks, and other adjacent facilities.

F. Obtain governing authorities' written permission when required to close or obstruct street, walks and adjacent facilities. Provide alternate routes around closed or obstructed traffic ways when required by governing authorities.

G. Control dust caused by work. Dampen surfaces as required. Comply with pollution control regulations of governing authorities.

H. Protect existing buildings, paving, and other services or facilities on site and adjacent to the site from damage caused by site work operations. Cost of repair and restoration of damaged items at Contractor's expense.

I. Protect and maintain street lights, utility poles and services, traffic signal control boxes, curb boxes, valves and other services, except items designated for removal. Remove or coordinate the removal of traffic signs, parking meters and postal mail boxes with the applicable governmental agency. Provide for temporary relocation when required to maintain facilities and services in operation during construction work.

J. Preserve from injury or defacement all vegetation and objects designated to remain.

PART 2 - PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment: As selected by Contractor, except as indicated in contract documents.

PART 3 - EXECUTION

3.01 PREPARATION

A. Examine the areas and conditions under which site work is performed. Do not proceed with the work until unsatisfactory conditions are corrected.

B. Consult the records and drawings of adjacent work and of existing services and utilities, which may affect site work operations.

END OF SECTION 02000

SECTION 02050
DEMOLITION

PART 1 - GENERAL

1.01 SCOPE

A. The work covered under this Section includes furnishing all labor and equipment required to remove, handle, crush and legally dispose of all equipment, materials, wells, and piping as shown on the Drawings, and required for the completion of the Work, including all necessary excavation and backfilling.

B. The work specified herein and shown on the Drawings is intended to give a general idea of the scope of this work but must not be construed as covering it entirely. The Contractor shall visit the site and judge the amount of work required and the problems anticipated in the performance of the work.

C. Requirements for removal of pavement and abandonment of site utilities are specified in the Section 02200.

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents. Prior to beginning work, a schedule of demolition and detail methods to be used on each facility to be demolished shall be submitted.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. The Contractor shall furnish equipment of the type normally used in demolition including but not limited to tractors, trucks and loaders.

2.02 MATERIALS

A. All concrete, mortar, grout, and backfill used in patching, plugging or repairing shall comply in all respects with the applicable material requirements of these Specifications.

PART 3 - EXECUTION

3.01 GENERAL

A. All material shall be removed as necessary for construction, or in any event, to a minimum depth of three feet below finished grades.

B. Protection

1. Take care to prevent the spread of dust and flying particles. Sprinkle rubbish and debris with water to keep dust to a minimum.
2. Maintain adequate fire protection, including extinguisher and operative waterhose lines during demolition.

C. Personnel: Perform work by personnel experienced in this type work and in such a manner as to eliminate hazards to persons and property without interference with new work and with use of adjacent areas, public rights-of-way, utilities and structures.

D. All asbestos and hazardous materials shall be properly and legally removed and disposed of prior to any demolition.

3.02 PROTECTION OF WORK AND EXISTING FACILITY

A. Perform the work in a manner that will not damage parts of the structure, facility, or system not intended to be removed. If, in the opinion of the Engineer, the method of demolition or cutting may endanger or damage parts of the structure(s) or affect the operation of the facilities, promptly change the method when so notified by the Engineer. Perform all cutting required regardless whether such cutting is specifically indicated. Examine the existing structures, evaluate conditions to be encountered in accomplishing the work, and accommodate such requirements accordingly in the Bid Proposal.

B. The Contractor shall exercise full care and shall use such methods and equipment during removal as will maintain the usefulness of the various materials and equipment removed.

3.03 DISPOSAL

A. Disposal: All rubble and waste material shall be removed from each work area in order to provide a clean area. Such removal and cleanup is to be completed upon conclusion of daily work, outage period, or a specific work period. Removal of waste material from the work areas constitutes physical removal of the debris, rubble, or waste from the building proper or work site to a storage container or stockpile. If the material is stockpiled for later disposal, the stockpile location shall be as approved by the Engineer. Should stockpiling not be approved an appropriate container may be used, or the Contractor may dispose of the material directly. If stockpiling is approved, disposal of stockpiled materials shall be accomplished at a frequency no less than weekly. Waste material is considered to be any item or material that is removed from an existing condition and is not intended for reinstallation or salvage to the City. The Contractor shall be fully responsible for proper and legal disposal of waste materials in accordance with all federal, state and local laws at no additional cost to the City.

END OF SECTION 02050

SECTION 02110
CLEARING AND GRUBBING

PART 1 - GENERAL

1.01 SCOPE

A. Work described in this Section includes furnishing all labor, equipment, tools and incidentals required for all clearing and grubbing including, but not limited to, the removal of trees, stumps, roots, brush, structures, abandoned utilities, trash, debris and all other materials found on or near the ground surface within the construction area. Precautionary measures to prevent damage to existing features to remain shall be part of the work.

B. Clearing and grubbing operations shall be coordinated with temporary and permanent erosion control procedures.

C. Related Work specified elsewhere:

1. Section 02050 - Demolition.
2. Section 02125 - Erosion and Sediment Control.
3. Section 02200 - Earthwork.

1.02 QUALITY ASSURANCE

A. The Contractor shall comply with applicable codes, ordinances, rules, regulations, and laws of local, municipal, state or federal authorities having jurisdiction over the Project. All required permits of a temporary nature shall be obtained for construction operations by the Contractor.

B. Burning shall not be allowed.

1.03 JOB CONDITIONS

A. Location of the Work: The area to be cleared and grubbed shall be the minimum required to perform the Work.

PART 2 - PRODUCTS

2.01 EQUIPMENT

A. The Contractor shall furnish equipment with operators of the type normally used in clearing and grubbing operations including, but not limited to, tractors, trucks, loaders and root rakes.

PART 3 - EXECUTION

3.01 EXISTING TREES AND VEGETATION

A. Avoid cutting or injuring trees and vegetation outside the construction limits. The Contractor shall be responsible for damages outside these limits.

3.02 CLEARING AND GRUBBING

A. Grubbing shall consist of completely removing roots, stumps, trash and other debris in the earthwork area so that topsoil is free of roots and debris. Topsoil is to be left sufficiently clean so that further picking and raking will not be required.

B. All stumps, roots, sheeting foundations and planking embedded in the ground shall be removed and disposed of. Stumps and roots larger than 1 inch shall be grubbed and removed to a depth not less than 4 feet below grade. All holes or cavities, which extend below the subgrade elevation of the proposed work shall be filled with crushed rock or other suitable material, compacted to the same density as the surrounding material.

C. Surface rocks and boulders shall be grubbed from the soil and removed from the site or used as fill in accordance with Section 02200, Earthwork.

D. Burying of any materials and organics shall not be allowed.

E. The Contractor shall be responsible for all damages to existing improvements resulting from Contractor's operations.

3.03 DISPOSAL OF REFUSE

A. The refuse resulting from the clearing and grubbing operation shall be hauled to a disposal site secured by the Contractor and shall be legally disposed of in accordance with all requirements of federal, state, county and municipal regulations. No refuse of any kind shall be deposited in any stream or body of water, or in any street or alley. In no case shall any material be left on the site, shoved onto abutting private properties, or buried on the Project Site.

3.04 KUDZU REMOVAL

A. The Contractor shall remove and eradicate all kudzu from the construction limits.

B. During the growing season, treat the emerging and existing growth with dicotyledon selective herbicide as per the manufacturer's directions and wait two weeks before starting the clearing and grubbing of the kudzu.

C. Remove the kudzu and roots by mechanical means. Hand clear the remaining roots.

D. Treat emerging growth with dicotyledon selective herbicide as per manufacturer's direction. After two weeks, remove the remaining kudzu.

E. Continue herbicide applications and removal to emerging kudzu as necessary.

F. Do not spill on slopes or other grassed areas. Keep the spray controlled so that it does not enter the waters of the State. Repair vegetated areas damaged by careless handling or overspray of the herbicide at no additional expense to the owner.

END OF SECTION 02110

SECTION 02112
TREE PROTECTION AND SELECTIVE TRIMMING

PART 1 - GENERAL

1.01 SCOPE

A. Tree protection shall be accomplished on all areas to be protected from impact by new construction. Tree protection operations include but are not limited to the following:

1. Tree protection staking of the areas on the site, construction of tree protection fencing, removal of indicated vegetation, protection of existing trees designated to remain, erosion control, underbrush clean-up, and pruning.

1.02 RELATED DOCUMENTS

A. The Drawings and general provisions of the Contract, including General and Special Conditions, apply to work of this section.

1.03 CODES AND STANDARDS

A. In addition to complying with all pertinent codes and regulations, comply with the requirements of those insurance carriers providing coverage for this work.

1.04 QUALITY ASSURANCE

A. Qualification of the Workmen: Provide at least one person who shall be present at all times during tree clearing and grubbing operations and who shall direct the trimming of roots and limbs where required. Provide at least one person who is qualified in the various other trades involved including demolition, protection of property, and erosion control.

1.05 JOB CONDITIONS

1. Dust Control: Use all means necessary to prevent the spread of dust during performance of the work of this section. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the work on the site and surrounding areas.
2. Erosion Control: Install and maintain berms, swales, and bales as required to trap waterborne soil particles. As work progresses, relocate and/or add to erosion control system as necessary and described in Section 02125 Erosion and Sedimentation Control.
3. Protection: Use all means necessary to protect existing objects designated to remain and, in the event of damage, immediately make all repairs and replacements necessary to the approval of the Landscape Architect at no additional cost to the Owner.
4. Tree Protection
5. Protect existing trees and other vegetation indicated to remain in place, against unnecessary cutting, breaking, or skinning of roots, skinning and bruising of bark, smothering of trees by stockpiling construction materials, or excavated materials within drip line, excess foot or vehicular traffic, or parking of vehicles within drip line.
6. Provide temporary fences, barricades, or guards as required to protect trees and vegetation to be left standing. Contractor shall not store, stack, or place materials of any form under the

drip line of trees to be saved. Equipment such as vehicles shall not be parked under trees or traverse beneath the drip line of trees to be saved.

7. Water trees and other vegetation which are to remain within the limits on the Contract work as required to maintain their health during the course of construction operations.

8. Provide protection for roots over 2-inch diameters that are cut during construction operation. Temporarily cover all exposed roots with wet burlap to prevent from drying out; provide earth cover as soon as possible.

9. Repair or replace trees and vegetation damaged by construction operations, in a manner acceptable to the Landscape Architect. Tree damage repair shall be performed by a qualified tree surgeon. Replace trees which cannot be repaired and restored to full growth status, as determined by the tree surgeon.

10. Protect tree root system from damage due to deleterious materials in solution caused by run-off, or spillage during mixing of construction materials or drainage from stored materials. Protect root system from flooding, erosion, or excessive wetting resulting from de-watering operations.

11. Tree Penalty: The intent of this clause is to emphasize the importance of all trees to be saved. All trees to be saved shall be maintained in an undamaged condition. Damage shall be defined as the act of scarring, nailing, cutting, breaking limbs, etc., of any tree or its root system in such a manner as may cause the tree to be permanently hurt. Accidental damage due to dead trees falling, equipment breakdown, or any act on the part of the operator which appears to the Landscape Architect as unavoidable would not warrant a penalty. However, the Contractor will be liable for consistently damaging trees by accidental damage. Damage due to improper location of utility trenches or ditches will not be considered accidental. The Contractor will be responsible for damage on the part of the operator or operators, whether by method of excavation, use of improper equipment, incompetency of the operator, or failure to properly inform the operator, as determined by the Landscape Architect.

12. All trees on the site shall be saved except those marked specifically to be removed, those within the clearing limits on the plans; and those marked specifically on the site by the Landscape Architect to be removed. No tree, either those marked for removal on the site, or any other tree may be removed from the site prior to the Landscape Architect's inspection. Penalties for damage to or removal of any tree not specifically approved by the Landscape Architect on the site will be as follows:

Large Trees			Small Trees & Evergreen Trees (Dogwoods, Hollies, Wax Myrtles, Magnolias, etc.)	
Caliper(inches)	Height Penalty	Price	Height Penalty(feet)	Price
I 1/2 - 2		135.00	6- 8	130.00
2 - 2 1/2		150.00	8-10	150.00
2 1/2 - 3		180.00	10-12	200.00
3 - 3 1/2		200.00	12-14	250.00
3 1/2 - 4		250.00	14-16	325.00
4 - 4 1/2		300.00	16-18	375.00
4 1/2 - 5		370.00	18- Up	500.00
5-6		475.00	Follow large tree schedule using caliper of trunk	
6-7		600.00		
7-8		650.00		
8 - 11		1,500.00		
12 - 20		2,500.00		
21 - Larger		3,500.00		

13. Root Rakes: No root rake devices shall be used in proximity to trees scheduled to remain.
14. Trees will be graded by the Landscape Architect as to species, condition, and site importance with the above figures acting as maximum penalties with the lowest assessment amounting to no less than one-half of the above penalty figures.
15. Disposal: All materials removed by the clearing operation shall be disposed of off-site. No burning of trees, stumps, or other matter shall be conducted on the site, unless permission is obtained from the Owner.

PART 2 - PRODUCTS

2.01 TEMPORARY BARRICADES

A. Unless otherwise approved by the Landscape Architect, use only new and solid lumber of utility grade or better to construct temporary barricades around trees and areas designated to remain undisturbed.

2.02 EXPLOSIVES

A. Do not use explosives in this work.

2.03 OTHER MATERIALS

A. All other materials not specifically described but required for proper completion of the work of this section, shall be as selected by the Contractor subject to approval of the Landscape Architect.

PART 3 - EXECUTION

3.01 SITE INSPECTION

A. Prior to any work of this section, carefully inspect the entire site and designate all trees to be preserved.

3.02 SCHEDULING

A. Schedule all work in a careful manner with all consideration for neighbors and the general public.

B. Notify the Landscape Architect at least five full working days prior to commencing clearing and tree removal work of this Contract.

3.03 STAKING

A. The Contractor shall stake the protective fence as to location and configuration. This stakeout may be accurate or rough, depending on the Contractor's preference.

B. The purpose of the staking, with inspection and adjustment by the Landscape Architect, is to adjust the areas of the site to allow the contractor maximum use of the land. Staking is subject to various degrees of adaptation which can only be determined by the Landscape Architect. This variation is an aesthetic decision, the amount of adjustment most often determined by the existing trees, terrain, soil conditions, sub-surface water and by other intangibles which are impractical to survey in absolute accuracy.

C. The Contractor shall notify the Landscape Architect at least three working days before inspection of the construction stakeout to coordinate tree protection. During the inspection the Landscape Architect will adjust the stake-out as necessary to fit the trees, topography, and all other objects and conditions on the site. At this time the Landscape Architect will clearly mark all trees and other vegetation to be removed. This staking-inspection process must take place prior to any tree removal, grading, construction, or any other work on the site.

D. During inspection, the general contractor's superintendent shall be at the site along with the foreman who will supervise the work under this Contract.

E. The staking-inspection process shall be repeated for any work not staked and approved or adjusted during the first site visit. No work shall ever be done without the stakeout first being adjusted and approved by the Landscape Architect. All alignments, dimensions, and elevation of any grading, excavation, construction, and planting is subject to adjustment to save trees and other vegetation. Refer to the staking process as described in the Special Conditions.

3.04 TOPSOIL REMOVAL

A. See Section 02200.

B. Where trees are to remain standing, stop topsoil stripping a sufficient distance from such trees to prevent damage to the main root system.

C. Stockpile topsoil in storage piles in areas where directed. Topsoil shall not be stockpiled in tree save areas. Construct storage pile to freely drain surface water. Cover storage pile as necessary to prevent windborne dust and erosion.

3.05 WOODLAND PRUNING AND UNDERBRUSHING

A. Clear the site of brush, rubbish, dead limbs, snags, fallen trees, and any other plant material designated by the Landscape Architect to be removed. No trees shall be removed, or limbs and roots cut without prior approval of Landscape Architect or Owner's Representative.

B. Do not remove stumps in areas to be left natural. Do not use root rakes or track equipment under any trees designated to be saved.

C. Prune remaining trees by removing all low hanging limbs less than six feet above the ground by cutting with a hand saw. Pruning cuts shall be made in accordance with good pruning practices. Pruner shall not cut the cambrium collar. Remove all dead trees, broken trees, leaning trees, and diseased trees. Refuse may be removed from the site or chipped with a chipper and spread under the trees.

D. Underbrush all small sprouts, scrubs, vines, and weeds as defined on-site by Landscape Architect. Landscape Architect shall meet on-site with Contractor to review the requirements and tag trees to be protected.

E. Do not rake up or remove existing leaf or pine nettle mulch on the ground.

3.06 EROSION CONTROL

A. Sow grass as necessary during construction to prevent erosion of disturbed areas and prevent damage to tree save areas from runoff and silt. See Section 02125.

3.07 INTERIM SEEDING AND MAINTENANCE

A. Seed temporarily with appropriate grass seed in the event that Bermuda grass cannot be sown during the specified season.

3.08 SILT CONTROL

A. The Contractor shall install silt barriers in locations necessary to prevent eroded material from silting undisturbed vegetation as shown on the Plans.

END OF SECTION 02112

SECTION 02125
EROSION AND SEDIMENTATION CONTROL

PART 1 - GENERAL

1.01 SCOPE

A. The work specified in this Section consists of providing and maintaining temporary and permanent erosion and sedimentation controls as shown on the Drawings. This Section also specifies the subsequent removal of temporary erosion and sedimentation controls.

B. Temporary and permanent erosion and sedimentation controls include grassing and mulching of disturbed areas and structural barriers at those locations that will ensure the erosion during construction will be maintained within acceptable limits. Acceptable limits are as established by the Georgia Erosion and Sedimentation Control Act of 1975, as amended, Section 402 of the Federal Clean Water Act, and applicable codes, ordinances, rules, regulations and laws of local and municipal authorities having jurisdiction.

C. Manual for Erosion and Sediment Control in Georgia and the Field Manual for Erosion and Sediment Control in Georgia by the Georgia Soil and Water Conservation Commission, 4310 Lexington Road, Post Office Box 8024, Athens, Georgia 30603, 706-542-3065, shall be considered part of these contract documents.

D. Land disturbance activity shall not commence until all applicable permits have been issued.

E. The Contractor shall file the NPDES Notice of Intent, Notice of Termination and Comprehensive Monitoring Plan with the state of Georgia.

F. Perform all operations in accordance with applicable provisions for erosion control as shown on the Drawings and as required by local, State and Federal regulations.

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents.

B. At the Pre-Construction Conference, the Contractor shall submit, for the Engineer's approval, a schedule for the accomplishment of temporary and permanent erosion and sedimentation control work. No work shall be started until the erosion and sedimentation control schedule and methods of operation have been approved by the Engineer.

1.03 QUALITY ASSURANCE

A. The temporary and permanent erosion and sedimentation control measures shown on the Drawings are minimum requirements. Any additional erosion and sedimentation control measures required by the Contractor's means, methods, techniques and sequence of operation will be installed by the Contractor at no additional cost to the Owner.

B. Implementation

1. The Contractor is solely responsible for the control of erosion within the Project site and the prevention of sedimentation from leaving the Project site or entering waterways.
2. The Contractor shall install temporary and permanent erosion and sedimentation controls which will ensure that runoff from the disturbed area of the Project site shall pass through a filter system before exiting the Project site.
3. The Contractor shall provide temporary and permanent erosion and sedimentation control measure to prevent silt and sediment from entering the waterways.
4. The Contractor shall limit land disturbance activities to those areas shown on the Drawings.
5. The Contractor shall maintain erosion and sedimentation control measures within disturbed areas on the entire site at no additional cost to the Owner until the acceptance of the Project. Maintenance shall include mulching, re-seeding, clean-out of sediment barriers and sediment ponds, replacement of washed-out or undermined rip rap and erosion control materials, to the satisfaction of the Engineer.
6. All fines imposed for improper erosion and sedimentation control shall be paid by the Contractor.

PART 2 - PRODUCTS

2.01 GENERAL

A. The materials shall meet the requirements of the Manual for Erosion and Sediment Control in Georgia and the Field Manual for Erosion and Sediment Control in Georgia or the Georgia Department of Transportation Standard Specifications Construction of Transportation Systems.

PART 3 - EXECUTION

3.01 GENERAL

A. Temporary and permanent erosion and sedimentation control measures shall prevent erosion and prevent sediment from exiting the site. If, in the opinion of the Engineer, the Contractor's temporary erosion and sedimentation control measures are inadequate, the Contractor shall provide additional maintenance for existing measures or additional devices to control erosion and sedimentation on the site at no additional cost to the Owner.

B. All erosion and sedimentation control devices and structures shall be inspected by the Contractor at least once a week and immediately prior to each rainfall occurrence. Any device or structure found to be damaged will be repaired or replaced by the end of the day.

C. Provide erosion and sediment control as follows:

1. Continuously coordinate the erosion and sediment control with the clearing and construction activity.
2. All cut and fill banks shall be top soiled and seeded within 3 weeks of their completion. Intermediate and temporary seeding shall be at the Contractor's expense.
3. Retain natural vegetation whenever feasible.

4. Restore and cover exposed areas subject to erosion as quickly as possible by means of seeding and mulching. Use diversion ditches and/or other methods as appropriate to prevent storm water from running over the exposed area until seeding is established as specified.

5. Mechanically retard the rate of runoff water with baled erosion checks anchored to the ground with two stakes per bale. Maintain the checks replacing broken or damaged bales and clean out trapped debris.

6. Trap the sediment contained in the runoff water with silt fences. Maintain the silt fence for the project duration and remove silt accumulation. Place sediment basins if necessary to meet governmental regulations.

7. Install baled erosion checks or silt fences where existing ground slopes toward or away from disturbed areas along the top or toe of slopes, along streams, in ditches, or other areas where siltation, erosion, or water runoff is a problem.

8. Divert water from erosive areas.

9. Control dust by sprinkling or other means as necessary to keep it to a minimum.

D. Re-grade and reseed surfaces eroded or otherwise damaged during any and all construction operations as necessary.

E. All erosion and sedimentation control measures and devices shall be constructed and maintained as indicated on the Drawings or specified herein until adequate permanent disturbed area stabilization has been provided and accepted by the Engineer. Once adequate permanent stabilization has been provided and accepted by the Engineer, all temporary erosion and sedimentation control structures and devices shall be removed.

3.02 CLEAN-UP

A. Upon completion of the work of this Section, remove all rubbish, trash and debris resulting from construction operations. Remove surplus equipment and tools. Leave the site in a neat and orderly condition acceptable to the Engineer, and in conformance with the General Conditions of the Contract Documents.

END OF SECTION 02125

SECTION 02140
DEWATERING

PART 1 - GENERAL

1.01 SCOPE

A. Work described in this Section includes furnishing all labor, equipment, tools and incidentals required for all dewatering. This work includes the installation, operation, and removal of all facilities required to maintain open excavations and trenches in a dewatered condition to permit unrestricted construction operations.

B. Construct all permanent work in areas free from water. Design, construct and maintain all pumping systems, dikes, levees, cofferdams, diversion and drainage channels as necessary to maintain the areas free from water and to protect the areas to be occupied by permanent work from water damage. Remove temporary works after they have served their purpose.

C. The Contractor shall be responsible for the stability of all temporary and permanent slopes, trenches, grades, foundations, materials and structures during the course of the Contract. Repair and replace all slopes, grades, foundations, materials and structures damaged by water, both surface and sub-surface, to the lines, grades and conditions existing prior to the damage at no additional cost to the Owner.

