

**SECTION 02200  
EARTHWORK**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. The work of this section includes, but is not limited to:
1. Excavation and backfill for structures
  2. Dewatering
  3. Sheeting and shoring
  4. Site grading
  5. All work in the State Highway Right-of-Way shall be in accordance with the specifications included in the Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, dated July 2008. Work not in the State Highway Right-of-Way shall be in accordance with this specification section.
- B. Related Work Specified Elsewhere
1. Section 02100 - Clearing and Grubbing
  2. Section 02221 - Trenching, Backfilling & Compacting
  3. Section 02850 - Finish Grading and Seeding
  4. Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, dated July 2008
- C. Classification of Excavation
- All excavation work under this Contract shall be unclassified, and includes excavation and removal of all soil, fill, and all other materials encountered of whatever nature.

**1.02 QUALITY ASSURANCE**

- A. Testing Agency: Density testing will be performed by an independent soils testing laboratory engaged and paid for by the Contractor.
- B. Referenced Standards
1. American Society for Testing and Materials (ASTM)

- a. D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort

### **1.03 JOB CONDITIONS**

- A. The locations shown for utility facilities are approximate. Proceed with caution in the areas of utility facilities and expose them by hand or other excavation methods acceptable to the utility owner.
- B. Erect sheeting, shoring, and bracing as necessary for protection of persons, improvements, and excavations.
- C. Furnish and maintain barricades, signs and markings for excavated areas.
- D. Select and install a system of dewatering to accomplish groundwater control in excavations.
- E. Preserve, protect and maintain operable existing drainage ways, drains and sewers.

### **1.04 SUBMITTALS**

- A. General: Submit in accordance with Section 01300.
- B. Certificates
  - 1. Submit a Certificate of Compliance, together with supporting data, from the materials supplier attesting that the composition analysis of backfill materials meets specification requirements.
  - 2. Compaction Equipment List: Submit a list of all equipment to be utilized for compacting, including the equipment manufacturer's lift thickness limitations.
  - 3. Submit certified density testing results from the soils testing laboratory.

## **PART 2 - PRODUCTS**

### **2.01 MATERIALS - GENERAL**

- A. On-site or imported natural soils as approved by Engineer.
- B. Load bearing fill is defined as earth fill or rock fill required for bearing loads imposed by structures, or pavement subject to motor traffic and all earth materials necessary to raise the grade from an existing elevation or prepared foundation elevation to the finished elevation in a designated fill area which cannot tolerate settlement.
- C. Nonbearing fill shall be free of roots, rock larger than 3" in size and building debris, capable of minimum 90% compaction at optimum moisture content.

**2.02 MATERIALS FOR BACKFILLING, LOAD BEARING FILLS OR EMBANKMENTS**

- A. Well-graded soil aggregate mixture consisting of Groups SW, SC, and SP soils of the Unified Soils Classification.
- B. Total content of gravel or rock fragments larger than ¾" shall not exceed 30% by weight of the mass.
- C. Backfill shall not contain topsoil, organic matter, debris, cinders, or frozen material.

**2.03 PERVIOUS MATERIAL**

- A. Compacted stone under slabs.
- B. Stone shall be granular material and shall comply with AASHTO #57, Section 901 of Maryland Department of Transportation State Highway Administration Standard Specifications.
- C. Pervious stone fill shall be provided beneath all concrete tanks having groundwater pressure relief valves as shown on the drawings.
- D. Pervious stone fill shall be provided beneath all concrete tanks that do not have groundwater pressure relief valves as shown on the drawings.

**2.04 SELECT STONE FILL**

- A. Compacted in areas of over excavation in load bearing areas.
- B. Crushed stone or gravel aggregate conforming to Fine Aggregate, Section 901, Table 901A of Maryland Department of Transportation State Highway Administration Standard Specifications.

**2.05 GEOTEXTILE FABRIC**

Geotextile fabric, also referred to as filter cloth, is to be installed under pervious material (stone under slab). The filter cloth shall be placed over the newly exposed subgrade or over the select stone backfill, prior to placement of pervious material, and shall conform to the following requirements:

Fabric Property	Test Method	Minimum Value
Grab tensile strength	ASTM D1682	400 x 250 lb.
Grab tensile elongation	ASTM D1682	35 lb.
Trapezoidal tear strength	ASTM D3786	110 x 55 lb.
Mullen burst strength	ASTM D3786	490 psi
Puncture strength	ASTM D3787	130 lb.
Abrasion Resistance	ASTM D3884	155 lb.
Coef. of permeability, K	CFMC-GET-2	.015 cm/sec
Water flow rate	CFMC-GET-2	60 gal./min./sf
EOS	COE-CW-02215	70-100 US Std. Sieve

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<b>Fabric Property</b>	<b>Test Method</b>	<b>Minimum Value</b>
Open area	COE Method	4.3%
Ultraviolet resistance	ASTM G26/D1682	90%

## **2.06 SOURCE OF MATERIALS**

- A. Use materials for fill which were excavated for the construction of structures or utilities on the project site if they meet the requirements specified herein. If sufficient material meeting these requirements is not available from required excavation, obtain requisite material from other sources.
- B. Use only material which has been approved as to quality, location of source and zone of placement in the fill.
- C. The Engineer has the right to reject material at the job site by visual inspection, pending sampling and testing.

## **2.07 TESTS**

- A. The Contractor shall hire an independent inspection agency and testing laboratory for inspection and testing of soils and compaction. The agency's responsibilities shall include:
  - 1. Inspection of exposed subgrade prior to preparation of site.
  - 2. Testing and approving all materials used for fill and/or backfill and borrow.
  - 3. Maintaining accurate records in regard to excavation and fill or backfill for ordered undercutting or over-excavation.
  - 4. Approving all backfilling procedures and mechanical compaction equipment.
  - 5. Verifying compaction by in-place density tests. Tests to be submitted to the Engineer for review. A minimum of one (1) density test per ASTM D 1557 shall be performed for each 5,000 square feet of lift area or pavement area or more often if directed by the inspection agency. At least one density test per ASTM D 1557 shall be performed per lift in structural areas or more often if directed by the inspection agency.
  - 6. Observe and inspect all proof rolling operations and determine whether additional excavation and backfilling is required. Inspect and test excavation for structure footings to determine that the design bearing pressures are available and that no voids, loose or soft pockets exist beneath the bearing surface. Approve the bearing surfaces or recommend undercutting and structural fills as necessary.
  - 7. Submitting weekly written reports as to the status of the backfill or fill.
  - 8. Submit a final report indicating that the backfill or fill meets the requirements of the Specifications.

9. Determine all earthwork quantities for which unit price payments apply.
- B. It shall be the responsibility of the Contractor to notify the inspection agency three (3) days prior to the beginning of work so that the inspection agency can have a soils technician on the site during the work. The Contractor shall pay for all costs of this inspection service.
- C. No backfill or fill to support structures or pavements shall be placed or compacted except in the presence of a qualified representative of the independent testing agency.

### **PART 3 - EXECUTION**

#### **3.01 PREPARATION AND LAYOUT**

- A. Establish and identify required lines, levels, contours and datum.
- B. Maintain bench marks, monuments and other reference points.
- C. Protect trees, shrubs, lawns and other features remaining as portion of final landscaping.

#### **3.02 ROUGH GRADING**

- A. Rough grade to uniform contours; form foundations for embankments and load bearing fills.
- B. Construct the finished subgrade to vary not more than 1" above or below the elevation shown.
- C. Rough grade to prevent ponding of water in any area; install temporary swales if necessary to improve surface drainage.
- D. Complete embankment slopes to vary not more than 6" from the slope line shown.
- E. In situ areas indicating sponginess and instability during earth moving operations shall be excavated and prepared to receive acceptable fill materials as specified; material excavated due to unsuitability shall be removed from site.
- F. Excavated subsoil materials to be used for fill materials shall be approved by Project Engineer; materials rejected by Project Engineer shall be removed from the site.

#### **3.03 FOUNDATION PREPARATION OF LOAD BEARING AREAS**

- A. A load bearing area is defined as an area supporting loads of a structure or pavement area subject to motor traffic.
- B. The entire exposed natural soil of the load bearing area shall be proof-rolled with no less than 10 complete coverage's of vibratory compaction equipment (minimum of

(1) 10,000 lb. smooth drum roller capable of a combined active and passive pressure of 30,000 pounds); all soft spots or irregularities within the natural soil, disclosed as the proof-rolling progresses, shall be excavated to sound material and then backfilled or leveled to grade as hereinafter specified; Project Engineer shall be so advised by Contractor that additional excavation is necessary to achieve satisfactory proof-rolling; additional excavation required will be paid for by a Change Order.

