

## **SECTION 02050**

### **DEMOLITION**

#### **PART 1 GENERAL**

##### **1.01 DESCRIPTION**

###### **A. Scope:**

1. Furnish all labor, materials, equipment and, incidentals required for demolitions, removal and disposal Work shown and specified.
2. The extent of this work is as follows:
  - a. Demolitions and removals of existing materials, equipment, buildings, or work necessary to install the new Work as shown and specified and to connect same with existing work in an approved manner.

###### **B. Description:**

1. Demolition includes structural concrete, foundations, appurtenances, piping, electrical, metering, and mechanical equipment, walks, fencing, and similar existing facilities.
2. Also included is the patching, filling and finishing to a smooth surface of the perimeter of all openings made and the finishing of surfaces roughened or left exposed by the demolition work.
3. Also included are any temporary or permanent supports required because of the demolition work.
4. Conform to the requirements of this section for all references to demolitions and removals in other sections.

###### **C. Compliance with ODOT CMS:**

1. Work under this section shall meet the requirements of Item 202 of the ODOT Construction and Material Specifications, Latest Edition.
2. Wherever requirements conflict, this section shall govern.

###### **D. Examination of Work Site:**

1. The Contractor is required to visit the work site during the bidding period to determine the hazards, working conditions, accessibility and extent of the work required under this section.

##### **1.02 SUBMITTALS**

###### **A. Schedule:**

1. Submit for review proposed methods, equipment, and operations sequence.
2. Provide two weeks notice prior to commencing demolition work.
3. Include coordination for shut-off, capping, temporary services, continuation of utility services, and other applicable items to ensure minimal interruption of Owner's operations.

### 1.03 JOB CONDITIONS

#### A. Protection:

1. Execute the demolition and removal Work to prevent damage or injury to structures, occupants thereof and adjacent features which might result from falling debris or other causes, and so as not to interfere with the use, and free and safe passage to and from adjacent structures.
2. Do not close or obstruct roadways, sidewalks or passageways adjacent to the Work by the placement or storage of materials.
3. Conduct all operations with a minimum interference to traffic and coordinate any street closures with the governing authority.
4. Erect and maintain barriers, lights, and other required protective devices.
5. Promptly repair damage done to facilities that are to remain, or to any property belonging to the Owner or occupants of the facilities.
6. Notify schools, sheriff's department, fire department, EMS and other appropriate authorities of any street closures.

#### B. Scheduling: Conduct Work to avoid interference with operations and work in the existing facilities.

#### C. Notification:

1. Notify the Owner and Engineer in writing at least 2 weeks prior to the start of any demolition or removal work.
2. Do not start any equipment removal or demolition operations without the permission of the Owner.

#### D. Explosives: The use of explosives is not permitted on the Job site.

## PART 2 PRODUCTS

Not Applicable.

## PART 3 EXECUTION

### 3.01 GENERAL

A. Disposal of Removed Items:

1. Remove and take from the site all concrete, brick, tile, concrete block, roofing materials, reinforcement, structural or miscellaneous metals, plaster, wire mesh and other items contained in or upon the structure unless otherwise directed by the Owner's Representative. Do not use demolished items in backfill adjacent to structures or in pipeline trenches.

B. Off-Site Disposal:

1. Dispose of all demolition materials and debris off the site in a legal manner.
2. Dispose of debris, which is not to remain the property of the Owner in conformance with all existing applicable laws and regulations.

C. Exposed Surfaces:

1. Repair all surfaces of walls, floors, ceilings, or other areas which are exposed by any of the removals specified herein, and which will remain as architecturally finished surfaces and which have holes, scars chipped or other roughened or damaged surfaces revealed by the removal.
2. Use the same or matching materials as the existing surface.

D. Pollution Controls:

1. Use water sprinkling, temporary enclosures and other suitable methods to limit the amount of dust and dirt rising and scattering in the air to the lowest practical level. Do not use water when it may create hazardous or objectionable conditions such as ice, flooding, and pollution.
2. Clean adjacent structures, facilities, and improvements of dust, dirt, and debris caused by demolition operations.
3. Return adjacent areas to conditions existing prior to the start of the Work.
4. Comply with governing regulations pertaining to environmental protection.

E. Foundation Demolition:

1. Completely excavate and remove below grade foundations in accordance with this section. Backfill and Finish grade foundation removal areas in accordance with the project specifications.

### 3.02 STRUCTURAL REMOVALS

A. Limits of Removal:

1. Remove structures to the lines and grades shown unless otherwise directed by the Owner's Representative.
  2. Where no limits are shown, use limits of 4 inches outside the item to be installed. Removal of masonry beyond these limits is at the Contractor's expense and these excess removals are to be reconstructed to the satisfaction of the Owner's Representative with no additional compensation to the Contractor.
- B. Junction Points: Neatly repair the point of junction after removal of parts or all of masonry walls, slabs and like work which tie into new Work or existing work, so as to leave only finished edges and surfaces exposed.
- C. Openings: Use new masonry, concrete or metal to dress the jambs, sills and heads of any new windows, passageways, doors, or other openings cut into new Work or existing work, to provide a smooth, finished appearance.
- D. Anchors: Provide new anchoring materials including bolts, nuts, hangers, welds and reinforcing steel, which are required to attach new Work to the existing work. All such anchorage into existing concrete or masonry shall be stainless steel.
- E. Reinforcing Steel: The ends of all reinforcing steel exposed after the removal of structural concrete shall be cleaned and then coated with a rust inhibitive alkyd primer as specified in Section 09900.
- F. Concrete Floors: Floor surfaces exposed by the removal of concrete equipment bases shall be restored to provide a finished surface equal in appearance to the surrounding floor.
1. The perimeter of the equipment base area, including any areas damaged by the base removal, shall be saw cut to a depth of 1 inch.
  2. The upper 1-inch of exposed floor shall be removed so as to provide a scarified surface.
  3. The 1-inch recess shall be patched with a patching mortar in accordance with the manufacturer's directions.

### 3.03 MECHANICAL REMOVALS

A. General:

1. Mechanical removals consist of dismantling and removing existing piping, valves, pumps, motors, equipment, blocking, supports, and other appurtenances as specified, shown, or required for the completion of the Work.

2. It includes cutting, capping, and plugging as required, except that the cutting of existing piping for the purpose of making connections is to be included under Division 15.
3. Where piping is called to be removed, it shall include all valves, meters, blocking, supports and other accessories that occur in the pipeline.

### 3.04 ELECTRICAL REMOVALS

#### A. General:

1. Electrical removals consist of the removal of existing transformers, distribution switchboards, control panels, motors, conduits and wires, poles and overhead wiring, panel boards, lighting fixtures, and miscellaneous electrical and metering equipment all as shown, specified, or required to perform the Work.
2. Electrical equipment and fixtures: Remove all existing electrical equipment and fixtures where shown with such care as may be required to prevent unnecessary damage, to keep existing systems in operation and to keep the integrity of the grounding systems.
3. In general, and unless specified otherwise or directed otherwise by the Owner's Representative, all electrical connections, including wiring and conduit, shall be removed back to the equipment starter where it shall be properly terminated.
4. Store in an enclosed, heated storage area all electrical equipment designated to remain the property of the Owner.

#### B. Overhead Wiring:

1. Abandon poles and overhead wiring as shown and specified.
2. Existing substation and poles owned by the power company will be removed by the power company.
3. Remove completely from the site abandoned poles not owned by the power company.
4. Salvage and store the overhead wires as specified.
5. Perform this work after the new service has been completed and energized, and in accordance with the approved schedule.
6. Make all the necessary arrangements with the power company for the removal of their transformers and metering equipment after the new electrical system has been installed and energized.

### 3.05 CLEAN-UP

#### A. General:

1. Remove from the site all debris resulting from the demolition operations as it accumulates.

2. Upon completion of the Work, remove all materials, equipment, waste, and debris of every sort and leave the premises clean, neat and orderly.
3. Finish grade and seed demolition work area in accordance with the project specifications.

END OF SECTION

## **SECTION 02130**

### **TRENCH EXCAVATION, BEDDING AND BACKFILL**

#### **PART 1 GENERAL**

##### **1.01 DESCRIPTION**

- A. Work Included: All trench excavations and fills to the lines and grades given for conduits, pipelines, etc. as required for proper completion of the work of this contract as shown on the Drawings.
- B. The trench excavation work item in this contract shall include the removal, handling, re-handling, filling, and disposal of any and all materials (whether they be wet or dry) found unsuitable by the Engineer encountered within the limits of the work and the transportation and placing thereof, and shall include all pumping, bailing, draining, sheeting and shoring, backfill, refill and protection , and backfill, together with rolling and tamping where such is required by these specifications and is not specifically included in another item of work in this contract.
- C. Existing ground elevations of the work site(s) are shown by figures and/or by contours on the Drawings. The contours and elevations of the present ground are believed to be reasonably correct, but do not purport to be absolutely so, and are presented only as an approximation. The Contractor shall satisfy himself, however, by his own actual examination of the site of the work, as to both the existing elevations and the amount of work required under this Section. If the Contractor is not willing to accept the ground surface elevations indicated upon the Drawings for payment, he shall notify the Engineer prior to the starting of any excavation work.
- D. Related Work:
  - 1. Including but not limited to the General Conditions, Supplementary Conditions and Division 1.
  - 2. All applicable Divisions of the Technical Specifications.

##### **1.02 QUALITY ASSURANCE**

- A. Compaction testing, as required, shall be performed by a soil's testing laboratory engaged and paid for by the Contractor. Testing shall be in accordance with ASTM Standards:
  - 1. ASTM C33 Specification for Concrete Aggregates.
  - 2. ASTM D698 Tests for Moisture – Design of Relations of Soils.
  - 3. ASTM D1556 Test for Density of Soil-in-Place by the Sand Cone Method.

4. ASTM D2922 Test for Density of Soil and Soil Aggregates in Place by Nuclear Methods.

### 1.03 SUBMITTALS

- A. Certifications attesting that the composition analysis of pipe protection and material stone backfill materials meets specification requirements.

### 1.04 JOB CONDITIONS

#### A. Control of Traffic

1. The Contractor shall provide all traffic control measures in accordance Ohio Manual of Uniform Traffic Control Devices (OMUTCD).

#### B. Utility Protection

1. Contractor shall notify all utility owners in accordance with Section 153.64 of the Ohio Revised Code a minimum of forty eight hours prior to the start of any work.
2. Contractor is responsible for the protection of all existing utilities and shall coordinate his work respectively.

#### C. Utility Services

1. The Contractor shall be responsible for maintaining all building utility service connections during the excavation and backfill process.
2. Immediately report to the utility company and the Engineer any break, leak or other damage to the lines or protective coatings made or discovered.
3. Allow free access to utility company personnel at all times for purposes of maintenance, repair and inspection.

## PART 2 PRODUCTS

### 2.01 PIPE BEDDING MATERIAL

#### A. Bedding materials shall be classified as follows:

1. Type 1 – Granular material shall be crushed limestone No. 57, 6, 67, 68, or 7 as shown in ODOT CMS Table 703.01-1.
2. Type 2 – Native soil, free from stones larger than 2 inches across their greatest dimension, top soil, vegetation, debris, rubbish or frozen material.
3. Type 3 – Concrete bedding, Class “C” concrete per ODOT CMS 511.



- B. Type 1 bedding material, a minimum 4 inches thick, shall be utilized where rock is encountered at the bottom of the trench.

## 2.02 BACKFILL MATERIAL

- A. Backfill materials shall be either natural materials or manufactured granular materials classified as follows:
  - 1. Type A – Crushed limestone granular material meeting the requirements of ODOT CMS Item 304.
  - 2. Type B – Natural soil free from stones larger than 2 inches across their greatest dimension, top soil, vegetation, debris, rubbish or frozen material.
  - 3. Type C – Low Strength Mortar as specified in ODOT CMS Item 613.
- B. Type A backfill material shall be utilized under and/or within five feet of existing or proposed roadways, paved shoulders, curbs, existing parking areas and drives.

## PART 3 EXECUTION

### 3.01 MAINTENANCE AND PROTECTION OF TRAFFIC

- A. Coordinate the work to insure the least inconvenience to traffic and maintain traffic in one or more unobstructed lanes unless closing the street is authorized.
- 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 to 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 installation of pipelines, miscellaneous structures, and appurtenances necessitate breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the centerline of the trench.
- B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.

### 3.03 BLASTING

- A. Blasting will not be permitted.

### 3.04 SUPPORT OF EXCAVATION

- A. The Contractor shall be responsible for supporting and maintaining all excavations required hereunder utilizing a trench box and even to the extent of sheeting, shoring the sides and ends of excavations with timber or other satisfactory supports. If the sheeting, braces, shores, and stringers or walling timbers or other supports are not properly placed or are insufficient, the Contractor shall provide additional or stronger supports. The requirements of sheeting or shoring, or of the addition of supports, shall not relieve the Contractor of this responsibility for their sufficiency. All trench protection and sheeting and shoring must conform to the regulations of the Federal Occupations Safety and Health (OSHA) and will be subject to conform to their respective inspections.
- B. All timbering shall be removed where and when required and, upon its removal, all voids carefully and compactly filled. If any timber is ordered in writing to be left in place, it shall be cut-off as directed and will be paid for in accordance with the change provisions outlined in the General Conditions. No payment will be made for wasted ends or for timber left in place without specific written authorization by the Owner.

### 3.05 REMOVAL OF WATER

- A. The Contractor shall pump out or otherwise remove and dispose of, as fast as it may collect any water, sewage, or any other liquids which may be found or may accumulate in the excavation, regardless or whether it be water or liquid wastes resulting from project activities or from existing conduits and works.
- B. Maintain pipe trenches in a dry condition until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Preclude trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.
- D. The Contractor shall maintain throughout construction, proper and approved pumps and machinery of sufficient capacity to meet the maximum requirements for the removal of water or other liquids and their disposal.

### 3.06 METHOD OF TRENCH EXCAVATION

- A. All excavation shall be open cut, unless otherwise permitted by the Engineer.
- B. Excavation shall be made to undisturbed finish subgrade six (6) inches below the bottom of the pipe, unless otherwise shown on the Drawings.
- C. Where unsuitable bearing material is encountered the trench shall be excavated to an additional depth below the excavation for the bottom of the pipe barrel of twelve (12) inches for pipe of twenty four (24) inches diameter and smaller and of eighteen (18) inches for pipe greater than twenty four (24) inches in diameter. This additional excavation is to be refilled with Type 1 (granular) or Type 3 (concrete) bedding material in a satisfactory manner to provide the proper foundation for the conduit bed.
- D. Trench must be excavated with vertical sides from the bottom of the trench to one (1) foot above the top of the pipe, from which point sides may slope to ground surface, except that, in streets or roadways, trenches must be excavated with vertical sides to the top of the trench. Width of trench in the vertical section shall be excavated only as wide as necessary to provide free forking space on each side of the piping according to the size of the pipe and the character of the ground. In every case there shall be sufficient space between the pipe and the sides of the trench to make it possible to thoroughly compact the backfill around the pipe and to secure tight joints, but in no case more than one (1) foot on either side of pipe. In no case, however, shall the width of the trench at the top of the pipe exceed the dimensions as shown on the Contract Drawings. In no case will it be permitted to excavate pipe trenches with sides sloping to the bottom.
- E. Bottom of trench bed must give a full, firm but slightly yielding support to the lower section of the pipe and so that the pipe barrel is firmly supported in the cradle throughout its entire length, in such manner as to prevent any subsequent settlement of the pipe. Boulders or loose rocks which might bear against the pipe will not be permitted in the trench bottom or sides below two (2) feet above the pipe. Bell holes must be excavated to assure full length bearing of the pipe barrel.
- F. Trenches must be kept free from water during pipe installation and until backfill operations have reached to the top of the pipe.
- G. At no time shall the Contractor advance trenching operations more than 100 feet ahead of completed pipeline except as approved by the Engineer.
- H. Where the Contractor, by error or intent, excavates beyond the minimum required depth, the trench shall be brought to the required pipeline grade with Type 1 or Type 3 bedding material at no cost to the Owner.

### 3.07 UNAUTHORIZED EXCAVATIONS

- A. All excavations carried outside of the lines and grades given or specified, together with the disposal of such material, and all excavations and other work resulting from slides, cave-ins, swellings or upheavals shall be at the Contractor's own cost and expense. All spaces resulting from unauthorized excavations or from slides or cave-ins shall be refilled at the Contractor's expense with concrete or other suitable material.

### 3.08 ADDITIONAL EXCAVATION

- A. It is expected that satisfactory foundations will be found at the elevations shown on the drawings, but in case the material encountered is not suitable, or in case it is found desirable or necessary to go to additional depth, the excavation shall be carried to an additional depth as ordered and refilled as directed by the Engineer.

### 3.09 THRUST RESTRAINT

- A. Provide pressure pipe with concrete thrust blocking at all bends, tees and changes in direction, in accordance with the details shown in the Drawings.