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents and as specified hereinafter.

B. Working Drawings

1. Submit complete working drawings and supporting documents showing the type of water control system proposed for each site where required. Obtain Engineer's approval prior to installation of the system.
2. Working Drawings and supporting documents will show:
   a. Arrangement and location of the system.
   b. Complete description of equipment and materials to be used.
   c. Installation and operation and maintenance procedures.
   d. Design calculations.
   e. Standby equipment and power supply.
   f. Location and size of berms, dikes, settling basins, sumps, and discharge items.
   g. Pollution control facilities.
   h. Discharge locations.
   i. Number and location of monitoring wells.
3. Working Drawings and supporting documents will be revised and resubmitted if the system is modified during installation or during operation.

C. Copies of all permits required to discharge the water as specified below.

1.03 JOB CONDITIONS

A. Permits: Prior to discharging water into a storm sewer or waterway, obtain all necessary permits from the jurisdictional agencies and submit a Notice of Intent to the Georgia Environmental Protection Division by certified return receipt mail at least 48 hours prior to conducting any land disturbance activities.

B. Responsibilities

1. Select and install a system to control water as herein specified, and to comply with the requirements of the jurisdictional agencies.
2. Take measures to prevent damage to properties, buildings or structures, sewers and other utility installations, pavements, sidewalks, improvements and work.
3. Do not overload or obstruct existing facilities.
4. Modify the system at no additional cost to the Owner if after installation and while in operation it causes or threatens to cause damage to existing buildings, structures, utilities, facilities, or other adjoining property.
5. Monitor the quality of the discharge from the dewatering system, as required, to meet requirements from jurisdictional agencies.
6. Measure and evaluate if movements are being caused to adjacent buildings, structures, utilities, facilities or other adjoining properties by dewatering operations.
7. Repair damage, disruption, or interference resulting directly or indirectly from dewatering operations at no additional cost to the Owner and to the Engineer's approval.
8. Restore, maintain and monitor on a weekly basis all existing piezometric observation wells located within or on the Project site. Additional piezometric observation wells shall be required to monitor the ground water level, to ensure proper dewatering prior to excavation below the static water table. The number of wells required will vary to meet the Contractor's responsibilities and will depend on the size and depth of the excavations required for the work to be constructed.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.01 CARE OF WATER

A. Except where the excavated materials are designated as materials for permanent work, material from required excavation may be used for dikes, levees, cofferdams and other temporary backfill.

B. Furnish, install, maintain and operate necessary pumping and other equipment for dewatering the various parts of the work and for maintaining the foundation and other parts free from water as required for constructing each part of the work.

C. Install all drainage ditches, sumps and pumps to control excessive seepage on excavated slopes, to drain isolated zones with perched water tables, and to drain impervious surfaces at final excavation elevation.

D. After they have served their purpose, remove all temporary protective work at a satisfactory time and in a satisfactory manner. All diversion channels and other temporary excavations in areas where the compacted fill or other structures will be constructed shall be cleaned out, backfilled and processed under the same Specifications as those governing the compacted fill.

E. When the temporary works will not adversely affect any item of permanent work or the planned usage of the Project, the Contractor may be permitted to leave such temporary works in place. In such instances breeching of dikes, levees and cofferdams may be required and grout filling of all wells. Otherwise the temporary works and all debris shall be completely removed and the site restored to its original condition.

F. Intercept and divert surface drainage away from the excavation, by the use of dikes, curb walls, ditches, pipes, sumps, or other means.

G. Design surface drainage systems so that they do not cause erosion on or off the site or cause unwanted flow of water.

3.02 DEWATERING

A. By the use of well points, pumps, tile drains or other approved methods, the Contractor shall prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed.

B. Excavations shall be continuously dewatered to maintain a ground water level no higher than three feet below the lowest point in the excavation unless otherwise specified. Dewatering systems shall be designed to allow for localized variations in the depth of excavations required to reach a suitable foundation. Dewatering shall be accomplished well enough in advance of excavation to ensure that groundwater is already lowered prior to completing the final excavation to finish subgrade.

C. Piezometric observation wells shall be required, to monitor the ground water level, to ensure proper dewatering prior to excavation below the static water table. The number of wells required will vary depending on the size and depth of structures.

D. No separate payment will be made for dewatering required to accomplish the work. The cost for such shall be considered incidental to the work for which it is required.

E. Provide and maintain ditches of adequate size to collect surface water and seepage which may enter the excavations and divert the water into a sump so that it can be drained or pumped into drainage channels and settling basins prior to discharge to storm sewers if approved by the Engineer and the jurisdictional agency concerned.

F. Dewater by means which will ensure dry excavations, preserve final lines and grades, and not disturb or displace adjacent soil.

G. All destabilized subgrade conditions caused by inadequate or untimely dewatering operations shall be undercut and backfilled with suitable backfill material at no additional cost to the City.

H. Should a storm sewer become blocked or have its capacity restricted due to the dewatering operations, make arrangements with the jurisdictional agency for the cleaning of the sewer and appurtenances at no additional expense to the City.

END OF SECTION 02140

SECTION 02200
EARTHWORK

PART 1 - GENERAL

1.01 SCOPE

A. This Section includes earthwork and related operations, including, but not limited to; excavating all classes of material encountered; trenching; handling; storage; transportation; and disposal of all excavated and unsuitable material; construction of fills and embankments; backfilling around structures and pipe; backfilling all trenches and pits; compacting; all sheeting; shoring and bracing; preparation of subgrades; surfacing and grading; and any other similar, incidental, or appurtenant earthwork operation which may be necessary to properly complete the Work.

B. The Contractor shall provide all services, labor, materials, and equipment required for all earthwork and related operations necessary or convenient to the Contractor for furnishing complete Work as shown on the Drawings or specified in these Contract Documents.

1.02 GENERAL

A. Safety: Comply with local regulations and with the provisions of the "Manual of Accident Prevention in Construction" of the Associated General Contractors of America, Inc., Occupational Safety and Health Act (OSHA) and all other applicable safety regulations.

B. The elevations shown on the Drawings as existing are taken from the best available data and are intended to give reasonable information about the existing elevations. The Contractor shall verify conditions to determine the exact quantities of excavation and fill required.

C. Earthwork operations shall be performed in a safe and proper manner with appropriate precautions being taken against all hazards.

D. All excavated and filled areas for structures, trenches, fills, topsoil areas, embankments and channels shall be maintained by the Contractor in good condition at all times until final acceptance by the City. All damage caused by erosion or other construction operations shall be repaired by the Contractor using material of the same type as the damaged material at no cost to the City.

E. The Contractor shall control grading in a manner to prevent water running into excavations. Obstruction of surface drainage shall be avoided and means shall be provided whereby storm water can flow uninterrupted in existing open ditches or channels; other surface drains; or temporary drains.

F. No classification of excavated materials will be made except as noted below. Excavation work shall include the removal and subsequent handling of all materials excavated or otherwise removed in performance of the Work, regardless of the type, character, composition or condition thereof. All excavating shall be unclassified except to determine if material is contaminated and requires hauling to landfill.

G. Soil testing will be performed by an independent testing laboratory in accordance with GC-30 and Section 01410. The Contractor shall make all necessary excavations and shall supply any samples of materials necessary for conducting compaction and density tests. The cost of all

retests made necessary by the failure of materials supplied by the Contractor, his agents or subcontractors, to conform to the requirements of these Contract Documents shall be paid by the Contractor. Contractor shall provide at least 24 hours advance notice of earthwork operations to the Testing Laboratory. Testing Laboratory shall provide periodic reports, at least monthly during the earthwork operations, to the Engineer with copies to the Contractor certifying (and sealed by a Registered Georgia Engineer) that earthwork is in conformance with the plans and specifications. As a minimum at least one density test shall be performed for every 5,000 square feet of fill area and every two feet of fill lift. The Testing laboratory shall witness the placement of all fill, unless otherwise directed by the Engineer.

H. Special testing as directed by the Engineer shall be in addition to that specified in the preceding paragraph and will include testing for contamination of soil and groundwater. Special testing will be performed by an independent testing laboratory in accordance with GC-30 and Section 01410. The Contractor shall make all any samples of materials accessible to the testing personnel as necessary for conducting tests. Contractor shall provide at least 24 hours advance notice of earthwork operations to the Testing Laboratory. Testing Laboratory shall provide immediate results of each special test performed and shall provide daily reports of test results to the Engineer with copies to the Contractor. It is anticipated a minimum of at least one soil test for lead contamination shall be performed for every 10 square yards of excavated material until excavation reaches residual material. It is anticipated a minimum of one daily test for groundwater contamination shall be performed until consistent results are observed that indicate no further testing is necessary, as determined by the Engineer. Payment shall be as an allowance item as described in section 01200 for "Additional Testing".

I. All earthwork operations shall comply with the requirements of OSHA Construction Standards, Part 1926, Subpart P, Excavations, Trenching, and Shoring, and Subpart O, Motor Vehicles, Mechanized Equipment, and Marine Operations, and shall be conducted in a manner acceptable to the Engineer.

J. Stockpile Areas: Provided there is space available, stockpiling material may be on site.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents. In addition, the following specific information shall be provided:

1. Copies of permits obtained by the Contractor for the work.
2. Test results, certification of compliance, source and samples for all imported materials.
3. Samples of fill materials to be used. Samples shall be submitted 2 weeks in advance of use and shall consist of 0.5 cubic feet of each type of material.

1.04 QUALITY ASSURANCE

A. Reference Standards. Comply with all Federal and State laws or ordinances, as well as all applicable codes, standards, regulations and/or regulatory agency requirements, including the partial listing below:

1. ASTM C136, Standard Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D1556, Test Method for Density of Soils in Place by the Sand Cone Method.

3. ASTM D1557, Test Methods for Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb. (4.5-kg) Rammer and 18-in. (457-mm Drop).
4. ASTM D3107, Test Method for Moisture Content of Soil and Soil Aggregate in Place by Nuclear Methods (Shallow Depth).

PART 2 - PRODUCTS

2.01 MATERIALS

A. Earthwork Materials

1. Controlled Fill:
   a. Proposed fill soils shall be laboratory tested prior to construction use to determine their suitability. All fill material shall be subject to the approval of the Engineer.
   b. Notification: For approval of imported fill material, notify the Engineer and Testing Laboratory at least three (3) weeks in advance of intention to import material, designate the proposed borrow area, and permit the Testing Laboratory to sample as necessary from the borrow area for the purpose of making acceptance tests to prove the quality of the material. Test results shall be submitted to the Engineer for approval. All fill shall be free of organic matter or debris, have a low to moderate plasticity, (PI<15) uniform composition, and be free of rock fragments greater than three inches in dimension. Soils selected for use as fill material shall also have a standard Proctor (ASTM D 698) maximum dry density of at least 95 pounds per cubic foot.
   c. All on-site fill material shall be soil exclusive of organic matter, frozen lumps or other deleterious substances.
   d. It shall contain no rocks or earth clumps over 3-inches maximum in dimension.
2. Structural Fill and Structural Backfill:
   a. Select on site materials may be suitable. Testing and recommendation of suitability shall be made by the Testing Laboratory and submitted by the Contractor to the Engineer for approval.
   b. Imported material shall be sand, uniformly graded crushed rock or other select material recommended by the Testing Laboratory and submitted by the Contractor to the Engineer for approval. Graded aggregate base material as specified in the Georgia Department of Transportation Standard Specifications is acceptable for structural fill and backfill.
   c. Crushed Rock: Crushed rock used for pipe bedding and drainage stone shall conform to the Georgia Department of Transportation Standard Specifications for construction of Road and Bridges, 800.01 for No. 57 Stone.
3. Coarse Aggregate: Coarse aggregate shall conform to the Georgia Department of Transportation Standard Specifications of Transportation Systems construction of Road and Bridges, 800 for No. 57 Stone, Group II, and shall have the following gradation:

Sieve size	Percent Passing	
1-½ inch	100	-
1 inch	95	100
½ inch	25	60
#4	0	10
#8	0	5

4. Top Soil: Dark organic weed free loam.

B. Sheeting, Bracing and Timbering: The Contractor shall furnish, place and maintain all sheeting, bracing and timbering required to properly support trenches and other excavations in open cut and to prevent all movement of the soil, pavement, structures, or utilities outside of the trench or pit.

1. General:
   a. All sheeting, bracing and timbering shall be designed by a registered Professional Engineer in the State of Georgia at the Contractor's expense. Submit a copy of the design to the Engineer for the Project files.
   b. Sheeting, bracing and timbering shall be so placed as to allow the Work to be constructed to the lines and grades shown on the Drawings.
   c. If at any time the method being used by the Contractor for supporting any material or structure in or adjacent to any excavation is not reasonably safe the Engineer may require and the Contractor shall provide additional bracing and support necessary to furnish the added degree of safety. The Contractor shall provide such added bracing and support by such method as Contractor may elect to use, but the taking of such added precautions shall in no way relieve the Contractor of sole and final responsibility for the safety of lives, work and structures.
   d. All sheeting and shoring in contact with the concrete or masonry shall remain in place. The sheeting or shoring above the structure may remain in place or be cut off. No sheeting shall be left in place within three feet below the ground surface.
   e. There shall be no payment for sheeting, bracing, and timbering left in place.
2. Timber:
   a. Timber may be substituted for steel sheet piling when approved by the Engineer. Timber for shoring, sheeting or bracing shall be sound and free of large or loose knots and in good condition. Size and spacing shall be in accordance with OSHA regulations.
   b. Remove bracing and sheeting in units when backfill reaches the point necessary to protect the work and adjacent property. Leave sheeting in place when it cannot be safely removed. Cut off sheeting left in place below the finished ground surface by three feet.
3. Steel Sheet Piling: Steel sheet piling shall be the continuous interlock type. The weight, depth and section modulus of the sheet piling shall be sufficient to restrain the loads of earth pressure and surcharge from existing foundations. Procedure for installation and bracing shall be so scheduled and coordinated with the removal of the earth that the ground under existing structures shall be protected against lateral or vertical movement at all times. In addition to the Drawings and computations, the Contractor shall provide closure and sealing details between sheet piling and existing facilities, as well as method of excavation within sheet piling to the Engineer for review before commencing construction operations. Contractor shall be responsible for all damage to existing utilities and structures resulting

from installation of sheet piling. Damage to existing utilities and/or structures resulting from installation of sheet piling shall be repaired at the Contractor's expense.

C. Other Materials: All other materials not specifically described but required for proper completion of the work of this Section, shall be as selected by the Contractor subject to the prior approval of the Engineer.

PART 3 - EXECUTION

3.01 GENERAL

A. Benching of Slopes: When the embankment is to be placed and compacted on hillsides, or when new embankment is to be compacted against existing embankments, or when the embankment is to be built ½ width at a time, the slopes that are steeper than 4:1 as measured at right angles to the embankment shall be continuously benched over those areas as the work is brought up in layers. Benching shall be of sufficient width to permit the operation of placing and compacting equipment. Each successive cut shall begin at the intersection of the original ground and the vertical side of the previous cut. Material thus cut shall be recompacted along with the new embankment material. Proofroll subgrade prior to placement of fill material.

B. Topsoil

1. Remove all topsoil to a depth at which subsoil is encountered, from all areas, which are to be cut to lower grades or filled.
2. Topsoil to be used for finish grading may be stored on the site. It shall be piled properly, sloped to drain and covered.

C. Bracing and Sheeting

1. Furnish, install, and maintain all sheeting, bracing, and shoring as may be required to properly support the sides of all excavations and to prevent all movement of earth, which could in any way injure the work, adjacent property, or workmen.
2. Properly support all trenches for piping and duct bank installation so as to conform to all pertinent rules and regulations and these Specifications. All trenches deeper than 5 feet shall be shored unless cut to the angle of repose of the excavated soils.
3. Exercise care in the removal of sheeting, shoring, bracing and timbering to prevent collapse or caving of the excavation faces being supported and damage to the work and adjacent property.
4. Do not leave any sheeting or bracing in the trench or excavation after completion of the work, unless approved or instructed by the Engineer. The cost of leaving sheeting or bracing shall be at the Contractor's expense.
5. All sheeting and shoring in contact with concrete or masonry shall remain in place. The sheeting and shoring above the structure may remain or be cut off. No sheeting or shoring left in place shall be within three feet below the ground surface.

D. Obstructions

1. Remove and dispose of all trees, stumps, roots, boulders, pavement, pipes and the like, as required for the performance of the work.
2. Exercise care in excavating around catch basins, inlets, manholes, piping, duct banks, underground vaults, etc.
3. Avoid removing or loosening castings or pushing dirt into structures.
4. Damaged or displaced casting shall be repaired and replaced, and dirt entering the structures during the performance of the work shall be removed at no additional cost to the City.

E. Utilities to be Abandoned:

1. When pipes, conduits, sewers or other structures are removed from the trench leaving dead ends in the ground, such ends shall be fully plugged and sealed.
2. Abandoned structures such as manholes, catch basins or chambers shall be entirely removed unless otherwise specified or indicated on the Drawings.

F. Extra Earth Excavation: In case soft material, which, in the opinion of the Engineer is not suitable, is encountered in the bottom of a trench or underneath a structure, the soft material shall be removed to a minimum depth of six (6) inches and replaced with structural fill or gravel.

G. Cutting Paved Surfaces and Similar Improvements:

1. Remove existing pavement as necessary for installing pipe utilities and appurtenances or as otherwise shown on the Drawings.
2. Before removing any pavement, mark the pavement neatly, paralleling pipe lines and existing street lines. Space the marks to match the width of the trench.
3. Break asphalt pavement along the marks using jack hammers or other suitable tools. Break concrete pavement along the marks by use of jack hammers or by scoring with a rotary saw and breaking below the score by the use of jack hammers or other suitable tools.
4. Do not pull pavement with machines until completely broken and separated from pavement to remain.
5. Do not disturb or damage the adjacent pavement. If the adjacent pavement is disturbed or damaged, remove and replace the damaged pavement. Refer to Section 02510 for replacement of damaged or removed pavement.
   a. NOTE: No additional payment will be made for removing and replacing damaged adjacent pavement.
6. Remove and replace sidewalks disturbed by construction for their full width and to the nearest undisturbed joint.
7. The Contractor may tunnel under curbs that are encountered. Remove and replace any curb disturbed by construction to the nearest undisturbed joint.

3.02 EXCAVATION

A. General

1. All excavations for pipe appurtenances and structures shall be made in such manner and to such depth and width as will give ample room for building the structures and for bracing, sheeting, and supporting the sides of the excavation, for pumping and draining groundwater and wastewater which may be encountered, and for the removal from the trench of all materials excavated.

2. Water shall not be allowed to accumulate in excavations. Contractor shall provide sufficient temporary pumping to assure that surface and ground waters do not saturate foundation soils.

B. Grades

1. Excavate to lines and grades indicated on the Drawings.

2. Where excavation grades are not indicated on the Drawings, excavate as required to accommodate installation.

C. Disposal of Excavated Material

1. Remove and legally dispose of all excavated material not needed to complete filling, backfilling, and grading.

2. Dispose of excess excavated material at locations secured by the Contractor and in accordance with all requirements of federal, state, county and municipal regulations. No debris of any kind shall be deposited in any stream or body of water, or on any street or alley. No debris shall be deposited on any private property except by written consent of the property owner. In no case shall any material be left on the Project, or be buried in embankments or trenches on the Project. With recommendation of the Testing Laboratory and approval by the Engineer, demolished, crushed concrete may be acceptable for use in fill areas.

3. Excavated materials shall be placed adjacent to the work to be used for backfilling as required.

4. Excavated materials shall be placed sufficiently back from the edge of the excavation to prevent caving of the trench wall, to permit safe access along the trench and to not cause any drainage problem. Excavated material shall be placed so as to not damage existing landscape or man-made improvements. Surcharging of any bank is not allowed.

D. Rock Excavation

1. Rock excavation shall be paid for as unclassified excavation.

2. Rock excavation shall mean rock requiring blasting and shall be such material which cannot be removed with a crawler tractor equal to a D-8 Caterpillar, equipped with a single-tooth ripper or by an excavator trackhoe equal to a Caterpillar 225 rated with a ¾ cubic yard capacity with a bucket curling pullout capacity of 25,000 pounds.

3.03 EXCAVATING FOR STRUCTURES

A. Dewatering

1. The proposed dewatering plan shall be submitted by the Contractor to the Engineer for approval at least ten (10) working days prior to the beginning of any excavation.
2. Furnish, install, maintain and operate necessary pumping and other equipment for dewatering the various parts of the Work and for maintaining the foundation and other parts free from water as required for constructing each part of the Work.
3. By the use of well points, pumps, tile drains or other approved methods, the Contractor shall prevent the accumulation of water in excavated areas. Should water accumulate, it shall be promptly removed.
4. Excavations shall be continuously dewatered to maintain a ground water level no higher than 3 feet below the lowest point in the excavation.
5. Piezometric observation wells shall be required, to monitor the ground water level, to ensure proper dewatering prior to excavation below the static water table. The number of wells required will vary depending on the size and depth of structures and shall be included in the plan.
6. The cost for all dewatering and discharge shall be at the Contractor's expense and shall be considered incidental.

B. Excavation

1. All excavation is unclassified and shall be included in the Lump Sum portion of the Contractor's Base Bid.
2. Excavation shall include all substances to be excavated. Excavation for structures shall be to limits not less than 2 feet outside wall lines, to allow for formwork and inspection.
3. Where rock excavation is carried below grade the Contractor shall backfill to grade using concrete or structural fill.
4. Where unsuitable material is encountered excavate material to a depth acceptable to the Engineer and fill with compacted structural fill as required.

C. Construction Observations: All excavations should be examined by the Engineer prior to reinforcing steel placement to verify that the design bearing pressure is available. All excavations should be clean, level and free of ponded water, mud and loose, frozen or water-softened soils. If it is necessary for an excavation to remain open overnight, or if rain is imminent, a 3-to 4-inch thick "mud mat" of Class B concrete may be placed in the bottom of the excavation to protect the bearing soils until reinforcing steel and concrete can be placed.

D. Unsuitable Bearing: If unsuitable bearing for foundations is encountered at the elevations indicated on the Drawings, the Engineer shall be notified immediately.

3.04 TRENCH EXCAVATION

A. Excavation for trenches shall include the removal of all material of any nature for the installation of the pipe or facility and shall include the construction of trench shoring and stabilization measures, timbering and all necessary installations for dewatering.

B. Minimum Width of Trench. The minimum width of pipe trenches, measured at the crown of the pipe, shall not be less than 24-inches greater than the exterior diameter of the pipe, exclusive of bells. The minimum base width, measured at the invert of the piping, of such trench shall be not less than 24-inches greater than the exterior diameter of the pipe, exclusive of special structures or connections, and such minimum width shall be exclusive of all trench supports.

C. Maximum Width of Trench. The maximum allowable width of trench for all pipelines measured at the top of the pipe shall be the outside diameter of the pipe (exclusive of bells or collars) plus 24-inches, and such maximum shall be inclusive of all timbers and/or trench boxes, shoring, etc. A trench wider than the outside diameter plus 24-inches may be used without special bedding if the Contractor, at his expense will furnish pipe of the required strength to carry the additional trench load. Such modifications shall be submitted to the Engineer and approved in writing. Whenever such maximum allowable width of trench is exceeded for any reason, except as provided for on the Drawings or in the Specifications or by the written instruction of the Engineer, the Engineer may require that the Contractor, at the Contractor's expense for all labor and materials, cradle the pipe in concrete, or other approved pipe bedding.