- C. Backfill in load bearing areas shall be select stone fill.
- D. All backfill shall be compacted to 95% of maximum density at  $\pm 2\%$  optimum moisture as determined by ASTM D1557.
- E. Conduct load bearing testing to demonstrate compliance with load bearing design criteria shown in 03400.

### **3.04 SHORING, SHEETING AND BRACING**

- A. Install shoring, sheeting and bracing to comply with Federal, State and local code requirements. Responsibility for the safety of the work, personnel and structures rests solely with the Contractor.
- B. Carry the bottom of the support system to depth below the main excavation, adequate to prevent ground movement.
- C. Follow the excavation closely with sheeting and shoring placement.
- D. Perform excavation for the installation of sheeting carefully to minimize the foundation of voids.
- E. If unstable material is encountered during excavation, take measures to contain it in place and prevent ground displacement.
- F. Have sufficient quantity of material on hand at all times for sheeting, shoring, bracing and other operations for the protection of the work and for use in case of accident or emergency.
- G. Leave sheeting and shoring in place as long as possible, compatible with the placing and compacting of backfill.

### **3.05 EXCAVATION - GENERAL**

- A. Excavate to the neat lines or setback lines for mixed face conditions and grades indicated on the Contract Drawings.
- B. Excavate in sequence and stages which will not subject permanent or temporary structures, installations, or surfaces to unstable conditions.
- C. Excavate as required to provide sufficient working space to permit placing, inspection, and completion of the structures.

- D. Shape excavations accurately to the cross-sections and grades indicated.
- E. Support the sides of excavations as specified or required.
- F. Keep excavations free from water.
- G. Where excess excavation is required to remove unsuitable material at bottom of foundation or structure excavations, fill to foundation/structure bearing or bottom of pervious material elevation with select stone fill material; properly compact select stone fill by methods acceptable to the Project Engineer to 95% of the maximum density at  $\pm 2\%$  of the optimum moisture as determined by modified proctor test.
- H. If rock is exposed at design footing grades, the rock shall be over-cut one foot and replaced with select stone fill.
- I. Fill all openings and fractures in the excavation bottom and sides with cement grout. Obtain Project Engineer's written approval of the foundation excavation before placing any foundation stone bedding or construction concrete.
- J. The Contractor's failure to maintain dewatering operations for structure excavations shall not be a basis for payment for removal and replacement of unsuitable materials.

### **3.06 EXCAVATION WITHIN LOAD BEARING FILL AREAS**

- A. After completion of the fill placement and compaction specified under this Specification and as approved by the Project Engineer, footing excavation can begin.
- B. Footing Inspections: The Project Engineer shall inspect the footing excavations for the building foundations; he shall verify that the design bearing pressures are available and that no loose pockets exist beneath the bearing surfaces of the footing excavations.
- C. Backfilling:
  - 1. Any excavation (such as for utilities, walls, footings, etc.) done within the controlled fill area shall be backfilled with controlled fill material with placement and compaction as described in this Section.
  - 2. Where controlled backfill is placed against walls, either (1) the difference in elevation of the top of the controlled fill on either side of the wall shall not be allowed to exceed 1'-0" or (2) the wall shall be adequately braced.

### **3.07 BLASTING**

No blasting will be permitted.

### **3.08 BACKFILL STRUCTURES**

- A. Do not commence backfilling around any structure until such structure has been examined and approved by the Project Engineer.
- B. Do not place backfill until the requirements for concrete curing and waterproofing have been complied with and, if required, until the test cylinders for the particular structure indicate that the concrete has attained the compressive strength specified.
- C. When backfilling against structures and where applicable, place backfill material in equal lifts and to similar elevations on opposite sides of structures in order to equalize opposing horizontal pressures. Place material in uniform increments over fill area.
- D. Protect structures from damage by construction activity, equipment, and vehicles. Repair or replace damaged structures to the satisfaction of the Owner.
- E. Backfill shall be compacted to 95% of maximum density at  $\pm 2\%$  optimum moisture as determined by ASTM D1557.

### **3.09 DISPOSAL OF EXCAVATED MATERIAL**

Surplus excavated materials shall become the property of the Contractor and be removed from the project site. Surplus excavated materials is defined as: 1. Excess excavated unsuitable materials, and/or 2. Excess excavated suitable materials.

### **3.10 MOISTURE CONTROL**

- A. Control moisture content of fill materials to  $\pm 2\%$  of the optimum moisture content as determined by ASTM D1577; material that is too wet may be spread and scarified on the fill surface and permitted to dry, until the moisture content is within specified limits; when fill material is too dry, sprinkle each layer of the fill and work moisture into the material until a uniform distribution within the specified limits is obtained; if, in the opinion of the Project Engineer, the top surface of a partial fill section becomes too dry to permit a suitable bond, scarify loosen the dried surface, dampen the loosened material and compact the moistened material.
- B. Keep the top plane of load bearing fill areas under construction sloped for drainage; when rain or inclement weather is expected, flat roll the top of embankment to seal it.

### **3.11 SURFACE DRAINAGE**

- A. Intercept and divert surface drainage away from the excavation by the use of dikes, curb walls, ditches, pipes, sumps or other means.
- B. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.
- C. Remove the surface drainage system when no longer required.



- D. Remove debris and restore the site or sites to original condition.

### **3.12 DRAINAGE AND DEWATERING OF EXCAVATED AREAS**

- A. Provide and maintain ditches to collect surface water and seepage which may enter the excavations and divert.
- B. Install a dewatering system to keep excavations dry and free of water.
- C. Maintain water level below subgrade until concrete work or backfill, or both, have been completed to offset uplift pressures.
- D. Dispose of precipitation and subsurface water clear of the work. Comply with provisions of the Sediment and Erosion Control Plan.
- E. Backfill drainage ditches and sumps when no longer required with granular material or other material as approved by the Project Engineer.

### **3.13 FINISHING**

- A. On completion of the work, clean ditches and channels and finish the site in a neat and presentable condition. Slope areas to provide positive drainage.
- B. Place topsoil and seed all areas disturbed by construction as specified in Section 02485, Finish Grading and Seeding, unless otherwise indicated.

### **3.14 PLACEMENT OF PERVIOUS MATERIAL - STONE UNDER SLAB**

- A. Grade pervious material smooth and even, free of voids, compacted, and to required thickness and elevation; provide final grades within a tolerance of  $\frac{1}{2}$ " when tested with a 10-foot straightedge.
- B. Compaction shall continue until all compaction marks are eliminated and the course is thoroughly and properly compacted.

**END OF SECTION 02200**

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**SECTION 02221  
TRENCHING, BACKFILLING AND COMPACTING**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. The Work Of This Section Includes, But Is Not Limited To:
1. Trench excavation, backfill and compaction
  2. Support of excavation
  3. Pipe bedding requirements
  4. Control of excavated material
  5. Restoration of unpaved surfaces
  6. All work in the State Highway Right-of-Way shall be in accordance with the specifications included in the Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, dated July 2008.
- B. Related Work Specified Elsewhere
1. Section 02100 - Clearing and Grubbing
  2. Section 02220 - Earthwork
  3. Section 02850 - Finish Grading and Seeding
  4. Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, dated July 2008
- C. Applicable Standard Details
1. Pipe Bedding Details
  2. Pipe Trench Detail
  3. Concrete Cradle and Encasement Details
  4. Thrust Block for Vertical Bends
  5. Thrust Block for Bends, Tees, and Caps

## 1.02 QUALITY ASSURANCE

- A. Testing Agency: Density testing shall be performed by an independent soils testing laboratory engaged and paid for by the Contractor and approved by the Engineer.
- B. Referenced Standards
  - 1. American Society For Testing And Materials (ASTM)
    - a. D698 Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort
    - b. D1556 Test Method for Density and Unit Weight of Soil in Place by the Sand Cone Method
    - c. D1557 Test Method for Laboratory Compaction Characteristics of Soil Using Modified Effort
    - d. Test Methods for Density of Soil and Soil Aggregate in Place by Nuclear Methods
- C. Density Testing
  - 1. Conduct ten density tests plus one test for each 1,000 linear feet of pipeline. Conduct density tests at locations as directed by the Engineer during backfilling operations.
  - 2. Determine density by ASTM D1556 or ASTM D2922 in areas other than state highways and shoulders.