### 3.10 BEDDING

- A. All conduits shall be laid on bedding as described in these specifications and as shown on the Drawings. Unless otherwise indicated, bedding shall be Type 1.
- B. Type 1 Bedding shall be placed below and around the pipe shall be compacted to the spring line of the conduit. A minimum of four (4) inches of bedding material is to be present under the conduit for the full width of the trench. Care shall be taken to ensure the bedding material does not bridge beneath the haunch of the pipe. Care shall also be taken when compacting material underneath and at either side of the pipe that the tool or the machine does not strike to pipe.
- C. Type 2 Bedding shall be placed below the pipe in a "loose" condition. A minimum of four (4) inches of bedding material is to be present under the conduit for the full width of the trench.
- D. Where foundation conditions are such that the above types of bedding cannot be provided, as in quicksand, etc., special provisions shall be made as called for by the Contract Documents or as directed by the Engineer by providing concrete cradle or lumber foundations.

### 3.11 BACKFILLING

- A. As the various pipelines, conduits, etc. or parts of same are completed and inspected, the Contractor shall refill the space under, around and over with material as specified herein. Unless otherwise directed, all forms, bracing and lumber shall be removed during backfilling and the cavities and voids resulting from the removal shall be thoroughly backfilled.
- B. Care shall be taken to avoid disturbing the pipe when removing trench shoring or moving trench box.
- C. The backfill material shall be as specified and placed in accordance with the details shown in the Drawings. The limits of backfill shall be as indicated on the Drawings. The Contractor must use special care in placing this portion of the backfill so as to avoid injuring or moving the pipe when compacting the backfill. When the backfill has progressed to the limit shown on the details for the respective pipe, the work of backfilling shall be stopped, and the backfill in place shall be tamped or puddled as directed. Care shall be taken to prevent floating of the pipe when puddling is used as a compaction method.
- D. No cinders, rubbish, rocks, boulders, shale or other objectionable material shall be used as backfill against the pipe or in any part of the trench when, in the opinion of the Engineer, it will be injurious to the work. No backfilling shall be done with frozen materials.
- E. Type A Backfill shall be placed and compacted, using power driven mechanical tampers in layers of eight (8) inch compacted thickness unless approved by the Engineer.
- F. Type B Backfill shall be lightly consolidated to the top of the pipe.

### 3.12 DISPOSAL OF WASTE

- A. A selected portion of the excavated material will be used for backfilling or filling about the pipe as ordered. Excavated material in excess of that needed for backfilling and filling and unsuitable material shall be disposed of by the Contractor at his own expense, and the cost of such disposal shall be deemed as having been included in the unit or lump sum prices bid.
- B. Prior to disposal, the Contractor shall obtain and submit to the Engineer written permission from the owner of the property upon which the material and debris are to be placed.

### 3.13 COMPACTION REQUIREMENTS

- A. Control compaction during construction to provide the minimum percentage of density specified for each area as determined according to ASTM D698.

B. Provide not less than the following minimum density of material compacted at optimum moisture content for the actual density of each layer of material in place, and as approved by the Engineer:

1. Structures, Pavements, Walkways, Curbs and Steps:
  - a. Compact the subgrade and each layer of fill material or backfill material at 98% of maximum density.
2. Lawn and Unpaved Area:
  - a. Compact each layer of fill material or backfill material at 90% of maximum density.

C. Moisture Control:

1. Where subgrade or layer of soil material must be moisture conditioned before compacting, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during or subsequent to compacting operations.
2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to specified density.
3. Soil material that has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests approved by the test laboratory.

D. Unsuitable Backfill Material:

1. 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 or suitable foreign backfill material.

E. Compaction testing shall be required every 100 cubic yards or as required by the Engineer. Backfill found to be deficient shall be removed and re-compacted until compliant at no additional cost to the Owner.

### 3.14 ROUGH GRADING

- A. Rough grade areas disturbed by construction to a uniform finish. Form the bases for terraces, banks, lawns and paved areas.
- B. Grade areas to be paved to depths required for placing sub-base and paving materials.
- C. Rough grade areas to be seeded three (3) inches below indicated finish

contours.

### 3.15 RESTORATION OF UNPAVED SURFACES

- A. Restore unpaved surfaces disturbed by construction to equal the surface condition prior to construction.
- B. Restore grassed areas in accordance with Section 02936, Seeding and Mulching.

### 3.16 RESTORATION OF PAVED SURFACES

- A. Restore paved surfaces disturbed by construction to equal the surface condition prior to construction.
- B. Restore paved areas in accordance with Section 02500, Pavement Construction.

### 3.17 MAINTENANCE OF RESTORED SURFACES

- A. Protection of newly graded areas:
  - 1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.
  - 2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.
- B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, clarify the surface, reshape, and compact to the required density prior to further construction.
- C. Maintain erosion control methods in accordance with Section 02270, Slope Protection and Erosion Control and in accordance with the Erosion Control Plan specific to the project.

END OF SECTION

## SECTION 02130

### TRENCH EXCAVATION, BEDDING AND BACKFILL

#### PART 1 GENERAL

##### 1.01 DESCRIPTION

- A. Work Included: All trench excavations and fills to the lines and grades given for conduits, pipelines, etc. as required for proper completion of the work of this contract as shown on the Drawings.
- B. The trench excavation work item in this contract shall include the removal, handling, re-handling, filling, and disposal of any and all materials (whether they be wet or dry) found unsuitable by the Engineer encountered within the limits of the work and the transportation and placing thereof, and shall include all pumping, bailing, draining, sheeting and shoring, backfill, refill and protection , and backfill, together with rolling and tamping where such is required by these specifications and is not specifically included in another item of work in this contract.
- C. Existing ground elevations of the work site(s) are shown by figures and/or by contours on the Drawings. The contours and elevations of the present ground are believed to be reasonably correct, but do not purport to be absolutely so, and are presented only as an approximation. The Contractor shall satisfy himself, however, by his own actual examination of the site of the work, as to both the existing elevations and the amount of work required under this Section. If the Contractor is not willing to accept the ground surface elevations indicated upon the Drawings for payment, he shall notify the Engineer prior to the starting of any excavation work.
- D. Related Work:
  - 1. Including but not limited to the General Conditions, Supplementary Conditions and Division 1.
  - 2. All applicable Divisions of the Technical Specifications.

##### 1.02 QUALITY ASSURANCE

- A. Compaction testing, as required, shall be performed by a soil's testing laboratory engaged and paid for by the Contractor. Testing shall be in accordance with ASTM Standards:
  - 1. ASTM C33 Specification for Concrete Aggregates.
  - 2. ASTM D698 Tests for Moisture – Design of Relations of Soils.
  - 3. ASTM D1556 Test for Density of Soil-in-Place by the Sand Cone



Method.

4. ASTM D2922 Test for Density of Soil and Soil Aggregates in Place by Nuclear Methods.

### 1.03 SUBMITTALS

- A. Certifications attesting that the composition analysis of pipe protection and material stone backfill materials meets specification requirements.

### 1.04 JOB CONDITIONS

#### A. Control of Traffic

1. The Contractor shall provide all traffic control measures in accordance Ohio Manual of Uniform Traffic Control Devices (OMUTCD).

#### B. Utility Protection

1. Contractor shall notify all utility owners in accordance with Section 153.64 of the Ohio Revised Code a minimum of forty eight hours prior to the start of any work.
2. Contractor is responsible for the protection of all existing utilities and shall coordinate his work respectively.

#### C. Utility Services

1. The Contractor shall be responsible for maintaining all building utility service connections during the excavation and backfill process.
2. Immediately report to the utility company and the Engineer any break, leak or other damage to the lines or protective coatings made or discovered.
3. Allow free access to utility company personnel at all times for purposes of maintenance, repair and inspection.

## PART 2 PRODUCTS

### 2.01 PIPE BEDDING MATERIAL

#### A. Bedding materials shall be classified as follows:

1. Type 1 – Granular material shall be crushed limestone No. 57, 6, 67, 68, or 7 as shown in ODOT CMS Table 703.01-1.
2. Type 2 – Native soil, free from stones larger than 2 inches across their greatest dimension, top soil, vegetation, debris, rubbish or frozen material.
3. Type 3 – Concrete bedding, Class “C” concrete per ODOT CMS 511.

- B. Type 1 bedding material, a minimum 4 inches thick, shall be utilized where rock is encountered at the bottom of the trench.

## 2.02 BACKFILL MATERIAL

- A. Backfill materials shall be either natural materials or manufactured granular materials classified as follows:
  - 1. Type A – Crushed limestone granular material meeting the requirements of ODOT CMS Item 304.
  - 2. Type B – Natural soil free from stones larger than 2 inches across their greatest dimension, top soil, vegetation, debris, rubbish or frozen material.
  - 3. Type C – Low Strength Mortar as specified in ODOT CMS Item 613.
- B. Type A backfill material shall be utilized under and/or within five feet of existing or proposed roadways, paved shoulders, curbs, existing parking areas and drives.

## PART 3 EXECUTION

### 3.01 MAINTENANCE AND PROTECTION OF TRAFFIC

- A. Coordinate the work to insure the least inconvenience to traffic and maintain traffic in one or more unobstructed lanes unless closing the street is authorized.
- 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 to 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 installation of pipelines, miscellaneous structures, and appurtenances necessitate breaking a paved surface, make cuts in a neat uniform fashion forming straight lines parallel with the centerline of the trench.
- B. Protect edges of cut pavement during excavation to prevent raveling or breaking; square edges prior to pavement replacement.

### 3.03 BLASTING

- A. Blasting will not be permitted.

### 3.04 SUPPORT OF EXCAVATION

- A. The Contractor shall be responsible for supporting and maintaining all excavations required hereunder utilizing a trench box and even to the extent of sheeting, shoring the sides and ends of excavations with timber or other satisfactory supports. If the sheeting, braces, shores, and stringers or walling timbers or other supports are not properly placed or are insufficient, the Contractor shall provide additional or stronger supports. The requirements of sheeting or shoring, or of the addition of supports, shall not relieve the Contractor of this responsibility for their sufficiency. All trench protection and sheeting and shoring must conform to the regulations of the Federal Occupations Safety and Health (OSHA) and will be subject to conform to their respective inspections.
- B. All timbering shall be removed where and when required and, upon its removal, all voids carefully and compactly filled. If any timber is ordered in writing to be left in place, it shall be cut-off as directed and will be paid for in accordance with the change provisions outlined in the General Conditions. No payment will be made for wasted ends or for timber left in place without specific written authorization by the Owner.

### 3.05 REMOVAL OF WATER

- A. The Contractor shall pump out or otherwise remove and dispose of, as fast as it may collect any water, sewage, or any other liquids which may be found or may accumulate in the excavation, regardless or whether it be water or liquid wastes resulting from project activities or from existing conduits and works.
- B. Maintain pipe trenches in a dry condition until pipe has been jointed, inspected, and backfilled, and concrete work has been completed. Preclude trench water from entering pipelines under construction.
- C. Intercept and divert surface drainage away from excavations. Design surface drainage systems so that they do not cause erosion on or off the site, or cause unwanted flow of water.
- D. The Contractor shall maintain throughout construction, proper and approved pumps and machinery of sufficient capacity to meet the maximum requirements for the removal of water or other liquids and their disposal.

### 3.06 METHOD OF TRENCH EXCAVATION

- A. All excavation shall be open cut, unless otherwise permitted by the Engineer.
- B. Excavation shall be made to undisturbed finish subgrade six (6) inches below the bottom of the pipe, unless otherwise shown on the Drawings.
- C. Where unsuitable bearing material is encountered the trench shall be excavated to an additional depth below the excavation for the bottom of the pipe barrel of twelve (12) inches for pipe of twenty four (24) inches diameter and smaller and of eighteen (18) inches for pipe greater than twenty four (24) inches in diameter. This additional excavation is to be refilled with Type 1 (granular) or Type 3 (concrete) bedding material in a satisfactory manner to provide the proper foundation for the conduit bed.
- D. Trench must be excavated with vertical sides from the bottom of the trench to one (1) foot above the top of the pipe, from which point sides may slope to ground surface, except that, in streets or roadways, trenches must be excavated with vertical sides to the top of the trench. Width of trench in the vertical section shall be excavated only as wide as necessary to provide free forking space on each side of the piping according to the size of the pipe and the character of the ground. In every case there shall be sufficient space between the pipe and the sides of the trench to make it possible to thoroughly compact the backfill around the pipe and to secure tight joints, but in no case more than one (1) foot on either side of pipe. In no case, however, shall the width of the trench at the top of the pipe exceed the dimensions as shown on the Contract Drawings. In no case will it be permitted to excavate pipe trenches with sides sloping to the bottom.
- E. Bottom of trench bed must give a full, firm but slightly yielding support to the lower section of the pipe and so that the pipe barrel is firmly supported in the cradle throughout its entire length, in such manner as to prevent any subsequent settlement of the pipe. Boulders or loose rocks which might bear against the pipe will not be permitted in the trench bottom or sides below two (2) feet above the pipe. Bell holes must be excavated to assure full length bearing of the pipe barrel.
- F. Trenches must be kept free from water during pipe installation and until backfill operations have reached to the top of the pipe.
- G. At no time shall the Contractor advance trenching operations more than 100 feet ahead of completed pipeline except as approved by the Engineer.
- H. Where the Contractor, by error or intent, excavates beyond the minimum

required depth, the trench shall be brought to the required pipeline grade with Type 1 or Type 3 bedding material at no cost to the Owner.

### 3.07 UNAUTHORIZED EXCAVATIONS

- A. All excavations carried outside of the lines and grades given or specified, together with the disposal of such material, and all excavations and other work resulting from slides, cave-ins, swellings or upheavals shall be at the Contractor's own cost and expense. All spaces resulting from unauthorized excavations or from slides or cave-ins shall be refilled at the Contractor's expense with concrete or other suitable material.

### 3.08 ADDITIONAL EXCAVATION

- A. It is expected that satisfactory foundations will be found at the elevations shown on the drawings, but in case the material encountered is not suitable, or in case it is found desirable or necessary to go to additional depth, the excavation shall be carried to an additional depth as ordered and refilled as directed by the Engineer.

### 3.09 THRUST RESTRAINT

- A. Provide pressure pipe with concrete thrust blocking at all bends, tees and changes in direction, in accordance with the details shown in the Drawings.

### 3.10 BEDDING

- A. All conduits shall be laid on bedding as described in these specifications and as shown on the Drawings. Unless otherwise indicated, bedding shall be Type 1.
- B. Type 1 Bedding shall be placed below and around the pipe shall be compacted to the spring line of the conduit. A minimum of four (4) inches of bedding material is to be present under the conduit for the full width of the trench. Care shall be taken to ensure the bedding material does not bridge beneath the haunch of the pipe. Care shall also be taken when compacting material underneath and at either side of the pipe that the tool or the machine does not strike to pipe.
- C. Type 2 Bedding shall be placed below the pipe in a "loose" condition. A minimum of four (4) inches of bedding material is to be present under the conduit for the full width of the trench.
- D. Where foundation conditions are such that the above types of bedding cannot be provided, as in quicksand, etc., special provisions shall be made as called for by the Contract Documents or as directed by the Engineer by

providing concrete cradle or lumber foundations.

### 3.11 BACKFILLING

- A. As the various pipelines, conduits, etc. or parts of same are completed and inspected, the Contractor shall refill the space under, around and over with material as specified herein. Unless otherwise directed, all forms, bracing and lumber shall be removed during backfilling and the cavities and voids resulting from the removal shall be thoroughly backfilled.
- B. Care shall be taken to avoid disturbing the pipe when removing trench shoring or moving trench box.
- C. The backfill material shall be as specified and placed in accordance with the details shown in the Drawings. The limits of backfill shall be as indicated on the Drawings. The Contractor must use special care in placing this portion of the backfill so as to avoid injuring or moving the pipe when compacting the backfill. When the backfill has progressed to the limit shown on the details for the respective pipe, the work of backfilling shall be stopped, and the backfill in place shall be tamped or puddled as directed. Care shall be taken to prevent floating of the pipe when puddling is used as a compaction method.
- D. No cinders, rubbish, rocks, boulders, shale or other objectionable material shall be used as backfill against the pipe or in any part of the trench when, in the opinion of the Engineer, it will be injurious to the work. No backfilling shall be done with frozen materials.
- E. Type A Backfill shall be placed and compacted, using power driven mechanical tampers in layers of eight (8) inch compacted thickness unless approved by the Engineer.
- F. Type B Backfill shall be lightly consolidated to the top of the pipe.

### 3.12 DISPOSAL OF WASTE

- A. A selected portion of the excavated material will be used for backfilling or filling about the pipe as ordered. Excavated material in excess of that needed for backfilling and filling and unsuitable material shall be disposed of by the Contractor at his own expense, and the cost of such disposal shall be deemed as having been included in the unit or lump sum prices bid.
- B. Prior to disposal, the Contractor shall obtain and submit to the Engineer written permission from the owner of the property upon which the material and debris are to be placed.