D. Maximum length of Open Trench. Except by special permission by the Engineer, only that amount of pipe construction will be permitted, including excavation, construction of pipeline, and backfill in any one location, which can be completed in one day; however, maximum length of open trench shall never exceed 100 feet. This length includes open excavation, pipe laying and appurtenant construction and backfill which have not been temporarily resurfaced.

E. Trench Side Slopes

1. Temporary trench excavations shall at all times conform to the safety requirements of OSHA.
2. Loose cobbles or boulders shall be removed from the sides of the trenches before allowing workmen into the excavation, or the trench slopes must be protected with screening or other methods. Trench side slopes shall be kept moist during construction to prevent local sloughing and raveling. Surcharge loads due to construction equipment shall not be permitted within 5 feet of the top of any excavated slope.

F. Trench Rock Excavation

1. Definition of Trench Rock: Any material which cannot be excavated with conventional excavating equipment, and is removed by drilling and blasting, and occupies an original volume of at least one-half cubic yard.
2. Blasting: Provide licensed, experienced workmen to perform blasting. Conduct blasting operations in accordance with all existing ordinances and regulations. Protect all buildings and structures from the effects of the blast. Repair any resulting damage. If the Contractor repeatedly uses excessive blasting charges or blasts in an unsafe or improper manner, the Engineer may direct the Contractor to employ an independent blasting consultant to supervise the preparation for each blast and approve the quantity of each charge.

3. Removal of Rock: Dispose of rock off site that is surplus or not suitable for use as rip rap or backfill.

4. The Contractor shall notify the Engineer prior to any blasting. Additionally, the Contractor shall notify the Engineer before any charge is set.

5. Blast monitoring shall be performed by the Contractor. The purpose of the blast monitoring is to ensure that the blasting activities produce acceptable results with regard to noise, overpressure and peak particle velocity.

3.05 EXCAVATION BELOW GRADE AND REFILL

A. If the bottom of any excavation is taken out below the limits shown on the Drawings or specified, it shall be refilled to the bottom grade, at the Contractor's expense, except where rock or unsuitable soil is encountered. The refill shall be 6-inch layers of structural fill or other material satisfactory to the Engineer. The type of material to be used shall be the Engineer's option.

3.06 BACKFILL AND FILL PLACEMENT

A. Compaction of fill shall be accomplished by placing the fill material in horizontal lifts of eight-inches (8") maximum loose thickness and mechanically compacting each lift to at least the specified dry density.

B. All fill placement shall be witnessed by an experienced soils technician of the Testing Laboratory and fill density and moisture tests for each lift shall be performed to verify that the specified degree of compaction is being achieved.

C. Prior to placement of any material in embankments, the area within embankment limits shall be stripped of topsoil and all unsuitable materials removed as described under Excavation. Area to receive fill shall then be scarified to a depth of at least 6-inches.

D. The fill shall be brought to the proposed elevation by placing and compacting only approved fill materials upon a subgrade approved by the Engineer.

E. Fill materials shall be placed in continuous approximately horizontal layers extending the full width of the embankment cross-section and the full dimension of the excavation where practicable.

F. The fill shall be placed at a moisture content that corresponds to a +/-3% of the optimum moisture content, as determined by the standard Proctor moisture-density relationship test.

G. Compaction

1. The fill shall be uniformly compacted to a dry density that corresponds to at least 95% of the standard Proctor maximum dry density (ASTM D 698) of the fill soil.

2. The upper twelve-inches (12") of fill beneath the structures and pavement areas shall be compacted to 98% of the standard Proctor maximum dry density.

3. Scarification and re-compaction of the upper fill soils immediately prior to the slab-on-grade and/or pavement construction shall be required.

4. Compaction of embankments shall be determined by the Contractor. Placement and compaction of materials shall extend beyond the final contours sufficiently to ensure

compaction of the material at the resulting final surface. Final contours shall then be achieved by a tracked bulldozer or grader shaping the face of the embankment.

5. The backfill placement in trenches and behind structures shall be uniformly compacted to a dry density that corresponds to at least 95% of the standard Proctor maximum dry density (ASTM D 698) of the fill soil. Compaction within four (4) horizontal feet of structures must be performed with portable compaction equipment and where confined areas require portable compaction equipment, the fill material shall be placed in horizontal lifts of four-inches (4") maximum loose thickness.

6. If tests indicate that density of backfill is less than that specified, the area shall either be recompacted or undercut, filled, and compacted until specified density is achieved.

H. Final Grading: Upon completion of construction operations, the area shall be graded to finish contour elevations and grades shown on the Drawings. Graded areas shall be made to blend with remaining ground surfaces. All surfaces shall be left smooth and free to drain.

I. Moisture

1. If fill material is too wet, provide and operate approved means to assist the drying of the fill until suitable for compaction.

2. If fill material is too dry, provide and operate approved means to add moisture to the fill layers.

J. Proofrolling

1. All areas where pavement or structures are to be built on compacted fill and other areas where indicated on the Drawing, shall be proofrolled to detect soft spots prior to the placement of fill material or construction of foundations.

2. Proofrolling shall consist of the moving a 20-30 ton loaded dump truck or pneumatic tire roller over the subgrade after the subgrade is shaped. Proofrolling shall be witnessed by the Engineer.

3. Pneumatic-tired rollers shall have not fewer than four pneumatic tired wheels which shall be of such size and ply that tire pressures can be maintained between 80 and 100 pounds per square inch for 25,000 pound wheel load during rolling operations. Unless otherwise required, rolling shall be done with tires inflated to 90 psi. The roller wheels shall be located abreast in a rigid steel frame. Each wheel shall be loaded with an individual weight box so that each wheel will bear an equal load when traversing uneven ground. The weight boxes shall be suitable for ballast loading such that the load per wheel shall be 25,000 pounds. The spacing of the wheels shall ensure that the distance between the nearest edges of adjacent tires shall be not greater than one-half of the tire

4. width of a single tire at the operating pressure for a 25,000 pound wheel load. The roller shall be operated not faster than 5 feet/second.

5. Subgrade shall be proofrolled with 6 passes. Depressions that develop during the proofrolling operation shall be filled with suitable material and those filled areas shall be proofrolled with 6 passes. If, after having been filled and proofrolled, the subgrade still contains depressions, the soil shall be undercut to the full depth of the soft material or 5 feet whichever is less, backfilled, and rolled to achieve a compacted subgrade.

6. After the proofrolled subgrade has been accepted by the Engineer, the surface of the subgrade shall be finish rolled with a smooth steel wheel roller weighing not less than 10 tons. Finished surface of the subgrade shall be within a tolerance of 0.04 feet at every point.

7. Conduits, pipes, culverts and underdrains shall be neither disturbed nor damaged by proofrolling operations. Rollers shall neither pass over, nor approach closer than 5 feet to conduits, pipes, culverts and underdrains unless the tops of those facilities are deeper than 3 feet.

K. During wet or rainy periods, aeration (drying) shall be required to reduce the fill materials to the required moisture condition. During dry periods, water shall be added to achieve the proper moisture content for compaction. Silty soils, which are wet, shall require aeration prior to compaction even during dry periods.

3.07 PIPE BEDDING

A. The Contractor shall excavate to a minimum of 6-inches below the bells or couplings for the full width of the trench and shall place a minimum of 6-inches of No. 57 crushed stone bedding upon which the pipe is to be laid. In cases as determined by the Engineer, where trench material is suitable for use as bedding, the trench may be excavated to a point above the invert grade, and the trench bottom hand shaped so that the bottom segment of the pipe is firmly supported on undisturbed material.

B. Gravity Sewers and Accessories: Lay all pipe with Class "B" bedding, unless shown or specified otherwise:

1. Class "A" (Bedding Factor: 2.8): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under around, and up to 4 inches above the top of the pipe

2. Class "B" (Bedding Factor: 1.9): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to the centerline of the pipe.

3. Class "C" (Bedding Factor: 1.5): Excavate the bottom of the trench flat at a minimum depth as shown on the Drawings, below the bottom of the pipe barrel. Place and compact bedding material to the proper grade. Haunching material shall then be carefully placed by hand and compacted to provide full support under and up to a height of one-fourth the outside diameter of the pipe above the bottom of the pipe barrel.

C. Manholes: Excavate to a minimum of 12-inches below the planned elevation of the base of the manhole. Place and compact crushed stone bedding material to the required grade before constructing the manhole.

D. Water Mains: Bedding shall meet the requirements for Gravity Sewers, Class B Pipe Bedding regardless of type of pipe material used.

E. At pipe subgrade, if foundation soil in trench is soft, wet, spongy, unstable or does not afford solid foundation for pipe, the Contractor shall excavate as instructed by Engineer and provide stable base for placement of pipe bedding.

F. Where rock is encountered in the trench, the Contractor shall excavate to a minimum 12-inch depth below subgrade and shall construct a base by placing crushed rock upon which a subgrade can be prepared, or as recommended by the pipe manufacturer.

G. Before any pipe is lowered in place, the trench bottom or bedding shall be prepared so that each pipe will have a firm and uniform bearing over the entire length of the barrel and a width equal to one-half the outside diameter of the pipe. All adjustments in line and grade shall be made by scraping away or filling and tamping in under the barrel of the pipe. Wedging or blocking is not permitted.

3.08 TRENCH BACKFILLING

A. Backfilling Pipe Zone. Selected backfill material for the pipe zone shall consist of hereinbefore specified material or native or imported granular material as approved by Engineer in advance of placement. Place material in the trench simultaneously on each side of the pipe for the full width of the trench and the depth of the pipe zone in layers 6-inches in depth. Each layer shall be thoroughly compacted by tamping. In all cases, backfilling of the pipe zone must be done by hand. Particular attention shall be given to underside of the pipe and fittings to provide a firm support along the full length of the pipe. The pipe zone shall be considered to extend 12-inches above the top of the pipe, and shall be compacted to a compaction of not less than 95 percent of maximum standard dry density at optimum moisture content as herein specified. Care shall be taken not to damage pipe or special coatings on the pipe.

B. Backfilling Pipe Trench. After the pipe has been laid in the trench and has been inspected and approved, and backfilling in the pipe zone is complete and compacted, the remainder of the trench may be backfilled. The backfill material shall be suitable material as hereinbefore specified. Care shall be taken to ensure that no voids remain under, around or near the pipes.

C. The backfill placement in trenches and behind structures shall be uniformly compacted to a dry density that corresponds to at least 95% of the standard Proctor maximum dry density (ASTM D 698) of the fill soil. In confined areas requiring portable compaction equipment the fill material shall be placed in horizontal lifts of four inches (4") maximum loose thickness.

D. Placement and Compaction of Trench Backfill. The placement and compaction of all trench backfill shall conform to one of the following methods subject to the qualification specified therein: Mechanically Compacted Backfill. Backfill may be mechanically compacted by means of tamping rollers, sheepsfoot rollers, pneumatic tire rollers, vibrating rollers, or other mechanical tampers to a minimum of 95 percent standard Proctor at optimum moisture. Trench backfill compaction above the pipe zone shall be to a minimum 98 percent standard Proctor in areas under buildings and pavements. Impact-type pavement breakers (stompers) will not be permitted over any pipe. Mechanically compacted backfill shall be placed in horizontal layers not exceeding the maximum thickness of 8 inches. Each layer shall be evenly spread, the moisture content brought to near optimum condition and then tamped or rolled until the specified compaction and moisture content has been attained. The Contractor shall be responsible for any damage to the pipe and shall replace damaged pipe at his expense.

3.09 BACKFILLING AROUND STRUCTURES

A. General

1. Remove debris from excavations before backfilling.
2. Do not backfill against foundation walls until so instructed by the Engineer
3. Wherever possible, backfilling shall be simultaneous on both sides of walls to equalize lateral pressures.
4. Do not backfill on only one (1) side of vertically spanning walls unless walls are adequately shored or permanent construction is in place to furnish lateral support on both top and bottom of wall.

3.10 GRADING

A. General

1. Perform all rough and finish grading required to attain the elevations indicated on the Drawings.
2. Perform rough grading to an accuracy of plus or minus 0.10 feet.

B. Grading Around Buildings: Control the grading around buildings so the ground is pitched to prevent water from running into the excavated areas of a building or damaging other site features.

C. Treatment After Completion of Grading

1. After grading is completed, permit no further excavation, filling or grading, except with the approval of the Engineer.
2. Use all means necessary to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.11 EXCESS WATER CONTROL

A. Unfavorable Weather

1. Do not place, spread or roll any fill material during unfavorable weather conditions.
2. Do not resume operations until moisture content and fill density are satisfactory to the Engineer.
3. Any inundated area that freezes shall be removed and refilled at the Contractor's expense.

B. Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collected in depressions.

C. Pumping, Drainage and Dewatering

1. Provide, maintain and use at all times during construction adequate means and devices to promptly remove and dispose of all water from every source entering the excavations or other parts of the Work.

2. Dewater by means, which will ensure dry excavations, preserve final lines and grades, and do not disturb or displace adjacent soil.

3. All pumping and drainage shall be done with no damage to property or structures and without interference with the rights of the public, owners of private property, pedestrians, vehicular traffic or the work of other contractors, and in accordance with all pertinent laws, ordinances, and regulations.

4. Do not overload or obstruct existing drainage facilities.

3.12 SETTLEMENT

A. The Contractor shall be responsible for all settlement of backfill, fills, and embankments, which may occur within one (1) year after final acceptance of the Work by the City.

B. The Contractor shall make, or cause to be made, all repairs or replacements made necessary by settlement within thirty (30) days after receipt of written notice from the Engineer.

3.13 CLEANING

A. Upon completion of the work of this Section, remove all rubbish, trash and debris resulting from construction operations. Remove surplus equipment and tools. Leave the site in a neat and orderly condition acceptable to the Engineer, and in conformance with the General Conditions of the Contract Documents.

END OF SECTION 02200

SECTION 02405
BLASTING

PART 1 - GENERAL

1.01 SCOPE

A. This Section covers the work necessary for the use of explosives and blasting in connection with rock excavation for underground excavations including excavations required for the Contractor's convenience.

B. Specifications in this Section govern blast design, blast limitations, explosive materials, equipment, labor, and supervision for transportation and storage of explosives, drilling and loading of blast holes, protection of existing facilities, test blasts, and damage repairs due to Contractor's blasting operations.

C. The Contractor's designated professional responsible for monitoring blasting activities shall participate in a public information program in cooperation with the Owner and Engineer to include furnishing information regarding planned blasting operations and attending public meetings to answer questions and describe the proposed blasting operations.

1.02 DEFINITIONS

A. Smoothwall Blasting (Trim Blasting): A controlled blasting technique used to produce smooth walls in underground excavations. The trim holes are located around the perimeter of the excavation but not along the bottom of the excavation or sidewall holes within three feet of the excavation floor. Trim charges are decoupled to reduce the linear charge density and are placed in holes with reduced spacing and are fired after main charge.

B. Peak Particle Velocity (PPV): The maximum of the three ground vibration velocities measured in the vertical, longitudinal, and transverse directions. Velocity units are expressed in inches per second (ips).

C. Air-Overpressure: Temporary changes in ambient air pressure caused by blasting. Air-overpressure is expressed in units of psi or dB. Measurements for blasting are made with microphones having a flat frequency response for over-pressure in the two (2) to two hundred (200) Hz range. A-weight or C-weight microphones shall not be used for these measurements.

D. Occupied Building: Structure on or off construction limits that is occupied by humans or livestock.

E. Residential Building: Includes single and multi-family dwellings, hotels, motels, and any other structure containing sleeping quarters.

F. Scaled Distance: A factor describing relative vibration energy based on distance and charge-per-delay. For ground vibration control and prediction purposes, Scaled Distance (Ds) is obtained by dividing the distance of concern (D) by the square root of the charge-per-delay (W) - $Ds=D/(W)^{1/2}$.

G. Charge-per-Delay(W): For purposes of vibration control, any charges firing within any eight (8) millisecond time period are considered to have a cumulative effect on vibration and air-

overpressure effects. Therefore, the maximum charge-per-delay equals the sum of the weight of all charges firing within any eight (8) millisecond time period. For example, if two 10 lb. charges fire at 100 ms and one 15 lb. charge fires at 105 ms, the maximum charge per delay would be 35 lbs.

H. Line Drilling: A method of controlling overbreak, in which a series of very closely spaced holes are drilled at the perimeter of the excavation. Line holes are generally not loaded with explosives; however, in some applications alternating holes may be loaded with light charges using detonating cord.

I. Pre-splitting: A blasting technique in which the perimeter charges are detonated first in the firing sequence or as a separate blast ahead of production blasting. This technique is designed to generate a fracture in the plane of the pre-split holes drilled along the perimeter of the excavation.

J. Production Holes: Blast holes in the main body of the rock mass being removed by drilling and blasting.

K. Stemming: Crushed stone, tamped clay or other inert earth material placed in the unloaded collar area of blastholes for the purpose of confining explosive charges and limiting rock movement and air overpressure.

L. Buffer Holes: Holes with reduced energy charges drilled adjacent to smoothwall, trim or open line-drilled holes at the perimeter of the excavation. The explosive charge in buffer holes is generally between fifty (50) and seventy-five (75) percent of the charge used in normal production blastholes. Buffer holes are usually drilled parallel to adjacent holes at the excavation perimeter.

M. Primary Initiation: The method whereby the blaster initiates the blast(s) from a remote and safe location. Primary initiation systems use pneumatic tubing or shock-tubes to convey firing energy from blasters to blast locations.

N. Sub-drilling: The portion of the blasthole that is drilled below or beyond the desired excavation depth or limit. Subdrilling is generally required to prevent the occurrence of high or tight areas of unfractured rock between blastholes.

O. Surface Blasting: All excavations where surface blasting techniques are required.

P. Cushion Blasting: A controlled blasting technique for surface excavations. Cushion blasting is a blasting technique in which the line of holes along the boundary of the excavation is detonated during the last delay period of the blast. The main burden is moved from the face by the main production holes, leaving only a small burden to be removed by the line holes on the perimeter. The holes along the perimeter are loaded lighter than the main production holes.

Q. Controlled Blasting: Excavation in rock in which the various elements of the blast, including hole size, position, alignment, depth, spacing, burden, charge size, distribution, and delay sequence are carefully controlled to excavate the rock to the desired lines with a relatively uniform surface with minimal overbreak and fracturing of rock beyond the design excavation limits and to maintain resulting noise, overpressure, and peak particle velocity within specified maximum limits.

R. Prohibited Persons: Persons prohibited from handling or possessing explosive materials as defined by the seven categories described in Title 27, Part 555 of the Code of Federal Regulations (CFR) ATF Rules.

S. Delay: Distinct pause of pre-determined time between detonations of single charges or groups of charges.

1.03 REFERENCED STANDARDS

A. U.S. Department of Justice, Alcohol, Tobacco and Firearms and Explosives Division (CFR Title 27 – Alcohol, Tobacco, and Firearms, Chapter II, Part 555, Implementation of the Safe Explosives Act, Title XI, Subtitle C of Public Law 107-296; Interim Final Rule).

B. Institute of Makers of Explosives

1. Dos and Don'ts - Instructions and Warnings for Consumers in Transporting, Storing, Handling, and Using Explosive Materials.
2. Destruction of Commercial Explosives.
3. Suggested Code of Regulations for the Manufacture, Transportation, Storage, Sale, Possession and Use of Explosive Materials.
4. Safety in the Transportation, Storage, Handling and Use of Explosive Materials.
5. Safety Guide for the Prevention of Radio Frequency Radiation Hazards in the Use of Electric Blasting Caps.

C. National Fire Protection Association (NFPA): NFPA 495 - Code for the Manufacture, Transportation, Storage, and Use of Explosive Materials, 2010 Edition.

D. U.S. Department of Labor, Occupational Safety and Health Administration (OSHA), Construction Standards and Interpretations 29 CFR Part 1926, Subpart U, Section 1926.900, "Blasting and Use of Explosives", final rule dated December 16, 1972.

E. Official Code of Georgia (OCGA); Code Section 25 - Georgia Blasting Standards Act of 1978, Code Section 25-9-1, et seq.

F. ISEE Field Practice Guidelines for Blasting Seismographs, 2009 ed.

1.04 QUALITY CONTROL

A. The design and execution of blasting shall be performed under the on-site supervision of a licensed blaster certified in the State of Georgia.

B. The Contractor shall perform blast monitoring as required to satisfy its legal obligation relative to all permits and all applicable federal, state and local codes, laws, regulations, and ordinances, and its contractual responsibilities, including safety.

C. The Engineer may perform blast monitoring to verify conformance with regard to air-overpressure (noise) and peak particle velocity criteria defined by this Section.

D. Qualifications and Clearance Status:

1. The blasting supervisors (blasters-in-charge) shall have a minimum of ten (10) years experience, directly related to the specific types of excavation blasting they will oversee. All blasting supervisors shall be able to document the completion of at least three (3) projects of similar scope and complexity.
2. All blasters and supervising shift foremen shall be properly qualified and licensed in accordance with applicable federal, state, and local government regulations. Necessary permits include an Explosives License issued by the Georgia Fire Safety Commissioner.
3. The Contractor shall retain the services of an experienced blasting consultant with at least ten (10) years experience in monitoring blasting operations (test blasts and production blasts), interpreting ground vibration, air overpressure, and impulse amplitudes for similar construction projects, and to prepare all blasting plans, test-blasting plans, and revisions to any of these plans. All blasting plans, test-blasting plans and revisions shall be reviewed by and covered with a signed review letter by the blasting consultant. The blasting consultant will not be required to sign the individual blast plans provided they are signed by an on-site licensed blaster.
4. All persons that handle explosive materials, have control over them, or access to them, and must be licensed or permitted, as defined in CFR Title 27 – Alcohol, Tobacco, and Firearms, Chapter II, Part 555, Subpart D (ATF Rules).

1.05 SUBMITTALS

A. Permits: The Contractor shall submit a copy of all applicable permits and licenses for transportation, storage, and use of explosives to the Engineer prior to the start of blasting operations. Submitted permits must include a copy of Federal ATF blasting license listing all responsible persons, blasting use, and storage permits issued by the Georgia State Fire Marshals Office, and any other necessary local permits. No explosives can be brought to any work sites until all necessary permits have been submitted to the Engineer.

B. Regulations: The Contractor shall obtain at least two (2) copies of all applicable federal, state, and local laws and regulations regarding the use of explosives. One (1) copy of these laws and regulations, shall be submitted to the Engineer at least fourteen (14) days prior to blasting. The second copy shall be maintained on-site in the Contractor's office, for review by all Contractor personnel involved in blasting.

C. Contractor Qualifications and Evidence of Experience: The Contractor shall submit resumes of proposed blasting supervisors to the Engineer. Resumes shall contain listing of experience, references with phone numbers, and copies of all required blasting licenses.

D. Blast Designs and Safety Measures: The Contractor shall submit to the Engineer the following information for initial test blasts and proposed production blast design for each area as appropriate:

1. Number, location, diameter, depth. and orientation of drill holes on a scaled drawing of the excavation or heading face.
2. Type of explosive and weight of charge in each hole.
3. Type and nomenclature of detonators.