## 1.03 SUBMITTALS

- A. General: Submit in accordance with Section 01300.
- B. Certificates
  - 1. Submit, prior to delivery of the material to the job site, a Statement of Compliance from the materials supplier, together with supporting data, attesting that the composition analysis of pipe bedding and select material stone backfill materials meets specification requirements. Should a change in source of materials be made during construction, submit a new Statement of Compliance from the new source for approval before the material is delivered to the job site.
  - 2. Submit certified density testing results from the soils testing laboratory.
- C. Compaction Equipment List: Submit a list of all equipment to be utilized for compacting, including the equipment manufacturer's lift thickness limitations.

- D. Agreements with Property Owners: Prior to storing or disposing of excavated materials on private property, submit a copy of the written agreement with the property owner.
- E. Contractor to provide to the Engineer for review and approval a grain size distribution curve, result of Atterberg limit testing, and ASTM D1557 Modified Proctor test results prior to delivery of select soil at the project site. Classification testing indicated above shall be provided for each on-site and borrow source proposed to be used as select borrow.

#### **1.04 JOB CONDITIONS**

- A. Classification of Excavation: All excavation work performed under this contract is unclassified, and includes excavation and removal of all soil, shale, rock boulders, fill, and all other materials encountered of whatever nature.
- B. Protection of Existing Utilities and Structures:
  - 1. Take all precautions and utilize all facilities required to protect existing utilities and structures. Advise each Utility at least 3 working days in advance of intent to excavate, do demolition work and give the location of the job site. Request cooperative steps of the Utility and suggestions for procedures to avoid damage to its lines.
  - 2. Advise each person in physical control of powered equipment used in excavation or demolition work of the type and location of utility lines at the job site, the Utility assistance to expect, and procedures to follow to prevent damage.
  - 3. Immediately report to the Utility and the Engineer any break, leak or other damage to the lines or protective coatings made or discovered during the work and immediately alert the occupants of premises of any emergency created or discovered.
  - 4. Allow free access to Utility personnel at all times for purposes of maintenance, repair and inspection.

### **PART 2 - PRODUCTS**

#### **2.01 PIPE BEDDING MATERIAL**

Type II and Type IV Bedding Material: Crushed stone or gravel aggregate conforming to AASHTO No. 8.

#### **2.02 BACKFILL MATERIAL**

- A. Select Material Backfill: Crushed stone or gravel aggregate conforming to Fine Aggregate, Section 901, Table 901A of Maryland Department of Transportation State Highway Administration Standard Specifications or a select soil with a maximum dry density of at least 105-pcf in accordance with ASTM D1557, maximum

percent passing the No. 200 sieve of 30-percent, maximum liquid limit of 34, and a maximum plasticity index of 7.

B. Suitable Backfill Material

1. From top of pipe bedding material to 24" over top of pipe

a. Material excavated from the trench if free of stones larger than 2" in size and free of wet, frozen, or organic materials.

2. From 24" above pipe to subgrade elevation

a. Material excavated from the trench if free of stones larger than 8" in size and free of wet, frozen, or organic materials.

C. Unsuitable Backfill Material: where the Engineer deems backfill material to be unsuitable and rejects all or part thereof due to conditions prevailing at the time of construction, remove the unsuitable material and replace with select material stone backfill as specified in paragraph 2.02A or suitable foreign backfill material.

### **PART 3 - EXECUTION**

#### **3.01 MAINTENANCE AND PROTECTION OF TRAFFIC**

A. See Maryland Department of Transportation State Highway Administration, Standard Specifications for Construction and Materials July 2008.

B. Maintain access to all streets and private drives.

C. Provide and maintain signs, flashing warning lights, barricades, markers, and other protective devices as required to conform with construction operations and to keep traffic flowing with minimum restrictions.

D. Comply with State and local codes, permits and regulations.

#### **3.02 CUTTING PAVED SURFACES**

A. Where excavation includes breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the centerline of the trench. Cut offsets at right angles to the centerline of the trench. Saw cut concrete surfaces; saw cut other hard surfaces or make straight cuts with jackhammer. No paving shall be broken except that which has been previously cut.

B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.

#### **3.03 BLASTING**

No blasting will be permitted.

#### **3.04 TRENCH EXCAVATION**

- A. Topsoil Stripping and Stockpiling: Strip topsoil encountered during trench excavation to its full depth and stockpile for reuse.
- B. Depth of Excavation
  - 1. Gravity Pipelines: Excavate trenches to the depth and grade shown on the profile drawings for the invert of the pipe plus that excavation necessary for placement of pipe bedding material.
  - 2. Pressure Pipelines:
    - a. Excavate trenches to the minimum depth necessary to place required pipe bedding material and to provide 4' from the top of the pipe to the finish ground elevation, except where specific depths are otherwise indicated on the Contract Drawings.
    - b. Where unsuitable bearing material is encountered in the trench bottom, continue excavation until the unsuitable material is removed, solid bearing is obtained or can be established, or concrete cradle can be placed. If no concrete cradle is to be installed, refill the trench to required pipeline grade with pipe bedding material.
    - c. Where the Contractor, by error or intent, excavated beyond the minimum required depth, backfill the trench to the required pipeline grade with pipe bedding material.
- C. Width of Excavation
  - 1. Excavate trenches to a width necessary for placing and jointing the pipe and for placing and compacting bedding and backfill around the pipe.
  - 2. Shape trench walls completely vertical from trench bottom to at least 24" above the top of pipe.
  - 3. For pressure pipeline fittings, excavate trenches to a width that will permit placement of concrete thrust blocks. Provide earth surfaces for thrust blocks that are perpendicular to the direction of thrust and are free of loose or soft material.
  - 4. Where rock is encountered in the sides of the trench, remove the rock to provide a minimum clearance between the pipe and rock of 6".
- D. Length of Open Trench: Do not advance trenching operations more than 50' ahead of completed pipeline.
- E. Pipes Install in Fills

Except where multiple pipes are installed in one trench no pipe or utility may be laid except in a prepared trench excavation having a top elevation at least one

foot above the top of the highest pipe or utility in the trench. Where pipes or utilities are to be placed entirely or partly in fills, the fill must be properly compacted and brought up to the required elevation before the trench excavation is performed.

### **3.05 SUPPORT OF EXCAVATION**

- A. Support excavations with sheeting, shoring, and bracing or a “trench box” as required to comply with Federal and State laws and codes. Install adequate excavation supports to prevent ground movement or settlement to adjacent structures, pipelines or utilities. Damage due to settlement because of failure to provide support or through negligence or fault of the Contractor in any other manner shall be repaired at the Contractor’s expense.
- B. Withdraw shoring, bracing, and sheeting as backfilling proceeds unless otherwise directed by the Engineer.

### **3.06 CONTROL OF EXCAVATED MATERIAL**

- A. See Maryland Department of Transportation State Highway Administration, Standard Specifications for Construction and Materials July 2008.
- B. Keep the ground surface within a minimum of 2' of both sides of the excavation free of excavated material.
- C. In areas where pipelines parallel or cross streams, ensure that no material slides, is washed, or dumped into the stream course. Remove cofferdams immediately upon completion of pipeline construction.
- D. Maintain accessibility to all fire hydrants, valve pit covers, valve boxes, curb boxes and other utility controls at all times. Keep gutters clear or provide other satisfactory facilities for street drainage. Do not obstruct natural watercourses. Where necessary, provide temporary channels to allow the flow of water either along or across the site of the work.
- E. Provide temporary barricades to prevent excavated material from encroaching on private property, walks, gutters, and storm drains.

### **3.07 DEWATERING**

- A. Keep excavations dry and free of water. Dispose of precipitation and subsurface water clear of the work.
- B. Maintain pipe trenches dry until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Prevent trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Maintain storm drainage facilities, gutters, and natural surface watercourses open and in operation. Provide and install temporary facilities to maintain excavations free of water as



required. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water. When mechanical equipment is utilized to control water conditions, provide and maintain sufficient standby units onsite.

- D. Comply with Federal and State requirements for dewatering to any watercourse, prevention of stream degradation, and erosion and sediment control. Comply with the Sediment and Erosion Control Plan.

### **3.08 PIPE BEDDING REQUIREMENTS**

- A. Type II Bedding
  - 1. Depth of bedding material aggregate as shown on Standard Detail.
  - 2. Provide Type II bedding as minimum for all pipe materials except plastic pipe, unless otherwise authorized by the Engineer.
- B. Type IV Bedding
  - 1. Depth of bedding material aggregate as shown on Standard Detail.
  - 2. Provide Type IV bedding when using ABS, PE, and PVC pipe.
- C. Shape recesses for the joints or bell of the pipe by hand. Assure that the pipe is supported on the lower quadrant for the entire length of the barrel.