### 3.13 COMPACTION REQUIREMENTS

- A. Control compaction during construction to provide the minimum percentage of density specified for each area as determined according to ASTM D698.
- B. Provide not less than the following minimum density of material compacted at optimum moisture content for the actual density of each layer of material in place, and as approved by the Engineer:
  - 1. Structures, Pavements, Walkways, Curbs and Steps:
    - a. Compact the subgrade and each layer of fill material or backfill material at 98% of maximum density.
  - 2. Lawn and Unpaved Area:
    - a. Compact each layer of fill material or backfill material at 90% of maximum density.
- C. Moisture Control:
  - 1. Where subgrade or layer of soil material must be moisture conditioned before compacting, uniformly apply water to surface of subgrade or layer of soil material to prevent free water appearing on surface during or subsequent to compacting operations.
  - 2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compacting to specified density.
  - 3. Soil material that has been removed because it is too wet to permit compacting may be stockpiled or spread and allowed to dry. Assist drying by disking, harrowing, or pulverizing until moisture content is reduced to a satisfactory value as determined by moisture-density relation tests approved by the test laboratory.
- D. Unsuitable Backfill Material:
  - 1. 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 or suitable foreign backfill material.
- E. Compaction testing shall be required every 100 cubic yards or as required by the Engineer. Backfill found to be deficient shall be removed and re-compacted until compliant at no additional cost to the Owner.

### 3.14 ROUGH GRADING

- A. Rough grade areas disturbed by construction to a uniform finish. Form the bases for terraces, banks, lawns and paved areas.

- B. Grade areas to be paved to depths required for placing sub-base and paving materials.
- C. Rough grade areas to be seeded three (3) inches below indicated finish contours.

### 3.15 RESTORATION OF UNPAVED SURFACES

- A. Restore unpaved surfaces disturbed by construction to equal the surface condition prior to construction.
- B. Restore grassed areas in accordance with Section 02936, Seeding and Mulching.

### 3.16 RESTORATION OF PAVED SURFACES

- A. Restore paved surfaces disturbed by construction to equal the surface condition prior to construction.
- B. Restore paved areas in accordance with Section 02500, Pavement Construction.

### 3.17 MAINTENANCE OF RESTORED SURFACES

- A. Protection of newly graded areas:
  - 1. Protect newly graded areas from traffic and erosion, and keep free from trash and weeds.
  - 2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.
- B. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, clarify the surface, reshape, and compact to the required density prior to further construction.
- C. Maintain erosion control methods in accordance with Section 02270, Slope Protection and Erosion Control and in accordance with the Erosion Control Plan specific to the project.

END OF SECTION



## **SECTION 02200**

### **EARTHWORK AND SITE PREPARATION**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Excavation and grading.
- B. Removal of debris and clean-up.

##### **1.02 REFERENCE**

- A. All applicable requirements of other portions of the Contract Documents apply to the Work of this Section.

##### **1.03 RELATED SECTIONS**

- A. Section 01500, Temporary Facilities and Controls
- B. Section 02500, Pavement Construction
- C. All embankment and fill shall conform to ODOT Item 203.

##### **1.04 SUBMITTALS**

- A. All submittals shall conform completely to the requirements of the Contract Documents.
- B. Site Plan showing:
  - 1. Vegetation removal limits.
  - 2. Areas for temporary construction and field offices.
- C. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.
- D. Reference Submittals
  - 1. Material Certification
    - a. Building porous fill
    - b. Gravel fill
    - c. Pavement sub base course
    - d. Other material certification as required

- E. Test Reports

1. General
  - a. Test soil materials proposed for use in the Work and promptly submit test result reports.
  - b. The Owner may require one optimum moisture-maximum density curve for each type of soil encountered in sub grade and fills under:
    - 1) Building slabs
    - 2) Foundations
    - 3) Paved areas
  - c. Determine maximum densities in accordance with ASTM D698.
  - d. The Engineer will determine the suitability of materials to be used as fill.
  - e. For borrow materials, perform a mechanical analysis (AASHTO T88), plasticity index (AASHTO T91), and a moisture-density curve (AASHTO T99 or ASTM DG98)
2. Backfill and fill materials
3. Verification of each footing sub grade
4. Field density test reports.
5. One optimum moisture-maximum density curve for each type of soil encountered.
6. Other tests as required
7. If a soil testing is not performed, contractor assumes responsibility for adequate foundations for each structure.

#### 1.05 JOB CONDITIONS

- A. Minimize production of dust due to operations; do not use water if it will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- B. Comply with other requirements specified in Section 01700.
- C. Use of Explosives: The use of explosives will not be permitted.

#### 1.06 QUALITY ASSURANCE

- A. Permits and Regulations:
  1. Obtain all necessary permits for work in roads, and rights-of-way, etc.
  2. Obtain permits as required by local, state, and federal agencies for discharging water from excavations to rivers and streams.
  3. Perform excavation work in compliance with applicable requirements of governing authorities having jurisdiction.

## PART 2 PRODUCTS

## 2.01 MATERIALS

### A. Soil Materials:

1. Gravel Fill: Naturally or artificially graded mixture of crushed limestone or gravel. The gradation shall conform to ASTM C33 size # 57.
2. Pavement Sub base Course: ODOT Item 304.
3. Backfill and Fill Materials.
  - a. Provide soil materials for backfill and fill free of clay, debris, waste, frozen materials, vegetation and other deteriorious matter.
  - b. Rock or gravel shall not be larger than 3" in any direction.
  - c. Backfill and fill shall consist of materials classified as "SC" or coarser by ASTM D2487.
  - d. Materials finer than "SC" may be used when a registered Geotechnical Engineer is engaged to analyze proposed fill material for its suitability as fill material and its ability to be compacted in accordance with this section. The material shall be such that the required compaction percentages of maximum density, listed in paragraph "Compaction" in Part 3 of this Section, can be reasonably achieved.
  - e. Materials classified as "ML" or finer by ASTM D2487 shall not be permitted, except when a registered Geotechnical Engineer is engaged.

### B. Alternate and Fill Material:

1. Contractor may, at his option, substitute a specially manufactured material upon approval.
2. The material shall have a cement base and is combined with other admixtures, fly ash, or other materials specifically designed for the product.
3. The material must have been successfully used in the completion of mass fills having a minimum of 20,000 cubic yards in the past 5 years.
4. Similar materials must have been successfully used for at least 10 years.
5. Material must have a minimum cast density of 30 pcf and a minimum compressive strength of 4,000 psi.
6. Material shall be Elastize II EF, or approved equal.

### C. Drainage Fill:

1. Washed, uniformly graded mixture of crushed stone, or crushed or uncrushed gravel conforming to AASHTO M43 No. 57.

### D. Controlled Density Fill:

1. Provide flowable and pumpable 100 percent water and fly ash mixture. Material must be mixed immediately prior to placement by volumetric mixing equipment. Proportions to yield approximately one cubic yard of mixture are as follows:
  - Fly Ash, Class F - 1,500 pounds
  - Fly Ash, Class C - 500 pounds
  - Water (maximum) - 850 pounds
2. Loss on ignition of Class F fly ash shall not exceed 8%. Class C fly ash shall meet ASTM C-618.

E. Stabilized Crushed Aggregate (ODOT Item 411):

1. Comply with Section 02500, Pavement Construction.

F. Crushed Aggregate Slope Protection:

1. Crushed gravel, stone or slag, Size No. 1 or No. 2.

G. Topsoil:

1. Characteristics: Fertile, friable, natural loam, surface soil, capable of sustaining vigorous plant growth, free of any admixture of subsoil, clods of hard earth, plants or roots, sticks or other extraneous material harmful to plant growth.
2. Material Analysis:
  - 3/4-inch mesh: 100 percent passing
  - #4 sieve: 90 to 100 percent passing
  - #200 sieve: 0 to 10 percent passing
  - Clay content of material passing #200 sieve not greater than 60 percent, as determined by hydrometer tests.
3. pH 5.0 to pH 6.5
4. Organic content not less than 5 percent nor more than 20 percent, as determined by ignition loss.
5. Free of pests and pest larvae.

## PART 3 EXECUTION

### 3.01 PROTECTION

A. General

1. Protection of Persons and Property
  - a. All excavations shall be backfilled before the end of the work day
  - b. Barricade open excavations occurring as part of this Work and post with warning lights. Operate warning lights during hours from dusk to dawn each day and as otherwise required.

- c. Protect structures, utilities, sidewalks, pavements, and other facilities from damages caused by settlement, lateral movement, undermining, washout and other hazards created by excavation operations.

## B. Existing Improvements Protection

### 1. General

- a. Provide protection necessary to prevent damage to existing improvements indicated to remain in place.
- b. Protect improvements on adjoining properties and on the Owner's property.
- c. Restore damaged improvements to their original condition, as acceptable to parties having jurisdiction.

### 2. Existing Utilities Protection

- a. Locate existing underground utilities in the areas of Work. Utilities on plans are shown to the best available information but are not warranted to be accurate. Contractor shall call the Ohio Utilities Protection Service, The Oil and Gas Producers Underground Protection Service, and other utilities as needed, and have utilities located 48 hours prior to any construction. If utilities are to remain in place, provide adequate means of protecting during excavation operations.
- b. Should uncharted or incorrectly charted piping or other utilities be encountered during excavation, consult the Engineer or Owner immediately. Cooperate with the Owner and public and private utility companies in keeping their respective services and facilities in operation. Repair damaged utilities to the satisfaction of the Utility Owner.
- c. Do not interrupt existing utilities serving facilities occupied and used by the Owner or others, except when permitted in writing by the Engineer or Owner and then only after acceptable temporary utility services have been provided.

## 3.02 EXCAVATION

### A. General

- 1. Excavation consists of the removal and disposal of materials encountered when establishing the required grade elevations.
- 2. Unauthorized excavation consists of removal of materials beyond indicated sub grade elevation or side dimensions without the specific direction of the Engineer, and/or the Owner
  - a. Under footings, foundation bases, or retaining walls, unauthorized excavation may be filled by extending the indicated bottom elevation of the footing or base to the excavation bottom (ENGINEER and/or

the Owner must be notified and approval given before commencing), without altering the required top elevation. Lean concrete fill (1500 psi minimum) may be used to bring elevations to the proper position, only when acceptable to the Engineer and/or the Owner and when approval has been given.

- b. Elsewhere, backfill and compact unauthorized excavations as specified for authorized excavations of the same classification, unless otherwise directed by the Engineer and/or the Owner.

B. Excavation Classification: All excavation is unclassified.

C. Stability of Excavations

1. Slope the sides of excavations to comply with local codes and ordinances having jurisdiction. Shore and brace where sloping is not possible either because of space restrictions or stability of material excavated.
2. Maintain sides and slopes of excavations in a safe condition until completion of backfilling.
3. The maximum slope ratio from bottom edge of foundation to the next foundation and/or any other excavation shall be one (1) vertical to two (2) horizontal, except where approved by a registered Geotechnical Engineer to be less than a 1 to 2 slope.

D. Shoring, Bracing and Underpinning

1. General
  - a. Design and provide shoring and bracing and underpinning to comply with local codes and authorities having jurisdiction.
2. Underpinning
  - a. The Contractor shall include in his bid the cost of underpinning. The Contractor shall not be entitled to any extra payments for unforeseen conditions during underpinning.
  - b. The Contractor shall take total responsibility for the design and construction of the underpinning. The submission of Drawings and calculations places no responsibility on the Owner or the Engineer to review such. If the Owner or the Engineer do review such, then they shall have the right to have reasonable and necessary modifications made in the design without any additional compensation.
3. Shoring and Bracing
  - a. Provide materials for shoring and bracing, such as sheet piling, soldier beams, stringer, rakes, walers and cross-braces, etc., in good serviceable condition.
  - b. Maintain shoring and bracing in excavations regardless of the period excavations will be open. Carry down shoring and bracing as the excavation progresses.

- c. Provide permanent steel sheet piling or pressure creosoted timber sheet piling wherever subsequent removal of sheet piling might permit the lateral movement of soil under adjacent structures. Cut-off tops as required and leave permanently in place.
- d. Excavations shall be shored and sheeted with members of sizes and arrangement sufficient to prevent injury to persons, damage to structure, injurious caving, or erosion; shoring, sheeting and bracing shall be removed as the excavations are backfilled; care shall be exercised to prevent injurious caving during the removal of the and/or sheeting.

#### E. Detection of Movement

1. Provide, install, and maintain monitoring equipment to detect horizontal or vertical movement of structures which might be affected
2. Visual methods of determining movements: Inscribe or firmly affix on each column, foundation, pile cap, or wall to be underpinned or supported, and at additional locations indicated by the Engineer or Owner. The method used is at the discretion of the Contractor but shall be capable of being read to an accuracy of 0.005'.
3. Take readings daily or more often, if necessary, during the progress of underpinning or support operations, and for a period of four weeks after completion of such operations. The frequency of the readings may be reduced at a specific location upon approval of the Engineer employed by the Contractor.

#### F. Dewatering

1. Prevent surface water and subsurface or groundwater from flowing into the excavations and flooding the Project Site and surrounding area.
2. Do not allow water to accumulate in excavations. Remove water from excavations to prevent softening of foundation bottoms, undercutting footings, and soil changes detrimental to the stability of sub grades and foundations. Provide and maintain pumps, sumps, suction and discharge lines, and other dewatering system components necessary to convey the water away from excavations.
3. Convey water removed from excavations and rainwater to collection or runoff areas. Provide and maintain temporary drainage ditches and other diversions outside the excavation limits for each structure. Do not use trench excavations for site utilities as temporary drainage ditches.

#### G. Material Storage

1. Stockpile excavated materials classified as satisfactory soil material where indicated by the Engineer or Owner, until required for backfill or fill. Place, grade and shape stockpiles for proper drainage.

2. Locate and retain fill materials away from edges of excavations.
3. Dispose of excess soil material and waste materials as specified hereinafter.

#### H. Removal of Unsatisfactory Soil Materials

1. Excavate unsatisfactory soil materials encountered that extend below the required elevations, to the additional depth as indicated by the Engineer or Owner.
2. Such additional excavation provided it is not due to the fault or neglect of the Contractor, shall be measured as indicated by the Engineer or Owner, and paid for as a change in the Work.

#### I. Cold Weather Protection

1. Protect excavation bottoms against freezing when the atmospheric temperature is less than 35 deg F.

#### J. Existing Improvements

1. General
  - a. Remove above-grade and below-grade improvements necessary to permit construction, and other Work as indicated.
  - b. Removal of abandoned underground piping or conduit interfering with construction is included under this Section.
2. Surface Structures
  - a. Remove buildings, curbs, gutters, walls, fences, walks, drives, etc., where indicated or where necessary for execution of the Work.
3. Subsurface Structures
  - a. Subsurface Structures Inside or Beneath New Structure.
    - 1) Remove during excavation where necessary to reach required elevations.
    - 2) Remove vertical projections and/or horizontal structures to a distance of 4'-0" below any part of new construction such as foundations, slabs, tie beams, grade beams and utilities.
    - 3) Existing horizontal surfaces below new construction shall be thoroughly fractured to ensure drainage.
  - b. Subsurface Structures Outside of New Structure and within 3' of New Footing Edges
    - 1) Remove all horizontal and vertical structures.
  - c. Subsurface Structures Beyond 3' of New Footing Edges
    - 1) Remove structures to a level at least 2' below new finish grades.
    - 2) Horizontal surfaces existing below finished grade shall be thoroughly fractured to ensure drainage.
4. Abandoned Underground Utilities



- a. Demolish and completely remove from the Site existing underground utilities indicated to be removed. Coordinate with local utility companies for shut-off of services if lines are active.
- b. Any lines to be abandoned that extend beyond the excavation must be capped or plugged.
- c. Abandoned underground utilities under structures to be constructed (concrete, masonry, cast iron, ceramic clay, etc.) which are no longer in use shall be filled solid with concrete, or remove and backfill as specified herein.
- d. Close open ends of metallic conduit and pipe with threaded galvanized metal caps or plastic plugs, or other suitable method for the type of material and size of pipe. Do not use wood plugs.
- e. Close open ends of concrete and masonry utilities with not less than 8" thick brick masonry bulkheads, constructed to completely fill the opening.
  - 1) Wet brick before laying, and lay brick in mortar so as to form a full bed with ends and side joints in one operation and joints not more than 3/8" wide. Protect fresh masonry from freezing or from rapid drying and maintain protection until mortar has set.

#### K. New Structures

1. Conform to the elevations and dimensions shown on the Drawings, within a tolerance of  $\pm 0.10'$ , and extending a sufficient distance from footings and foundations to permit placing and removal of concrete formwork, installation of services, other construction required, and for inspection.
2. In excavating for footings and foundations, take care not to disturb the bottom of the excavation. Excavate by hand to final grade just before concrete is placed. Trim bottoms to the required lines and grades to leave a solid base to receive concrete.

#### L. Pavements

1. Cut surface under pavements to comply with grades indicated.

#### M. Ditches

1. Cut ditches to cross-sections and grades as shown. Deposit excavated materials to prevent cave-ins or material falling or sliding into ditch. Keep ditches free of debris until final acceptance of the Work.

#### N. Pipe Trenches

1. Width of trench excavation shall be the size of the pipes plus 2'-0"; use sheeting and as required to help minimize width of trench. The

excavation of pipe trenches shall not endanger the bearing of building foundations.

2. Comply with paragraph "Shoring and Bracing" in Part 3 of this Section for other information.
3. Compaction of soil in the backfilling operation for utility lines shall be as specified herein. A minimum cover of 2' shall be maintained over all piping at all times during construction. Any pipe damage during construction due to inadequate cover or other protection as required shall be replaced at no additional expense to the Owner.

### 3.03 COMPACTION

A. General: Control soil compaction during construction for compliance with the percentage of maximum density specified for each area classification.