4. Type and distribution of stemming used to fill hole collars for charge confinement.
5. Total amount of explosives in the blast and maximum charge-per-delay.
6. Delay arrangement showing delay period in each hole.
7. Description of the proposed blasting system and type of firing source.
8. Specific measures taken to protect structures, buried utilities, and other facilities that may be potentially affected by blasting operations.
9. Type and methods of shaft covers, matting, and containment of blast area to mitigate fly rock.
10. Description of and locations of signage used to announce blast warning signals to any persons that might enter blast areas.
11. Clearing, guarding and communication procedures to confirm that all persons are evacuated to safe areas and that blast areas are secured prior to blasting.
12. Prediction calculations for noise (air-overpressure) and peak particle velocity (PPV) at the closest structure and at other adjacent structures, pipelines, or facilities that may be potentially affected by blasting operations.
13. Any redesign of the blasting program shall be submitted to the Engineer.

E. Blasting Records: The Contractor shall maintain a record of each blast detonated. The Contractor shall submit to the Engineer the following records and information the same day the blasting is performed:

1. Depth of blast holes and the location of the blast point in relation to Project stationing.
2. Type, strength, and quantities of all explosives, types and quantities of detonators, powder factor (lb/cy), and actual firing times of all charges.
3. Total explosive loadings per round and maximum charge per delay.
4. Type of rock blasted.
5. Reference to approved blast design submittal noting any modification.
6. Time spent scaling rock and approval of rock scaling by designated individual.
7. On a diagram of the approved blast pattern indicate any holes not drilled, drilled but not loaded, changes in spacing or in pattern of delay charges or in loading of holes. Include notes explaining why changes were made.
8. Submit an evaluation of the blast indicating tights, areas of significant overbreak, and any recommended adjustments for future blasts.
9. Comments by the blaster in charge regarding any misfires, unusual results, or unusual effects.
10. Date and exact firing time of blast; name of person in responsible charge of loading and firing, and blaster permit number.
11. Signature and title of person making recording entries.

12. Record of peak overpressure: Two copies of all blast vibration monitoring data obtained independent of monitoring performed by the Engineer. Submit hard copies of 4-channel waveforms for each blast.

13. Any other records required by federal, state and local laws and regulations.

F. Blasting Safety and Security Plans:

1. A complete description of the clearing and guarding procedures that will be employed to ensure personnel, staff, visitors, and all other persons are at safe locations during blasting. This information shall include details regarding visible warning signs or flags, audible warning signals, method of determining blast area zones, access blocking methods, guard placement and guard release procedures, primary initiation method, and the system by which the blaster-in-charge will communicate with site security guards.

2. Detailed description of how explosives will be safely stored, transported, and used at the various work sites. Plans shall explain how storage magazines and explosive transport vehicles will satisfy all applicable regulations. This plan shall also indicate how explosives will be inventoried, secured, and guarded to prevent theft or unauthorized use of explosives.

3. If the Georgia State Fire Marshal authorizes overnight storage of the explosives, the Contractor must submit a detailed storage plan that includes scaled maps indicating proposed location of detonator and explosives that will be stored overnight, distances to nearest occupied buildings, roadways, and other limiting items in the American Table of Distances.

4. The Contractor shall include Material Safety Data Sheets (MSDS) and specific details about hazard communication programs for employees.

5. Equipment that will be used to monitor the approach of lightning storms and in the event of such, evacuation and site safety security plans.

6. Contingency plans for handling of misfires caused by cut-offs or other causes.

7. Fire prevention plan details, including smoking policies, procedures, and limitations for work involving any open flames or sparks, description and location of all fire fighting equipment, and fire fighting and evacuation plans.

8. Initial and ongoing blasting and fire safety training programs.

9. Description of the personal protective equipment that will be used by the Contractor's personnel, including but not limited to, safety glasses, hard-toe footwear, hard hats, and gloves.

10. Description of blast monitoring equipment and listing of individuals that will operate such equipment. Submittal shall indicate that all equipment meets the standards defined in Article 2.02 of this Section.

11. The Contractor's Safety Representative shall ensure that ongoing blasting work complies with all applicable federal, state, and local regulations.

12. The Contractor shall submit copies of ATF Employee Possessor questionnaire forms (OMB No. 1140-0072) or ATF letters of clearance for all employees that will possess explosives for this Work as defined in 27 CFR Part 555. Contractor employees without submitted evidence of satisfactory ATF clearance, must not handle, control, or have access to explosive materials.

13. Ground Vibration and Air-Overpressure Monitoring Records: Submit two (2) copies of all 4-channel monitoring records done independently of the monitoring performed by the Engineer.

14. The Contractor shall deliver to the Engineer, fourteen (14) days prior to the start of blasting at any location, two bound copies of the property condition inspection reports (condition survey) containing all field notes, sketches, diagrams, photos, and videos as required in the Agreement Documents

G. Notification:

1. For all work sites prior to starting blasting, the Contractor shall notify the appropriate local municipal officials, above- and below-ground utility owners and the Engineer who will notify the general public expected to be potentially affected by blasting operations. Notice shall be given to all operators of all buried pipes, cables, conduits, and overhead utility lines and poles located within a two hundred (200)-foot radial distance of the blast area.
   Notification to appropriate local municipal officials and utility owners or operators shall be done in writing, at least forty-eight (48) hours prior to the start of blasting at a particular site or sooner if so required by any applicable laws or regulations, and shall indicate the expected frequency of blasting, hours that blasting might occur and the expected date that blasting will be completed. Upon completion of blasting at the particular site, utility owners or operators shall be notified that blasting has ceased in the area for the duration of the Project.

2. The Contractor shall furnish the Engineer with a list of those parties notified in accordance herewith prior to the start of such blasting. The list shall include names, addresses, and telephone numbers of those notified.

3. The Contractor shall submit copies of written notification letters sent to the responsible fire protection agency for any sites where explosives are stored overnight. These letters shall be submitted to the Engineer at least forty-eight (48) hours before any explosives are stored at the site. These letters must be submitted by the Contractor to the responsible fire protection agency, forty-eight (48) hours before explosives are stored at the site.

H. Pre-Blast Survey:

1. A pre-construction survey shall be conducted on and reported for all structures within the influence range of any blasting operations or within a minimum of 500 feet from the site perimeter, whichever is greater. The survey shall consist of a visual inspection and recording by notes and photographs of cracks or other structural damage previously sustained, and shall be conducted by a qualified technical furnished by the Contractor's insurance underwriter.

2. A copy of all notes and photographs shall be submitted to the Engineer prior to the commencement of blasting operations. The records so obtained shall be retained by the Contractor for at least one year after completion of the Contract.

3. In the event of damage claims, a report shall be prepared by the Contractor on the particular structure(s) as requested by the engineer or Owner from those notes and photographs and submitted to the Owner.

1.06 PRODUCT DELIVERY, STORAGE AND HANDLING

A. The Contractor shall deliver all explosives to magazines by land transportation in accordance with all applicable federal, state, and local laws and regulations.

B. Storage of Explosives:

1. Transportation, use, and storage of explosives shall be as prescribed by the most stringent of the rules promulgated by all federal, state and local laws, regulations,, and these Specifications.
2. Initiation devices shall not be stored, transported, or kept in the same place in which other explosives are stored, transported, or kept.
3. Only those explosive materials required for a twenty-four (24)-hour period shall be allowed at the site of the Work. Storage of explosives during non-blasting periods is not permitted and the day-storage magazine shall be empty during these periods.
4. The Contractor shall provide a dedicated on-site vehicle that meets all applicable DOT and OSHA standards regarding the transportation of explosive materials from the magazine to the blasting site. Records shall be maintained that clearly show quantities and types of all explosive materials and detonators received from suppliers and returned to them. The differences in received and returned quantities must accurately correspond with the amounts reported in blasting records.
5. No statement in these Specifications shall be considered to relieve the Contractor from sole responsibility for the safe transportation, use, and storage of explosives.

1.07 GROUND CONDITIONS

A. A geotechnical investigation was performed and the resulting report is included in the Appendix for information. The Contractor shall satisfy himself as to the existing ground conditions above and below the ground surface.

1.08 JOB CONDITIONS

A. Blasting must be performed safely in accordance with applicable federal, state, and local laws and regulations, including those promulgated by OSHA. The Engineer will exercise his prerogative to examine, carefully, the qualifications of any persons whose knowledge and skills may bear on the outcome of the Work. In addition, the Engineer may reject any person who is deemed unqualified for any tasks that may be required.

B. Methods of construction shall be such as to ensure the safety of the Work, Project participants, the public, third parties, and adjacent property, whether public or private. The Contractor is solely responsible for maintaining safe working conditions at the site of the Work.

1.09 INDEMNITY

A. Notwithstanding full compliance with this Section, review of all submittals and successful limitation to the peak particle velocity specified in the Georgia Blasting Standards Act, the Contractor shall be solely responsible for any damage, direct or indirect, arising from blasting and

shall hold the Owner, Engineer and their consultants harmless from any costs, liens, charges, claims or suits, including the costs of defense, arising from such damage, real or alleged.

B. The Owner, the Engineer and their consultants shall be additionally-named insured on any insurance policy covering blasting carried by the Contractor and this requirement shall also be enforced on any subcontractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Only explosive and initiation devices packaged by federally-licensed explosives manufacturing firms shall be used in blasting. All explosives and Blasting agents to be used underground shall meet the Fume Class I requirement of the Institute of Makers of Explosives (IME). This restriction does not apply to detonation cords that may be used for trunk lines or in controlled perimeter blasting charges.

B. Only packaged or cartridge type, non-flowing explosives shall be used in the Work. Black powder and nitroglycerine are prohibited for all blasting.

C. Non-electric detonating devices shall be used.

D. Only explosives designed and manufactured for smoothwall (trim) blasting shall be used in perimeter holes for blasting in the underground excavations. The linear charge-weight-per-foot of explosives shall not exceed 0.4 lb/ft. This limitation does not apply to the primer stick, which must not weigh more than one-half (1/2) pounds. Cartridge configurations and detonating cord shall be included in the linear charge weight-per-foot.

E. Explosives, blasting agents, primers, initiators, and ancillary blasting materials shall be kept in original packaging with clearly marked date codes. All explosives and initiating devices used shall be less than one (1) year old.

F. If the Engineer determines that a blasting product appears to be in a damaged or deteriorated condition, the suspect product shall not be used until its condition can be determined. Products found to be damaged or in a deteriorated condition shall immediately be returned to the supplier for safe disposal.

2.02 BLAST MONITORING EQUIPMENT

A. Equipment for on-site and off-site particle velocity and air overpressure monitoring shall be four (4)-channel (one (1) overpressure and three (3) seismic channels) units capable of digitally storing collected data. Equipment must be capable of printing ground motion time histories and summaries of peak motion intensities, frequencies and USBM RI8507 PPV frequency plots. Printed report records must also include date, time of recording, operator name, instrument number and date of last calibration.

1. Instruments shall have a flat frequency response between two (2) and two hundred and fifty (250) Hz for particle velocity and from two (2) to two hundred (200) Hz for air-overpressure.

2. The digitizing sampling rate for peak particle velocity and air overpressure measurements shall be at least 1,024 samples per second.

3. Seismographs shall be capable of performing a self-test of velocity transducers and printed event records shall indicate whether or not the sensor test was successful.

4. Seismographs used for off-site compliance monitoring shall be capable of recording overpressure from one hundred (100) to one hundred and forty-eight (148) dB-L, and particle velocity from 0.05 to 5.0 inches/second.

5. Systems shall be capable of providing printed event reports that include all peak measurements, frequencies and complete waveform plots.

6. Seismographs shall have adequate memory to digitally record the entire duration of the blast-induced motion.

7. All seismograph/software systems shall be capable of saving back-up copies of all event files.

8. If the frequency of blast-induced ground motion for close-in blasting is expected to exceed two hundred and fifty (250) Hz, monitoring shall be done with instruments that measure acceleration with intensities up to ten (10) gs and at frequencies between 200 and 5,000 Hz.

B. The Contractor shall supply the Engineer with four (4) blast monitoring units as described in Article 2.02, Paragraph A of this Section, for the duration of the blasting and for each area of the Project where blasting is taking place. The Contractor shall provide for annual calibration for each of the blast monitoring units and any repair or maintenance required.

2.03 CONDITION SURVEY

A. Prior to the commencement of any underground or surface blasting operation, a pre-blast survey shall be conducted in accordance with the requirements of Section 1.05 and the Agreement Documents.

PART 3 - EXECUTION

3.01 GENERAL BLASTING LIMITATIONS

A. Blasting shall be limited to the hours of 7:00 a.m. to 7:00 p.m., Monday through Friday, and 9:00 a.m. to 5:00 p.m. on Saturdays. Blasting is not allowed on Sundays or Holidays.

B. Blasting vibration and air-overpressure limitations are defined in Articles 3.05 and 3.06 below.

3.02 WARNING SYSTEM

A. The Contractor shall erect signboards of adequate size stating that blasting operations are taking place in the area, and such signs shall be clearly visible at all points of access to the area. These signs shall also clearly display the audible warning signals (horn signals) that will be used to warn all people in the area of the impending blast.

B. An audible blast warning system shall be established, publicized, and operated only during blasting hours.

C. The Contractor shall operate a system to ensure that no personnel remain underground during blasting operations and blasting operations shall not be undertaken until it can be demonstrated that all personnel are accounted for and in a safe location.

3.03 BLASTING OPERATIONS

A. The Engineer shall be notified twenty-four (24) hours before blasts occur at any specific location. The Contractor shall provide the Engineer with a schedule for all blasts and shall notify the Engineer if any blast is delayed for more than one hour. However, the Contractor will be allowed to re-shoot missed holes and tights, as they are uncovered without advance notice to the Engineer.

B. Acceptable Controlled Blasting methods will be those utilizing smooth wall blasting, cushion blasting, and line drilling techniques. Use of "pre-splitting" in shafts and surface excavations is specifically prohibited. Maximum drill round lengths, including subdrilling shall not exceed 0.75 times the minimum dimension of the excavation opening, or as limited by ground conditions. The first eight feet of any excavation shall utilize rounds that do not exceed four feet in length. The four foot round length restriction does not include subdrilling which shall not exceed six (6) inches.

C. Holes shall not be charged with explosives at the same time that drilling or other mechanized equipment not needed to charge the round is being operated within fifty (50) feet of the blast area.

D. The first blasting operation shall be conducted by the Contractor as a test case. The first test blasts shall be no larger than twenty-five (25) percent of the planned production design blast sized as measured by charge-weight-per-delay. The second and third test blasts shall be no larger than sixty (60) and one hundred (100) percent respectively of the planned production design blast. Alternate test blasting plans may be proposed by Contractor with approval of Engineer. After each test blast and review of test blasting data, the Contractor and Engineer shall meet to review the program. Modifications to the blasting program may be required as a result of this review. Drilling and delay patterns, amount and type of explosive to be used in subsequent production blasts shall be revised according to the results of the test case.

E. Monitoring and recording of air-overpressure and vibration will be performed by the Engineer for every test blast round. Changes in drilling and delay patterns and amount of explosives shall be made when test blasts indicate vibrations and/or overpressures in excess of that specified herein. Any major changes in the production blast design shall be submitted to the Engineer.

F. All blasts in open cut excavations shall be covered with a sufficient number of steel cable mats or other substantial covering device in order to prevent injury to persons and property, including the structure and equipment used in connection with shaft or tunnel operation, from flying rock or other material.

When blasting underground, the Contractor shall ventilate the excavation prior to personnel entering. After a blast is fired, all loose and shattered rock or other loose material, which may endanger the structure or the workers shall be removed and the excavation made safe before proceeding with work. Before drilling of blast holes for a new round, the face shall be thoroughly cleaned and examined for missed holes and unexploded charges. Blasting techniques shall be developed and improved as work progresses. The fact that the removal of loose or shattered rock or other loose material may enlarge the excavation beyond the required limits shall not relieve the Contractor of responsibility for such removal and subsequent additional backfill or concrete, and the Contractor shall not be entitled to additional payment for overexcavation or overbreak.

G. No blasting is allowed within forty (40) feet of freshly placed concrete or grouted rock until twelve (12) hours has elapsed since placement. Shotcrete is exempt from these requirements.

H. All transportation of explosives on the surface or underground and any handling, blast charging or tie-in operations shall be stopped immediately upon the approach of an electrical storm, and all persons shall immediately be evacuated from the blasting area to a place of safety. Persons underground shall be notified of the approach and cessation (all clear) of an electrical storm, each by means of different signals. In underground excavations or other excavations, handling of explosives, loading of holes, connecting up or firing of charges shall not be performed during an electrical storm and all persons shall withdraw to a safe distance from a partially or totally loaded face. During such storms, explosives on the surface shall be left in OSHA-approved transport containers, delivery vehicles, day-storage boxes or in approved storage magazines. At all times, explosives shall be watch guarded and secured by the Contractor's personnel that are in safe locations.

I. All light and power circuits shall be disconnected and/or removed to a point not less than one hundred (100) feet from the face while explosives are being transported into the area and while the loading operations are taking place. During the loading operations only OSHA approved lighting may be used.

3.04 SMOOTHWALL BLASTING

A. Excavation to final rock surfaces shall be carried out using smoothwall blasting techniques to minimize the damage to the finished rock surface.

B. The perimeter holes for smoothwall blasting shall conform to the following requirements:

1. Hole spacing shall not exceed eighteen (18)-inches unless a variance is approved by the Engineer. Justification to increase hole spacing shall be based on results from the test blasts.
2. Explosives, excepting the primer stick, shall be distributed evenly and de-coupled from wall of hole. The maximum charge-weight-per-foot of the primary column explosive (loading factor) shall not exceed 0.4 lb/ft. The weight of the primer stick or booster used in smoothwall-perimeter holes shall not exceed 0.5 pounds.
3. Burden shall be between 1.2 and 1.5 times the hole-spacing.
4. Lookout of perimeter holes shall be limited to the minimum necessary to collar the next round.

3.05 AIR-OVERPRESSURE LIMITATIONS

A. Air-overpressure shall not exceed one hundred and thirty (130) decibels when measured at the nearest occupied building.

B. To meet the specified one hundred and thirty (130) dB air-overpressure limit, the Contractor should be prepared to install additional sound reducing materials on the shaft cover, stem blastholes with tamped clay dummies, or use whatever other additional measures are needed to conform to the one hundred and thirty (130) dB limit.

C. All measurements of blast-induced air-overpressure shall be done in accordance with ISEE Field Practice Guidelines for Blasting Seismographs, 2009 edition.

3.06 VIBRATION LIMITATIONS

A. The maximum intensity of motion in the vertical, longitudinal, and transverse directions, measured in the ground near any adjacent residential or occupied building shall not exceed one-half (1/2) inch per second at any frequency of motion.

B. The maximum intensity of motion in the vertical, longitudinal and transverse directions, measured on the ground above any buried utility lines or pipes shall not exceed four (4) inches per second at any frequency of motion.

C. The Contractor shall monitor each blast with a minimum of four (4) seismographs located, as approved, between the blast area and the closest structures and/or utilities.

D. All measurements of blast-induced vibrations shall be done in accordance with ISEE Field Practice Guidelines for Blasting Seismographs, 2009 edition.

3.07 SUSPENSION OF BLASTING

A. Blasting operations may be suspended by the Engineer for any of the following reasons:

1. The Contractor's safety precautions are inadequate.
2. Air overpressure or ground motion levels exceed specified limits.
3. Existing structural conditions on and off site are aggravated and are damaged by blasting.
4. Blasting causes instability of slopes or causes damage to rock outside the prescribed limits of excavation.
5. The results of the blasting, in the opinion of the Engineer, are not satisfactory.
6. Failure of the Contactor to adhere to the submitted and accepted blast plan.

B. Blasting operations shall not resume until the Engineer has approved the Contractor's revised blasting plan with modifications correcting the conditions causing the suspension.

3.08 DAMAGE REPAIR

A. When blasting operations damage off-site properties or a portion of the Work or material surrounding or supporting the Work, the Contractor shall promptly repair or replace damaged items to the condition that existed prior to the damage at no cost to the Owner and to the satisfaction of the Engineer.

END OF SECTION 02405

SECTION 02510
PAVING

PART 1 - GENERAL

1.01 SCOPE

A. The work under this Section includes, but it is not necessarily limited to, the furnishing and installation of all concrete and asphalt paving materials and pavement base materials as indicated on the Drawings and as necessary for the proper performance of this work.

B. Related Work specified elsewhere: Section 02200 - Earthwork.

1.02 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents. In addition, the following specific information shall be provided:

1. Batch design.
2. Density and viscosity tests on each run.
3. Weight slips for pavement base and asphalt paving materials.
4. Certificate signed by the asphalt supplier and the Contractor stating that materials comply with the specifications.
5. Traffic paint manufacturer's application instructions and a description and other data relative to the Contractor's application equipment and methods.

1.03 QUALITY ASSURANCE

A. Unless otherwise indicated on the Drawings or herein specified, all work under this Section shall be performed in accordance with the current Georgia Department of Transportation Standard Specifications for Transportation Systems.

B. Furnish weight slips for all material incorporated in the Project to verify that the required tonnage has been applied.

C. Use only materials which are furnished by a bulk asphalt concrete producer regularly engaged in production of hot-mix, hot-laid asphalt concrete. The Georgia Department of Transportation must currently rate material suppliers as furnishing acceptable materials for State Highway Projects.

D. Retain a test laboratory equipped and qualified to test the materials.

E. Protect all manholes and valve covers from damage due to the paving operation.

1.04 PRODUCT HANDLING

A. Protection: Use all means necessary to protect the materials of this Section before, during and after installation and to protect the installed work and materials of all other trades.

B. Replacement: In the event of damage, immediately make all repairs and replacements necessary to gain the approval of the Engineer at no additional cost to the City.

PART 2 - PRODUCTS

2.01 MATERIALS

A. All materials and products for the work under this Section shall conform to the current Georgia Department of Transportation Standard Specifications for Transportation Systems except as otherwise specified herein.

PART 3 - EXECUTION

3.01 GENERAL

A. The roadway and curbing construction shall meet the Georgia Department of Transportation Specifications.

B. In the event that construction materials are to be supplied for pavement construction on this contract similar to those being produced for similar work by others which are being tested by a reputable testing laboratory or by representatives of the Georgia Department of Transportation, certified copies of the tests and inspections reports on such materials, if in compliance with the contract, will be accepted in lieu of separate tests by a testing laboratory.

3.02 PROTECTION AND MAINTENANCE

A. The Contractor shall be responsible for the protection and maintenance of any existing roadbed or any roadbed constructed during the contract. The roadbed shall be maintained free from ruts and other depressions, in a smooth and compacted condition and true to lines and grades. Any of the Contractor's hauling and other equipment used in such a way as to cause excessive rutting or raveling of the roadbed material shall either be removed from the work or suitable runways shall be provided to prevent rutting.

3.03 TESTING AND INSPECTION SERVICES

A. All materials to be incorporated in the construction of pavements shall be subject to the tests and inspections listed herein and in the standard specifications referred to in this section.

B. The cost for testing for material compliance shall be paid for by the Contractor. The Contractor shall pay for any re-testing required due to test failures.

C. The Contractor shall provide at his expense the testing and inspection services required by the Contract Documents.

D. The Contractor shall employ and pay for the services of a testing laboratory to perform specified services and testing. Employment of the laboratory shall in no way relieve Contractor's obligations to perform the work of the Contract.

E. The Contractor shall advise the Engineer at least 48 hours before tests are to be conducted.

3.04 SOIL CLASSIFICATIONS

A. The minimum tests required on soil materials to prove compliance with the specifications, which are to be paid for by the Contractor, shall be as follows:

B. A determination of soil classification, including sieve analysis and Atterburg Limits of soil material proposed for use as base shall be made from each material source.