### **3.09 PIPE LAYING**

Lay pipe as specified in the appropriate Section of these Specifications for pipeline construction.

### **3.10 THRUST RESTRAINT**

Provide pressure pipe with concrete thrust blocking or use restrained joint fittings at all bends, tees, valves, and changes in direction, in accordance with the Specifications, Contract Drawings, and Standard Details.

### **3.11 BACKFILLING TRENCHES**

- A. After pipe installation and inspection, backfill trenches from trench bottom or from the top of pipe bedding material, whichever is greater, to 12" above the crown of the pipe with specified backfill material hand placed and carefully compacted with hand-operated mechanical tampers in layers of suitable thickness to provide specified density around and under the haunches of the pipe. Backfill and compact the remainder of the trench with specified backfill material.
- B. Exposed Joints for Testing
  - 1. The Contractor has the option to test the pipe prior to backfilling the trench. If this option is selected, install reaction blocks where required and place 2'

of thoroughly compacted backfill over the pipe leaving pipe joints partially exposed.

2. If the Contractor elects to completely backfill the trench prior to testing, the shall be responsible for locating and uncovering leaks which may cause the test to fail.

C. Lift thickness Limitations

1. In no case shall maximum lift thickness placed exceed the maximum limits specified by the manufacturer's recommendations. However, if the equipment manufacturer's lift thickness recommendation is followed and the specified density is not obtained, the Contractor shall, at his own expense, remove, replace, and retest as many times as is required to obtain the specified density.
2. Compact each layer of material to 95% of the maximum density at  $\pm$  two percent ( $\pm 2\%$ ) of the optimum moisture content as determined by ASTM D698.
3. Notwithstanding the specified requirements for trench backfill compaction, trenches that settle below the surrounding grade prior to final completion shall be filled to surrounding grade level with appropriate materials.

### **3.12 UTILITY MARKING TAPE**

Install detectable utility marking tape as specified in Section 15060 above all plastic pressure pipelines, 12"-18" below final grade.

### **3.13 DISPOSAL OF EXCAVATED MATERIAL**

Excavated material remaining after completion of backfilling shall remain the property of the Contractor, removed from the construction area and legally disposed.

### **3.14 RESTORATION OF UNPAVED AREAS**

- A. Restore unpaved surfaces disturbed by construction to equal the final grade shown on the Contract Drawings.
- B. Restore grassed areas in accordance with Section 02485, Finish Grading and Seeding.
- C. See Maryland Department of Transportation State Highway Administration, Standard Specifications for Construction and Materials July 2008 for work in the State Right-of-Way.

### **3.15 COMPACTION FOR SELECT BACKFILL MATERIAL**

- A. Select backfill material shall be compacted to 95-percent of the Modified Proctor (ASTM D1557) using loose lifts not to exceed 8-inches in thickness.

**END OF SECTION 02221**

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**SECTION 02240  
DEWATERING**

**PART 1 - GENERAL**

**1.01 SUMMARY**

- A. The work to be performed under this section includes, but is not limited to, the furnishing of all materials, labor, tools and equipment necessary to provide construction dewatering to keep all excavations and structures free from water during excavation and construction.

**1.02 PERFORMANCE REQUIREMENTS**

- A. Design, furnish, install, test, operate, monitor, and maintain dewatering system of sufficient scope, size, and capacity to control surface water and groundwater flows into excavations and permit construction to proceed on dry, stable subgrades.
1. Dewatering plans, including detailed shop drawings, shall be prepared, sealed and signed by a qualified Professional Engineer registered in the State of Maryland.
  2. Maintain dewatering operations to ensure erosion control, stability of excavations and constructed slopes, that excavation does not flood, and that damage to subgrades and permanent structures is prevented.
  3. Prevent groundwater and surface water from entering excavations.
  4. Accomplish dewatering without damaging existing buildings, pavements, utilities, and other improvements adjacent to excavations.
  5. Remove dewatering system when no longer needed.

**1.03 SUBMITTALS**

- A. Shop Drawings for Information Only: Show arrangement, locations, and details of wells and well points; locations of headers and discharge lines; and means of discharge and disposal of water. Shop drawings shall be prepared, sealed and signed by a qualified Professional Engineer for dewatering systems.
1. Include layouts of piezometers and flow-measuring devices for monitoring performance of dewatering system.
  2. Include a written report outlining control procedures to be adopted if dewatering problems arise.

- B. Qualification Data: For the Professional Engineer and the dewatering system installer.
- C. Photographs or videotape, sufficiently detailed, of existing conditions of adjoining improvements that might be misconstrued as damage caused by dewatering operations.
- D. Record drawings identifying and locating any capped utilities and other subsurface conditions performed during dewatering, including locations and capping depth of wells and well points.
- E. Field Test Reports: Before starting excavation, submit test results and computations demonstrating that the dewatering system is capable of meeting performance requirements.

#### **1.04 PROJECT CONDITIONS**

- A. Existing Utilities: Do not interrupt utilities serving the existing pumping station or other facilities unless permitted in writing by the Engineer and then only after arranging to provide temporary utility services according to requirements indicated.
- B. Project Site Information: Geotechnical soil borings obtained in the project site area during design, if any, are available for information purposes only. The soil borings, and opinions expressed in any accompanying reports, are those of the geotechnical engineer and represent interpretations of subsoil conditions, tests and results of analyses conducted by the geotechnical engineer for design purposes only. The Owner and Engineer will not be responsible for interpretations or conclusions drawn from this data. The Contractor shall make his own test borings and conduct other exploratory operations as necessary for providing dewatering systems.
- C. Survey adjacent structures and improvements, employing a qualified Professional Engineer or Land Surveyor, and establish exact elevations at fixed points to act as benchmarks. Clearly identify benchmarks and record existing elevations. During dewatering, regularly resurvey benchmarks, maintaining an accurate log of surveyed elevations for comparison with original elevations. Promptly notify the Engineer if changes in elevations or positions occur or if cracks, sags, or other damage is evident in adjacent improvements.

#### **PART 2 - PRODUCTS**

(NOT USED)

## **PART 3 - EXECUTION**

### **3.01 PREPARATION**

- A. Protect structures, utilities, pavements, and other facilities and improvements from damage caused by settlement, lateral movement, undermining, washout, and other hazards that could develop during dewatering operations.
  - 1. Prevent surface water and subsurface or groundwater from entering excavations, from ponding on prepared subgrades, and from flooding site and surrounding area.
  - 2. Protect subgrades and foundation soils from softening and damage by rain or water accumulation.
- B. Install dewatering systems to ensure minimum interference with roads, streets, alleys, walks, driveways, residences and other adjacent occupied or used facilities. Do not close or obstruct roads, streets, alleys, walks, driveways and other adjacent occupied or used facilities without permission of the Owner and authorities having jurisdiction.
- C. Promptly repair damages to adjacent facilities or improvements caused by dewatering operations at no additional cost to the Owner.

### **3.02 INSTALLATION**

- A. Install dewatering system utilizing wells, well points, or similar methods complete with pump equipment, standby power and pumps, filter material gradation, valves, appurtenances, water disposal, and surface-water controls.
- B. Before excavating below groundwater level, place system into operation to lower water to specified levels. Operate system continuously until drains, sewers and structures have been constructed and fill materials placed, or until dewatering is no longer required.
- C. Provide an adequate system to lower and control groundwater to permit excavation, construction of structures, and placement of fill materials on dry subgrades. Install sufficient dewatering equipment to drain water-bearing strata above and below bottom of foundations, drains, sewers and other excavations. Do not permit open-sump pumping that leads to loss of fines, soil piping, subgrade softening, and slope instability.
- D. Reduce hydrostatic head in water-bearing strata below subgrade elevations of foundations, drains, sewers, and other excavations. Maintain piezometric water level a minimum of 24-inches below surface of excavation.

- E. Dispose of water removed by dewatering in a manner that avoids endangering public health, property, and portions of work under construction or completed. Dispose of water in a manner that avoids inconvenience to others. Provide sumps, sedimentation tanks, and other flow-control devices as required by authorities having jurisdiction.
- F. Provide standby equipment on-site, installed and available for immediate operation, to maintain dewatering on continuous basis if any part of the system becomes inadequate or fails. If dewatering requirements are not satisfied due to inadequacy or failure of dewatering system, restore damaged structures and foundation soils at no additional expense to the Owner.
- G. Remove dewatering system upon completion of dewatering. Plug or fill well holes with sand or cut off and cap wells a minimum of 36-inches below overlying construction.