#### B. Percentage of Maximum Density Requirements

1. In fill areas, provide not less than the following percentages of maximum density of soil material compacted at optimum moisture content, according to standard proctor ASTM D69B dry density.
  - a. Structures: Compact each 8" layer of backfill or fill material at a minimum 98% density. Fill shall be in compliance with tank manufacturer requirements for structural loads.
  - b. Building slabs and steps: Compact each 8" layer of backfill or fill material at 98% density.
  - c. All other areas: Contractor to backfill native material and compact as necessary to prevent settlement. Contractor shall be required to refill any settled areas and restabilize.
  - d. Contractor to restore all disturbed areas to pre-construction condition or better.

#### C. Moisture Control

1. Where the sub grade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to the surface of sub grade, or layer of soil material, to prevent free water appearing on the surface during or subsequent to compaction operations.
2. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density.
  - a. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by dicing, harrowing or pulverizing, until the moisture content is reduced to a satisfactory value, as determined by moisture-density relation tests.

### 3.04 BACKFILL AND FILL

## A. General

1. Place acceptable soil material in layers to required sub grade elevations, for each area classification listed below.
  - a. In all excavations: Excavated or borrow backfill and fill materials
  - b. Under grassed areas: Excavated or borrow backfill and fill materials.
  - c. Under walks and pavements: Approved sub base material.
2. All soil materials shall be sampled and tested for compliance with all requirements of Part 2 of this Section.

## B. Preparation for Backfill

1. Backfill excavations as promptly as the Work permits, but not until completion of the following:
  - a. Acceptance by ENGINEER or Owner of construction below finish grade including, where applicable, damp proofing, waterproofing, and perimeter insulation.
  - b. Inspection, testing, approval, and recording locations of underground utilities.
  - c. Removal of concrete formwork.
  - d. Removal of shoring and bracing, and backfilling of voids with satisfactory materials. Cut off temporary sheet piling driven below bottom of structures and remove in a manner to prevent settlement of the structure or utilities, or leave in place if required.
  - e. Removal of trash and debris.
  - f. Permanent or temporary horizontal bracing is in place on horizontally supported walls.
  - g. Do not backfill against walls until slab on grade and first framed floor is complete and concrete has attained its design strength.

## C. Placement and Compaction

1. Place backfill and fill materials in layers not more than 8" in loose depth. Before compaction, moisten or aerate each layer as necessary to provide the optimum moisture content of the soil material. Compact each layer to the required percentage of maximum density for each area classification. Do not place backfill or fill material on surfaces that are muddy, frozen, or contain frost or ice.
2. Pipe backfill: Roadways, Sidewalks and Drive; 98% Standard Proctor compaction; lawn areas; 95% Standard Proctor compaction. Contractor shall place backfill materials evenly adjacent to structures, to the required elevations. Contractor shall take care to prevent wedging action and unequal horizontal pressures of the backfill against structures by placing the material uniformly on all sides of the structure to approximately the same elevation in each lift ( $\pm 1'-0"$ ).

3. Where utility facilities and structures are supported in place, use special equipment and techniques as required to achieve the specified compaction under and around them.

#### D. Alternate Backfill and Fill Material

1. The installer shall be certified by the manufacturer of the material and approved by the Engineer.
2. All equipment used in batching, mixing, and placement must be approved by the manufacturer.
3. A representative of the manufacturer must be on site for the initial placement of materials and make any appropriate changes in operations.
4. Five (5) samples will be taken for testing from each 200 cubic yards of material placed. Testing will be conducted by the Contractor at no additional cost to Owner.

### 3.05 GRADING

- A. General: Uniformly grade areas within the limits of grading under this Section, including adjacent transition areas. Smooth finished surfaces within specified tolerances, with uniform levels or slopes between points where elevations are shown, or between such points and existing grades.

#### B. Grading Outside Building Lines

1. Grade areas outside building lines to drain away from structures and to prevent ponding of water. Compact as specified.
2. Finish the surfaces free from irregular surface changes, and as follows:
  - a. Grassed Areas: Finish areas to receive topsoil to within not more than 0.10' above or below the required sub grade elevations.
  - b. Walks: Shape the surface of areas under walks to line, grade and cross-section, with the finish surface not more than 0.10' above or below the required sub grade elevation.
  - c. Pavements: Shape the surface of areas under pavement to line, grade and cross-section indicated, with the finish surface not more than 1/2" above or below the required sub grade elevation, and graded to prevent ponding of water after rains. Include such operations as plowing, dicing, and any moisture or aerating required to provide the optimum moisture content for compaction. Fill low areas resulting from removal of unsatisfactory soil materials, obstructions, and other deleterious materials, using satisfactory material.
  - d. Ditches: Finish ditches to ensure proper flow and drainage. Conduct final rolling operations to produce a hard, uniform and smooth cross-section. Permanently stabilize as required by Erosion Control Plan.

### C. Grading Surface of Under Building Slabs

1. Grade the surface of fill under building slabs smooth and even, free of voids, compacted a specified, and to required elevation.
2. Provide final grades within a tolerance of 1/4" when tested with a 10' straight edge; the maximum out-of-level tolerance for the entire length of grade for slabs in either direction shall be  $\pm 2$ ".

### 3.06 FIELD QUALITY CONTROL

#### A. Compact each 8" layer of backfill to levels stated previously or fill material at 98% density Quality Control Testing Construction

1. Testing service must inspect and the Geotechnical Engineer must approve existing ground surface, fill layers and sub grades before further construction Work is performed thereon. Tests will be taken as follows:
  - a. Footing Sub grade: For each stratum of existing soil on which footings will be placed, provide visual verification and any tests that are required to verify that design bearing capacities have been met. This verification shall be made by a qualified Soils Engineer. The Engineer or Owner reserve the right to order more or fewer inspection tests as required.
  - b. Paved Areas and Building Slab Subgrade: Make at least one field density test of the subgrade surface in cut areas for every 2,000 sq. ft. of paved area or building slab, but in no case less than three tests. In each compacted fill layer, make one field density for every 2,000 sq. ft. of overlaying building slab or paved area, but in no case less than three tests. The Engineer or Owner reserve the right to order more or less inspection tests as required.
2. If, in the opinion of the Engineer or Owner, based on reports of the testing service and inspection, the subgrade or fills which have been placed are below the specified density, provide additional compaction and testing at no additional expense to the Owner.
  - a. The results of the density tests shall be equal to or greater than the specified density except that 1 density test out of 5 consecutive density tests for the same area being tested may have a test result of 2% below specified density.

### 3.07 MAINTENANCE

#### A. Protection of Graded Areas

1. Protect newly graded areas from traffic and erosion, and keep free of trash and debris.

2. Repair and reestablish grades in settled, eroded, and rutted areas to the specified tolerances.

B. Reconditioning Compacted Areas

1. Where completed compacted areas are disturbed by subsequent construction operations or adverse weather, scarify the surface, reshape, and compact to the required density prior to further construction. Use hand tamping for re-compaction over underground utilities and under floor sub drains, if any.

3.08 DISPOSAL OF EXCESS AND WASTE MATERIALS

- A. Burning on Owner's property shall not be permitted.
- B. Contractor shall remove all waste materials, including excavated material classified as unsatisfactory soil material, trash and debris, from the Owner's property and legally dispose of it.

END OF SECTION

## SECTION 02226

### COMPACTED GRANULAR BACKFILL

#### PART 1 GENERAL

##### 1.01 SCOPE

- A. The Contractor shall furnish all the materials from the top of bedding to the pavement sub grade and shall properly place and compact gravel backfill, as approved, over conduits, pipelines and elsewhere, when ordered by the Engineer, when they are located under pavement or cross under roads, drives and elsewhere when backfill is required to be accomplished without future settlement, and only when and as called for by the Drawings or as may be ordered by the Engineer.
- B. Gravel, or other granular material that is excavated from the project area as part of the excavation shall not be used for the purposes of this specification.

#### PART 2 PRODUCTS

##### 2.01 MATERIALS

- A. Backfill material shall be in conformance with ODOT Item 304.

#### PART 3 EXECUTION

##### 3.01 PLACING

- A. Granular backfill, when called for by the Drawings, or ordered by the Engineer, for trench backfill shall be properly graded and placed in layers not over six (6") inches in depth, with voids reduced to a minimum, and thoroughly compacted with mechanical equipment, or as directed by the Engineer, so as to prevent after settlement. The placing of this material shall be continued until the required depth is compacted, and the top of this backfill shall be finished to the lines and grades called for by the Drawings, or as ordered by the Engineer. Should settlement occur, the Contractor must add and compact additional fill, and he must maintain the backfill at the required sub grade until the project is satisfactorily completed.

END OF SECTION

**SECTION 02270**

**SLOPE PROTECTION AND EROSION CONTROL**

**PART 1 GENERAL**

**1.01 WORK INCLUDED**

A. Water, erosion and sediment control.

**1.02 REFERENCES**

- A. Rainwater and Land Development Manual, 2006, prepared by the Ohio Department of Natural Resources.
- B. Ohio Department of Transportation Construction and Material Specifications (ODOT-CMS).
- C. Section 02936 - Seeding and Mulching.

**PART 2 PRODUCTS**

**2.01 SILT FENCE MATERIALS**

A. Silt fence fabric shall be ODOT Type C Geotextile fabric or as described in the chart below:

Fabric Properties	
Minimum Tensile Strength	120 lbs
Maximum Elongation at 60 lbs	50%
Minimum Puncture Strength	50 lbs
Minimum Tear Strength	40 lbs
Minimum Burst Strength	200 psi
Apparent Opening Size	≤ 0.84mm
Minimum Permittivity	1x10 <sup>-2</sup> sec. <sup>-1</sup>
Ultraviolet Exposure Strength Retention	70%

B. Fence Posts - The length shall be a minimum of 32 inches long.

Wood posts will be 2 inch by 2 inch hardwood of sound quality. The maximum spacing between posts shall be 10 feet.

**2.02 MULCH MATERIALS**

A. Straw – Straw shall be unrotted small grain applied at the rate of 2 tons/acre or 90 pounds/1,000 square feet (two to three bales). The straw mulch shall be spread uniformly by hand or mechanically so the soil surface is covered. For uniform distribution of hand-spread mulch, divide area into



approximately 1,000 square foot sections and place two 45 pound bales of straw in each section.

- B. Hydroseeders – Wood cellulose fiber should be used at 2,000 pounds/acre or 46 pounds/1,000 square feet.
- C. Other – Other acceptable mulches include mulch matting applied according to manufacturer’s recommendations or wood chips applied at 10-20 ton/acre.

2.03 MATTING MATERIALS

- A. Excelsior matting shall be 48 inches wide and weigh an average of 0.75 pound/square yard or greater.
- B. Jute matting shall be 48 inches wide and weigh an average of 0.75 pounds/square yard greater.
- C. Matting made of other material and providing equal or greater stabilization than the above may be submitted.

2.04 FILTER BERM MATERIALS

- A. Compost used for filter berms shall be weed, pathogen and insect free and free of any refuse, contaminants or other materials toxic to plant growth. They shall be derived from a well-decomposed source of organic matter and consist of a particles ranging from 1/4" to 3".

2.05 FILTER SOCK MATERIALS

- A. Compost used for filter socks shall be weed, pathogen and insect free and free of any refuse, contaminants or other materials toxic to plant growth. They shall be derived from a well-decomposed source of organic matter and consist of a particles ranging from 3/8" to 2".
- B. Filter Socks shall be 3 or 5 mil continuous, tubular, HDPE 3/8" knitted mesh netting material, filled with compost passing the above specifications for compost products.

2.06 TEMPORARY SEED MIXTURES

- A. Temporary seeding mixtures shall comply with the following table:

Seeding Dates	Species	Lb./1000 ft2	Lb/Acre
---------------	---------	--------------	---------

March 1 to August 15	Oats	3	128 (4 Bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Perennial Ryegrass	1	40
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Annual Ryegrass	1.25	55
	Perennial Ryegrass	3.25	142
	Creeping Red Fescue	0.4	17
	Kentucky Bluegrass	0.4	17
August 16th to November	Oats	3	128 (3 bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Rye	3	112 (2 bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Wheat	3	120 (2 bushel)
	Tall Fescue	1	40
	Annual Ryegrass	1	40
	Perennial Rye	1	40
Tall Fescue	1	40	
Annual Ryegrass	1	40	
Annual Ryegrass	1.25	40	
Perennial Ryegrass	3.25	40	
Creeping Red Fescue	0.4	40	
Kentucky Bluegrass	0.4		
November 1 to Feb. 29	Use mulch only or dormant seeding		
Note: Other approved species may be substituted.			

## 2.07 GEOTEXTILES FOR CONSTRUCTION ENTRANCES

- A. Geotextiles utilized in the installation of construction entrances shall meet the following parameters:

Minimum Tensile Strength	200 lbs.
Minimum Puncture Strength	80 psi.
Minimum Tear Strength	50 lbs.
Minimum Burst Strength	320 psi.
Minimum Elongation	20%
Equivalent Opening Size	EOS < 0.6 mm.
Permittivity	$1 \times 10^{-3}$ cm/sec.

## PART 3 EXECUTION

### 3.01 GENERAL WATER, EROSION AND SEDIMENT CONTROL

- A. CONTRACTOR shall grade site to drain and shall maintain excavations free of water. Provide, operate, and maintain pumping equipment.
- B. CONTRACTOR shall protect site from puddling or running water.
- C. CONTRACTOR shall provide erosion control measures as necessary to control discharge of sediment-laden water to surface waters and wetlands.
- D. CONTRACTOR shall use jute or synthetic netting, silt fences, straw bales, dikes, channels, check dams and other applicable measures to prevent erosion of soils disturbed by its construction operation.

### 3.02 INSTALLATION OF SEDIMENT BASINS

- A. Sediment basins shall be constructed and operational before upslope land disturbance begins.
- B. Site Preparation -The area under the embankment shall be cleared, grubbed, and stripped of any vegetation and root mat. The pool area shall be cleared as needed to facilitate sediment cleanout. Gullies and sharp breaks shall be sloped to no steeper than 1:1. The surface of the foundation area will be thoroughly scarified before placement of the embankment material.
- C. Cut-Off Trench -The cutoff trench shall be excavated along the centerline of the embankment. The minimum depth shall be 3 ft. unless specified deeper on the plans or as a result of site conditions. The minimum bottom width shall be 4 ft., but wide enough to permit operation of compaction equipment. The trench shall be kept free of standing water during backfill operations.
- D. Embankment -The fill material shall be free of all sod, roots, frozen soil, stones over 6 in. in diameter, and other objectionable material. The placing and spreading of the fill material shall be started at the lowest point of the foundation and the fill shall be brought up in approximately 6 in. horizontal layers or of such thickness that the required compaction can be obtained with the equipment used. Construction equipment shall be operated over each layer in a way that will result in the required compaction. Special equipment shall be used when the required compaction cannot be obtained without it. The moisture content of fill material shall be such that the required degree of compaction can be obtained with the equipment used.

- E. Pipe Spillway -The pipe conduit barrel shall be placed on a firm foundation to the lines and grades shown on the plans. Connections between the riser and barrel, the anti-seep collars and barrel and all pipe joints shall be water-tight. Selected backfill material shall be placed around the conduit in layers and each layer shall be compacted to at least the same density as the adjacent embankment. All compaction within 2 ft. of the pipe spillway will be accomplished with hand-operated tamping equipment.
- F. Riser Pipe Base -The riser pipe shall be set a minimum of 6 in. in the concrete base.
- G. Trash Racks -The top of the riser shall be fitted with trash racks firmly fastened to the riser pipe.
- H. Emergency Spillway - The emergency spillway shall be cut in undisturbed ground. Accurate construction of the spillway elevation and width is critical and shall be within a tolerance of 0.2 ft.
- I. Seed and Mulch -The sediment basin shall be stabilized immediately following its construction. In no case shall the embankment or emergency spillway remain bare for more than 7 days.
- J. Sediment Cleanout -Sediment shall be removed and the sediment basin restored to its original dimensions when the sediment has filled one-half the pond's original depth or as indicated on the plans. Sediment removed from the basin shall be placed so that it will not erode.
- K. Final removal - Sediment basins shall be removed after the upstream drainage area is stabilized or as indicated in the plans. Dewatering and removal shall NOT cause sediment to be discharged. The sediment basin site and sediment removed from the basin shall be stabilized.

### 3.03 INSTALLATION OF SEDIMENT TRAPS

- A. Work shall consist of the installation, maintenance and removal of all sediment traps at the locations designated on the drawings.
- B. Sediment traps shall be constructed to the dimensions specified on the drawings and operational prior to upslope land disturbance.
- C. The area beneath the embankment shall be cleared, grubbed and stripped of vegetation to a minimum depth of six (6) inches. The pool shall be cleared as needed to facilitate sediment cleanout.
- D. Fill used for the embankment shall be evaluated to assure its suitability and it must be free of roots or other woody vegetation, large rocks, organics or

other objectionable materials. Fill material shall be placed in six (6) inch lifts and shall be compacted by traversing with a sheepsfoot or other approved compaction equipment. Fill height shall be increased five (5) percent to allow for structure/foundation settlement. Construction shall not be permitted if either the earthfill or compaction surface is frozen.