C. If base material is to be road mixed, the tests shall be taken for each 6,000 square yard of base to be placed.

D. Maximum Dry Densities (Proctors): One (1) test representative of the soils for each in-place density test.

3.05 IN-PLACE DENSITY (COMPACTION TEST)

A. At least one (1) test shall be made on the roadbed for each 1,000 linear feet or 25,000 square feet (or portion) of pavement to be placed.

B. At least one (1) test shall be made on each lift of base for each 1,000 linear feet or 25,000 square feet (or portion) of pavement to be placed.

C. Test requirements on surface course materials, including: marshal density tests every 1,000 linear feet and corings (if deemed necessary by the Engineer), shall be made at the direction of the Engineer to prove compliance with the specifications. The Contractor shall pay for such tests.

3.06 CITY TESTING

A. The City reserves the right of performing tests as frequently as deemed necessary above and beyond that, which is required by this section to be performed and paid for by the Contractor.

B. The Contractor shall cooperate fully with the Testing Laboratory of the City and render any assistance necessary in order to facilitate the necessary sampling and testing work.

C. If requested by City, Contractor shall perform such additional tests for City by the Contractor's testing facility for which Contractor will be reimbursed.

D. Unless otherwise designated by the authority having jurisdiction over the road, street, or highway involved, minimum traffic requirements shall be one way traffic from sun up to sun down and two-way traffic from sun down to sun up. Flagmen shall be required during periods of one-way traffic.

3.07 CLEANING

A. Prior to acceptance of the work of this Section, clean the pavement and related areas in accordance with the requirements of the General Conditions of the Contract Documents.

END OF SECTION 02510

SECTION 02530
CONCRETE WALKS

PART 1 - GENERAL

1.01 SCOPE

A. The extent of concrete walks is as shown on the Drawings or as required to replace existing walks damaged or destroyed by the Contractor's work.

B. Concrete walk construction includes, but is not limited to, the furnishing, placing, forming, finishing, curing and jointing of Portland cement concrete on prepared subgrade for walks, sidewalks, wheelchair and/or curb cut ramps, paved medians, and drive ramps.

1.02 RELATED SECTIONS

A. The Work of the following Sections specifically apply to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of Work.

1. Section 02532 - Concrete Curbs and Gutters

2. Section 03300 - Cast In-Place Concrete

PART 2 - PRODUCTS

2.01 MATERIALS

A. Forms: Either full depth steel or wood forms of a size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use forms that are straight and free of distortion and defects. Use flexible spring steel forms or laminated boards to form radius bends.

B. Concrete: Ready-mix concrete of 3,000 psi comprehensive strength conforming to ASTM C94 except where small quantities are needed. In which cases, small capacity batchers or mixers may be used.

C. Joint Filler: Preformed joint filler meeting AASHTO M153 or AASHTO M213.

2.02 CONCRETE MIX

A. Design the mix to produce standard-weight concrete consisting of Portland cement, aggregate and water to produce the following properties:

1. Compressive Strength: 3,000 psi minimum at 28 days as determined by ASTM C39.

2. Slump: 4 inches maximum per ASTM C143.

3. Air Content: 3% to 6%.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

A. Remove loose material from compacted subgrade immediately before placing concrete.

3.02 FORM CONSTRUCTION

A. Set forms to the required grades and lines rigidly braced and secured.

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

1. Top of form: Within 1/8 inch of design line and grade.

2. Vertical face: Not more than 1/4 inch in 10 feet from vertical.

C. Thoroughly clean forms and coat with form release agent as required, ensuring form separation from concrete without damage before placing concrete.

D. Slip form placement methods will be permitted provided completed walks meet requirements herein specified. Should slip form method not produce a product conforming to these specifications, the unacceptable work is to be removed and reconstructed, at no additional cost to the City, using fixed forms.

3.03 REINFORCEMENT

A. Locate, place and support reinforcement (if any), as indicated or specified.

3.04 CONCRETE PLACEMENT

A. Do not place concrete until subgrade and forms have been checked for line and grade. Moisten subgrade as required to provide a uniform dampened condition at the time concrete is placed. Do not place concrete on muddy or frozen subgrade.

B. Place concrete in one course, monolithic construction, for the full width and depth of walks.

C. Spread concrete as soon as it is deposited on the subgrade using methods that prevent segregation and separation of the mix, and with as little re-handling as possible. Consolidate concrete along the face of forms and adjacent to transverse joints.

3.05 JOINTS

A. General: Construct expansion and weakened plane contraction joints true to line with face perpendicular to surface of the walk, unless otherwise shown. Construct transverse joints at right angles or radial to the walk centerline, unless otherwise shown. When the walkway is abutting existing walks, place transverse joints to align with previously paved joints, unless otherwise indicated.

B. Contraction Joints: Provide weakened plane transverse joints as shown on the Drawings. Construct joints for a depth equal to at least 1/3 the walk thickness, using one of the following procedures:

1. Tooled Joints: Form joints in the fresh concrete by grooving the top portion of slabs and finishing edges to a 1/4 inch radius.

2. Sawed Joints: Cut joints, approximately 3/16 inch wide, into hardened concrete as soon as the surface will not be torn, abraded, or otherwise damaged by the cutting action.

C. Expansion Joints: Form expansion joints with 1/2 inch thick premolded joint filler. Locate transverse expansion joints no more than 100 feet apart. Where walks abut cold joints, curbs, existing walks, walls, catch basins, manholes, or other structures, provide expansion joint. Furnish joint fillers in one-piece that extend the full width and depth of the joint. After concrete is finished, trim any protruding joint material flush with concrete surface.

3.06 CONCRETE FINISHING

A. After striking off and consolidating concrete, smooth the exposed surface to a uniform finish by screeding and floating.

B. Before the surface is given the final finish, test the surface for trueness with a 10 foot straightedge. Correct any irregularities more than 1/4 inch in 10 feet.

C. Round all edges to 1/4 inch radius.

D. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing, as follows: Broom finish: by drawing a stiff-bristle broom across the concrete surface, perpendicular to walk centerline.

3.07 CURING

A. Protect and cure finished concrete walks with type 2 membrane curing compound.

3.08 REPAIR AND PROTECTION

A. Repair or replace broken or defective walks using methods acceptable to the Engineer. Where removal is required, remove and replace complete panels.

B. Protect completed walks from damage until final acceptance.

C. Clean concrete walks free of stains, discolorations, dirt, trash, leaves and other foreign material just prior to substantial completion and final acceptance.

END OF SECTION 02530

SECTION 02532
CONCRETE CURBS AND GUTTERS

PART 1 - GENERAL

1.01 SCOPE

A. The extent of concrete curbs and gutters is as shown on the Drawings or as required to replace curbs and gutters damaged or destroyed by the Contractor's work.

1.02 RELATED SECTIONS

A. The Work of the following Sections specifically apply to the Work of this Section. Other Sections of the Specifications, not referenced below, shall also apply to the extent required for proper performance of Work.

1. Section 02530: Concrete Walks

2. Section 03300: Cast In-Place Concrete

PART 2 - PRODUCTS

2.01 FORMS

A. Either full depth steel or wood forms of a size and strength to resist movement during concrete placement and to retain horizontal and vertical alignment until removal. Use forms that are straight and free of distortion and defects.

B. Use flexible spring steel forms or laminated boards to form radius bends as required.

2.02 CONCRETE

A. Ready-Mix concrete, 3,000 psi compressive strength, conforming to ASTM C94.

2.03 JOINT FILLER

A. Preformed joint filler meeting AASHTO M153 or AASHTO M213.

2.04 CONCRETE MIX

A. Comply with applicable requirements of Section 03300 for concrete mix design, sampling and testing, and quality control, and as herein specified. Design the mix to produce standard-weight concrete consisting of Portland cement, aggregate and water to produce the following properties:

1. Compressive Strength: 3,000 psi minimum at 28 days as determined by ASTM C39.

2. Slump: 4 inches maximum per ASTM C143.

3. Air Content: 3% to 6%.

PART 3 - EXECUTION

3.01 SUBGRADE PREPARATION

A. Remove loose material from compacted subgrade immediately before placing concrete.

3.02 FORM CONSTRUCTION

A. Set forms to the required grades and lines rigidly braced and secured.

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

1. Top of Form: Within 1/8 inch of design line and grade.

2. Vertical Face: Not more than 1/4 inch in 10 feet from vertical.

C. Thoroughly clean forms and coat, with form release agent as required ensuring form separation from concrete without damage, before placing concrete.

3.03 REINFORCEMENT

A. Locate, place and support reinforcement, if any, as indicated or specified.

3.04 CONCRETE PLACEMENT

A. General: Comply with the applicable requirements of Section 03300 for mixing and placing concrete and as herein specified.

B. Do not place concrete until subgrade and forms have been checked for line and grade. Moisten subgrade as required to provide a uniform dampened condition at the time concrete is placed.

C. Place concrete using methods that prevent segregation and separation of the mix, and with as little re-handling as possible. Consolidate concrete along the face of forms with an internal vibrator. Keep vibrator away from joint assemblies, reinforcement, or side forms. Discontinue vibration before segregation or excessive surface grout occurs. Perform any necessary hand spreading and consolidation with hand tools that will not cause segregation and separation.

D. Deposit and spread concrete in a continuous operation between transverse joints, as far as possible.

E. Machine methods of placing and forming may be used at Contractor's option, provided that an acceptable finished product, true to line, grade and cross section and conforming to specified finish and jointing requirements, is consistently produced. If machine results are not acceptable, remove and replace with formed concrete as specified.

3.05 JOINTS

A. General: Construct contraction and expansion joints true to line with face perpendicular to surface of curb and gutter, unless otherwise shown. Construct transverse joints at right angles or radial to the curb centerline, unless otherwise shown.

B. When curb and gutter is constructed abutting concrete pavement, place transverse joints to align with pavement joints.

C. Contraction Joints: Provide contraction joints at intervals of 10 feet, except where a lesser interval is required for closure, but no section is to be less than 6 feet in length.

1. Contraction joints may be formed by metal divider plates or may be sawed. In either case, joint depth is to be 20 to 25 percent the depth of the concrete.

D. Expansion Joints: Form expansion joints with 1/2 inch thick pre-molded joint filler. Locate expansion joints no further than 100 feet apart, unless otherwise shown, where curb and gutter is constructed adjacent to asphalt concrete paving. Match pavement expansion joints where curb and gutter is placed abutting concrete pavement.

E. Furnish joint fillers in one-piece that extend the full width and depth of the joint. After concrete is finished, trim any protruding joint material flush with concrete surface.

3.06 CONCRETE FINISHING

A. After striking off and consolidating concrete, smooth the exposed surface to a uniform finish by screeding and floating.

B. With the exception of sawed joints, round all joint edges to 1/4 inch radius.

C. After completion of floating and when excess moisture or surface sheen has disappeared, complete surface finishing as follows:

1. Broom finish, by drawing a fine-hair broom across the concrete, perpendicular to the line of traffic.

2. Trowel finish, smooth, and free of trowel marks, uniform in texture and appearance.

3.07 CURING

A. Protect and cure finished concrete curbs and gutters complying with applicable requirements of Section 03300.

3.08 REPAIR AND PROTECTION

A. Acceptably repair or replace broken or defective curbs and gutters.

B. After the concrete has set sufficiently, backfill and compact adjacent ground to design line and grade.

C. Protect completed curbs and gutters from damage until final project acceptance.

D. Clean concrete curbs and gutters free of stains, discolorations, dirt, trash, leaves, and other foreign material just prior to final inspection.

END OF SECTION 02532

SECTION 02710
ANTI-RAM BARRIER FENCING AND GATES

PART 1 - GENERAL

1.01 SCOPE

A. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete installation of anti-ram barrier fences, gates and motors as indicated on drawings.

1.02 SECTION INCLUDES

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

B. Section 03300- Cast in Concrete

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, and installation instructions for metal fencing, fabric, gates and accessories.

1.04 QUALITY ASSURANCE

A. Provide anti-ram barrier system, panels, and gates as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

B. The contractor shall provide laborers and supervisors who are thoroughly familiar with the type of construction involved and materials and techniques specified.

1.05 REFERENCES

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvannealed) by the Hot-Dip Process.

B. ASTM B117 - Practice for Operating Salt-Spray (Fog) Apparatus.

C. ASTM D523 - Test Method for Specular Gloss.

D. ASTM D714 - Test Method for Evaluating Degree of Blistering in Paint.

E. ASTM D822 - Practice for Conducting Tests on Paint and Related Coatings and Materials using Filtered Open-Flame Carbon-Arc Light and Water Exposure Apparatus.

F. ASTM D1654 - Test Method for Evaluation of Painted or Coated Specimens Subjected to Corrosive Environments.

G. ASTM D2244 - Test Method for Calculation of Color Differences from Instrumentally Measured Color Coordinates.

H. ASTM D2794 - Test Method for Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).

I. ASTM D3359 - Test Method for Measuring Adhesion by Tape Test.

J. ASTM F2656 – Standard Test Method for Vehicle Crash Testing of Perimeter Barriers

K. Federal Specification RR-W-410E / Wire Rope and Strand.

L. ASTM F2408 – Ornamental Fences Employing Galvanized Steel Tubular Pickets.

PART 2 - PRODUCTS

2.01 GENERAL

A. This system shall be tested and certified to meet ASTM F2656, Impact Condition Designation M50, Penetration Rating P1, with capability of stopping a 15,000 lb vehicle traveling at speeds up to 50mph.Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:

1. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   a. Anti-ram barrier fencing and gate system:
      i) Ameristar Fence Products, Inc.
      ii) SecureUSA
      iii) Payne Fence Products

2.02 FENCE PANELS

A. Material

1. Steel material for cable-supporting framework (i.e., corrugated pales, rails and posts) shall be galvanized prior to forming and shall conform to the requirements of ASTM A653/A653M, with a minimum yield strength of 45,000 psi (310 MPa). The steel shall be hot-dip galvanized to meet the requirements of ASTM A653/A653M with a minimum zinc coating weight of 0.90 oz/ft2 (276 g/m2), Coating Designation G-90.

2. Material for corrugated pales shall be a nominal 2.75" x .75" x 14 Ga. The cross-sectional shape of the rails shall conform to the manufacturer's Stalwart IS rail design a nominal 2" x 2" x 11 Ga. Pre-drilled holes in the Stalwart IS rail shall be spaced 6" on center, providing a pale airspace of no greater than 3.25". Tamperproof fasteners shall be used to fasten each pale to rail at every intersection. Posts shall conform to the manufacturer's Stalwart IS I-Beam design with a nominal 3" x 2.75" x 12 Ga.

3. Material for corrugated pales shall have a nominal material thickness of 0.075 inches. The cross-sectional shape of the rails shall conform to the manufacturer's Impasse™ rail design with a nominal thickness of 0.100 inches. Pre-drilled holes in the Impasse™ rail shall be spaced 6" o.c. Tamperproof fasteners shall be used to fasten each pale to each rail. Posts shall conform to the manufacturer's Impasse™ I-Beam design with a nominal thickness of 0.100 inches.

4. The cable material shall be 1-1/2" diameter structural wire strand conforming to ASTM A586, Grade 2, Class A coating throughout, with a breaking strength of 159 tons. Cables shall be equipped with threaded studs swaged to a holding strength equivalent to cable breaking strength.

B. Fabrication

1. Pales, rails and posts shall be pre-cut to specified lengths. Rails shall be pre-punched to accept tamperproof security fasteners. Post flange shall be pre-punched to accept rail to post attachment. Post web shall be punched providing a clear opening for interior of rails to align throughout the entire system for affixing conduit, video cabling, IDS wiring, and other components for a complete systems integration. Rails shall be attached to post flange providing a bracket-less design at each intermediate post

2. The manufactured galvanized framework shall be subjected to the PermaCoat® thermal stratification coating process (high-temperature, in-line, multi-stage, multi-layer) including, as a minimum, a six-stage pretreatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic spray application of a polyester finish. The base coat shall be a thermosetting epoxy powder coating (gray in color) with a minimum thickness of 2 mils (0.0508mm). The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be black. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 1.

Table 1 – Coating Performance Requirements

Quality Characteristics	ASTM Test Method	Performance Requirements
Adhesion	D3359 – Method B	Adhesion (Retention of Coating) over 90% of test area (Tape and knife test).
Corrosion Resistance	B117, D714 & D1654	Corrosion Resistance over 3,500 hours (Scribed per D1654; failure mode is accumulation of 1/8" coating loss from scribe or medium #8 blisters).
Impact Resistance	D2794	Impact Resistance over 60 inch lb. (Forward impact using 0.625" ball).
Weathering Resistance	D822 D2244, D523 (60° Method)	Weathering Resistance over 1,000 hours (Failure mode is 60% loss of gloss or color variance of more than 3 delta-E color units).

2.03 SLIDING ROLL GATES

A. Fabrication:

1. Fabricate gates from metal and finish to match fence framework. Assemble gate frames by welding or with special fittings and rivets for rigid connections, providing security against removal or breakage connections. Provide horizontal and vertical members to ensure proper gate operation and attachment of fabric, hardware and accessories.

2. Pales, rails, uprights and posts shall be precut to specified lengths. Diagonals shall be precut to specified lengths and angles. Frame materials shall be joined by welding. Pales shall be face welded to roll gate frame, except for Gauntlet style gates over 18' long. Gauntlet style

gates over 18' long shall have pales face-welded to 2" x 2" angle iron to form panels equal in length to the gate frame bay width.

3. The manufactured roll gates and bolt-on panels (if applicable) shall be subjected to the PermaCoat® thermal stratification coating process (hightemperature, in-line, multi-stage, multi-layer) including, as a minimum, asix-stage pre-treatment/wash (with zinc phosphate), an electrostatic spray application of an epoxy base, and a separate electrostatic sprayapplication of a polyester finish. The base coat shall be a thermosetting epoxypowder coating (gray in color) with a minimum thickness of of 2 mils (0.0508mm). The topcoat shall be a "no-mar" TGIC polyester powder coat finish with a minimum thickness of 2 mils (0.0508mm). The color shall be Black. The stratification-coated framework shall be capable of meeting the performance requirements for each quality characteristic shown in Table 1.
4. Completed gates shall be capable of supporting a 200 lb. load applied at midspan without permanent deformation..

B. Material:

1. Steel material for roll gate components (i.e. pales, rails, diagonals and uprights), shall be commercial steel with minimum yield strength of 45,000 psi (344 MPa).
2. Ornamental pale material shall be 3/4" square x 14 Ga. Tubing. Pale spacing shall be 6" o.c.. Material for toprails, uprights and diagonals rails shall be 2" square x 11 Ga. Material for the bottom rail shall be 2" x 4" x 11 Ga. Posts shall be 4" square x 11 Ga.

2.04 SWING GATES

A. Swing gates shall be fabricated using 1.75" x 14ga Forerunner double channel rail, 2" sq. x 11ga. gate ends, and 1" sq. x 14ga. pickets. Gates that exceed 6' in width will have a 1.75" sq. x 14ga. intermediate upright. All rail and upright intersections shall be joined by welding. All picket and rail intersections shall also be joined by welding. Gusset plates will be welded at each upright to rail intersection. Cable kits will be provided for additional trussing for all gates leaves over 6'.

2.05 GATE MOTOR

A. Gate Motor shall be self-adjusting, no maintenance magnetic limits, partial-open feature, anti-tailgating feature, gate tracker reporting output and ports for plug-in loop detectors. DC Powered Convenience Open (Optional).

B. Two convenience outlets, fail-safe release (fail-secure optional), programming switches, built-in reset switch and built-in power on/off switch.

C. AC Drive:

1. The variable frequency drive unit shall allow for programmable speeds and programmable soft-start and soft-stop features.

D. Overload Protection:

1. Motors shall be protected against overload by either a thermal or a current sensing overload device.

E. Gear (Box) Reducer:

1. The self-enclosed gear-head gearbox shall be manufactured as a single unit, and shall consist of hardened steel, machine cut worm and mating bronze gear running in oil bath. Oil shall be #634 specialty oil with a fluid pour point of –44 degrees F. The gearbox shall perform the following functions:
   a. Adjustable Clutching Device.
   b. Manual disconnect by crank handle.

F. Gear Box Heater:

1. Operator shall include internal gearbox heater and a heater strip for the control box.

G. Drive – Chain:

1. A #100 roller chain shall be utilized. All chain brackets and required attachment hardware shall be supplied.

H. Manual Operation

1. A crank handle, located at ground level in the motor box, shall provide a two-step emergency procedure for manual operation:
   a. Unlock and open motor-box door.
   b. Fold out handle and crank gate opened or closed.

I. Limits: The operator shall be equipped with an integral limit system, providing accurate settings to control the open and close positions of the gate, and shall not be affected by manual operation or motor removal.

J. Control Circuit: U.L. listed operator shall have 5vdc controls.

K. Control wiring: The electrical contractor shall supply all exterior control wiring.

L. Audio Alarm: This alarm shall have a dual function.

1. The first function shall be as a warning prior to gate movement. When the motor control board recognizes a command, this alarm shall be activated three (3) seconds before the motor is energized and the gate begins to move. This shall be continuously activated while the gate is in motion.
2. For UL Class III operation only, the audio alarm shall be an entrapment notification alarm. This alarm shall sound as a result of a second activation of the external primary entrapment prevention device before an end limit (open or close) is reached. The pulsing rate of the alarm in the entrapment notification mode shall be faster than the pulsing rate when in the warning mode prior to gate movement.

M. Main Power Disconnect Switch and Wiring Compartment:

1. When this switch is in the OFF position, the main power shall be disconnected from the Variable Speed Drive, Motor Control Board and power transformer(s).

N. Speed: The gate operator speed shall be fully programmable allowing a maximum speed of 2.2 feet per second.

O. Transformer: Operators shall have an isolated low voltage (24V) secondary circuit supplied by a Class II transformer (minimum of 40va) to provide separate power for external control devices (not including external gate lock).

P. Auto Close Timer: The timer provides an automatic closure of the gate from the full open position, adjustable from 2 to 60 seconds.

2.06 GATE MOTOR HOUSING:

A. Water Resistant Motor Box

1. The motor box shall be constructed of 10-gauge sheet steel, hot-dip galvanized per ASTM 123, gasketed and located at ground level for easy maintenance.
2. Security Hinges and Tamper Resistant Security Screws
3. Security hinges and screws shall be furnished to secure operator enclosure components.

B. Motor Box Lock:

1. Motor box shall be locked with a prison dead bolt. Three (3) paracentric keys shall be provided per key code.

C. Compliant with UL 325 and 991. ETL listed.

1. To be compliant with UL 325 and industry safety guidelines, a secondary entrapment prevention device(s) is required to be installed with this gate operator.

D. Welded heavy-duty frame.

E. Heavy duty 10:1 gear reducer allows emergency manual operation without tools.

F. Fail secure lock standard (gate locks when power off).

G. Overload sensing system.

H. MVP "smart" radio receiver with FC antenna.

I. Built-in operator lock, auto close timer, maximum run timer and master/second capability.

J. Solid-state circuitry with diagnostic LED readout.

K. UL Listed for UL 325 (Class I-IV) for U.S. and Canada (120 VAC only) -HS (Class III-IV only).

PART 3 - EXECUTION

3.01 INSTALLATION

A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

B. When cutting/drilling rails or posts adhere to the following steps to seal the exposed steel surfaces;

1. Remove all metal shavings from cut area.
2. Apply zinc-rich primer to thoroughly cover cut edge and/or drilled hole; let dry. 3) Apply 2 coats of custom finish paint matching fence color.
3. Follow manufacturer's recommendations and requirements.

C. Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacing indicated, in firm, undisturbed or compacted soil.

1. If not indicated on drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 4 times largest cross-section of post.
2. Unless otherwise indicated, excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.
3. Setting Posts: Center and align posts in holes 3" above bottom of excavation.
4. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.
5. Unless otherwise indicated, extend concrete footings 2" above grade and trowel to a crown to shed water.

D. Gates: Install gates plumb, level, and secure for full opening without interference. Install ground-set items in concrete for anchorage. Adjust hardware for smooth operation and lubricate where necessary. The manufacturers' gate drawings shall identify the necessary gate hardware required for the application. Gate hardware shall be provided by the manufacturer of the gate and shall be installed per manufacturer's recommendations.

E. Equipment in this section shall be installed in strict accordance with the company's printed instructions unless otherwise shown on the contract drawings.

F. The complete system shall be adjusted to assure it is performing properly. The system shall be operated for a sufficient period of time to determine that the system is in proper working order.

G. Ensure the owner is clear with regard to the safety points concerning the basic operational guidelines of the safety features of the gate operator system. These safety points are listed in the operator manual and must be read prior to system use

H. Test and Explain Safety Features:

1. Each system feature and device is a separate component of the gate system.
2. Read and follow all instructions for each component.
3. Ensure that all instructions for mechanical components, safety devices and the gate operator are available for everyone who will be using the gate system.
4. The warning signs shipped with the gate operator must be installed in prominent position on both sides of the gate.

END OF SECTION 02710

SECTION 02711
CHAIN LINK FENCING

PART 1 - GENERAL

1.01 SCOPE

A. Work described in this Section includes furnishing all labor, materials, equipment, tools and incidentals required for a complete installation of chain link fences, as indicated on drawings.

B. Under this section, the Contractor shall remove the existing gate and a portion of existing fencing as shown on the Drawings. New fencing shall be installed in the location as shown on the Drawings.

1.02 SECTION INCLUDES

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

B. Section 03300- Cast in-Place Concrete

1.03 SUBMITTALS

A. Product Data: Submit manufacturer's technical data, and installation instructions for metal fencing, fabric, and accessories.

1.04 QUALITY ASSURANCE

A. Provide chain link fences as complete units controlled by a single source including necessary erection accessories, fittings, and fastenings.

PART 2 - PRODUCTS

2.01 GENERAL

A. Dimensions indicated for pipe, roll-formed, and H-sections are outside Dimensions, exclusive of coatings.

B. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products which may be incorporated in the work include; but are not limited to, the following:

1. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   a. Galvanized Steel Fencing and Fabric:
      i) Allied Tube and Conduit Corp.
      ii) American Fence Corp.
      iii) Anchor Fence, Inc.

b. Barbed Tape:
   i) American Fence Corp.
   ii) Man Barrier Corp.
   iii) Boundary Fence & Railing Systems, Inc.

2.02 STEEL FABRIC

A. Fabric: No. 9 gauge (0.148" t 0.005") size steel wires, 2" mesh, with top selvages knuckled for fabric 60" high and under, and both top and bottom selvages twisted and barbed for fabric over 60" high:

1. Furnish one-piece fabric widths for fencing up to 12' high.

B. Fabric Finish: Galvanized, ASTM A 392, Class I, with not less than 1.2 oz. zinc per sq. ft. of surface.

2.03 FRAMING AND ACCESSORIES

A. Steel Framework, General: Galvanized steel, ASTM A 120 or A 123, with not Less than 1.8 oz. Zinc per sq. ft. of surface.

1. Fittings and Accessories: Galvanized, ASTM A 153, with zinc weights per Table I.

B. End, Corner and Pull Posts: Minimum sized and weights as follows:

1. 8' – 10' fabric height, 2.375" OD steel pipe, 3.65 lbs per linear ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs per linear ft.
2. Over 6' fabric height, 2.875" OD steel pipe, 5.79 lbs per linear ft., or 3.5" x 3.5" roll-formed sections, 4.85 lbs per linear ft.
3. Either 2.875" OD aluminum pipe 2.0 lbs. per linear ft. or 2.50" square tubing, 2.9 lbs per linear ft.

C. Line Posts: Space 10' o.c. maximum, unless otherwise indicated, of following minimum sized and weights.

1. Up to 6' fabric height, 1.90" OD steel pipe, 2.70 lbs per linear ft. or 1.875" x 1.625" C-sections, 2.28 lbs per linear ft.
2. 8' to 10' fabric height, 2.375" OD steel pipe, 3.65 lbs per linear ft. or 2.25" x 1.875" H-sections, 2.64 lbs linear ft.
3. Over 8' fabric height, 2.875" OD steel pipe, 5.79 lbs per linear ft. or 2.25" x 1.875" H-sections, and 3.26 lbs per linear ft.
4. Up to 8' fabric height, either 2.375" OD aluminum pipe, 1.26 lbs per linear ft. or 2.25" x 1.875" H-section, 1.25 lbs per linear ft.
5. Over 8' fabric height, 2.875" OD aluminum pipe, 2.0 lbs per linear ft.

D. Top Rail: Manufacturer's longest lengths, with expansion type couplings, approximately 6" long, for each joint. Provide means for attaching top rail securely to each gate corner, pull and end post.

1. Steel fencing: 1.66" OD pipe, 2.27 lbs. per ft. or 1.625" x 1.25" roll-formed sections, 1.35 lbs. per ft.

E. Tension Wire: 7-gage, coated coil spring wire, metal and finish to match fabric.

1. Locate at bottom and top of fabric.

F. Wire Ties: 11 gauge galvanized steel, to match fabric core material.

G. Post Brace Assembly: Manufacturer's standard adjustable brace at end and gate posts and at both sides of corner and pull posts, with horizontal brace located at mid-height of fabric. Use same material as top rail for brace, and truss to line post with 0.375" diameter rod and adjustable tightener.

H. Post Tops: Provide weathertight closure cap with loop to receive tension wire or top rail; one cap for each post.

I. Stretcher Bars: One-piece lengths equal to full height of fabric, with minimum cross-section of 3/16" x 3/4". Provide one stretcher with bar for each gate and end post, and 2 for each corner and pull post, except where fabric is integrally woven into post.

J. Stretcher Bar Bands: Space not over 15" o.c., to secure stretcher bars to end, corner, pull, and gateposts.

K. Barbed Wire Supporting Arms: Manufacturer's standard barbed wire supporting arms, metal and finish to match fence framework, with provision for anchorage to posts and attaching 3 rows of barbed wire to each arm. Supporting arms may be either attached to posts or integral with post top weather cap and must be capable of withstanding 250 lbs. downward pull at outermost end. Provide following type:

1. Single 45-degree arm; for 3 strands barbed wire, one for each post.

L. Barbed Wire: 2 strand 12-1/2 gauge. Wire with 14 gauge. 4-point barbs spaced not more than 5" o.c.; metal and finish to match fabric.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Do not begin installation and erection before final grading is completed, unless otherwise permitted.

B. Excavation: Drill or hand excavate (using post hole digger) holes for posts to diameters and spacing indicated, in firm, undisturbed or compacted soil.

1. If not indicated on drawings, excavate holes for each post to minimum diameter recommended by fence manufacturer, but not less than 4 times largest cross-section of post.

2. Unless otherwise indicated, excavate hole depths approximately 3" lower than post bottom, with bottom of posts set not less than 36" below finish grade surface.

3. Setting Posts: Center and align posts in holes 3" above bottom of excavation.

4. Place concrete around posts and vibrate or tamp for consolidation. Check each post for vertical and top alignment, and hold in position during placement and finishing operations.

5. Unless otherwise indicated, extend concrete footings 2" above grade and trowel to a crown to shed water.

C. Top Rails: Run rail continuously through post caps, bending to radius for curved runs. Provide expansion couplings as recommended by fencing manufacturer.

D. Center Rails: Provide center rails where indicated. Install in one piece between posts and flush with post on fabric side, using special offset fittings where necessary.

E. Brace Assemblies: Install braces as posts are plumb when diagonal rod is under proper tension.

F. Tension Wire: Install tension wires through post cap loops before stretching fabric and tie to each post cap with not less than 6 ga. galvanized wire. Fasten fabric to tension wire using 11 ga. Galvanized steel hog rings spaced 24" o.c.

G. Fabric: Leave approximately 2" between finish grade and bottom selvage, unless otherwise indicated. Pull fabric taut and tie to posts, rails, and tension wires. Install fabric on security side of fence, and anchor to framework so that fabric remains in tension after pulling force is released.

H. Stretcher Bars: Thread through or clamp to fabric 4" o.c., and secure to posts with metal bands spaced 15" o.c.

I. Barbed Wire: Pull wire taut and install securely to extension arms and secure to end post or terminal arms in accordance with manufacturer's instructions.

J. Tie Wires: Use U-shaped wire, conforming to diameter of pipe to which attached, clasping pipe and fabric firmly with ends twisted at least 2 full turns. Bend ends of wire to minimize hazard to persons or clothing. Tie fabric to line posts, with wire ties spaced 12" o.c. Tie fabric to rails and braces, with wire ties spaced 24" o.c. Tie fabric to tension wires, with hog rings spaced 24"o.c.

K. Fasteners: Install nuts for tension bands and hardware bolts on side of fence opposite fabric side. Peen ends of bolts or score threads to prevent removal of nuts.

END OF SECTION 02711

SECTION 02723
CATCH BASINS AND GRATE INLETS

PART 1 - GENERAL

1.01 SCOPE

A. The work covered by this Section shall consist of furnishing all labor, materials, and equipment for constructing complete all catch basins and headwalls at the locations shown on the Drawings or designated by the Engineer.

B. Related Work specified elsewhere:

1. Section 02200 - Earthwork.
2. Section 03100 - Concrete Formwork.
3. Section 03200 - Concrete Reinforcement and Dowelling.
4. Section 03300 - Cast-in-Place Concrete.

1.02 GENERAL

A. Catch basins and headwalls shall be constructed to the size, shape, and dimensions and at the locations shown on the Drawings or as directed by the Engineer.

B. Each catch basin and headwall shall be connected to a nearby storm sewer as indicated on the Drawings by means of concrete pipe and suitable fittings.

1.03 SUBMITTALS

A. Submit the following in accordance with the requirements of the General Conditions of the Contract Documents:

1. Product information on materials in Part 2 of this Section.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Concrete, cement, sand, and water shall conform to the applicable requirements of Section 03300 Cast-In-Place Concrete. Concrete shall be 3,000 psi.

B. Steel reinforcement shall conform to the requirements of Section 03200 Concrete Reinforcement and Dowelling.

C. Precast concrete structure shall conform to the requirements of ASTM C476.

D. Unless otherwise indicated, grate inlets shall be provided with cast iron grate as shown in the Drawings. All castings shall be true to pattern in form and dimensions, free from faults, sponginess, cracks, blowholes and other defects affecting their strength. Bearing surfaces between cast frames and gratings shall be machined, fitted together, and match marked to prevent

rocking. All castings shall be thoroughly cleaned and painted or coated with a coal tar pitch varnish.

PART 3 - EXECUTION

3.01 EXCAVATION

A. Excavation shall be in accordance with the requirements of Section 02200 Earthwork.

3.02 CONCRETE CONSTRUCTION

A. Forms for concrete shall be constructed of such materials and in a manner meeting the requirements of Section 03100 Concrete Formwork.

B. Unless otherwise indicated on the Drawings, all Portland cement concrete structures or parts of structures shall be constructed of concrete meeting the requirements of Section 03300 Cast-In-Place Concrete.

C. Any surface plastering or "parging" shall be done with Portland cement and sand mix. All grouted slopes and inverts shall also use this mix.

3.03 INVERTS

A. All inverts shall be of concrete meeting the requirements of Section 03300 Cast-In-Place Concrete, and shall conform to the shape indicated on the Drawings or as directed by the Engineer. All pipe sizes, weir sizes, and invert elevations shall be as shown on the Drawings.

3.04 OUTLET PIPE

A. Each piece of pipe and special fitting shall be carefully inspected before it is placed and no defective pipe shall be laid in the trench. Pipe laying shall proceed upgrade, starting at the lower end of the grade and with the groove uphill. No pipe shall be laid except in the presence of an inspector representing the Engineer. Trench bottoms found to be unsuitable for foundations after pipe laying operations have started shall be corrected and brought to exact line and grade with approved compacted materials where necessary.

B. Pipe placed in the walls for outlet connections shall extend through the wall and beyond the outside surface of the walls to allow for connections. The end of the pipe being placed shall be rounded and flush with the inside face of the wall. Masonry shall be carefully constructed around the pipe so there will be no leakage around the outer surface.

3.05 CASTINGS

A. Cast iron frames shall be set accurately to line and finished elevation so that subsequent adjustments will not be necessary.

B. Frames shall be set in full cement mortar beds and set in place to match the finished concrete surface in paved areas.

3.06 CLEANING

A. After completion of the catch basin, the interior shall be thoroughly cleaned of all excess materials, the grating placed and all unused materials, tools, equipment and debris removed from the area.

B. After the masonry and frames have had sufficient time to set, but in no case less than 24 hours after placement, the space around the catch basin shall be backfilled and compacted to the required grade.

C. Final cleaning shall be performed in accordance with the requirements of the "General Conditions" of the Contract Documents.

END OF SECTION 02723

SECTION 02730
SEWERS, STORM DRAINS AND ACCESSORIES

PART 1 - GENERAL

SCOPE

A. The Work described in this Section includes furnishing all labor, materials, and equipment required for a complete and operable installation of all sewers, storm drains and accessories. All gravity sewers, storm drains, and accessories shall be installed, adjusted, tested and placed in operation in accordance with these Specifications and the manufacturer's recommendations and as shown on the Drawings.

B. Supply all products and perform all work in accordance with applicable American Society for Testing and Material (ASTM), American Water Works Association (AWWA), American National Standards Institute (ANSI), or other recognized standards. Latest revisions of all standards are applicable.

C. Pipe not specified in this section is specified in Section 15060 Piping and Appurtenances.

1.02 QUALIFICATIONS

A. If requested by the Engineer, submit evidence that manufacturers have consistently produced products of satisfactory quality and performance for a period of at least two (2) years.

1.03 SUBMITTALS

A. Submittals shall be made in accordance with the requirements of the General Conditions of the Contract Documents.

B. The Contractor shall submit proposed methods, equipment, materials, and sequence of operations for sewer construction. The Contractor shall plan operations to minimize disruption of utilities and to occupied facilities on adjacent property.

C. The Contractor shall submit manufacturers' instructions indicating special procedures required to install products specified.

D. Submit shop drawings to the Engineer for review showing a complete laying plan of all pipe, including all fittings adapters, valves, flumes, vortex inserts, and specials along with the manufacturer's drawings and specifications indicating complete details of all items. The pipe details shall include stationing, pipe class or design and supporting computations; and laying schedule which specifies pipe class, class coding, station limits, and transition stations for various pipe classes. The above shall be submitted to the Engineer for review before fabrication and shipment of these items. The locations of all pipes shall conform to the locations indicated on the Drawings.

1.04 TRANSPORTATION AND HANDLING

A. Unloading: Furnish equipment and facilities for unloading, handling, distributing and storing pipe, fittings, valves, and accessories. Make equipment available at all times for use in unloading.

B. Do not drop or dump materials. Any materials dropped or dumped will be subject to rejection without additional justification.

C. Handling: Handle pipe, fittings, valves and accessories carefully to prevent shock or damage. Handle pipe by rolling on skids, forklift, or front loader. Do not use material damaged in handling.

1.05 STORAGE AND PROTECTION

A. Store all pipe which cannot be distributed along the route. Make arrangements for the use of suitable storage areas.

B. Stored materials shall be kept safe from damage. The interior of all pipes, fittings, and other appurtenances shall be kept free from dirt or foreign matter at all times.

C. Pipe shall be stored per the manufacturer's recommendations.

D. Store joint gaskets in a cool location, out of direct sunlight. Gaskets shall not come in contact with petroleum products. Gaskets shall be used on a first-in, first-out basis.

1.06 QUALITY ASSURANCE

A. Product manufacturers shall provide the Engineer with written certification that all products furnished comply with all applicable provisions of these Specifications.

PART 2 - PRODUCTS

2.01 PIPE

A. Ductile Iron Pipe:

1. Ductile iron pipe shall be utilized as shown on the Drawings.
2. Ductile iron pipe shall be manufactured in accordance with AWWA C151. All pipe, except specials, shall be furnished in nominal lengths of 18 to 20 feet. Sizes will be as shown on the Drawings. All pipe shall have a minimum pressure rating as indicated in the following table, and corresponding minimum wall thickness, unless otherwise shown:

Pipe Sizes (inches)	Pressure Class (psi)
4 - 12	350
14 - 18	350
20	300
24	250
30 - 54	200
60 - 64	200

3. Flanged pipe minimum wall thickness shall be equal to Special Class 53.
4. All ductile iron pipe fittings shall have a double cement-mortar lining conforming to the

requirements of ANSI A21.4 (AWWA C104) and a standard bituminous outer coating unless shown on the Drawings or directed by the Engineer.

5. Fittings shall be ductile iron and shall conform to AWWA C110 or AWWA C153 with a minimum rated working pressure of 250 psi.

6. Joints: Unless shown on the Drawings or specified otherwise, joints shall be push-on. Joints shall conform to AWWA C111. Flanged joints shall conform to AWWA C115.

7. Provide the appropriate gaskets for joints. Gaskets for flange joints shall be made of 1/8-inch thick, cloth reinforced rubber; gaskets may be ring type or full face type.

8. Provide the necessary bolts for mechanical and flange connections. Bolts for flange connections shall be steel with American Regular unfinished square or hexagon heads. Nuts shall be steel with American Standard Regular hexagonal dimensions, all as specified in ANSI B17.2. All bolts and nuts shall be threaded in accordance with ANSI B1.1, Coarse Thread Series, Class 2A and 2B fit. Mechanical joint glands shall be ductile iron.

9. Wall Pipes
   a. Where piping passes through concrete structures, furnish and install wall pipes or other provisions as specifically shown on the Drawings. Wall sleeves shall be accurately located and securely fastened into position before concrete is poured.
   b. Wall Pipes
      i) Wall pipes shall be either statically cast iron with integral waterstop collar or centrifugally cast ductile iron with a continuously welded waterstop collar. The waterstop collar shall be capable of withstanding a thrust force caused by a 250 psi dead end load from either direction on that size pipe. Wall pipes shall be furnished uncoated on the outside and cement lined on the inside. Unless specified or shown otherwise for a specific situation, wall pipes shall be flange-flange type.
      ii) Wall pipes shall be cast and/or fabricated and lined in one manufacturer's facilities and delivered to the job site ready for use.

10. Acceptance: Acceptance will be on the basis of the Engineer's inspection and the manufacturer's written certification that the pipe was manufactured and tested in accordance with the applicable standards.

B. Steel Pipe: Steel pipe shall be provided as specified in Section 15060 Piping and Appurtenances.

C. Reinforced Concrete Pipe:

1. Pipe shall be bell and spigot reinforced concrete pipe conforming to ASTM C76. Class III pipe Wall B, unless otherwise shown.

2. In addition, the pipe and materials shall meet the following requirements:
   a. Concrete shall have a minimum compressive strength of 5,000 psi for Class III.
   b. Cement shall meet the requirements of ASTM C 150, Type II.
   c. Absorption shall not exceed six percent when tested in accordance with ASTM C 497.

3. Reinforced concrete pipe shall be supplied in lengths of at least eight feet, where applicable.

4. Joints: Pipe shall have concrete and rubber O-ring gasket type joints conforming to ASTM C 361. A rectangular groove shall be supplied in the spigot end to receive the rubber O-ring gasket, and it shall be so formed that when the joint is complete the gasket will be deformed to a rectangular shape and confined on all four sides. Bell and spigot surfaces shall be

accurately formed and smooth to provide a close sliding fit with a nominal clearance of 1/16-inch.

5. Fittings and Specials: Reinforced concrete pipe fittings and specials shall meet all requirements for reinforced concrete pipe, including materials of construction, structural strength, linings, and joints. Provide couplings for connection to pipe of different materials as shown on the Drawings and as specified herein.

6. Pipe Couplings:
   a. Unless shown or specified otherwise, pipe couplings shall be carbon steel and slip-on, gasketed type, with a diameter to properly fit the pipe.
   b. Couplings shall be Depend-O-Lok EXE as manufactured by Brico Industries, Inc. or equal.

7. Acceptance:
   a. Acceptance of pipe shall be on the basis of plant load-bearing tests for the load to produce 0.01-inch crack and the ultimate strength of the pipe, material tests, and inspection of manufactured pipe for visual defects and imperfections as described in Paragraph 5.1.1, Acceptance on the Basis of Plant Load-Bearing Tests,Material Tests, and Inspection of Manufactured Pipe for Visual Defects and Imperfections, of ASTM C 76.
   b. Provide results of tests on pipe, pipe materials, joint material, and made-up joints performed by an independent testing laboratory approved by the Engineer. Include materials, absorption, crushing, and hydrostatic leakage tests on pipe of each size in accordance with applicable specifications.
   c. Each length of pipe shall be stamped by a regular employee of the approved testing laboratory.
   d. Inspect pipe after delivery for laboratory stamp, shape, cracks, uniformity, blisters and imperfect surfaces, hammer test, damaged ends, and gasket grooves. Do not accept or use pipe with repaired or patched gasket grooves or shoulders. Any pipe repaired or patched is subject to rejection by the Engineer.

8. No pipe shall be shipped before it has been cured for a minimum of 14 days.

D. PVC pipe:

1. This specification covers polyvinyl chlorinated (PVCpipe for gravity sewer and surface water applications. This product is intended for gravity applications where the operating temperature will not exceed 140°F.

2. Pipe material shall be manufactured from virgin rigid PVC (polyvinyl chloride) vinyl compounds meeting requirements of ASTM D 1784, classification 12454 or 12364.

3. Pipe shall be bell and spigot pipe conforming to ASTM D 3034 with a side dimension raito of SDR 35 with a stiffness value of 46, unless otherwise shown.

4. Joints: Provide pipe with integral bells with locked-in gaskets meeting requirements of ASTM D 3212 and F 477. Furnish pipe in minimum lengths of 14 feet.

5. Fittings and Specials: PVC pipe fittings and specials shall meet all requirements for PVC pipe, including materials of construction, structural strength, and joints. Provide couplings for connection to pipe of different materials as shown on the Drawings and as specified herein.

2.02 MANHOLES AND PRECAST CONCRETE PRODUCTS

A. Precast Concrete Sections:

1. Precast concrete sections shall meet the requirements of ASTM C 478 and ASTM C 913 for rectangular precast concrete products. The minimum compressive strength of the concrete in precast sections shall be 4,000 psi.
2. The minimum wall thickness shall be one-twelfth of the inside diameter of the base, riser, or the largest cone diameter. Additionally, the wall thickness shall be sufficient for the proper installation of the rubber boots.
3. Transition slabs which convert bases larger than four feet in diameter to four foot diameter risers shall be designed by the manhole manufacturer to carry the live and dead loads exerted on the slab.
4. Seal joints between precast sections by means of rubber O-ring gaskets or flexible butyl rubber sealant. Butyl rubber sealants shall meet the requirements of AASHTO M-198. Sealant shall be pre-formed type with a minimum nominal diameter of 1-inch. Butyl rubber sealant shall be equal to Kent Seal No. 2 or Concrete Sealants CS202.