### **3.03 OBSERVATION WELLS**

- A. Provide, take measurements, and maintain at least the minimum number of observation wells or piezometers necessary and additional observation wells as may be required by authorities having jurisdiction.
- B. Observe and record daily elevation of ground water and piezometric water levels in observation wells.
- C. Repair or replace, within 24 hours, observation wells that become inactive, damaged, or destroyed. Suspend construction activities in areas where observation wells are not functioning properly until reliable observations can be made. Add or remove water from observation well risers to demonstrate that observation wells are functioning properly.
- D. Fill observation wells, remove piezometers, and fill holes when dewatering is completed.

**END OF SECTION 02240**



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**SECTION 02700  
EROSION AND SEDIMENT CONTROL**

**PART 1 - GENERAL****1.01 DESCRIPTION**

- A. The Work of This Section Includes, But Is Not Limited To
  - 1. Erosion and Sediment Controls: This work consists of temporary methods to control water pollution such as berms, dikes, dams, sediment basins, crushed stone gravel, mulches, grasses, straw bales, silt fence and other erosion devices as indicated on the contract Drawings.
- B. Related Work Specified Elsewhere
  - 1. Section 02200 - Earthwork
  - 2. Section 02850 - Finish Grading and Seeding

**1.02 SUBMITTALS**

- A. Submit shop drawings and material certificates of compliance in accordance with Section 01300.

**1.03 REGULATORY REQUIREMENTS**

- A. Erosion Controls: Erosion controls shall be as indicated on the Contract Drawings.
- B. Erosion Controls shall be in accordance with all Local requirements.

**PART 2 - PRODUCTS****2.01 MATERIALS - GENERAL**

- A. All products and materials shall comply with Maryland Department of the Environment (MDE) Standards.

**PART 3 - EXECUTION****3.01 TEMPORARY EROSION AND SEDIMENTATION CONTROL**

- A. Provide temporary erosion and sedimentation control measures to prevent soil erosion and discharge of soil-bearing water runoff or airborne dust to adjacent properties and roadways.
- B. Inspect, repair and maintain erosion and sedimentation control measures during

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construction until permanent vegetation has been established.

- C. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.
- D. Provide erosion and sedimentation control measures for stockpiled material, which will remain in place longer than 30 days.
- E. Maintain erosion and sedimentation measures throughout the life of the Contract.
- F. Comply with the provisions of the Storm Water Pollution Prevention Plan.

### **3.02 RESTORATION**

- A. Seed, mulch and fully restore all disturbed areas within 15 days after final grading. In no case shall a construction area be denuded for more than 60 days.

**END OF SECTION 02700**

**SECTION 02850  
FINISH GRADING AND SEEDING**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. The work of this Section includes, but is not limited to:
  - 1. Placing topsoil
  - 2. Soil conditioning
  - 3. Finish grading
  - 4. Seeding
  - 5. Maintenance
  - 6. Termite Control
  - 7. All work in the State Highway Right-of-Way shall be in accordance with the specifications included in the Maryland Department of Transportation, State Highway Administration Standard Specifications for Construction and Materials, dated July 2008. Work not in the State Highway Right-of-Way shall be in accordance with this specification section.
- B. The "Seeding Restoration Table" shown on the Contract Drawings lists specified seeding restoration requirements.
- C. Related Work Specified Elsewhere
  - 1. Section 02100 - Clearing and Grubbing
  - 2. Section 02200 - Earthwork
  - 3. Section 02221 - Trenching, Backfilling & Compacting

**1.02 QUALITY ASSURANCE**

- A. Soil and soil supplement testing shall be performed by a Soils Testing Laboratory engaged and paid for by the Contractor and approved by the Engineer.
- B. Collect soil samples under the direction of the Engineer.
- C. Reference Standards:
  - 1. Maryland Department of Transportation - Standard Specifications for

Construction and Materials, July 2008.

2. Maryland State Board of Agriculture, "Seed Regulations", as Amended.
3. Requirements of Turf Grass Law and Regulations, Publication No. 41.
4. Maryland Standard Method of Procedure.

### **1.03 SUBMITTALS**

#### **A. Certificates**

1. Prior to use or placement of material, submit a Statement of Compliance from the materials suppliers, together with supporting data, attesting that the composition of the following products meets specification requirements.
  - a. Topsoil analysis - State pH, texture, and organic content.
  - b. Fertilizer - analysis content and percent of each.
  - c. Lime - analysis content and percent of each.
  - d. Seed mixture(s) - State percentage of mixtures, purity, germination and maximum weed seed content of each grass mixture.
2. If soil tests are performed to justify decreased liming and fertilizer rates, submit certified soil sample analyses, including laboratory's recommended soil supplement formulation.

### **1.04 PRODUCT DELIVERY, STORAGE AND HANDLING**

#### **A. Seed**

1. Deliver seed fully tagged and in separate packages according to species or seed mix.
2. Seed which has become wet, moldy, or otherwise damaged in transit or storage will not be accepted.

## **PART 2 - PRODUCTS**

### **2.01 TOPSOIL**

- #### **A.**
- All topsoil stripped from the site and stockpiled may be reused provided the following requirements are met:
1. Have a pH of between 6.0 and 7.0; contain not less than 2% nor more than 10% organic matter as determined by AASHTO T194.
  2. Fertile friable loam, sand loam, or clay loam which will hold a ball when

squeezed with the hand, but which will crumble shortly after being released.

3. Free of clods, grass, roots, or other debris harmful to plant growth. Free of pests, pest larvae, and matter toxic to plants.
4. Topsoil shall comply with the requirements of Section 920.01.01 of the Maryland Department of Transportation, State Highway Administration Standard Specifications.

## **2.02 SEED**

- A. Fresh, clean, dated material from the last available crop and within the date period specified, with a date of test not more than 9 months prior to the date of sowing.
- B. Percentage of pure seed present shall represent freedom from inert matter and from other seeds distinguishable by their appearance.
- C. All seeds will be subject to analysis and testing.
- D. Seed shall be certified by the Maryland State Board of Agriculture and shall conform to requirements of Maryland Turf Grass Law and Regulations, Publication No. 41.
- E. Seed mix shall be in accordance with Maryland Department of Transportation Standard Specifications, Sections 705.01.02 and 920.04.02.
- F. Seeding shall be accomplished in accordance with Maryland Department of Transportation Standard Specifications, Section 701.01.03.
- G. Seed shall comply with Maryland Department of Transportation Standard Specifications, Section 920.04.01.

<b>TABLE 1 - GRASS AND AGRICULTURAL SEEDS</b>			
<b>Species</b>	<b>Minimum Guaranteed Purity (Percent)</b>	<b>Maximum Weed Seed (Percent)</b>	<b>Minimum Guaranteed Germination (Percent)</b>
Kentucky Bluegrass ( <i>Poa pratensis</i> ) Domestic origin min. 21 lb. per bushel	90	0.20	80
Perennial Ryegrass ( <i>Lolium perenne</i> , var. Pennfine)	98	0.15	90
Kentucky 31 Fescue ( <i>Festuca elatior</i> arundinacea)	98	0.25	85
Crownvetch ( <i>coronilla varia</i> , var. Penngift)	99	0.10	70
Pennlawn Red Fescue ( <i>Festuca rubra</i> , var. Pennlawn)	98	0.15	85
Annual Ryegrass ( <i>Lolium multiflorum</i> )	95	0.15	90
Timothy ( <i>Phleum pratense</i> )	98	0.25	95

**2.03 FERTILIZER**

- A. Liquid formulations may be used in lieu of dry formulations, provided the rate of application is adjusted to apply the same quantities of nitrogen, phosphorus and potassium per unit area as specified for dry formulations.
- B. Fertilizer in accordance with Section 920.03 of the Standard Specifications for Construction and Materials, Maryland Department of Transportation, 2008, and applied in accordance with Section 705.03.01(e).
- C. Contractor may submit soils samples to an approved laboratory for fertilizing recommendations. Recommendations shall be submitted to Owner for his review and decision relating to modifying the application rate as shown on the Restoration Table.