- E. The maximum height of embankment shall be five (5) feet. All cut and fill slopes shall be 2:1 (H:V) or flatter.
- F. A minimum storage volume below the crest of the outlet of 67 yd<sup>3</sup>. for every acre of contributing drainage area shall be achieved at each location noted on the drawings with additional sediment storage volume provided below this elevation.
- G. Temporary seeding shall be established and maintained over the useful life of the practice.
- H. The outlet for the sediment trap structure shall be constructed to the dimensions shown on the drawings.
- I. The outlet shall be constructed using the materials specified on the drawings. Where geotextile is used, all overlaps shall be a minimum of two (2) feet or as specified by the manufacturer, whichever is greater. All overlaps shall be made with the upper most layer placed last. Geotextile shall be keyed in at least 6" on the upstream side of the outlet.
- J. Warning signs and safety fence shall be placed around the traps and maintained over the life of the practice.
- K. After all sediment-producing areas have been permanently stabilized, the structure and all associated sediment shall be removed. Stable earth materials shall be placed in the sediment trap area and compacted. The area shall be graded to blend in with adjoining land surfaces and have positive drainage. The area shall be immediately seeded.

#### 3.04 INSTALLATION AND MAINTENANCE OF SILT FENCE

- A. Silt fence shall be constructed before upslope land disturbance begins.
- B. All silt fence shall be placed as close to the contour as possible so that water will not concentrate at low points in the fence and so that small swales or depressions that may carry small concentrated flows to the silt fence are dissipated along its length.
- C. Ends of the silt fences shall be brought upslope slightly so that water ponded by the silt fence will be prevented from flowing around the ends.

- D. Silt fence shall be placed on the flattest area available.
  - E. Where possible, vegetation shall be preserved for 5 feet (or as much as possible) upslope from the silt fence. If vegetation is removed, it shall be reestablished within 7 days from the installation of the silt fence.
  - F. The height of the silt fence shall be a minimum of 16 inches above the original ground surface.
  - G. The silt fence shall be placed in an excavated or sliced trench cut a minimum of 6 inches deep. The trench shall be made with a trencher, cable laying machine, slicing machine, or other suitable device that will ensure an adequately uniform trench depth.
  - H. The silt fence shall be placed with the stakes on the downslope side of the geotextile. A minimum of 8 inches of geotextile must be below the ground surface. Excess material shall lay on the bottom of the 6-inch deep trench. The trench shall be backfilled and compacted on both sides of the fabric.
  - I. Seams between sections of silt fence shall be spliced together only at a support post with a minimum 6-in. overlap prior to driving into the ground.
  - J. Silt fence shall allow runoff to pass only as diffuse flow through the geotextile. If runoff overtops the silt fence, flows under the fabric or around the fence ends, or in any other way allows a concentrated flow discharge, one of the following shall be performed, as appropriate: 1) the layout of the silt fence shall be changed, 2) accumulated sediment shall be removed, or 3) other practices shall be installed.
  - K. Sediment deposits shall be routinely removed when the deposit reaches approximately one-half of the height of the silt fence.
  - L. Silt fences shall be inspected after each rainfall and at least daily during a prolonged rainfall. The location of existing silt fence shall be reviewed daily to ensure its proper location and effectiveness. If damaged, the silt fence shall be repaired immediately.
- 3.05 INSTALLATION OF STORM DRAIN INLET PROTECTION – EXCAVATED DROP INLET SEDIMENT PROTECTION
- A. The excavated trap should be sized to provide a minimum storage capacity calculated at the rate of 135 cubic yards for one (1) acre of drainage area. A trap should be no less than one (1) foot, nor more than two (2) feet deep measured from the top of the inlet structure. Side slopes should not be steeper than 2:1.

- B. The slopes of the trap may vary to fit the drainage area and terrain.
  - C. Where the area receives concentrated flows, such as in a highway median, provide the trap with a shape having a 2:1 ratio of length to width, with the length oriented in the direction of the flow.
  - D. Sediment should be removed and the trap restored to the original depth when the sediment has accumulated to 40% the design depth of the trap. Removed sediment should be spread in a suitable area and stabilized so it will not erode.
  - E. During final grading, the inlet should be protected with geotextile-stone inlet protection. Once final grading is achieved, sod or a suitable temporary erosion control material shall be implemented to protect the area until permanent vegetation is established.
- 3.06 INSTALLATION OF STORM DRAIN INLET PROTECTION – GEOTEXTILE INLET PROTECTION
- A. Inlet protection shall be constructed either before upslope land disturbance begins or before the storm drain becomes operational.
  - B. The earth around the inlet shall be excavated completely to a depth of at least 18 inches.
  - C. The wooden frame shall be constructed of 2 inch by 4 inch construction grade lumber. The 2 inch by 4 inch posts shall be driven 1 foot into the ground at four corners of the inlet and 2 inch by 4 inch frame assembled using a lap joint. The top of the frame shall be at least 5 inches below adjacent road if ponded water would pose a safety hazard to traffic.
  - D. Wire mesh shall be of sufficient strength to support fabric with water fully impounded against it. It shall be stretched tightly around the frame and fastened securely to the frame.
  - E. Geotextiles shall have an equivalent opening size of 20-40 sieve and be resistant to sunlight. It shall be stretched tightly around the frame and fastened securely. It shall extend from the top of the frame to 18 inches below the inlet notch elevation. The geotextile shall overlap across one side of the inlet so the ends of the cloth are not fastened to the same post.
  - F. Backfill shall be placed around the inlet in compacted 6 inch layers until the earth is even with notch elevation on ends and top elevation on sides.
  - G. A compacted earth dike or check dam shall be constructed in the ditch line

below the inlet if the inlet is not in a depression and if runoff bypassing the inlet will flow to setting pond. The top of earth dikes shall be at least 6 inches higher than the top of the frame.

### 3.07 INSTALLATION OF STORM DRAIN INLET PROTECTION – GEOTEXTILE-STONE INLET PROTECTION

- A. Inlet protection shall be constructed either before upslope land disturbance begins or before the inlet becomes functional.
- B. Geotextile and/or wire material shall be placed over the top of the storm sewer and approximately six (6) inches of 2-inch or smaller clean aggregate placed on top. Extra support for geotextile is provided by placing hardware cloth or wire mesh across the inlet cover. The wire should be no larger than ½" mesh and should extend an extra 12 inches across the top and sides of the inlet cover.
- C. Maintenance must be performed regularly, especially after storm events. When clogging of the stone or geotextile occurs, the material must be removed and replaced.

### 3.08 STORM DRAIN INLET PROTECTION – GEOTEXTILE-STONE INLET PROTECTION FOR CURB INLETS

- A. Inlet protection shall be constructed either before upslope land disturbance begins or before the inlet becomes functional.
- B. Construct a wooden frame of 2-by-4-in. construction-grade lumber. The end spacers shall be a minimum of 1 ft. beyond both ends of the throat opening. The anchors shall be nailed to 2-by-4-in. stakes driven on the opposite side of the curb.
- C. The wire mesh shall be of sufficient strength to support fabric and stone. It shall be a continuous piece with a minimum width of 30 in. and 4 ft. longer than the throat length of the inlet, 2 ft. on each side.
- D. Geotextile cloth shall have an equivalent opening size (EOS) of 20-40 sieve and be resistant to sunlight. It shall be at least the same size as the wire mesh.
- E. The wire mesh and geotextile cloth shall be formed to the concrete gutter and against the face of the curb on both sides of the inlet and securely fastened to the 2-by-4-in. frame.



- F. Two-inch stone shall be placed over the wire mesh and geotextile in such a manner as to prevent water from entering the inlet under or around the geotextile cloth.
- G. This type of protection must be inspected frequently and the stone and/or geotextile replaced when clogged with sediment.

### 3.09 INSTALLATION OF STORM DRAIN INLET PROTECTION – BLOCK AND GRAVEL DROP INLET FILTER

- A. Place 4-inch by 8-inch by 12-inch concrete blocks lengthwise on their sides in a single row around the perimeter of the inlet, with the ends of adjacent blocks abutting. The height of the barrier can be varied, depending upon the design needs, by stacking combinations of the same size blocks. The barrier of blocks should be at least 12-inches high but no greater than 24-inches high.
- B. Wire mesh should be placed over the outside vertical face (webbing) of the concrete blocks to prevent stone from being washed through the block cores. Hardware cloth or comparable wire mesh with ½-inch openings should be used.
- C. Two-inch stone should be piled against the wire to the top of the block barrier, as shown below.
- D. If the stone filter becomes clogged with sediment so that it no longer adequately performs its function, pull stone away from the blocks, clean and/or replace.

### 3.10 INSTALLATION AND MAINTENANCE OF FILTER BERM

- A. Filter berms will be placed on a level line across slopes, generally parallel to the base of the slope or other affected area. On slopes approaching 2:1, additional berms shall be provided at the top and as needed mid-slope.
- B. Filter berms are not to be used in concentrated flow situations or in runoff channels.
- C. Maintenance – Inspect filter berms after each significant rain, maintaining the berms in a functional condition at all times. Remove sediments collected at the base of the filter berms when they reach 1/3 of the exposed height of the practice. Where the filter berm deteriorates or fails it will be, it will be repaired or replaced with a more effective alternative.
- D. Removal – Filter berms no longer needed will be dispersed on site in a manner that will facilitate seeding.

### 3.11 INSTALLATION AND MAINTENANCE OF FILTER SOCK

- A. Filter socks will be placed on a level line across slopes, generally parallel to the base of the slope or other affected area. On slopes approaching 2:1, additional socks shall be provided at the top and as needed mid-slope.
- B. Filter socks intended to be left as a permanent filter or part of the natural landscape, shall be seeded at the time of installation for establishment of permanent vegetation.
- C. Filter Socks are not to be used in concentrated flow situations or in runoff channels.
- D. Routinely inspect filter socks after each significant rain, maintaining filter socks in a functional condition at all times.
- E. Remove sediments collected at the base of the filter socks when they reach 1/3 of the exposed height of the practice.
- F. Where the filter sock deteriorates or fails, it will be repaired or replaced with a more effective alternative.
- G. Filter socks will be dispersed on site when no longer required in such a way as to facilitate and not obstruct seedings.

### 3.12 INSTALLATION OF ROCK CHECK DAMS

- A. The check dam shall be constructed of 4-8 inch diameter stone, placed so that it completely covers the width of the channel. ODOT Type D stone is acceptable, but should be underlain with a gravel filter consisting of ODOT No. 3 or 4 or suitable filter fabric.
- B. Maximum height of check dam shall not exceed 3.0 feet.
- C. The midpoint of the rock check dam shall be a minimum of 6 inches lower than the sides in order to direct across the center and away from the channel sides.
- D. The base of the check dam shall be entrenched approximately 6 inches.
- E. Spacing of check dams shall be in a manner such that the toe of the upstream dam is at the same elevation as the top of the downstream dam.
- F. A Splash Apron shall be constructed where check dams are expected to be in use for an extended period of time, a stone apron shall be constructed

immediately downstream of the check dam to prevent flows from undercutting the structure. The apron should be 6 in. thick and its length two times the height of the dam.

G. Stone placement shall be performed either by hand or mechanically as long as the center of check dam is lower than the sides and extends across entire channel.

H. Side slopes shall be a minimum of 2:1.

### 3.13 INSTALLATION OF SLOPE DRAINS

A. The slope drain shall be constructed on a minimum slope of 3 percent.

B. All points along the top of the dike/earthfill for the storage area shall be at least one (1) foot higher than the top of the inlet pipe.

C. The pipe drain may be constructed of corrugated metal or PVC pipe. All pipe connections shall be watertight. Flexible tubing may be used, provided rigid pipe is use for the inlet, the flexible tubing is of the same diameter as the inlet, and pipe connections are made with metal strapping or watertight connecting collars. The flexible pipe shall be constructed with hold down apparatus spaced on 10 foot centers for anchoring the pipe.

D. The entrance to the pipe shall be a hooded type.

E. The soil around and/or under the pipe shall be placed in 4-inch layers and hand compacted to the top of the earth dike.

F. A riprap apron shall be installed at the pipe outlet where clean water is discharged into a stabilized area or drainageway.

### 3.14 INSTALLATION OF TEMPORARY DIVERSIONS

A. Drainage area should not exceed 10 acres. Larger areas require a more extensive design.

B. The channel cross section may be parabolic or trapezoidal. Disk the base of the dike before placing fill. Build the dike 10% higher than designed for settlement. The dike shall be compacted by traversing with tracked earth-moving equipment.

C. The minimum cross section of the levee or dike will be as follows: (Minimum design freeboard shall be 0.3 foot.) Where construction traffic will cross, the top width may be made wider and the side slopes flatter than specified

below.

Dike Top Width (ft.)	Height (ft.)	Side Slopes	Shape
0	1.5	4.1	Trapezoidal
4	1.5	2.1	Parabolic

- D. The grade may be variable depending upon the topography, but must have a positive drainage to the outlet and be stabilized to be non-erosive.

Temporary Diversion Stabilization Treatment			
Diversion Slope	< 2 acres	2 – 5 acres	5 – 10 acres
0 – 3 %	Seed and straw	Seed and straw	Seed and straw
3 – 5%	Seed and straw	Seed and straw	Matting
5 – 8%	Seed and straw	Matting	Matting
8 – 20%	Seed and straw	Matting	Engineered
Note: Diversions with steeper slopes or greater drainage areas are beyond the scope of this standard and must be designed for stability. Seed, straw and matting used shall meet the Specifications for Temporary Seeding, Mulching and Matting.			

- E. Outlet runoff onto a stabilized area, into a properly designed waterway, grade stabilization structure, or sediment trapping facility.
- F. Diversions shall be seeded and mulched in accordance with the requirements outlined herein as soon as they are constructed or other suitable stabilization shall be applied in order to preserve dike height and reduce maintenance.

### 3.15 INSTALLATION OF TEMPORARY DIVERSIONS ABOVE STEEP SLOPES

- A. Drainage area should not exceed 5 acres. Larger areas require a more extensive design.
- B. The channel cross section may be parabolic, v-shaped, or trapezoidal. Disk the base of the dike before placing fill. Build the dike 10% higher than designed for settlement. The dike shall be compacted by traversing with tracked earth-moving equipment.
- C. The minimum cross section of the levee or dike will be as follows: (Minimum design freeboard shall be 0.3 foot.)

Dike Top Width (ft.)	Height (ft.)	Side Slopes	Shape
0	1.5	4.1	Trapezoidal
4	1.5	2.1	Parabolic

- D. The grade may be variable depending upon the topography, but must have a positive drainage to the outlet and be stabilized to be non-erosive.

Temporary Diversion Stabilization Treatment			
Diversion Slope	< 2 acres	2 – 5 acres	5 – 10 acres
0 – 3 %	Seed and straw	Seed and straw	Seed and straw
3 – 5%	Seed and straw	Seed and straw	Matting
5 – 8%	Seed and straw	Matting	Matting
8 – 20%	Seed and straw	Matting	Engineered
Note: Diversions with steeper slopes or greater drainage areas are beyond the scope of this standard and must be designed for stability. Seed, straw and matting used shall meet the Specifications for Temporary Seeding, Mulching and Matting.			

- E. Outlet runoff onto a stabilized area, settling pond, or into a drop structure.
- F. Diversions shall be seeded and mulched in accordance with the requirements specified herein as soon as they are constructed or other suitable stabilization shall be applied in order to preserve dike height and reduce maintenance.

### 3.16 EROSION CONTROL METHODS FOR INSTALLATION OF STREAM UTILITY CROSSINGS

- A. When site conditions allow, one of the following shall be used to divert stream flow or keep the flow away from construction activity.
1. Drill or bore the utility lines under the stream channel.
  2. Construct a cofferdam or barricade of sheet pilings, sandbags or a turbidity curtain to keep flow from moving through the disturbed area. Turbidity curtains shall be a pre-assembled system and used only parallel to flow.
  3. Stage construction by confining first one-half of the channel until work there is completed and stabilized, then move to the other side to complete the crossing.
  4. Route the stream flow around the work area by bridging the trench with a rigid culvert, pumping, or constructing a temporary channel. Temporary channels shall be stabilized by rock or a geotextile completely lining the channel bottom and side slopes.
- B. Crossing Width -The width of clearing shall be minimized through the riparian area. The limits of disturbance shall be as narrow as possible

including not only construction operations within the channel itself but also clearing done through the vegetation growing on the streambanks.