B. Iron Castings:

1. Cast iron manhole frames, covers and steps shall meet the requirements of ASTM A 48 for Class 30 gray iron and all applicable local standards. All castings shall be tough, close grained, smooth, and free from blow holes, blisters, shrinkage, strains, cracks, cold shots, and other imperfections. No casting will be accepted which weighs less than 95 percent of the design weight. Shop drawings must indicate the design weight and provide sufficient dimensions to permit checking. All castings shall be thoroughly cleaned in the shop and given two coats of approved bituminous paint before rusting begins.
2. Manhole frames and covers shall be City of Atlanta standard as shown on the Drawings.
3. All frames and covers shall have machined horizontal bearing surfaces.
4. All manholes shall be standard frames and covers except unless shown otherwise.
5. Watertight covers shall be bolt-down type and shall be equipped with four 1/2-inch stainless steel bolts and a 1/8-inch neoprene or rubber O-ring gasket. Covers shall be rotatable and interchangeable. Bolt holes shall be bored through so that debris entering the bolt hole will fall into the manhole. Bolt holes shall have the full 360 degree circle within the cover's radius when bored through the cover.

C. Manhole Steps: Manhole steps of polypropylene molded around a steel rod equal to products of M.A. Industries shall be used.

D. Rubber Boots: Provide preformed rubber boots and fasteners equal to those manufactured by Kor-N-Seal or Press Seal Gasket Corporation.

PART 3 - EXECUTION

3.01 LOCATION AND GRADE

A. The Drawings show the alignment and grade of the sewer and drain and the position of manholes and other appurtenances. The slope shown on the Drawings and/or called for in the Specifications is the slope of the invert of the pipe.

B. The Contractor shall perform all surveys necessary for the establishment of the horizontal and vertical alignment of the sewer.

C. Reference Points:

1. The Contractor shall take all precautions necessary, which includes, but is not necessarily limited to, installing reference points.
2. The Contractor shall give the Engineer reasonable notice that reference points are set. The reference point locations may be verified by the Engineer.
3. The Contractor shall be responsible for any damage done to reference points, base lines, center lines and temporary bench marks, and shall be responsible for the cost of re-establishment of reference points, base lines, center lines, and temporary bench marks as a result of the Contractor's operations.

3.02 LAYING AND JOINTING PIPE AND ACCESSORIES

A. Lay all pipe and fittings to accurately conform to the lines and grades shown on the Drawings.

B. Pipe Installation:

1. Proper implements, tools and facilities shall be provided for the safe performance of the Work. All pipe, fittings and valves shall be lowered carefully into the trench by means of slings, ropes, or other suitable tools or equipment in such a manner as to prevent damage to sewer materials, protective coatings, and linings. Under no circumstances shall sewer materials be dropped or dumped into the trench.
2. All pipe, fittings, valves and other appurtenances shall be examined carefully for damage and other defects immediately before installation. Defective materials shall be marked and held for inspection by the Engineer, who may prescribe corrective repairs or reject the materials.
3. All lumps, blisters and excess coating shall be removed from the socket and plain ends of each pipe, and the outside of the plain end and the inside of the bell shall be wiped clean and dry and free from dirt, sand, grit, or any foreign materials before the pipe is laid. No pipe which contains dirt shall be laid.
4. Foreign material shall be prevented from entering the pipe while it is being placed in the trench. No debris, tools, clothing, or other materials shall be placed in the pipe at any time.
5. As each length of pipe is placed in the trench, the joint shall be assembled and the pipe brought to correct line and grade. The pipe shall be secured in place with approved backfill material.

6. Lay pipe with the bells up the grade.

7. Applying pressure to the top of the pipe, such as with a backhoe bucket, to lower the pipe to the proper elevation or grade shall not be permitted.

C. Expediting of Work: Excavate, lay the pipe, and backfill as closely together as possible. Do not leave unjointed pipe in the trench overnight. Backfill and compact the trench as soon as possible after laying and jointing is completed. Cover the exposed end of the installed pipe each day at the close of work and at all other times when work is not in progress. If necessary to backfill over the end of an uncompleted pipe or accessory, close the end with a suitable plug.

D. Joint Assembly:

1. Push-on, mechanical and flange type joints shall be assembled in accordance with the manufacturer's recommendations.

2. The Contractor shall internally inspect each pipe joint to ensure proper assembly after the pipe has been brought to final alignment.

E. Pipe Coupling Installation:

1. Pipe couplings shall be installed where shown on the Drawings. Couplings shall be installed in strict conformance with the manufacturer's instructions.

2. Pipe ends shall be cleaned, brushed or filed to produce a mating surface that is free of dirt, rust, chuck marks, mill scores, dents, burrs, or other foreign substances that would impede proper gasket seating.

3. A lubricant recommended by the coupling manufacturer shall be used in seating all gaskets.

F. Cutting Pipe:

1. Cut the pipe per the manufacturer's written recommendations.

2. Remove all burrs and smooth the end before jointing.

3. The Contractor shall cut the pipe and bevel the end, as necessary, to provide the correct length of pipe necessary for installing the fittings, valves, accessories, and closure pieces in the correct location.

3.03 MANHOLE AND PRECAST CONCRETE PRODUCT CONSTRUCTION

A. Construct manholes as shown on the Drawings.

B. Precast Concrete: Handle sections carefully to prevent cracking or chipping. Provide uniform bedding of the bottom section to prevent uneven loading. Install gaskets and joint sealants in accordance with manufacturer's recommendations to produce a watertight structure.

C. Pipe Connections: Seal the void between the pipe and the manhole with brick and mortar on both the inside and outside.

1. Pipe 36-Inch Diameter and Less: Connect pipe to manhole utilizing rubber boots unless shown otherwise on the Drawings.

2. If preformed openings must be enlarged or altered, or if new openings must be made in the field, minimize the amount of material removed to provide closely matched surfaces for grouting.

D. Inverts: Form channels as shown on the Drawings, rounded, and troweled smooth. Maintain consistent grade through the invert.

E. Seal all manhole joints and lift holes, both inside and out, with grout. Seal between precast sections, this is in addition to manufacturer's recommended gaskets and joint sealants.

F. Invert Elevations: The invert elevations shown on the Drawings shall be for the invert at the centerline of the manhole. Prior to setting the laser or other vertical alignment control system for the sewer or drain upstream of the manhole, the Contractor shall verify the elevation of the sewer or drain installed at the manhole. Should the elevation differ from that shown on the Drawings, the Contractor shall take the following corrective action:

1. If the sewer or drain is laid at negative grade, the Contractor shall remove and reinstall the sewer or drain at the correct grade at no additional cost to the Owner.

   If the sewer or drain is laid at a grade less than that shown on the Drawings, thus reducing the sewer's capacity, the Owner may require the sewer to be removed and relaid at the correct grade at no additional cost to the Owner. As a minimum, the grade to the next upstream manhole shall be adjusted such that the next upstream manhole shall be set at the correct elevation.

2. If the sewer or drain is laid at a grade greater than that shown on the Drawings, and if the Contractor can show that there are no conflicts with upstream existing utilities or obstructions, the Contractor shall adjust the grade of the next upstream manhole such that the next upstream manhole shall be set at the correct elevation. If such an adjustment, in the Engineer's opinion, is substantial, the grade adjustment shall be spread over multiple sections of the sewer. If such an adjustment, in the Owner's opinion, significantly reduces the sewer's capacity, the Owner may require the Contractor to remove and relay at no additional cost to the Owner that portion of the sewer laid at the improper grade.

G. Manholes shall be constructed such that their walls are plumb.

3.04 INSPECTION AND TESTING

A. Clean and test lines before requesting final acceptance. Where any obstruction is met, clean the sewers by means of rods, swabs, or other instruments. When directed by the Engineer, flush out lines and manholes before final inspection.

B. Alignment: Pipe lines shall be straight and show a uniform grade between manholes. Straight alignment shall be checked by either using a laser beam or lamping. Each segment between manholes must show at least 90 percent of the full pipe circle visible when looking from manhole to manhole. If unacceptable sags are detected, the pipe must be taken up and relaid. Correct any discrepancies discovered during inspection.

C. Watertightness: All sewers and drains constructed shall be tested for watertightness to the maximum extent feasible. Tests shall be performed on all new sewers and drains constructed as indicated below, except for those new sewers constructed which have active services tied into them as the pipe is being installed. In such cases the watertightness of the sewers less than or equal to 24-inches shall be based low pressure air test, and for sewers 30-inches and larger based on the individual joint test as specified below. All visible leaks shall be repaired by the Contractor at no additional cost to the Owner.

D. Tests

1. Low-Pressure Air Test of Sewer and drain diameters less than or equal to 24-inches:
   a. Prior to air testing, the section of sewer between manholes shall be thoroughly cleaned and may be wetted. Immediately after cleaning or while the pipe is water soaked, the sewer shall be tested with low-pressure air. At the Contractor's option, sewers may be tested in lengths between manholes or in short sections (25 feet or less) using inflatable balls pulled through the line from manhole to manhole. Air shall be slowly supplied to the plugged sewer section until internal air pressure reaches approximately 4.0 psi. After this pressure is reached and the pressure allowed to stabilize (approximately two to five minutes), the pressure may be reduced to 3.5 psi before starting the test. If a 1.0 psi drop does not occur within the test time, then the line has passed the test. If the pressure drops more than 1.0 psi during the test time, the line is presumed to have failed the test, and the Contractor will be required to locate the failure, make necessary repairs, and retest the line. Minimum test time for various pipe sizes is as follows:

Nominal Pipe Size (Inches)	Time (Min/100 feet)
6	5.7
8	7.6
10	9.4
12	11.3
15	14.2
18	17.0
21	19.8
24	22.8

   b. Required test equipment, including inflatable balls, braces, air hose, air source, timer, rotameter as applicable, cut-off valves, pressure reducing valve, 0-15 psi pressure gauge, 0-5 psi pressure gauge with gradations in 0.1 psi and accuracy of + two percent, shall be provided by the Contractor. Testing equipment shall be equal to Cherne Air-Loc Testing Systems.
   c. The Contractor shall keep records of all tests made. Copy of such records will be given to the Engineer. Such records shall show date, line number and stations, operator, and such other pertinent information as required by the Engineer.
   d. The Contractor is cautioned to observe proper safety precautions in performance of the air testing. It is imperative that plugs be properly secured and that care be exercised in their removal. Every precaution shall be taken to avoid the possibility of over-pressurizing the sewer line.

2. Individual Joint Test for sewers 30-inches in diameter and larger:
   a. Each pipe joint shall be tested with an Ultrasonic Transmitter and Detector during installation. The Contractor shall submit the test procedure for approval.
3. All manholes shall be vacuum tested per ASTM C 1244 or hydraulically tested to leak less than ¼ inch of level over a period of 24 hours.

END OF SECTION 02730

SECTION 02823
ALUMINUM LOUVER FENCING

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes: Ornamental fixed louver modular fencing panels fabricated with extruded aluminum louvers and flat aluminum bars including extruded aluminum fence posts and aluminum louver gates.

1.02 RELATED SECTIONS:

A. Section 03300 - Cast-in-Place Concrete: Concrete footings for support of fence posts.

1.03 REFERENCES

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

1. ASTM B209 - Aluminum and Aluminum-Alloy Sheet and Plate.
2. ASTM B221 - Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube.
3. ASTM B117 - Standard Practice for Operating Salt Spray (Fog) Apparatus.
4. ASTM D822 - Tests on Paint and Related Coatings Using Filtered Open-Flame Carbon-Arc Exposure Apparatus.
5. ASTM D1794 - Resistance of Organic Coatings to the Effects of Rapid Deformation (Impact).
6. ASTM D3363 - Test Method for Film Hardness by Pencil Test.

1.04 SUBMITTALS

A. Provide in accordance with General Conditions requirements for submittal procedures:

1. Product data for components and accessories.
2. Shop drawings showing layout, dimensions, spacing of components, interface with electric gate operator, and anchorage and installation details.
3. Sample: 8 by 10 inches minimum size sample of fence panel illustrating design, fabrication workmanship, and selected color coating.
4. Copy of warranty specified in Paragraph 1.4 for review by Architect.

1.05 WARRANTY

A. Provide in accordance with General Conditions:

1. 20 years warranty for factory finish against cracking, peeling, and blistering under normal use.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Ametco® Manufacturing Corporation, 4326 Hamann Parkway, P.O. Box 1210, Willoughby,Ohio 44096; 800-362-1360, or equal. Products of Ametco Manufacturing Corporation is the basis of design and approved for use.

2.02 MATERIALS

A. Extruded aluminum: ASTM B221, Alloy 6063, Temper T-6.

B. Sheet aluminum: ASTM B209 6063, Temper T-6.

C. Grout: Non-shrink type, pre-mixed compound consisting of non-metallic aggregate, cement, and water reducing and plasticizing additives.

2.03 FENCE SYSTEM

A. Phoenix: Inclined, extruded aluminum 1/2 x 4 inch (13 by 104 mm) tubular louver blades installed horizontally and spaced to provide either 80 or 100 percent direct visual screening.

B. Type: Ornamental fencing system consisting of horizontal, fixed louver, modular fence panels fabricated with extruded aluminum framing bars and supported by extruded aluminum fence posts; Phoenix Aluminum Fixed Louver Fencing as manufactured by Ametco® Manufacturing Corporation.

C. Fence panel:

D. Fixed louver bars: Two rows of Extruded aluminum tube,1/2 inch x 4 inches wide, spaced at 4 inches for 100 percent visual screening.

E. Cross bars: 1/2 by 1/8 inch flat bars welded perpendicular to back side of louver bars and spaced at 18 inches

F. Panel height: 62-3/8 inches.

G. Panel width: 64-21/32 inches.

1. Posts: Extruded aluminum solid shapes.
   a. Size: 2-1/2 by 5/16 inch.
   b. Length: as required

2.04 GATES

A. Provide gates of type and size indicated on Drawings. Equip gates with manufacturer's standard hardware as required for complete functional operation.

B. Type: Hinged swinging single or double gate.

1. Construction: Welded frame fabricated from extruded aluminum tubing with aluminum fixed louver panels to match fencing material.
2. Nominal size: as shown on drawings.
3. Hardware:
   a. Hinges: Size and type as determined by manufacturer. Provide 2 hinges for each leaf up to 6 feet high and 1 additional hinge for each additional 24 inches in height or fraction thereof.
   b. Latch: 3/4 inch diameter slide bolt to accommodate padlock.
   c. For double gates provide pad lockable, 5/8 inch diameter center cane bolt assembly and strike.
4. Type: V-wheeled rolling gates.
   a. Construction: Welded frame fabricated from extruded aluminum tubing with aluminum fixed louver panels to match fencing material. Frame configuration shall be as indicated on Drawings and approved shop drawings.
   b. Nominal size:
      i) Gate opening: as shown on drawings.
   c. Support posts: Pair of tubular aluminum posts with solid cap. See drawings for size.
   d. Rolling mechanism: Steel wheels with V-shaped edge groove and 6 inches diameter, mounted to gate frame and riding on ground set V-track. Assembly braced at top by adjustable guide wheels mounted with brackets to support posts.
5. Type: Cantilevered horizontal sliding gate.

2.05 ACCESSORIES

A. Fasteners: Stainless steel bolts of type, size, and spacing as recommended by fence manufacturer for specific condition.

B. For exposed locations, provide anti-intruder bolts consisting of cup head bolt and nut with clamping hexagon such that tightening shears hexagon and render bolt impossible to release.

2.06 FACTORY FINISH

A. Aluminum fence panels and posts shall receive polyester powder coating. Large gate panels shall be coated with 2-part polyurethane coating.

B. Polyester powder coating: Electrostatically applied colored polyester powder coating heat cured to chemically bond finish to metal substrate.

1. Minimum hardness measured in accordance with ASTM D3363: 2H.
2. Direct impact resistance tested in accordance with ASTM D2794. Withstand 160 inch-pounds.
3. Salt spray resistance tested in accordance with ASTM B117: No undercutting, rusting, or blistering after 500 hours in 5 percent salt spray at 95 degrees F and 95 percent relative humidity and after 1000 hours less than 3/16 inch undercutting.

4. Weatherability tested in accordance with ASTM D822: No film failure and 88 percent gloss retention after 1 year exposure in South Florida with test panels tilted at 45 degrees.
5. Polyurethane coating: 1.0 mil dry film thickness of coating of test panel cured 30 minutes at 180 degree F and aged 14 days shall resist the following test conditions without failure:
   a. 5 percent salt spray for 500 hours.
   b. 100 percent relative humidity for 1000 hours.
   c. Water immersion for 100 hours.
   d. 20 double rubs with cloth saturated with either lacquer thinner, acetone, MEK, gasoline, xylene.
   e. Exposure to lubricating oils, hydraulic fluids, and cutting oils.
   f. 16 cycles of 24 hours at 100 percent humidity, 24 hours at 10 degrees F, and 24 hours at 77 degrees F.
   g. Hardness: H to 2H.
   h. Flexibility: 1/8 inch
6. Color: Selected by Architect from manufacturer's Custom color range.

PART 3 - EXECUTION

3.01 PREPARATION

A. Prior to fabrication, field verify required dimensions.

B. Coordinate fence and gate installation with provision of gate operator to ensure proper power supply and that conduit and wiring are concealed.

C. Cast concrete footings in accordance with Section 03300 - Cast-in-Place Concrete as detailed on Drawings and approved shop drawings.

1. Minimum footing diameter:
   a. Terminal and gate posts: 12 inches.
   b. Intermediate line posts: 10 inches.
   c. Allow 12 inches minimum embedment of posts.
   d. Allow 6 inches minimum concrete beneath post bottom.
2. Provide setting holes for embedment of fence posts. Hole shall be 2 inches minimum greater than post width.

3.02 INSTALLATION

A. Install fencing in accordance with manufacturer's installation instructions and approved shop drawings.

B. Install fence posts plumb and level by setting post in hole cast or drilled in concrete and grouting solid. Temporarily brace fence posts with 2 by 4 wood supports until concrete is set.

C. Do not installed bent, bowed, or otherwise damaged panels. Remove damaged components from site and replace.

D. Secure fence panels with stainless steel anti-intruder bolts to fence posts after posts have been set in footings.

E. Gates:

1. Install gates and adjust hardware for smooth operation.
2. Provide concrete center foundation depth and drop rod retainers at center of double swinging gate openings.
3. Provide concrete surface for length of operation of V-wheeled rolling gate. Anchor track to concrete with countersunk fasteners.
4. After installation, test gate and operator. Open and close a minimum of five times. Correct deficiencies and adjust.
5. Touch-up damaged finish with paint supplied by manufacturer and matching original coating.

END OF SECTION 02823

SECTION 02900
LANDSCAPE

PART 1 - GENERAL

1.01 SCOPE

A. Furnish all labor, materials, equipment, and incidentals required for clearing and grubbing of existing vegetation and weed eradication in areas where new plantings are to be provided, bed preparation as specified herein and shown on the Drawings, providing trees, plants and ground covers where specified, maintenance of the work prior to Final Acceptance, repair and replacement of damaged landscape work, and all activities designated on the Project Schedule.

1.02 QUALITY OF WORK AND MATERIALS

A. The Contractor shall have minimum five years successful experience in the field and shall furnish all materials and perform all work in accordance with these Specifications, Drawings, and instructions provided by the Landscape Architect or Owner's representative hereafter also referred to as Landscape Architect. The work shall include everything shown on the Drawings and required by the Specifications and everything to which in the judgment of the Landscape Architect is incidental to what is shown on the Drawings or required by the Specifications. Workmanship and materials shall be of the best quality and shall be in strict accordance with the intention of the Drawings, Specifications and samples. The Contractor shall cooperate with the Landscape Architect so that no error or discrepancy in the Drawings or Specifications shall cause defective or inappropriate materials to be used or poor workmanship to be allowed and so that the work may proceed in the most efficient and effective manner.

1.03 WEATHER

A. Plant only during weather conditions favorable to landscape construction and to the health and welfare of plants. Contractor to notify Landscape Architect immediately if directed to commence planting operations in conditions detrimental to plant health.

1.04 PERCOLATION TEST

A. The Contractor shall be responsible for determining existing sub-surface drainage conditions for areas to be planted or sodded. The Contractor shall include as a part of his proposal the cost for making the following percolation tests in any area where he is uncertain about adequate sub-surface drainage. Report unacceptable areas to Landscape Architect/Owner's Representative for instructions.

B. Percolation tests shall be made as follows:

1. Wait at least 24 hours after rain and dig test pit 12-inches square or 13-1/2- inches in diameter to depth of bottom of plant bed and remove all loose soil. (If standing water is visible, notify Landscape Architect).
2. Quickly fill pit bottom with 6 inches (approximately 3-1/4 gallons) of water.
3. Record length of time from filling until disappearance of water and divide number of minutes by 6 to give average time of 1-inch fall.

4. Compare 1-inch time with following table:
   a. 1 inch in 0 - 3 minutes indicates rapid absorption
   b. 1 inch in 3 - 5 minutes indicates medium absorption
   c. 1 inch in 5 - 30 minutes indicates slow absorption
   d. 1 inch in over 60 minutes indicates impervious soil
5. In plant bed areas where sub-soil conditions do not percolate or the bed is enclosed by pavement, curbs, walks or other hard construction, the Contractor shall install a 4-inch drain line that allows the sub-surface of the bed to drain to the storm system or out to day light on the nearest slope.

1.05 SUBMITTALS

A. It is the responsibility of the Contractor, before ordering or purchasing materials, to provide two photographs of each tree type with description to the Landscape Architect for review and approval. Contractor shall tag and deliver trees that match approved sample photographs. Landscape Architect will decide final approval of all plant material on site.

B. The Contractor is to submit certification tags from trees, shrubs, seed, and sod verifying type and purity.

C. Materials: Samples of materials as listed below shall be submitted for inspection on the job site, or as otherwise determined by the Landscape Architect.

Material	Sample
Pine Straw	1 Bale
Topdressing Sand	1 Cup
Soil Amendment - Pine Bark Humus	1 Bag
Topsoil	1 Bag
Lime – pelletized	1 Bag
Fertilizer (as specified by soil tests for turf)	1 Bag
Seed (as specified on erosion plan)	1 Bag
Pre-emergent Herbicide	Brand name and contents

D. Soils test results: It is the responsibility of the contractor to obtain soils tests and submit results to the Landscape Architect with specific recommendations for soil amendments and fertilization as indicated by the soils tests. Where areas vary significantly in soil composition, slope, or watering schedule, separate tests are required for each area. The Contractor must specify the type of grass, trees and other plants to be installed in each area to be tested. Fertilizer specified for turf grasses will be applied at planting time. The Owner shall be informed of fertilizer specified for trees so that application can be made after the initial growing season when slow-release fertilizer in the root ball has been exhausted.

E. Plants shall be subject to inspection and approval at the place of growth, or upon delivery to the site, as determined by the Landscape Architect, for quality, size and variety. Such prior approval will not impair the right of inspection and rejection at the site during progress of the work or after completion, for size and conditions of balls or roots, latent defects or injuries. Rejected plants shall be removed immediately from the site. Notice requesting inspection should be submitted by the Contractor at least one week prior to anticipated date.

F. Typical samples shall be furnished from each separate source of supply. Approved samples shall be stored on the site and protected until furnishing of material is completed. Plant samples may be planted in permanent positions, but labeled as samples.