**2.04 LIME**

- A. Conform to Section 920.02 of the Standard Specifications for Construction and Materials, Maryland Department of Transportation, July 2008, and apply in accordance with Section 705.03.03.
- B. All lime in accordance with application rates shown in the Restoration Table.

**2.05 INOCULANT**

- A. Inoculate leguminous seed before seeding with nitrogen fixing bacteria culture prepared specifically for the species.
- B. Do not use inoculant later than the date indicated by the manufacturer.
- C. Protect inoculated seed from prolonged exposure to sunlight prior to sowing.
- D. Reinoculate seed not sown within 24 hours following initial inoculation.

**2.06 EROSION CONTROL FABRIC**

- A. Shall be a knitted construction of yarn with uniform openings interwoven with strips of biodegradable paper, furnished in rolls with 4-mil opaque polyethylene base as protection for outdoor storage.
- B. Fabric 0.2 pound per square yard.

**2.07 JUTE MATTING**

Shall be heavy weight, minimum 0-9 pound per square yard, jute mesh with 1" opening.

**2.08 FABRIC/MATTING ANCHORS**

Staples for fastening fabric to ground shall be minimum 11 gauge wire, "U" shaped, with a 1" crown and 6" legs.

**2.09 MULCHING MATERIALS**

- A. Mulches for seeded areas shall be one, or a combination, of the following:
  - 1. Timothy hay or mixed clover and timothy hay, or wheat, or oat straw; thoroughly threshed.
    - a. Cured to less than 20% moisture content by weight.
    - b. Containing no stems of tobacco, soybeans, or other coarse or woody material, free of mature seed bearing stalks or roots of prohibited or noxious weeds.
  - 2. Wood Cellulose
    - a. Containing no growth or germination-inhibiting substances.
    - b. Green-dyed and air-dried.
    - c. Packages not exceeding 100 pounds.

- d. Moisture Content: 12% ± 3%
  - e. Organic Matter (Dry oven basis) 98.6% ± 0.2%
  - f. Ash Content: 1.4% ± 0.2%
  - g. Minimum Water-Holding Capacity: 100%
3. Mushroom Manure:
- a. Organic origin, free of foreign material larger than 2" and substances toxic to plant growth.
  - b. Organic Matter: 20% minimum
  - c. Water-Holding Capacity: 120% minimum
  - d. pH: 6.0
- B. Mulch Binders
- 1. Emulsified Asphalt AASHTO M140, Grade SS-1.
  - 2. Cut Back Asphalt AASHTO M81, RC 250.
  - 3. Nonasphaltic Emulsion - Natural Vegetable Gum Blended with Gelling and Hardening Agents
  - 4. Polyvinyl Acetate Emulsion Resin, Containing 60% (± 1%) total Solids by Weight.

## 2.10 SOIL TREATMENT MATERIALS

- A. Chemicals
- 1. Soil treatment chemicals shall be one of the following:
    - a. Dursban TC: To be used at a concentration of 1.0%, applied in water emulsion.
    - b. Dragnet TC: To be used at a concentration of 0.5%, applied in water emulsion.
    - c. Pryfon 6: To be used at a concentration of 0.75% applied in water emulsion.
  - 2. Soil treatment chemicals used shall be mixed in the following proportions:
    - a. Dursban TC: 1.0% water emulsion, 2 gallons of Dursban TC per 98 gallons of water.



- b. Dragnet TC: 0.5% water emulsion, 1.25 gallons of Dragnet TC per 98.75 gallons of water.
- c. Pryfon 6: 0.75% water emulsion, 1 gallon of Pryfon 6 with 96 gallons of water.

### **PART 3 - EXECUTION**

#### **3.01 TIME OF OPERATIONS**

Conduct seeding operations during the times specified in the Seeding Restoration Table.

#### **3.02 PREPARATION OF SUBGRADE**

- A. "Hard pan" or heavy shale
  - 1. Plow to a minimum depth of 6".
  - 2. Loosen and grade by harrowing, discing, or dragging.
  - 3. Handrake subgrade.
  - 4. Remove stones over 2" in diameter and other debris.
- B. Loose loam, sandy loam, or light clay
  - 1. Loosen and grade by harrowing, discing, or dragging.
  - 2. Handrake subgrade.
  - 3. Remove rocks over 2" in diameter and other debris.

#### **3.03 PLACING TOPSOIL**

- A. Place topsoil and spread over the prepared subgrade to obtain the required depth and grade elevation.
- B. Final compacted thickness of topsoil not less than thickness shown on Drawings.
- C. Roller weight over 120 pounds per foot of width shall not be used for compaction.
- D. Handrake topsoil and remove all materials unsuitable or harmful to plant growth.
- E. Do not place topsoil when the subgrade is frozen, excessively wet, or extremely dry; do not handle topsoil when frozen or muddy.
- F. Material unsuitable for finish grading which accumulates during spreading and raking shall be removed and legally disposed of off site by Contractor.
- G. Finish surface of topsoil shall be smooth, even and true to lines and grades with no

ponding areas.

### **3.04 TILLAGE**

- A. After seed bed areas have been brought to proper compaction elevation, thoroughly loosen to a minimum depth of 5" by discing, harrowing, or other approved methods.
- B. Do not work topsoiled areas when frozen or excessively wet.
- C. Liming
  - 1. Distribute limestone uniformly at the rate indicated on the Seeding Restoration table.
  - 2. Thoroughly incorporate into the topsoil to a minimum depth of 4" as a part of the tillage operation.
- D. Basic Fertilizer
  - 1. Distribute basic fertilizer uniformly at the rate indicated on the Seeding Restoration Table.
  - 2. Incorporate into soil to depth of 4" by approved methods as part of tillage operation.
- E. Liming and fertilizer rates may be decreased if lesser rates are indicated by soil tests provided by the Contractor.

### **3.05 FINISH GRADING**

- A. Remove unsuitable material larger than 2" in any dimension.
- B. Uniformly grade surface to the required contours without the formation of water pockets.
- C. Rework areas which puddle by the addition of topsoil and fertilizer; rake.
- D. Distribute starter fertilizer at the rates indicated on the Seeding Restoration Table.
- E. Incorporate starter fertilizer into the upper 1" of soil.

### **3.06 SEEDING**

- A. Uniformly sow specified seed mix by use of approved hydraulic seeder, power-drawn drill, power-operated seeder or hand-operated seeder, or by hand.
- B. Do not seed when winds are over 15 mph.
- C. Upon completion of sowing, cover seed to an average depth of 1/4" by hand

reraking or approved mechanical methods.

- D. Upon completion of seed covering, roll the area with a roller, exerting a maximum force of 65 pounds per foot width of roller.

### **3.07 MULCHING**

- A. Mulch within 48 hours of seeding.
- B. Place hay and straw mulch in a continuous blanket at a minimum rate of 1,200 pounds per 1,000 square yards.
- C. Anchor hay or straw mulch by use of twine, stakes, wire staples, paper or plastic nets.
- D. Emulsified asphalt or cut back asphalt may be used for anchorage provided it is applied uniformly at a rate not less than 31 gallons per 1,000 square yards.
- E. Chemical mulch binders or a light covering of topsoil may be used for anchorage when the size of the area precludes the use of mechanical equipment.
- F. Apply approved chemical mulch binders at the manufacturer's recommended rate.
- G. Apply wood cellulose fiber hydraulically at a rate of 320 pounds per 1,000 square yards; incorporate as an integral part of the slurry after seed and soil supplements have been thoroughly mixed.
- H. Spread mushroom manure uniformly to a minimum depth of ½" or to the depth indicated on the Contract Drawings.
- I. When mulch is applied to grass areas by blowing equipment, the use of cutters in the equipment will be permitted to the extent that a minimum of 95% of the mulch is 6" or more in length.
- J. For cut mulches applied by the blowing method, achieve a loose depth in place of not less than 2".
- K. Asphalt Mix Method
  - 1. Apply the mulch by blowing.
  - 2. Spray the asphalt binder material into the mulch as it leaves the blower.
  - 3. Apply the binder to the mulch in the proportion of 1.5 to 2.0 gallons per 45 pounds of mulch.
  - 4. Protect structures, pavements, curbs, and walls to prevent asphalt staining.
  - 5. Erect warning signs and barricades at intervals of 50 feet or less along the perimeter of the mulched area.