- C. Clearing shall be done by cutting NOT grubbing. The roots and stumps shall be left in place to help stabilize the banks and accelerate revegetation.
- D. Material excavated from the trench shall be placed at least 20 ft. from the streambanks.
- E. To the extent other constraints allow, stream shall be crossed during periods of low flow.
- F. Duration of Construction -The time between initial disturbance of the stream and final stabilization shall be kept to a minimum. Construction shall not begin on the crossing until the utility line is in place to within 10 ft. of the streambank.
- G. Fill Placed Within the Channel -The only fill permitted in the channel should be clean aggregate, stone or rock. No soil or other fine erodible material shall be placed in the channel. This restriction includes all fill for temporary crossings, diversions, and trench backfill when placed in flowing water. If the stream flow is diverted away from construction activity the material originally excavated from the trench may be used to backfill the trench.
- H. Streambank Restorations -Streambanks shall be restored to their original line and grade and stabilized with riprap or vegetative bank stabilization.
- I. Runoff Control Along the Right-of-Way -To prevent sediment-laden runoff from flowing to the stream, runoff shall be diverted with water bar or swales to a sediment trapping practice a minimum of 50 ft. from the stream.
- J. Sediment laden water from pumping or dewatering or pumping shall not be discharged directly to a stream. Flow shall be routed through a settling pond, dewatering sump or a flat, well-vegetated area adequate for removing sediment before the pumped water reaches the stream.
- K. Dewatering operations shall not cause significant reductions in stream temperatures. If groundwater is to be discharged in high volumes during summer months, it shall first be routed through a settling pond or overland through a flat well-vegetated area.
- L. Permits -In addition to these specifications, stream crossings shall conform to the rules and regulations of the U.S. Army Corps of Engineers for in-stream modifications (404 permits) and Ohio Environmental Protection Agency's State Water Quality Certification (401 permits).

### 3.17 INSTALLATION OF CULVERT STREAM CROSSING

- A. Stream Disturbance -Disturbance to the stream shall be kept to a minimum. Streambank vegetation shall be preserved to the maximum extent practical and the stream crossing shall be as narrow as practical.
- B. Clearing shall be done by cutting NOT grubbing. The roots and stumps shall be left in place to help stabilize the banks and accelerate revegetation.
- C. To minimize interference with fish spawning and migration, crossing construction should be avoided where practical from March 15 through June 15.
- D. Water shall not be allowed to flow along the road directly to the stream. Diversions and swales shall direct runoff away from the access road to a sediment-control practice.
- E. Placement -Culverts shall be placed on the existing streambed to avoid a drop or waterfall at the downstream end of the pipe, which would be a barrier to fish migration. Crossings shall be made in shallow areas rather than deep pools where possible.
- F. Culvert Size -Culvert diameter shall be at least three times the depth of normal stream flow at the point of the stream crossing. If the crossing must be placed in deep, slow-moving pools, the culvert diameter may be reduced to twice the depth of normal stream flow. The minimum size culvert that may be used is 18 in.
- G. Number of Culverts -There shall be sufficient number of culverts to completely cross the stream channel from streambank to streambank with no more than a 12-in. space between each one.
- H. Fill and Surface Material -All material placed in the stream channel, around the culverts and on the surface of the crossing shall be stone, rock or aggregate. ODOT No. 1 shall be the minimum acceptable size. To prevent washouts, larger stone and rock may be used and they may be placed in gabion mattresses. No soil shall be used in the construction of a stream crossing or placed in the stream channel.
- I. Removal -Aggregate stone and rock used for this structure does not need to be removed. Care should be taken so that any aggregate left does not create an impoundment or impede fish passage. All pipes, culverts, gabions or structures must be removed.
- J. Stabilization -Streambanks shall be stabilized. Plantings shall include woody vegetation where practical.

### 3.18 INSTALLATION OF TEMPORARY STREAM FORD

- A. Timing -No construction or removal of a temporary stream ford will be permitted on perennial streams from March 15 through June 15 to minimize interference with fish spawning and migration.
- B. Stream Disturbance -Disturbance to the stream shall be kept to a minimum. Streambank vegetation shall be preserved to the maximum extent practical and the stream crossing shall be as narrow as practical. Clearing shall be done by cutting NOT grubbing where possible.
- C. Surface Runoff -Water shall not be allowed to flow along the road directly to the stream. Diversions and swales shall direct runoff away from the access road to a sediment-control practice.
- D. Fill and Surface Material -All material placed in the stream channel shall be stone, rock or aggregate. ODOT No. 1 shall be the minimum acceptable size. Larger stone and rock may be used. No soil shall be used in the construction of a stream ford or placed in the stream channel.
- E. Removal -Aggregate, stone and rock used for the stream crossing shall NOT be removed but shall be formed so it does not create an impoundment, impede fish passage, or cause erosion of streambanks.
- F. Stabilization -Streambanks shall be stabilized. Plantings shall include woody vegetation where practical.

### 3.19 INSTALLATION OF A WATER BAR

- A. The minimum water bar dimensions shall be:
  - 1. Top width of berm/dike – 2 feet minimum.
  - 2. Height/depth – 18 inches unless otherwise noted on plans.
  - 3. Side Slopes – Sufficiently flat to accommodate the expected traffic.
- B. The spacing between water bars shall be as follows:



Road Grade (%)	Distance (Ft.)
1	400
2	250
5	135
10	80
15	60
20	45

- C. The field location shall be adjusted as needed to provide a stabilized safe outlet.
- D. The diverted runoff shall be directed onto an undisturbed vegetative area, to a settling trap or basin or trap if contributing area is stable.
- E. Diversions/dikes shall be compacted by traversing with equipment during construction.
- F. The water bars shall be angled slightly downslope across the centerline of the travel lane.

### 3.20 EROSION CONTROL METHODS RELATED TO DEWATERING OPERATIONS

- A. A de-watering plan shall be developed prior to the commencement of any pumping activities.
- B. The de-watering plan shall include all pumps and related equipment necessary for the dewatering activities and designate areas for placement of practices. Outlets for practices shall be protected from scour either by riprap protection, fabric liner, or other acceptable method of outlet protection.
- C. Water that is not discharged into a settling/treatment basin but directly into waters of the state shall be monitored hourly. Discharged water shall be within +/- 5° F of the receiving waters.
- D. Settling basins shall not be greater than four (4) feet in depth. The basin shall be constructed for sediment storage as outlined herein for a Sediment Basin Or Sediment Trap. The inlet and outlet for the basin shall be located at the furthest points of the storage. A floating outlet shall be used to ensure that settled solids do not re-suspend during the discharge process. The settling basin shall be cleaned out when the storage has been reduced by 50% of its original capacity.
- E. All necessary National, State and Local permits shall be secured prior to discharging into waters of the state.

### 3.21 TREE AND NATURAL PRESERVATION AREAS

- A. Tree and natural preservation areas shall be fenced prior to beginning clearing operations.
- B. Fence materials shall be metal fence posts with two strands of high tensile wire, plastic fence or snow fence.
- C. Signage shall clearly identify the tree and natural preservation area and state that no clearing or equipment is allowed within it.
- D. Fence shall be placed as shown on plans and beyond the drip line or canopy of trees to be protected.
- E. If any clearing is done around specimen trees it shall be done by cutting at ground level with hand held tools and shall not be grubbed or pulled out. No clearing shall be done in buffer strips or other preserved forested areas.
- F. If any clearing is done around specimen trees it shall be done by cutting at ground level with hand held tools and shall not be grubbed or pulled out. No clearing shall be done in buffer strips or other preserved forested areas.
- G. No filling or stockpiling of materials shall occur within the tree protection area, including deposition of sediment.

### 3.22 TREE PROTECTION DURING UTILITY INSTALLATION

- A. Where utilities must run through a tree's dripline area, tunneling should be used to minimize root damage. Tunneling should be performed at a minimum depth of 24 inches for trees less than 12 inches in diameter or at a minimum depth of 36 inches for larger diameter trees.
- B. Where tunneling will be performed within the dripline of a tree, the tunnel should be placed a minimum of 2 feet away from the tree trunk to avoid taproots.
- C. Minimize excavation or trenching within the dripline of the tree. Route trenches around the dripline of trees.
- D. Roots two inches or larger that are severed by trenching should be sawn off neatly in order to encourage new growth and discourage decay.
- E. Soil excavated during trenching shall be piled on the side away from the tree.

- F. Roots shall be kept moist while trenches are open and refilled immediately after utilities are installed or repaired.

### 3.23 INSTALLATION OF CONSTRUCTION ENTRANCES

- A. Stone Size—ODOT # 2 (1.5-2.5 inch) stone shall be used, or recycled concrete equivalent.
- B. Length -The Construction entrance shall be as long as required to stabilize high traffic areas but not less than 70 ft. (exception: apply 30 ft. minimum to single residence lots).
- C. Thickness -The stone layer shall be at least 6 inches thick for light duty entrances or at least 10 inches for heavy duty use.
- D. Width -The entrance shall be at least 14 feet wide, but not less than the full width at points where ingress or egress occurs.
- E. Geotextile -A geotextile shall be laid over the entire area prior to placing stone. It shall be composed of strong rot-proof polymeric fibers and meet the material specifications outlined above.
- F. Timing -The construction entrance shall be installed as soon as is practicable before major grading activities.
- G. Culvert -A pipe or culvert shall be constructed under the entrance if needed to prevent surface water from flowing across the entrance or to prevent runoff from being directed out onto paved surfaces.
- H. Water Bar -A water bar shall be constructed as part of the construction entrance if needed to prevent surface runoff from flowing the length of the construction entrance and out onto paved surfaces.
- I. Maintenance -Top dressing of additional stone shall be applied as conditions demand. Mud spilled, dropped, washed or tracked onto public roads, or any surface where runoff is not checked by sediment controls, shall be removed immediately. Removal shall be accomplished by scraping or sweeping.
- J. Construction entrances shall not be relied upon to remove mud from vehicles and prevent off-site tracking. Vehicles that enter and leave the construction-site shall be restricted from muddy areas.
- K. Removal—the entrance shall remain in place until the disturbed area is stabilized or replaced with a permanent roadway or entrance.

### 3.24 DUST CONTROL OPERATIONS

- A. Vegetative Cover and/mulch – Apply temporary or permanent seeding and mulch to areas that will remain idle for over 21 days. Saving existing trees and large shrubs will also reduce soil and air movement across disturbed areas. See Temporary Seeding; Permanent Seeding; Mulching Practices; and Tree and Natural Area Protection practices.
- B. Watering – Spray site with water until the surface is wet before and during grading and repeat as needed, especially on haul roads and other heavy traffic routes. Watering shall be done at a rate that prevents dust but does not cause soil erosion. Wetting agents shall be utilized according to manufacturers' instructions.
- C. Spray-On Adhesives – Apply adhesive according to the following table or manufacturers' instructions.

Adhesive	Water Dilution (Adhesive: Water)	Nozzle Type	Application Rate Gal./Ac.
Latex Emulsion	12.5:1	Fine	235
Resin in Water Acrylic Emulsion (No-traffic)	4:1	Fine	300
Acrylic Emulsion (No-traffic)	7:1	Coarse	450
Acrylic Emulsion (Traffic)	3.5:1	Coarse	350

- D. Stone – Graded roadways and other suitable areas will be stabilized using crushed stone or coarse gravel as soon as practicable after reaching an interim or final grade. Crushed stone or coarse gravel can be used as a permanent cover to provide control of soil emissions.
- E. Barriers – Existing windbreak vegetation shall be marked and preserved. Snow fencing or other suitable barrier may be placed perpendicular to prevailing air currents at intervals of about 15 times the barrier height to control air currents and blowing soil.
- F. Calcium Chloride - This chemical may be applied by mechanical spreader as loose, dry granules or flakes at a rate that keeps the surface moist but not so high as to cause water pollution or plant damage. Application rates should be strictly in accordance with suppliers' specified rates.
- G. Operation and Maintenance - When Temporary Dust Control measures are used; repetitive treatment should be applied as needed to accomplish control.

- H. Street Cleaning - Paved areas that have accumulated sediment from construction should be cleaned daily, or as needed, utilizing a street sweeper or bucket -type endloader or scraper.

### 3.25 GRADE TREATMENT (SLOPE ROUGHENING) FOR EROSION CONTROL

#### A. Cut Slopes-Greater than 3:1 Slopes

1. Stair-step grading may be carried out on any material soft enough to be ripped with a bulldozer. The ratio of the horizontal distance to the vertical cut distance shall be flatter than 1:1 and the horizontal portion of the "step" shall slope toward the vertical wall. Individual vertical cuts shall not be more than 24 inches on soft soil materials and not more than 36 inches in rocky materials.
2. Grooving may be made with any appropriate implement which can be safely operated on the slope and which will not cause undue compaction. Suggested implements include discs, tillers, spring harrows, and the teeth on a front-end loader bucket. Such grooves shall not be less than 3 inches deep nor further than 15 inches apart.

#### B. Fill Slopes-Greater than 3:1 Slopes - Fill slopes steeper than 3:1 shall be grooved or allowed to remain rough as they are constructed utilizing one of the following methods:

1. Grooving may be made with any appropriate implement which can be safely operated on the slope and which will not cause undue compaction such as discs, tillers, spring harrows, and the teeth on a front-end loader bucket. Grooves left shall not be less than 3 inches deep nor further than 15 inches apart.
2. As lifts of the fill are constructed, soil and rock materials may be allowed to fall naturally onto the slope surface. At no time shall slopes be bladed or scraped to produce a smooth, hard surface.

#### C. Cuts, Fills, and Graded Areas Which Will Be Mowed

1. Mowed slopes should not be steeper than 3:1 and shall avoid excessive roughness. These areas may be roughened with shallow grooves such as those, which remain after tilling, discing, harrowing, raking, or use of a cultipacker-seeder. The final pass of any such tillage implement shall be on the contour (perpendicular to the slope).
2. Grooves formed by implements shall be not less than 1 inch deep and not further than 12 inches apart. Fill slopes that are left rough during construction may be smoothed with a chain harrow or similar implement to facilitate mowing.

#### D. Roughening With Tracked Machinery

1. Avoid tracking clayey soils if possible, due to their potential for compaction. Conversely sandy soils will have low potential for compaction.
2. Operate tracked machinery up and down the slope to leave horizontal depressions in the soil. As few passes of the machinery should be made as possible to minimize compaction.

### 3.26 EROSION CONTROL DURING TOPSOILING OPERATIONS

#### A. Salvaging and Stockpiling

1. Determine the depth and suitability of topsoil at the site. (For help, contact your local SWCD office to obtain a county soil survey report).
2. Prior to stripping topsoil, install appropriate downslope erosion and sedimentation controls such as sediment traps and basins.
3. Remove the soil material no deeper than what the county soil survey describes as "surface soil" (ie. A or Ap horizon).
4. Construct stockpiles in accessible locations that do not interfere with natural drainage. Install appropriate sediment controls to trap sediment such as silt fence immediately adjacent to the stockpile or sediment traps or basins downstream of the stockpile. Stockpile side slopes shall not exceed a ratio of 2:1.
5. If topsoil is stored for more than 21 days, it should be temporary seeded, or covered with a tarp.

#### B. Spreading the Topsoil

1. Prior to applying topsoil, the topsoil should be pulverized.
2. To ensure bonding, grade the subsoil and roughen the top 3-4 in. by disking.
3. Do not apply when site is wet, muddy, or frozen, because it makes spreading difficult, causes compaction problems, and inhibits bonding with subsoil.
4. Apply topsoil evenly to a depth of at least 4 inches and compact slightly to improve contact with subsoil.
5. After spreading, grade and stabilize with seeding or appropriate vegetation.

### 3.27 TEMPORARY SEEDING OPERATIONS FOR EROSION CONTROL

- A. Structural erosion and sediment control practices such as diversions and sediment traps shall be installed and stabilized with temporary seeding prior to grading the rest of the construction site.

- B. Temporary seed shall be applied between construction operations on soil that will not be graded or reworked for 21 days or greater. These idle areas shall be seeded within 7 days after grading.
- C. The seedbed should be pulverized and loose to ensure the success of establishing vegetation. Temporary seeding should not be postponed if ideal seedbed preparation is not possible.
- D. Soil Amendments—Temporary vegetation seeding rates shall establish adequate stands of vegetation, which may require the use of soil amendments. Base rates for lime and fertilizer shall be used.
- E. Seeding Method—Seed shall be applied uniformly with a cyclone spreader, drill, cultipacker seeder, or hydroseeder. When feasible, seed that has been broadcast shall be covered by raking or dragging and then lightly tamped into place using a roller or cultipacker. If hydroseeding is used, the seed and fertilizer will be mixed on-site and the seeding shall be done immediately and without interruption.

### 3.28 MULCHING OF TEMPORARY SEEDING AREAS

- A. Applications of temporary seeding shall include mulch, which shall be applied during or immediately after seeding. Seedings made during optimum seeding dates on favorable, very flat soil conditions may not need mulch to achieve adequate stabilization.
- B. Materials:
  - 1. Straw—If straw is used, it shall be unrotted small-grain straw applied at a rate of 2 tons per acre or 90 lbs./ 1,000 sq. ft. (2-3 bales)
  - 2. Hydroseeders—If wood cellulose fiber is used, it shall be used at 2000 lbs./ ac. or 46 lb./ 1,000-sq.-ft.
  - 3. Other—Other acceptable mulches include mulch mattings applied according to manufacturer's recommendations or wood chips applied at 6 ton/ ac.
- C. Straw Mulch shall be anchored immediately to minimize loss by wind or water. Anchoring methods:
  - 1. Mechanical—A disk, crimper, or similar type tool shall be set straight to punch or anchor the mulch material into the soil. Straw mechanically anchored shall not be finely chopped but left to a length of approximately 6 inches.

2. Mulch Netting—Netting shall be used according to the manufacturers recommendations. Netting may be necessary to hold mulch in place in areas of concentrated runoff and on critical slopes.
3. Synthetic Binders—Synthetic binders such as Acrylic DLR (Agri-Tac), DCA-70, Petroset, Terra Track or equivalent may be used at rates recommended by the manufacturer.
4. Wood-Cellulose Fiber—Wood-cellulose fiber binder shall be applied at a net dry wt. of 750 lb./ac. The wood-cellulose fiber shall be mixed with water and the mixture shall contain a maximum of 50 lb. / 100 gal.