G. Upon approval of samples by the Landscape Architect, delivery of materials may begin.

H. Samples: Submit.

1.06 PLANT MATERIAL SIZE AND MEASUREMENT

A. Plants shall be measured when branches are in their normal position.

B. Shrubs shall meet the size requirements stated in the Plant List. The measurements are to be taken from the ground level to the average height of the shrub and not to the longest branch. Height and spread dimensions specified refer to the main body of the trees (measured from the crown of the roots to the tip of the top branch) and shall be not less than the minimum size designated.

C. Caliper measurements shall be taken at a point on the trunk six inches above natural ground line for trees up to four inches in caliper, and at a point 12 inches above the natural ground line for trees exceeding four inches in caliper.

D. If a range of size is given, no plant shall be less than the minimum size, and not less than 50% of the plants shall be as large as the upper half of the range specified.

E. The measurements specified are the minimum size acceptable and, where pruning is required, are the measurements after pruning.

F. All dimensions on Schedule shall be the minimum acceptable size. Plants larger in size than specified in the Plant List may be used if approved by the Landscape Architect. If the use of larger plants is approved, the ball of earth or spread of roots shall be increased in proportion to the size of the plant.

G. The minimum acceptable ball size for trees shall be 11-inch diameter per 1-inch caliper taken 6-inches above the ground for trees up to and including 4-inch caliper. Caliper shall be measured 12-inches above the ground for trees larger than 4-inch caliper. In special cases the ball size may be reduced as directed or approved by the Landscape Architect.

1.07 NOTIFICATION OF DELIVERY

A. Unless otherwise authorized by the Landscape Architect, the Contractor shall notify the Landscape Architect at least 48 hours in advance of the anticipated delivery date of any plant materials.

1.08 RIGHT OF REJECTION

A. The Landscape Architect reserves the right to inspect and reject plants at any time and at any place. Plants held on site for longer than 2 months must be approved by Landscape Architect before installation

1.09 MAINTENANCE

A. All planting shall be protected and maintained by the Contractor until time of final acceptance as defined in the guarantee. Maintenance shall include but is not limited to watering, weeding, cultivating, removal of dead material, resetting plants to proper grades or upright position, lawn mowing, fertilizing, and other necessary operations. The Owner is responsible for providing adequate maintenance during the warranty period. The Contractor shall submit, in writing, maintenance instructions for use by the Owner in caring for the plants.

1.10 PLANT GUARANTEE

A. All plants, grass, shrubs and trees shall be guaranteed to be alive and healthy two years after the date of final acceptance. The Owner is responsible for notifying Contractor of any plant, including grass, or tree that is dead or not showing satisfactory growth. After not more than a 90-day period following notification, said plant shall be replaced, or conditions contributing to unsatisfactory growth shall be corrected by Contractor. All replacements shall be of the original quality and shall be of a size equal to that attained by adjacent plants or trees of the same species. Replacement plant material shall be guaranteed to be alive and healthy at the beginning of the following growing season. Only one replacement will be required for each dead grass area. The number of replacements for other plant materials is not limited.

B. The guarantee may become void if it is determined that plant material death or unsatisfactory growth results from Owner negligence. The decision for determination of responsibility for damage shall rest solely with the Landscape Architect.

1.11 FINAL APPROVAL

A. The Landscape Architect shall have the final approval for acceptance of the landscaping.

PART 2 - PRODUCTS

2.01 GENERAL

A. Water: All water necessary for planting and maintenance shall be of satisfactory quality to sustain the growth of plants and shall not contain harmful, natural or man-made elements detrimental to plants. Water meeting the above standard shall be furnished by the Contractor and all arrangements for securing water and any expenses of transporting to the site and dispersal on the site shall be the responsibility of the Contractor.

B. Commercial Fertilizer: Provide a complete fertilizer, uniform in composition, dry and free flowing, delivered to the site in the original unopened containers, each bearing the manufacturer's statement of analysis, meeting all requirements specified in soils tests.

C. Lime: Shall be agricultural grade hydrated dolomitic lime, pelletized lime, and shall be of such fineness that 90% will pass through a No. 20 sieve and not less than 50% through a No. 50 sieve.

D. Soil Test: Revise fertilizer analysis, quantities of fertilizer and lime as dictated by soil tests made prior to planting.

E. Hardwood Mulch: Shall be aged for a minimum of three years and ground to a fine texture. Mulch shall be fresh, clean, free from sticks, cones, leaves and other debris.

F. Pine Straw Mulch: Shall be fresh, clean, free from sticks, cones, leaves and other debris. Pine straw mulch shall be used and maintained as a three-inch top dressing in all plant beds and around all trees planted by the Landscape Contractor. Single trees or shrubs shall be mulched to the outside edge of the saucer. Depth to be minimum three inches at final acceptance.

G. Topsoil: Where required shall be a natural, fertile, friable soil, possessing characteristics of representative productive soils in the vicinity. It shall be obtained from naturally well-drained areas, free from substances harmful to plant growth, and free from clay lumps, stones, stumps, roots, or similar substances two inches or more in diameter. The source and material shall be approved by the Landscape Architect before placing on site. Topsoil shall be free from noxious grass and weeds.

H. Peat Moss: Shall not be used.

I. Pre and Post emergent Herbicide: Contractor to have a licensed herbicide applicator with a minimum three years experience performing all herbicide applications to lawns, trees and shrubs. Herbicides shall be utilized employing Best Management Practices and only as necessary to control weeds in bed, tree plantings and turf areas, unless applicable codes or ordinances stipulate otherwise. Contractor is responsible to be familiar with all applicable local, state and federal codes, ordinances and regulations. No post or pre-emergent shall be applied to the soil until after all plant installation is complete and before mulching is installed.

J. Staking Material: Trees: Stakes for guying trees under shall be No. 2 Southern Pine, 2 x 2, 36-inch, pressure treated with waterborne preservative complying with AWPA standards U1-04 and T1-04, below ground contact standard, with ACQ minimum retention of 0.40 LB/cu ft.

K. Guying: ArborTie (tm) green or white staking and guying material is to be flat woven polypropylene material, ¾" wide, 900 lb. break strength. Arbortie shall be fastened to stakes in a manner which permits tree movement and supports the tree in accordance with manufacturer's instructions.

L. Seed: All seed shall be certified stock and appropriately labeled. Contractor shall deliver empty seed bags to Landscape Architect on site.

M. See Planting Plan and schedule for plants required. Quantities necessary to complete the work shown on the drawings shall be furnished. Although quantity estimates have been carefully made, the Landscape Architect assumes no liability for omissions or errors.

N. Plants that meet the requirements specified on the Plant List, but which do not possess a normal balance between height and spread will not be accepted. All plants shall be fresh dug, sound, healthy, vigorous, well branched and free of disease and insect egg and larvae and shall have adequate root systems. Trees for planting in rows shall be uniform in size and shape. All materials shall be subject to approval by the Landscape Architect. Where any requirements are omitted from the Plant List, the plants furnished shall be normal for the variety. Plants shall be pruned prior to delivery only upon the approval of the Landscape Architect.

O. Container Grown Material: All container grown materials shall be healthy, vigorous, well-rooted and established in the containers in which they are sold. They shall have tops which are of good quality and are in a healthy growing condition.

P. An established container grown plant shall be transplanted into a container and grown in that container sufficiently long for the new fibrous roots to have developed so that the root mass will retain its shape and hold together when removed from the container.

Q. The container shall be sufficiently rigid to hold the ball shape protecting the root mass during shipping.

R. Container stock shall be delivered to the site in first class condition. Plants shall have stakes in containers where required to support the plants. Plants furnished in containers shall not be handled by the stems, but only by the containers. Plants root bound in containers shall not be accepted.

2.02 QUALITY OF PLANTS

A. Plants shall in all cases conform with requirements of the following:

1. Trees and shrubs must comply with the standards found in the most recent edition of the American Standard for Nursery Stock (ANSI Z60.1), published by the American Nursery and Landscape Association (The Standard). If you need to purchase a copy of the Standard, contact ANLA Publications in Washington, DC at 202-789-5980, extension 3019.
2. Georgia State Plant Board Codes and Standards.
3. Georgia Nurseryman and Grower's Association Approved Planting Practices.
4. Bailey, Hortus III

B. Unless specifically noted otherwise, all plants shall be of selected specimen quality, exceptionally heavy, symmetrical, tightly knit, so trained or favored in their development and appearance as to be superior in form, number of branches, compactness and symmetry. All plants shall have a normal growth habit, be free of disease, show vigorous health and have a well developed root system.

C. Plants shall be free of disease, insect pests, eggs or larvae.

D. Plants shall not be pruned before delivery.

E. Trees with abrasion of the bark, sunscalds, disfiguring knots or fresh cuts of limbs over one and one-fourth inches which have not completely callused shall be rejected.

F. All plants shall be typical of their species or variety and shall have a normal habit of growth and be legibly tagged with the proper name. All plants shall have been grown under climatic conditions similar to those in the locality of the site of the project under construction or have been acclimated to such condition for at least two years.

G. The root system of each shall be well provided with fibrous roots. All parts shall be sound, healthy, vigorous, well-branched and densely foliated when in leaf.

H. Container stock shall be delivered to the site in first class condition. Plants shall have stakes in containers where required to support the plants. Plants furnished in containers shall not be handled by the stem, but only by the containers. Plants that are root bound by their containers shall not be accepted.

I. Balled and burlapped plants (BB) shall be dug with firm, natural balls of soil and of sufficient size to encompass the fibrous and feeding roots of the plants. No plants moved with a ball shall be planted if the ball is cracked or broken, except upon special approval. Plants balled and burlapped shall be handled by the stems.

J. Plants marked "BR" in the Plant List shall be dug with bare roots. The roots shall not be cut within the minimum spread specified in the Plant List. Care shall be exercised that the roots do not dry out in moving.

PART 3 - EXECUTION

3.01 GENERAL

A. Planting operations shall be conducted under favorable weather conditions preferably during the period from October 1 to March 15. The Contractor has the option and assumes full responsibility for planting in unseasonable conditions.

B. Planting of grass shall be accomplished during recommended season dependent on specified grass and planting method.

C. Protect roots or balls of plants at all times from sun and drying winds, water and freezing, as necessary until planting.

3.02 PROTECTION

A. Before commencing work, all trees and shrubs which are to be saved must be protected from damage by the placement of fencing flagged for visibility or some other suitable protective procedure approved by the Owner. No work may begin until this requirement is fulfilled.

B. In order to avoid damage to roots, bark or lower branches, no truck or other equipment shall be driven or parked within the drip line of any tree, unless the tree overspreads a paved way.

C. The Contractor shall use any and all precautionary measures when performing work around trees, walks, pavements, utilities, and any other features either existing or previously installed under this Contract.

D. The Contractor shall adjust depth of earthwork and loaming when working immediately adjacent to any of the aforementioned features in order to prevent disturbing tree roots, undermining walks and pavements, and damage in general to any existing or newly incorporated item.

E. Plants transported to the project in open vehicles shall be covered with tarpaulins or other suitable covers securely fastened to the body of the vehicle to prevent injury to the plants. Closed vehicles shall be adequately ventilated to prevent overheating of the plants. Evidence of inadequate protection following digging, carelessness while in transit, or improper handling or storage shall be cause for rejection. All plants shall be kept moist, fresh, and protected. Such protection shall encompass the entire period during which the plants are in transit, being handled, or are in temporary storage.

3.03 PLANTING PROCEDURE

A. Cleaning Up Before Commencing Work: The Contractor shall clean up work and surrounding areas of all rubbish or objectionable matter. All mortar, cement and toxic material shall be removed from the surface of all plant beds. They must not be stirred with the soil. Extensive clean up work will not be required under this Contract. Should the Contractor find such conditions beneath the soil which shall in any way adversely affect the plant growth, he shall immediately call it to the attention of the Landscape Architect. Failure to do so before planting shall render the Landscape Contractor liable for subsequent problems arising from unacceptable subsoil conditions. Use approved herbicide to eliminate temporary plant material as directed.

B. Moving Plants: When trees and smaller plants are moved, the root ball should always be supported. Trees and shrubs should never by handled by the trunk.

C. Stake Out: Stake tree or plant locations and secure approval of them from the Landscape Architect before digging pits, and make adjustments as directed. Locate no tree closer than two feet from pavement or structures.

D. Planting Pit Size: For ball up to two feet in diameter shall be twice the diameter of the ball. Diameter of hole for ball two feet and greater shall be two feet larger in diameter than diameter of ball. Excavate pits with vertical sides.

E. Planting Soil Mixture: For trees shall consist of 1/3 topsoil and 2/3 thoroughly pulverized existing soil mixed with fertilizer and lime if specified in soil test results.

F. Large Plastic Containers: After approval of plant location and orientation by Owner or Owner's representative, cut off bottom of containers over 5 gallons, place plant and containers in planting hole, cut the container on two sides, removing the remaining part of the container. Examine roots to insure that roots have not begun to circle the container. If roots have begun to circle the plant, Contractor may realign the roots in the hole. If root circling is too severe, plant must be rejected and returned to supplier.

G. Wire Baskets: After placing in planting hole and obtaining approval of plant location and orientation by Owner or Owner's representative, remove all twine and rope used to secure wire basket and burlap. Push the wire to the bottom of the root ball. Fill planting pit to two thirds depth with approved planting soil then slit and remove all burlap from the top of the ball at least 1/3 of the way down sides or further as possible. Backfill and cover top of ball with mulch.

H. Trees and Shrubs: Trees shall be set straight and at such level that after settlement the plant crown shall be a minimum of 2 inches above grade. Trees with a ball size of 24" or larger shall be set 4" above grade to allow for settlement. Shrubs shall stand 1 inch – 2 inches above grade mounded. Each plant shall be set in the center of the pit. Backfill mixture shall be thoroughly tamped around the ball and shall be settled by water after tamping. A water holding saucer shall be formed with extra soil. Do not handle the tree by the trunk or use the trunk to straighten or adjust the location. (See Details)

I. Fill: Fill hole with soil mixture and fertilizer as required. Pack lightly with feet. Add more soil. Do not cover top of ball with soil, only with mulch. Make sure no burlap is exposed since exposed burlap acts as a wick causing excessive loss of water.

J. Water Basin: Build basin around all plants or trees which stand alone and are not in larger mulched beds. A water holding earth dam shall be built on the outside of the hole to form a basin to hold water; it shall be 4 – 6-inches high of soil firm enough to remain in place. If necessary, bring in soil. See Detail.

K. Pruning: Each tree shall be pruned to preserve the natural character of the plant as directed by the Landscape Architect. All soft wood or sucker growth and all broken or badly damaged branches shall be removed with a clean cut.

L. Guying or Staking: Shall be done immediately after planting. Trees shall stand plumb after staking or guying in accordance with the Drawings.

3.04 FINISH GRADING

A. Prior to applying mulch, plant beds shall be stirred 3-inches deep to loosen soil mixture. Fine grade areas until all bumps and depressions are removed and until the grade conforms to requirements of the grading plan. Eliminate any water pockets and verify surfaces drain away from all buildings. The minimum surface slope of plant beds shall be four percent. Minimum surface slope in lawn areas shall be two percent.

3.05 WEED CONTROL (HERBICIDE)

A. Immediately after planting and before applying the mulch, apply pre emergent herbicide per manufacturer's instructions. Apply to all plant beds. Protect lawns, annual beds, ferns, meadow areas and any other susceptible plants. Do not apply within 50 feet of any wetland, stream, lake or other body of water. Do not apply to wet foliage.

3.06 MULCHING

A. On completion of planting, all trees, shrubs and ground cover areas shall be mulched with 3-inch layer of pine straw. All annual beds shall be covered with 2-inch layer of pine bark mini-nuggets.

3.07 TURF

A. General: Includes soil preparation, applying fertilizer, planting and maintenance as required to produce an acceptable stand of grass on areas shown on planting plan.

1. Any damage to planting soil by erosion, construction equipment, construction operations, or other damage shall be repaired prior to application of fertilizer. Finished surface shall be smooth and even.

B. Soil Preparation: After the area to be grassed has been brought to finished grade, prepare the soil by thoroughly loosening the area by plowing, discing, harrowing, or scarifying until these areas are friable, well pulverized and acceptable to the Landscape Architect. Any irregularities in the surface resulting from the above operation or from other operations by the Contractor shall be smoothed out before any subsequent operations are begun. All roots and stones larger than 1-1/2-inch in any dimension, stumps and other foreign material detrimental to final grading, proper bonding, the rise of capillary moisture, or the proper growth of the desired plantings shall be removed.

1. The completed surface shall conform to the finished grades or subgrades shown and shall have a smooth pulverized surface at the time of planting. Any irregularities shall be corrected before the lime and fertilizer are placed.
2. Spread lime and fertilizer over the prepared surface before turning. Fertilizer and lime shall be sufficient to correct irregularities in the soil based on soil tests for the specified turf. Turn the soil one last time the day before planting or placing sod.

C. Sodding

1. Sod is to be blue tag certified for species designated on Drawings.
2. Sod is to be installed from sod rolls: min. width is to be 42-inches and minimum length is to be 30 feet. Owner's Representative will reject any sod segments less than 30 feet in length.
3. Prepare planting bed as described for seeded areas except that fine graded soil shall be 1 inch below finished grade established by the grading plan.
4. Stored sod of the species required in the Schedule shall be kept moist prior to laying. Wet all areas prior to sodding.
5. Unroll the sod on the prepared soil. Lay the strips parallel with the strip ends staggered as in bricklayers' running bond pattern. Press each successively laid strip snugly up against the one next to it. Fill cracks, holes, joints with clean, loose sand, free of all grass and plant seeds. Owner's Representative to be the sole judge of acceptance.
6. Watering, fertilizing and rolling shall be done by the Contractor as described under "Maintenance of Sodded Areas" below.

D. Maintenance of Sodded Areas: The Contractor shall be responsible for maintaining sodded areas by properly watering, weeding and mowing the grass until an acceptable stand has been produced, and been accepted by the Owner and a minimum of 30 days thereafter.

1. A stand shall be considered acceptable when 95% of the total sodded area has been covered with grass and no bare areas greater than one square foot exist. All cracks, joints, dips, pits and other irregularities in the surface must have been corrected by top dressing with sand.
2. The Contractor shall be responsible for resodding all bare areas greater than one square foot with the specified mixture and for repairing and resodding wash-outs and eroded areas to the original finished grade.
3. Sodded areas shall be mowed when the grass attains a height of 2 inches and as required thereafter until the acceptance of the stand. Reel type mowers, kept well sharpened, shall be used. Turf shall not be accepted until all sod has knitted together and tacked to the soil.
4. All lawn areas shall be given a top dressing of fertilizer to provide 100 pounds available nitrogen per acre when the grass has attained a satisfactory growth and the first mowing has been performed. Nitrogen shall be derived from Ammonium Nitrate or Nitrate of Soda.
5. Contractor shall be responsible to administer a final top dressing of the turf to fix all dips, pits, cracks, etc., for up to 6 months after final acceptance.

E. Seeding

1. Area: All exterior ground within the limit of contract, except surfaces occupied by buildings, structures, paving, and except areas indicated to be undisturbed or mulched, shall be seeded or planted as shown on Drawings.
   a. Furnish topsoil.
   b. Finish grading.
   c. Prepare seed bed.
   d. Seed and maintain areas as indicated on the Drawings.
2. Seed bed preparation: Grade areas to finish grades, filling as needed or removing surplus dirt and floating areas to a smooth, uniform grade as indicated on grading plans. All lawn areas shall slope to drain. Where no grades are shown, areas shall have a smooth and continual grade between existing or fixed controls (such as walks, curbs, catch basins, elevational steps or buildings) and elevations shown on plans. Roll, scarify, rake and level as necessary to meet approval of the Landscape Architect, before grass seed is sown. Loosen soil to a depth of six inches in lawn areas by approved method in the specifications and grade to remove ridges and depressions. Remove stones or foreign matter over two inches in diameter from the top two inches of soil. Float lawn areas to approximately finish grades.
3. Seed beds should be permitted to settle or should be firmed by rolling before seeds are broadcast.
4. Seeding should not be performed in windy weather.
5. Seeding shall be done in two directions at right angles to each other.
6. Lawn areas shall be seeded by sowing evenly with an approved mechanical seeder at the rate of a minimum of three pounds per 1,000 square feet. Culti-packer or approved similar equipment may be used to cover the seed and to form the seed bed in one operation. In areas inaccessible to culti-packer, the seeded ground shall be lightly raked with flexible rakes and rolled with a water ballast roller. After rolling, seeded areas are to be lightly mulched with wheat straw.
7. If the Project completion date prohibits in-season planting, the Contractor shall prepare for out-of-season seeding or sodding so that all lawns shall be completed and ready for acceptance at time of Project completion, without additional cost to the Owner. Lawn maintenance shall be the same as for other planting.
8. Lawns shall be maintained by the Contractor for at least 30 days after sodding and 60 days after seeding, or as long as is necessary to establish a uniform stand of the specified grasses, or until substantial completion of the Project or until acceptance of lawns, whichever is later.
9. In the event that lawn operations are completed too late in the fall for adequate germination and/or growth, maintenance shall continue into the following growing season or until a uniform stand of the specified grasses has been established.
10. Water seeded areas twice the first week to a minimum depth of six inches with a fine spray and once per week thereafter as necessary to supplement natural rain to the equivalent of one inch or to a six-inch depth.
11. The surface layer of soil for seeded areas must be kept moist during the germination period. After first cutting, water as specified above.
12. Make weekly inspections to determine the moisture content of the soil and adjust the watering schedule established by the irrigation system installer to fit conditions.

13. After grass growth has started all areas or parts of areas which fail to show a uniform stand of grass for any reason whatsoever shall be reseeded in accordance with the plans and as specified herein. Such areas and parts of areas shall be reseeded repeatedly until all areas are covered with a satisfactory growth of grass at no additional cost to the Owner.

14. Watering shall be done in such a manner and as frequently as is deemed necessary by the Contractor to assure continued growth of healthy grass. All areas of the site shall be watered in such a way as to prevent erosion due to excessive quantities applied over small areas and to avoid damage to the finished surface due to the watering equipment.

15. Water for the execution and maintenance of this work shall be provided by the Owner at no expense to the Contractor. The Contractor shall, however, furnish his own portable tanks, pumps, hose, pipe, connections, nozzles, and any other equipment required to transport the water from the available outlets and apply it to the seeded areas in an approved manner.

16. Mowing of the seeded areas shall be initiated when the grass has attained a height of one and one-half to two inches. Grass height shall be maintained between one and one-half inches at subsequent cuttings depending on the time of year. Not more than one third of the grass leaf shall be removed at any cutting and cutting shall not occur more often than ten days apart.

17. When the amount of invading grass is heavy, it shall be removed to prevent destruction of the underlying turf. If weeds or other undesirable vegetation threaten to smother the planted species, such vegetation shall be mowed or, in the case of rank growths, shall be uprooted, raked and removed from the area by methods approved by the landscape architect.

18. Protect seeded areas against trespassing while the grass is germinating. Furnish and install fences, signs, barriers or any other necessary temporary protective devices. Damage resulting from trespass, erosion, washout, settlement or other causes shall be repaired by the Contractor at his expense.

3.08 CLEANING

A. Perform cleaning during installation of the work and upon completion of the work, remove from site all excess materials, debris and equipment. Repair damage resulting from landscape operations.

B. After all work has been completed and all soil settled and final finished grading completed, clean-up and adjustments shall be made to insure proper depth of topsoil, proper drainage, proper grades adjacent to walks and curbs, proper slope of plant beds, etc. Remove any soil, mulch or plant materials from walks and paving, leaving the areas broom clean.

END OF SECTION 02900