6. Do not spray asphalt and chemical mulch binders onto any area within 100 feet of a stream or other body of water.

### 3.08 MAINTENANCE

- A. Contractor shall be responsible for maintenance of seeded work.
- B. Maintenance includes watering, weeding, initial mowing, cleanup, edging, and repair of washouts or gullies.
- C. Keep seeded areas wet, close to the saturation point, to a depth of 3" for a period of 10 days following seeding and sodding.
- D. Those areas which do not show a prompt catch of grass within 10 days of seeding or sodding shall be reseeded or resodded until complete grass catch occurs.
- E. When the grass reaches an average height of 2-1/2", cut to a height of 1-1/2"; irregularities or depressions which show up at this time shall be leveled and reseeded.
- F. Contractor's maintenance shall continue until all areas are grassed and free from bare spots or off-color areas, and all work under this Contract is complete and accepted.

### 3.09 SOIL TREATMENT

- A. Application
  1. Treat all soil under floor slabs of building and at footings and foundation walls.
  2. Treatment should not be made (1) when the soil or fill is excessively wet or (2) directly following rains, as, in such instances, it will not penetrate to the desired depth, and some of the chemical may be lost through surface runoff.
  3. At Foundation Wall:
    - a. Along the outside of the foundation wall, before backfilling, apply the treatment by pouring at bottom of trench.
    - b. Backfill approximately 6", tamp and again apply the treatment.
    - c. Repeat until backfilling has been brought to proper grade.
    - d. All treatment shall be covered with earth.
    - e. Application shall be at the rate of 4 gallons per 5 linear feet total for

all pours.

4. Rate of Application for Slab-on-Ground Type of Construction
  - a. Apply 1 gallon per each 10 square feet of soil surface as an overall treatment prior to pouring the slab.
  - b. Unless the treated soil or fill is to be covered promptly with a vapor barrier or by the slabs, precautions must be taken to prevent disturbance of the treatment by humans or animals.
- B. Apply soil treatment at the rate of 2 gallons per 5 lineal feet at the following areas
  1. Immediately below expansion joints, control joints and all areas where slab will be penetrated by construction features.
  2. When exterior facings or veneers extend below grade level, along the exterior side of all foundation walls, or where unit masonry foundation construction is used.

**END OF SECTION 02850**

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**SECTION 02900  
CHAIN-LINK FENCE AND GATES**

**PART 1 - GENERAL**

**1.01 DESCRIPTION**

- A. This Section includes requirements for providing chain-link fence, gates, and accessories, as indicated herein and as shown on the drawings, to include the tie in to the existing fencing and posts that are to remain in order to provide a completely functional system. Fence fabric shall be galvanized.

**1.02 SUBMITTALS**

- A. Submit the following shop drawings:
1. Plan layout including spacing of posts and other components, locations of gates, post foundation dimensions, abrupt changes in grade, locations of corner, end and pull posts, hardware anchorage, and schedule of components.
  2. Cross sectional dimensions of posts, braces, rails, fittings, gates and accessories.
  3. Design of gates and details of gate hardware and accessories.
- B. Product data on fabric, post, fittings, accessories and hardware. Contractor shall take accurate field measurements to confirm existing fence fabric mech opening size and fabric height prior to submission to the Engineer for approval.
- C. Two (2) samples of fence fabric, 12 x 12 inches in size, illustrating construction.

**1.03 PROJECT RECORD DOCUMENTS**

- A. Submit as-built drawings of the fence and gates.
- B. Accurately record actual locations of perimeter posts relative to property lines.

**1.04 PRODUCT DELIVERY, STORAGE AND PROTECTION**

- A. Materials shall be delivered to the site in an undamaged condition. Materials shall be carefully stored off the ground to provide proper protection against oxidation caused by ground contact. Defective or damaged materials shall be replaced by the Contractor at no expense to the Owner.

## **PART 2 - PRODUCTS**

### **2.01 FENCE FABRIC**

- A. Fence fabric shall be made from galvanized fabric in accordance with ASTM A392. Fence fabric shall be woven in 2-inch mesh. Contractor shall take accurate field measurements to confirm existing fence fabric mesh opening size prior to submission to the Engineer for approval. Fabric shall be fabricated of 9-gauge wire. Fabric height shall be 7-feet. Contractor shall take accurate field measurements to confirm and match existing fabric height prior to product submission to the Engineer for approval. Fabric shall be knuckled on the top and bottom selvages.

### **2.02 GATES**

- A. Gates shall be the types and sizes as shown on the drawings. Gate frames shall be ASTM 1043 Group 1C pipe with zinc external coating Type B, minimum nominal pipe size (NPS) 1 5/8-inch. Swing gates shall be galvanized steel welded fabrication in accordance with ASTM F900 and horizontal slide gate shall be in accordance with ASTM F1184. Gates shall be same height as fencing.
- B. Swing gate leaves more than 8-feet wide shall have either intermediate members and diagonal truss rods or shall have tubular members as necessary to provide rigid construction, free from sag or twist. Gate leaves less than 8-feet wide shall have truss rods or intermediate braces.
- C. Gate fabric shall be same as specified for fence fabric. Gate fabric shall be attached to the gate frame by method standard with the manufacturer, except that welding will not be permitted.
- D. Latches, hinges, stops, keepers, rollers, and other hardware items shall be furnished as required for the operation of the gates. Latches shall be arranged for padlocking so that the padlocks will be accessible from both sides of the gates. Stops shall be provided for holding the gates in the open position.

### **2.03 SLIDE GATES**

- A. Slide gates shall be the cantilever type with sizes as shown on the drawings. Slide gates shall be in accordance with ASTM F1184, Type II, Class 2 - Internal Roller Design. Gate frames shall be ASTM F1043 Group 1C steel pipe with zinc external coating Type B minimum nominal pipe size (NPS) 2 3/8-inch. Gates shall be same height as adjacent chain link fencing.
- B. Design Criteria:
  - 1. Gate track system shall be keyed to interlock into gate frame member. When interlocked with and welded to the "keyed" frame top member, gate track shall form a composite structure.



2. Gate shall have a minimum counterbalance length of 50% of the opening.
  3. Gate shall have intermediate vertical members with spacing less than 50% of the gate frame height.
  4. Entire gate frame, including the counterbalance section, shall include two adjustable stainless steel cables (minimum 3/16-inch diameter) per bay to allow complete gate frame adjustment.
  5. Gate truck assemblies shall be tested for continuous duty and shall have zinc plated steel bearings meeting ASTM B117 salt spray test with no red rust after 790 hours. Bearings shall be specifically designed for roller applications with full complement ball bearings, shock resistant outer races, and captured seals.
  6. Gate truck assemblies shall be supported by a minimum 5/8-inch diameter zinc plated steel bolt with self-aligning capability, rated to support a 2,000-pound reaction load.
  7. Hanger brackets shall be hot-dipped galvanized steel with a minimum 3/8-inch thickness and gusseted.
  8. Gate top track and supporting hanger bracket assemblies shall be designed to withstand a 2,000-pound vertical reaction load without exceeding allowable stresses.
- C. Gate frame shall be fabricated from 6063-T6 aluminum alloy extrusions. The top member shall be a 3" x 5" aluminum structural tube extrusion weighing not less than 3.0 lb/ft. This frame member shall be keyed to interlock with a keyed track member. If fabricated as a single horizontal piece, the bottom members shall be a 2" x 5" aluminum structural tube weighing not less than 2.0 lb/ft. If fabricated in two horizontal pieces, the bottom member shall be a 5" aluminum structural channel weighing not less than 2.65 lb/ft.
- D. Major vertical members at the ends of the opening portion of the frame shall be "P" shaped in cross section with a nominal base dimension of no less than 2" x 2" and weighing not less than 1.6 lb/ft. Major members shall separate each bay and be spaced at intervals less than the gate height. Intermediate vertical members weighing not less than 0.82 lb/ft shall alternate between the 2" x 2" major members.
- E. The gate frame shall have separate semi-enclosed keyed tracks extruded from 6005A-T61 or 6105-T5 aluminum alloy, and weighing not less than 2.9 lb/ft. Track members are to be located on each side of the top member. When interlocked and welded to the keyed top member, it shall form a composite structure with the top of the gate frame. Welds shall be placed alternately along the top and side of the track at 9-inch centers with welds being a minimum of 2-inch long. All welds shall

conform to AWS D1.2 Structural Welding Code and all welders shall be certified to AWS D1.2 Structural Welding Code.