### 3.29 MULCHING FOR EROSION CONTROL

- A. Mulch and other appropriate vegetative practices shall be applied to disturbed areas within 7 days of grading if the area is to remain dormant (undisturbed) for more than 21 days or on areas and portions of the site which can be brought to final grade.
- B. Mulch shall consist of one of the following:
  1. Straw - Straw shall be unrotted small grain straw applied at the rate of 2 tons/ac. or 90 lb./1,000 sq. ft. (two to three bales). The straw mulch shall be spread uniformly by hand or mechanically so the soil surface is covered. For uniform distribution of hand-spread mulch, divide area into approximately 1,000 sq.ft. sections and place two 45-lb. bales of straw in each section.
  2. Hydroseeders - Wood cellulose fiber should be used at 2,000 lb./ac. or 46 lb./1,000 sq. ft.
  3. Other - Acceptable mulches include mulch mattings and rolled erosion control products applied according to manufacturer's recommendations or wood mulch/chips applied at 10-20 tons/ac.
- C. Mulch Anchoring - Mulch shall be anchored immediately to minimize loss by wind or runoff. The following are acceptable methods for anchoring mulch.
  1. Mechanical - Use a disk, crimper, or similar type tool set straight to punch or anchor the mulch material into the soil. Straw mechanically anchored shall not be finely chopped but be left generally longer than 6 inches.
  2. Mulch Nettings - Use according to the manufacturer's recommendations, following all placement and anchoring requirements. Use in areas of water concentration and steep slopes to hold mulch in place.
  3. Synthetic Binders - For straw mulch, synthetic binders such as Acrylic DLR (Agri-Tac), DCA-70, Petroset, Terra Tack or equal may be used at rates recommended by the manufacturer. All applications of Synthetic



Binders must be conducted in such a manner where there is no contact with waters of the state.

4. Wood Cellulose Fiber - Wood cellulose fiber may be used for anchoring straw. The fiber binder shall be applied at a net dry weight of 750 lb./acre. The wood cellulose fiber shall be mixed with water and the mixture shall contain a maximum of 50 lb./100 gal. of wood cellulose fiber.

### 3.30 INSTALLATION OF TEMPORARY ROLLED EROSION CONTROL PRODUCT (EROSION CONTROL MATTING)

- A. Channel/Slope Soil Preparation Grade and compact area of installation, preparing seedbed by loosening 2"-3" of topsoil above final grade. Incorporate amendments such as lime and fertilizer into soil. Remove all rocks, clods, vegetation or other debris so that installed RECP will have direct contact with the soil surface.
- B. Channel/Slope Seeding Apply seed to soil surface prior to installation. All check slots, anchor trenches, and other disturbed areas must be reseeded. Refer to the Permanent Seeding specification for seeding recommendations.
- C. Slope Installation
  1. Excavate top and bottom trenches (12"x6"). Intermittent erosion check slots (6"x6") may be required based on slope length. Excavate top anchor trench 2' x 3' over crest of the slope.
  2. If intermittent erosion check slots are required, install RECP in 6"x6" slot at a maximum of 30' centers or the mid point of the slope. RECP should be stapled into trench on 12" centers.
  3. Install RECP in top anchor trench, anchor on 12" spacings, backfill and compact soil.
  4. Unroll RECP down slope with adjacent rolls overlapped a minimum of 3". Anchor the seam every 18". Lay the RECP loose to maintain direct soil contact, do not pull taught.
  5. Overlap roll ends a minimum of 12" with upslope RECP on top for a shingle effect. Begin all new rolls in an erosion check slot if required, double anchor across roll every 12".
  6. Install RECP in bottom anchor trench (12"x6"), anchor every 12". Place all other staples throughout slope at 1 to 2.5 per square yard dependant on slope. Refer to manufacturer's anchor guide.
- D. Channel Installation
  1. Excavate initial anchor trench (12"x6") across the lower end of the project area.

2. Excavate intermittent check slots (6"x6") across the channel at 30' intervals along the channel.
3. Excavate longitudinal channel anchor slots (4"x4") along both sides of the channel to bury the edges. Whenever possible extend the RECP 2'-3' above the crest of channel side slopes.
4. Install RECP in initial anchor trench (downstream) anchor every 12", backfill and compact soil.
5. Roll out RECP beginning in the center of the channel toward the intermittent check slot. Do not pull taught. Unroll adjacent rolls upstream with a 3" minimum overlap (anchor every 18") and up each channel side slope.
6. At top of channel side slopes install RECP in the longitudinal anchor slots, anchor every 18".
7. Install RECP in intermittent check slots. Lay into trench and secure with anchors every 12", backfill with soil and compact.
8. Overlap roll ends a minimum of 12" with upstream RECP on top for a shingling effect. Begin all new rolls in an intermittent check slot, double anchored every 12".
9. Install upstream end in a terminal anchor trench (12"x6"); anchor every 12", backfill and compact.
10. Complete anchoring throughout channel at 2.5 per square yard using suitable ground anchoring devices (U shaped wire staples, metal geotextile pins, plastic stakes, and triangular wooden stakes). Anchors should be of sufficient length to resist pullout. Longer anchors may be required in loose sandy or gravelly soils.

### 3.31 INSTALLATION OF TURF REINFORCEMENT MATTING (PERMANENT ROLLED EROSION CONTROL PRODUCTS)

- A. Channel/Slope Soil Preparation Grade and compact area of installation, preparing seedbed by loosening 2"-3" of topsoil above final grade. Incorporate amendments such as lime and fertilizer into soil. Remove all rocks, clods, vegetation or other debris so that installed TRM will have direct contact with the soil surface.
- B. Channel/Slope Seeding Apply seed to soil surface prior to installation. All check slots, anchor trenches, and other disturbed areas must be reseeded. Refer to the Permanent Seeding specification for seeding recommendations.
- C. Slope Installation
  1. Excavate top and bottom trenches (12"x6"). Intermittent erosion check slots (6"x6") may be required based on slope length. Excavate top anchor trench 2' x 3' over crest of the slope.

2. If intermittent erosion check slots are required install Turf Reinforcement Matting (TRM) in 6"x6" slot at a maximum of 30' centers or the mid point of the slope. TRM should be stapled into trench on 12" centers.
3. Install TRM in top anchor trench, anchor on 12" spacings, backfill and compact soil.
4. Unroll TRM down slope with adjacent rolls overlapped a minimum of 3". Anchor the seam every 18". Lay the TRM loose to maintain direct soil contact, do not pull taught.
5. Overlap roll ends a minimum of 12" with upslope TRM on top for a shingle effect. Begin all new rolls in an erosion check slot if required, double anchor across roll every 12".
6. Install TRM in bottom anchor trench (12"x6"), anchor every 12". Place all other staples throughout slope at 1 to 2.5 per square yard dependant on slope. Refer to manufacturer's anchor guide.

#### D. Channel Installation

1. Excavate initial anchor trench (12"x6") across the lower end of the project area.
2. Excavate intermittent check slots (6"x6") across the channel at 30' intervals along the channel.
3. Excavate longitudinal channel anchor slots (4"x4") along both sides of the channel to bury the edges. Whenever possible extend the TRM 2'-3' above the crest of channel side slopes.
4. Install TRM in initial anchor trench (downstream) anchor every 12", backfill and compact soil.
5. Roll out TRM beginning in the center of the channel toward the intermittent check slot. Do not pull taught. Unroll adjacent rolls upstream with a 3" minimum overlap (anchor every 18") and up each channel side slope.
6. At top of channel side slopes install TRM in the longitudinal anchor slots, anchor every 18".
7. Install TRM in intermittent check slots. Lay into trench and secure with anchors every 12", backfill with soil and compact.
8. Overlap roll ends a minimum of 12" with upstream TRM on top for a shingling effect. Begin all new rolls in an intermittent check slot, double anchored every 12".
9. Install upstream end in a terminal anchor trench (12"x6"); anchor every 12", backfill and compact.
10. Complete anchoring throughout channel at 2.5 per square yard using suitable ground anchoring devices (U shaped wire staples, metal geotextile pins, plastic stakes, and triangular wooden stakes). Anchors should be of sufficient length to resist pullout. Longer anchors may be required in loose sandy or gravelly soils.

### 3.32 GENERAL SMALL CONSTRUCTION SITE CONTROLS

- A. Preexisting vegetation shall be retained on idle portions of the building area for as long as construction operations allow. Clearing shall be done so only active working areas are bare.
- B. Temporary seed and/or mulch shall be applied to areas, such as stockpiles and rough graded areas, that are bare and not actively being worked. This shall apply to areas that will not be reworked for 21 days or more.
- C. Stockpiles created from excavation and grading shall be situated away from streets, swales, or other waterways and shall be seeded and/or mulched immediately.
- D. Silt fence or other sediment barriers shall control sheet flow runoff from the construction area. These shall not be constructed in channels or areas of concentrated flow. Other sediment controls such as sediment traps and inlet protection shall also be used as needed to control sediment runoff. Sediment control practices shall be inspected weekly after storm events, and maintained in good working condition.
- E. Construction vehicle access shall be limited to one route, to the greatest extent practical. The access shall be gravel or crushed rock underlain with geotextile.
- F. Mud tracked onto streets or sediment settled around curb inlet protection shall be removed daily or as needed to prevent it from accumulating. It shall be removed by shoveling and scraping and shall NOT be washed off paved surfaces or into storm drains. Sediment removed shall be placed where it will not be subject to erosion or concentrated runoff.

END OF SECTION

## SECTION 02500

### PAVEMENT CONSTRUCTION

#### PART 1 GENERAL

##### 1.01 SCOPE

- A. The Contractor shall furnish all of the equipment, labor and materials necessary to install, replace, and/or restore existing pavement structures together with their respective appurtenances as specified herein. This work shall include all of the sub grade preparation, sub base, base, intermediate pavement course(s), and finish pavement courses together with guttering, tack and/or prime coating, and other pertinent work as necessary to meet the conditions of this contract.

##### 1.02 DESCRIPTION OF WORK

- A. Work of this Section includes, but is not limited to:
  - 1. Concrete Pavement
    - a. Aggregate base course.
    - b. Surface course.
    - c. Joints.
  - 2. Asphalt Concrete Pavement
    - a. Aggregate base course.
    - b. Prime coat.
    - c. Asphalt concrete base.
    - d. Tack coat.
    - e. Intermediate course.
    - f. Surface course.
  - 3. Aggregate (Gravel) Pavement
    - a. Stabilized crushed aggregate.

##### 1.03 RELATED WORK

- A. Specification 02130, Trench Excavation, Bedding, and Backfill
- B. Specification 02226, Compacted Granular Backfill
- C. Specification 03300, Cast-in-Place Concrete

##### 1.04 SUBMITTALS

- A. All submittals shall conform completely to the requirements of the Contract Documents, including all requirements set forth in Section 01300,

Submittals.

B. Reference Submittals

1. Testing Reports and Material Certification.

a. Concrete

1) Slump Tests

- a) By approved laboratory at Contractor's expense.
- b) Slump tests shall be taken at each 20 cu yd of concrete being placed.
- c) No concrete shall be placed that does not meet slump requirements of the Specification.

2) Compression Tests

- a) By approved laboratory at Contractor's expense.
- b) Tests made in accordance with ASTM C39.
- c) Cylinders shall be taken and broken by an approved laboratory at the rate of 4 cylinders per 1,500 sq yd of concrete poured but not less than 4 cylinders for each day's continuous pour.
- d) Two cylinders to be used for 7-day compression test and two for 28-day tests.

b. Aggregate Base Course

- 1) Submit 2 copies of laboratory test reports, endorsed by the Contractor, certifying compliance with the specifications as to material gradations and densities.
- 2) Material and density tests by approved laboratory at Contractor's expense.

c. Asphalt Concrete Pavement

- 1) Aggregate Base Course: Submit 2 copies of laboratory test reports, endorsed by the Contractor, certifying compliance with the Specifications as to material gradations and densities.
- 2) Asphalt Concrete Pavement Surface, and Intermediate and Asphalt Concrete Base Course: Submit 2 copies of job mix formula as specified herein.

1.05 QUALITY ASSURANCE

A. Standards

- 1. References to ODOT Specifications are to the latest edition of "State of Ohio, Department of Transportation, Construction and Material Specifications.
- 2. Comply with requirements of the ODOT Specifications.
- 3. Comply with the requirements of the Ohio Manual of Uniform Traffic Control Devices for Streets and Highways.

1.06 JOB CONDITIONS

A. General

1. Test holes by the Contractor will be permitted provided the area is returned to as near original condition as possible.
2. Take all measurements and determine all elevations at the Site.

B. Subgrade: Unsatisfactory subgrade shall be reworked as specified.

C. Safeguards

1. During paving operations, maintain vehicular and pedestrian traffic as required for construction activities.
2. Provide flagmen, barricades, warning signs, and warning lights for the safe movement of traffic and in a manner that will cause the least interruption of work.

PART 2 PRODUCTS

2.01 MATERIALS

A. Concrete Pavement

1. General
  - a. Pavement thickness and joints shall be as indicated on the Drawings.
  - b. Reinforcement steel is not required.
2. Aggregate Base Course: Comply with ODOT Specifications, Item 304 - Aggregate Base Course.
3. Surface Course
  - a. Comply with ODOT Specifications, Item 452 - Plain Portland Cement Concrete Pavement.
  - b. Concrete shall contain 4-8% entrained air after it is in place.
  - c. Proportions shall conform to Class FS concrete, ODOT Specifications, Item 499 - Concrete - General.
  - d. Concrete shall develop a minimum strength of 4,000 psi in 28 day tests.
  - e. Slump
    - 1) Nominal: 1 to 3 inches.
    - 2) Maximum: 4 inches.
4. Pavement Joints: Expansion joint materials and joint sealers shall be in accordance with ODOT Specifications, Item 705.

B. Asphalt Concrete Pavement

1. Aggregate Base Course
  - a. Comply with ODOT Specifications, Item 304 - Aggregate Base.
  - b. Materials shall conform to the following gradation:

SIEVE	TOTAL PERCENT PASSING
2 inch	100
1 inch	70 – 100
3/4 inch	50 – 90
No. 4	30 – 60
No. 30	9 – 33
No. 200	0 - 13

- c. Moisture Content: - 4% to +2% of optimum moisture.
2. Asphalt Concrete Base
  - a. Comply with ODOT Specifications, Item 301 – Asphalt Concrete Base.
  - b. Materials shall conform to the following gradation:

SIEVE	TOTAL PERCENT PASSING
2 INCH	100
1 INCH	75 – 100
1/2 INCH	50 – 85
NO. 4	25 – 60
NO. 8	15 – 45
NO. 16	10 – 35
NO. 50	3 – 18
NO. 200	1 – 7

- c. Asphalt Binder content: 4% to 8%.
3. Tack Coat: Comply with ODOT Specifications, Item 407 - Tack Coat.
4. Surface or Intermediate Course:
  - a. The asphalt concrete shall be composed of coarse and fine aggregate and asphalt cement in accordance with ODOT Specifications, Items 401, 441 and 448, Asphalt Concrete.
  - b. Material gradation of the aggregate portion of the mix shall conform to the following:
    - 1) Item 448 - Asphalt Concrete Surface Course, Type 1



SIEVE	TOTAL PERCENT PASSING
1/2 inch	100
3/8 inch	90-100
No. 4	45-57
No. 8	30-45
No. 16	17-35
No. 30	12-25
No.50	5-18
No. 100	2-10

- 2) Asphalt Binder content: 5.8% to 10%
- 3) Item 448 - Asphalt Concrete Intermediate Course, Type 2

SIEVE	TOTAL PERCENT PASSING
1 1/2 inch	100
1 inch	95-100
3/4 inch	85-100
1/2 inch	65 – 85
No. 4	35-60
No. 8	25-48
No. 16	16- 36
No. 30	12-30
No. 50	5-18
No. 100	2-10

- 4) Asphalt Binder content: 4.0% to 9%.

C. Aggregate (Gravel) Pavement (Shoulders)

1. The work shall consist of compacted crushed aggregate on a prepared subgrade to conform to the width, thickness and details indicated.
2. Comply with ODOT Specifications, Item 411 - Stabilized Crushed Aggregate.
3. Materials shall meet the following gradation:

SIEVE	TOTAL PERCENT PASSING
1-1/2 inch	100
1 inch	75 – 100
3/4 inch	60 – 100
3/8 inch	35 – 75
No. 4	30 – 60
No. 30	7 – 30
No. 200	3 -15

## PART 3 EXECUTION

### 3.01 PREPARATION

#### A. Subgrade

1. Proof-roll using heavy, rubber-tired rollers to check for unstable areas and areas that require additional material and compaction.
2. Replace unacceptable areas with new material.

B. Existing Structures: When castings, valve boxes and other structures are encountered, they shall be reset to established grade as required.

C. Removal of Existing Paving: Saw-cut along the line of removal or of new work, in order to provide a smooth junction and a minimum of patching.