F. Gate Mounting:

1. Gate frame shall be supported from the track by four (4) swivel type, self-aligning, 4-wheeled, sealed lubricant, ball-bearing truck assemblies.
2. The bottom of each support post shall have a bracket equipped with a pair of 3-inch UHMW guide wheels. Wheel cover protectors shall be included with bottom guides to comply with UL325.
3. Gap protectors compliant with ASTM F2200 shall also be provided.
4. The slide gate shall slide on the inside of the fence.
5. Provide lockable catch assembly. Latches, catches, keepers, rollers, and other hardware items shall be furnished as required for the fully functional operation of the gate. Latches shall be arranged for padlocking so that the padlocks will be accessible from both sides of the gates.

- G. Gate fabric shall be same as specified for fence fabric. Gate fabric shall be attached at each end of the gate frame by standard fence industry tension bars and tied at each 2" x 2" vertical member with standard fence industry ties. There shall be no leading or bottom edge protrusions in accordance with ASTM F2200.

## 2.04 POSTS

- A. Posts shall be zinc-coated Group IC steel pipe conforming to the requirements of ASTM F1043 and F1083. Minimum sizes shall be as shown on the drawings. Line posts and terminal (corner, gate, and pull) posts selected shall be of the same designation throughout the fence. Gate posts shall be for the gate type indicated to the limitations specified in ASTM F900 and ASTM F1184, with minimum NPS of 2 1/2-inch for line posts, 3-inch for terminal posts, and 4-inch for gate posts.

## 2.05 BRACES AND RAILS

- A. Braces and top rails shall be zinc coated Group IC steel pipe minimum NPS 1 5/8-inch conforming to the requirements of ASTM F1043.

## 2.06 WIRE

- A. Tension wire shall be 0.177-inch diameter, Type II, Class 2 coating, in accordance with ASTM A824.

## 2.07 ACCESSORIES

- A. All accessories shall be in accordance with ASTM F626. Ferrous accessories shall be zinc-coated with minimum thickness of 0.006-inch and maximum thickness of 0.015-inch.
- B. Tension and brace bands shall be galvanized pressed steel complying with ASTM F626, minimum steel thickness of 12 gauge, minimum width of 3/4 inch and minimum zinc coating of 1.20 oz/ft<sup>2</sup>.
- C. Truss rods shall be furnished for each terminal post. Truss rods shall be provided with turnbuckles or other equivalent provisions for adjustment. Truss rods shall be minimum 3/8-inch diameter steel with a minimum zinc coating of 1.2 oz/ft<sup>2</sup>, assembly capable of withstanding a minimum tension of 2,000 lbs.
- D. Tension bars shall be galvanized steel with minimum zinc coating of 1.2 oz/ft<sup>2</sup>. Bars for 2 inch mesh shall be a minimum cross section of 3/16 inch by 3/4 inch.
- E. Tie wire for attaching fabric to rails, braces, and posts shall be 9-gauge steel wire and match the coating of the fence fabric.
- F. Miscellaneous hardware coatings shall conform to ASTM A153 unless modified.
- G. Barbed wire arms shall be corrosion-resistant, with clips, slots, or other means for attaching strands of barbed wire, and means for attaching to posts or integral with post cap; for each post. Line posts shall have arms that accommodate top rail or tension wire. Fence corner posts shall have corner arms. Barbed wire arms shall be Type I, single slanted arm.

## 2.08 BARBED WIRE

- A. Zinc-coated steel barbed wire shall be in accordance with ASTM A121, chain-link fence grade for standard three-strand barbed wire. Barbed wire shall consist of 0.099-inch diameter line wire with 0.080-inch diameter, 4-point round barbs spaced not more than 5-inches on center.

## PART 3 - EXECUTION

### 3.01 INSTALLATION

- A. Fence shall be installed to the lines and grades indicated. Line posts shall be spaced equidistant at intervals not exceeding 10 feet. Terminal (corner, gate, and pull) posts shall be set at abrupt changes in vertical and horizontal alignment. Fabric shall be continuous between terminal posts; however, runs between terminal posts shall not exceed 500 feet. Any damage to galvanized surfaces, including welding, shall be repaired with paint containing zinc dust in accordance with ASTM

A780.

### **3.02 EXCAVATION**

- A. Post holes shall be cleared of loose material. Waste material shall be disposed of by the Contractor. Ground surface irregularities along the fence line shall be eliminated to the extent necessary to maintain no clearance between the bottom of the fence fabric and finish grade.

### **3.03 POSTS**

- A. Posts shall be set plumb and in alignment. Posts shall be set in concrete to the depth indicated on the Contract Drawings. Hole diameters shall be not less than 16-inches for terminal posts and not less than 12-inches for line posts. Concrete and grout shall be thoroughly consolidated around each post, shall be free of voids and finished to form a dome. Concrete and grout shall be allowed to cure a minimum of seventy-two (72) hours prior to attachment of any item to the posts.

### **3.04 RAILS, TENSION WIRE, BRACES AND TRUSS RODS**

- A. Top rails shall be supported at each post to form a continuous brace between terminal posts. Where required, sections of top rail shall be joined using sleeves or couplings that will allow expansion or contraction of the rail.
- B. Tension wire shall be installed in accordance with ASTM F567, maintaining plumb position and alignment of fencing. Pull wire taut, without sags. Fasten fabric to tension wire with 0.120-inch diameter hog rings of same material and finish as fabric wire, spaced a maximum of 24 inches o.c. Install bottom tension wire within 6 inches of bottom of fabric and tie to each post with not less than same diameter and type of wire.
- C. Braces and truss rods shall be installed as indicated and in conformance with the standard practice for the fence furnished. Horizontal compression braces and diagonal tension truss rods shall be installed. Braces and truss rods shall extend from terminal posts to line posts. Diagonal braces shall form an angle of approximately 40 to 50 degrees with the horizontal.

### **3.05 FABRIC**

- A. Chain-link fabric shall be installed on the side of the post indicated. Fabric shall be attached to terminal posts with stretcher bars and tension bands. Bands shall be spaced at approximately 15-inch intervals. The fabric shall be installed and pulled taut to provide a smooth and uniform appearance free from sag, without permanently distorting the fabric diamond or reducing the fabric height. Fabric shall be fastened to line posts at approximately 15-inch intervals and fastened to all rails and tension wires at approximately 12-inch intervals. Fabric shall be cut by untwisting and removing pickets. Splicing shall be accomplished by weaving a

single picket into the ends of the rolls to be joined. The bottom of the installed fabric shall be to the finished grade, but not more than 2-inch above the ground.

### **3.06 GATES**

- A. Gates shall be installed at the locations shown on the drawings. Hinged gates shall be mounted to swing as indicated. Latches, stops, and keepers shall be installed as required. Hinge pins, and hardware shall be welded or otherwise secured to prevent removal. Slide gate shall be installed in accordance with ASTM F1184, and as recommended by the manufacturer.

### **3.07 EXISTING FENCE AND MESH**

- A. Take extreme caution to not damage the existing fence, to include all posts and mesh to remain in order to tie in the new fence mesh and all other necessary fence components to the nearest fence post to the 100-year floodplain line on the property (and outside of the 100-year floodplain) as shown on the drawings. This would include the nearest fence post near Property Corner Coordinate 8 and the nearest fence post nearest Control Coordinate 1029 and not within the 100-year floodplain.
- B. Provide all components as necessary to complete the fence tie in so that there is no gap in the fencing between the existing and new fence and mesh. Ensure existing fence is securely fastened to the existing post to remain.

### **3.08 ERECTION TOLERANCES**

- A. Maximum Variation from Plumb: 1/4-inch.
- B. Maximum Offset from True Position: 1-inch.

### **3.09 GROUNDING**

- A. Install fence grounding at maximum intervals of 750-feet by driving a grounding rod vertically until the top is 6-inches below finished grade. Connect rod to fence with No. 6 AWG conductor. Connect conductor to each fence component at the grounding location. Ground fence on each side of gate openings. Bond metal gates to gate posts using No. 2 AWG wire and bury it at least 18-inches below finished grade. Connect bonding jumper between gate post and gate frame. Make connections so possibility of galvanic action or electrolysis is minimized.

### **3.10 BARBED WIRE**

- A. Install barbed wire uniformly spaced and angle outward. Pull wire taut and install securely to extension arms and secure to end post or terminal arms.

**3.11 ADJUSTING AND DEMONSTRATION**

- A. Adjust gate to operate smoothly, easily, and quietly, free of binding, warping, excessive deflection, distortion, non-alignment, misplacement, disruption, or malfunction, throughout the entire operating range. Confirm that latches and locks engage accurately and securely without forcing or binding.
- B. Lubricate hardware and other moving parts.

**END OF SECTION 02900**