### 3.02 INSTALLATION

A. General: Lines, grades and minimum thicknesses shall be as indicated.

#### B. Concrete Pavement

##### 1. Aggregate Base Course

- a. Aggregate base course shall be placed directly on compacted subgrade.
- b. The aggregate base shall be constructed in layers not to exceed 6 inches compacted depth.

##### 2. Surface Course

- a. Plain portland cement concrete pavement shall be placed directly on a prepared aggregate base course.
- b. Thickness shall be as shown on the Drawings.
- c. Curing shall comply with ODOT Specifications, Item 451.10.

3. Pavement Joints: Comply with ODOT Specifications Section 451.08.

#### C. Asphalt Concrete Pavement

##### 1. Aggregate Base Course

- a. Aggregate base course shall be placed directly on compacted subgrade.
- b. The aggregate base shall be constructed in layers not to exceed 8 inches compacted depth.
- c. At the beginning of the work, the Contractor shall build a test section and compact at optimum moisture content to determine density requirements.
- d. All subsequent aggregate base course shall be compacted until the density is 98% of the test section.
- e. Water shall be added to obtain the moisture content at or near

- optimum during compaction.
2. Asphalt Concrete Base
    - a. Asphalt concrete base shall be placed directly on a prepared surface.
    - b. The asphalt concrete base shall be constructed in layers not to exceed 6 inches compacted depth.
  3. Tack Coat
    - a. Thoroughly clean and dry the surface to which the tack coat is to be applied.
    - b. Apply to existing pavement where indicated or to new asphalt paving which has been in place over 14 days or has been used by traffic.
    - c. Tack coat shall be applied at the rate of 0.10-gal/sq. yd.
  4. Intermediate and Surface Course
    - a. Intermediate and surface courses shall be applied in accordance with ODOT Specifications, Items 401, 441 and 448 to the aggregate base course or, where so detailed, to the asphalt concrete base course.
    - b. Transportation, placing, spreading and finishing of asphalt concrete paving shall be done in accordance with ODOT Specifications, Item 401.
    - c. Asphalt concrete paving to and including 3" total compacted thickness shall be placed in a single layer and compacted while hot.
    - d. Particular note is to be taken of Items 401.05 through 401.19 inclusive of the ODOT Specifications, which refer to construction methods and weather limitations.

END OF SECTION

## SECTION 02610

### WATERLINE CONSTRUCTION

#### PART 1 GENERAL

##### 1.01 REFERENCE

- A. All applicable requirements of other portions of the Contract Documents apply to the Work of this Section, including but not limited to Division 1, General Requirements.

##### 1.02 DESCRIPTION OF WORK

- A. Water line piping, valves, hydrants and appurtenances.
- B. Water line testing and disinfection.
- C. Related work specified elsewhere includes, but is not limited to:
  - 1. Section 02130, Trench Excavation, Bedding and Backfill

##### 1.03 QUALITY ASSURANCE

- A. General: All materials shall be free from defects impairing strength and durability and be of the best quality for the purposes specified or shown on the Drawings. It shall have structural properties sufficient to solely sustain or withstand strain and stresses to which it is normally subjected and be true to detail.
- B. Manufacturer's Qualifications
  - 1. Provide piping and appurtenances that are standard products in regular production by manufacturers whose products have proven reliable in similar service for at least two years.
  - 2. Provide piping and appurtenances of the same type from a single manufacturer.
- C. The Contractor shall be responsible for making all field measurements prior to installation of his work. Any deviations in measurements between the field conditions and the Drawings shall be immediately reported to the Engineer.
- D. Testing

1. Manufacturer's certified test results as defined for the type of pipe shall be stamped approved by the Contractor and forwarded to the Engineer as a Reference Submittal. No pipe shall be installed which does not meet the requirements of these Specifications.
2. All pipe, joints, and fittings shall be pressure tested as required by this Specification for the type of pipe. The Contractor shall notify the Engineer and Owner, in writing, at least 48 hours prior to performing the tests.

#### 1.04 SUBMITTALS

- A. Provide technical submittals in accordance with Section 01300, Submittals, demonstrating piping and accessories conform completely to the requirements of this Section.
- B. Product Data
  1. Catalog cut sheets and description of all items.
  2. Construction materials.
  3. Standard diameters, wall thickness and other pertinent dimensions of all sizes of piping and accessories.
- C. Testing: Copies of all field test reports.

#### 1.05 HANDLING, DELIVERY, AND STORAGE

- A. General
  1. Handling, delivery, and storage shall be in accordance with Section 01600 of the Project Manual and the manufacturer's recommendations.
  2. In no case shall the pipe or appurtenance be dumped, dropped, or thrown.
  3. Interior of piping shall be completely free of dirt and foreign matter.

### PART 2 PRODUCTS

#### 2.01 POLYVINYL CHLORIDE (PVC) PIPE (AWWA C900)

- A. General: Polyvinyl chloride (PVC) pipe shall be pressure rated pipe with push-on gasket joints (unless otherwise noted). Products delivered under this specification shall meet the requirements of AWWA C900.
- B. Manufacturers: Pipe shall be as manufactured by Certain-Teed Products Corp., Valley Forge, Pennsylvania; Johns-Manville, New York, New York; Anesite Division, Clow Corporation, Chicago, Illinois; or approved equal.

- C. Materials: Pipe shall be made from unplasticized PVC compounds having a minimum cell classification of 12454 as defined in ASTM D 1784. The compound shall qualify for Hydrostatic Design Basis (HDB) of 4000 psi for water at 73.4°F, in accordance with the requirements of ASTM D 2837.
- D. Dimensions: Nominal outside diameters and wall thicknesses of restrained joint pipe shall conform to the requirements of AWWA C900. Integral bell joint pipe shall be furnished in 4", 6", 8", 10" and 12" sizes, in Class 165(DR25), Class 235(DR18) and Class 305(DR14). Pipe shall be furnished in standard lengths of 20 feet.
- E. Joints: Where push-on joints are utilized, pipe shall incorporate a formed bell complete with a single rubber gasket conforming to ASTM F477. Where restrained joints are specified, pipe shall be joined using non-metallic couplings to form an integral system for maximum reliability and interchangeability. high-strength, flexible thermoplastic splines shall be inserted into mating, precision machined grooves in the pipe and coupling to provide full 360° restraint with evenly distributed loading. Couplings shall be designed for use at or above the pressure class of the pipe with which they are utilized, and shall incorporate twin elastomeric sealing gaskets meeting the requirements of ASTM F 477. Joints shall be designed to meet the zero leakage test requirements of ASTM D 3139.
- F. Workmanship: Pipe shall be homogeneous throughout and free from voids, cracks, inclusions and other defects, and shall be as uniform as commercially practicable in color, density and other physical characteristics.
- G. Quality Control: Every pipe shall pass the AWWA C900 hydrostatic proof test requirements of 4 times the pressure class for 5 seconds.
- H. Marking: Pipe shall be legibly and permanently marked in ink with the following minimum information:
1. Nominal Size (for example, 4")
  2. PVC
  3. Dimension Ratio (for example, DR25)
  4. AWWA pressure class (for example, PC165)
  5. ANSI/AWWA C900-07 (or latest edition)
  6. Manufacturer's name or trademark and production record code
  7. Seal (mark) of the testing agency verifying the suitability of the pipe material for potable water service
- I. Markings of pipe-printing shall be color coded for pressure class identification. Pipe shall be furnished with a minimum of one (1) contrasting color circumferential stripe painted on the plain end or uncoupled end of each length to allow field checking of pipe construction joints.

- J. Each lot shipment of pipe and related materials shall include a shipment itemized check list for recording damages and/or deficiencies.
- K. All PVC material for pipe shall be light gray, light blue or white in color to minimize material heat gain.

## 2.02 DUCTILE IRON PIPE

- A. Ductile iron pipe shall conform to AWWA C151 with wall thickness provided in accordance with AWWA C150 for the depth of cover shown on the Drawings using a minimum rated working pressure of 350 psi and Laying Condition 4; minimum Pressure Class 350, unless otherwise shown or specified.
- B. Pipe shall have standard asphaltic coating on the exterior.
- C. Pipe shall have a standard thickness cement mortar lining in accordance with ANSI/AWWA C104/A21.4.
- D. The class or nominal thickness, net weight without lining, and casting period shall be clearly marked on each length of pipe. Additionally, the manufacturer's mark, country where cast, year in which the pipe was produced, and the letters "DI" or "Ductile" shall be cast or stamped on the pipe.
- E. Push-on and mechanical joint ends shall conform to AWWA C110 with gaskets conforming to AWWA C111.
- F. Flange joints shall conform to AWWA C110 with gaskets and bolts conforming to AWWA C110, Appendix A.
- G. Restrained joints for push-on joint piping shall be the equal of TR Flex by U.S. Pipe and Foundry Co., Flex-Ring by American Cast Iron Pipe Co., or Tyton Joint with Field Lok Gasket instant joint restraint by U.S. Pipe and Foundry Co.
- H. Restrained joints for mechanical joint piping shall be the equal of Megalug by EBBA Iron, Inc.; MJ Gripper Gland by U.S. Pipe and Foundry Co.; or Lok-Fast Joint by American Cast Iron Pipe Co.

## 2.03 D.I. FITTINGS AND ACCESSORIES

- A. All fittings shall be ductile iron unless otherwise specified. Fittings shall have mechanical joints unless otherwise noted. Ductile iron standard fittings shall

conform to AWWA C110 and compact fittings shall conform to AWWA C153. Pressure rating shall be 250 unless otherwise noted.

- B. All lining and coating for fittings shall be as specified for ductile iron pipe.
- C. Fittings shall be as manufactured by U.S. Pipe and Foundry Co., American Cast Iron Pipe Co., Clow Corp. or approved equal.
- D. Mechanical and push-on joint fittings shall conform to AWWA C111/ANSI 21.11.
- E. Flange joint fittings shall conform to AWWA C110 with gaskets and bolts conforming to AWWA C110, Appendix A.
- F. Long radius elbows, reducing elbows, reducing-on-the-run tees, side outlets, eccentric reducers and laterals supplied as flanged fittings shall conform to ANSI B16.1.
- G. All flanged joint fittings shall be furnished with 1/8 inch thick rubber gaskets. The bolts shall have American Standard heavy unfinished hexagonal head and nut dimensions all as specified in American Standard for Wrench Head Bolts and Nuts and Wrench Openings (ANSI B18.2). Material for bolts and nuts shall conform to ASTM A307 Grade B.
- H. Anchor pipe and fittings shall consists of plain end MJ pipe fittings furnished with integral fixed or split rotatable ring follower glands. A mechanical joint anchoring tee may be substituted for a mechanical joint tee with anchoring piece.

#### 2.04 GATE VALVES

- A. All gate valves installed under this contract shall be resilient wedge gate valves and shall be of the same class as the pipe on which they are installed. Valves shall have joint ends compatible with type of pipe used, non-rising stems, 2" square operating nut and shall open "left".
- B. Approved Manufacturers: Mueller Co. or approved equal.
- C. Valves shall conform to AWWA C509 and shall incorporate an iron body, bronze-mounted, and parallel seat. Valve seals shall be O-ring type in lieu of a stuffing box. Valve stems shall be manganese bronze, non-rising type.
- D. Gate valves 4-inch and larger shall be cast iron with bronze gate rings.
- E. All gate valves 2 1/2" and smaller shall be of an Engineer approved manufacture and suitable for the service required. All valves shall have



openings through the body of the same circular area as that of the pipe to which they are attached. All valves shall be designed to take the full unbalanced pressure upon either face.

- F. Except as otherwise stated or indicated upon the plans, underground valves shall be fitted with standard, two-inch square operating nut. All valves in interior or above ground piping shall be fitted with hand wheels and shall have flanged or screwed ends depending upon the size of pipe with which they are being used, or as shown on the plans. Underground valves will be provided with boxes, covers and operating nuts extended to grade. All underground valves shall have cast iron bodies.
- G. All hand-operated gate valves shall open by turning counter clockwise (left). The direction of opening shall be indicated by an arrow on hand wheels and on operating nuts.
- H. All submerged valves shall be furnished with "o" ring packing.
- I. All gate valves shall be designed for a minimum working pressure equivalent to that of the connecting pipe.
- J. The valve body and bonnet shall be coated with fusion bonded epoxy, interior and exterior, in accordance with AWWA C550. The coating material shall comply with NSF Standard 61.
- K. All valves shall have the manufacturer's name, pressure rating and year of manufacture cast into the body.

## 2.05 HYDRANTS

- A. Flush hydrants located at water storage tanks shall be Mueller Super Centurion A-423 with 5-1/4 inch main valve, compression shutoff, two 2-1/2 inch and one 4-1/2 inch nozzles with three chains and No. 2 nut. Shoe connection shall be 6-inch MJ.
- B. Hydrant shall open left (counter clockwise). Hydrants shall be built for 4 1/2 feet bury and be painted red in reflective paint.
- C. Approximately 1/2 cubic yards of coarse gravel shall be placed from the bottom of the trench up the hydrant barrel. Brace with solid concrete block not concrete.
- D. Provide restrained joint system from hydrant to hydrant valve to hydrant tee.
- E. Hydrant valve shall be gate valve. Hydrant shall be installed using MJ by swivel tee and 6-inch by 13-inch swivel by swivel adapter.

## 2.06 CONCRETE BLOCKING

- A. Concrete blocking will be placed at all tees, bends, and valve locations unless otherwise noted. Blocking shall be placed in accordance with the details shown in the Drawings.
- B. Concrete shall be ready mix concrete with a minimum compressive strength of 4,000 psi at 28 days.

## 2.07 VALVE BOXES

- A. Valve boxes shall be supplied for all buried valves.
- B. The assembly shall consist of two (2) pieces and a cover. The cover shall be marked "Water". The valve box shall be screw-type, cast iron with 5-1/4-inch shaft. A round base that will enclose the valve bonnet shall be furnished with 6-inch and 8-inch valves. An oval base shall be supplied with valves larger than 8-inches.
- C. The valve box shall be supported at the base on concrete blocking to stabilize the assembly.
- D. Valve boxes shall be Mueller Model No. 21 or approved equal

## 2.08 TRACER WIRE

- A. Tracer wire installed on water line shall be solid single strand, green, TW, insulated 12 AWG copper wire.
- B. Splices shall be made by looping wire and tying it into a knot. Connection is to be completed using a wire nut and a 3M DBR-6 type connector.
- C. Monitor stations shall be constructed from 1-inch diameter PE tube.

## 2.09 UTILITY MARKING TAPE

- A. Three (3) inch wide detectable utility marking tape bearing the word "CAUTION...WATERLINE" permanently printed on the tape. Tape shall be blue as specified by the APWA color code.

# PART 3 EXECUTION

## 3.01 INSTALLATION OF PIPE

- A. Size, Type and Joining: All materials shall conform to the size and type shown on the drawings or called for in the specification. In joining two dissimilar types of pipe, standard fittings shall be used when available. In the event fittings are not available, the method of joining shall be selected by the Contractor and submitted for review by the Engineer.
- B. Installation Standards: Except where noted or specified, all underground waterline shall be laid in accordance with AWWA C600 or AWWA C605 for ductile iron or PVC pipe, respectively. All clearances and separations between water lines and sewer lines shall be in accordance with OEPA guidelines.
- C. General Excavation:
1. Contractor shall do all excavation, undercutting, dewatering and backfilling necessary for work under this contract unless otherwise noted.
  2. Work shall conform to other sections of Division 2 except where modified by this section.
  3. The width of trench below the top of the pipe shall not exceed the nominal diameter of the pipe plus 2 feet for all pipelines.
  4. Where the maximum trench width is exceeded, the pipe shall be placed in a concrete cradle or a stronger pipe shall be used as necessary. If the maximum trench width is exceeded for any reason other than by request of the Engineer, the concrete cradle or the stronger pipe shall be placed at the Contractor's expense.
  5. Excavation shall include all necessary clearing of excavated areas, tree removal, all grubbing, all wet, dry, fill and rock excavation, the removal of pavement and all incidental work thereto.
  6. Contractor shall excavate whatever materials are encountered as required to place the pipe and appurtenances at the elevations noted.
  7. The trench shall be constructed in accordance with Section 02130 – Trench Excavation, Bedding and Backfill.
  8. Excavations at the crossing of all underground utility services in place shall be as narrow as practicable.
  9. Unless otherwise noted, all existing underground services shall be protected from damage and maintained in service at their original location and grade during the process of the work. Any damage to underground services shall be replaced or repaired at no cost to the Owner or to the owner of the service. The present underground services shown on the drawings are located in accordance with available data. Encountering these services at a different location or encountering services not shown shall not release the Contractor from the previous stated conditions.

10. Any service connections encountered which are to be removed shall be cut off at the limits of the excavation and capped in accordance with the requirements of owners of such connections.
11. Excavated material that is unsuitable or not required for filling shall be wasted.
12. Materials to be used for fill and suitable for this purpose shall be deposited where required, except that no fill shall be placed where trenches for sewers, water lines or other services will be located until after the trench work is completed.
13. Contractor shall provide adequate shoring, sheet piling and bracing to prevent earth from caving or washing into the excavation, and shall do all shoring and underpinning necessary to properly support adjacent or adjoining structures. All shoring, sheet piling and underpinning must be maintained until permanent support is provided.

#### D. Laying Pipe:

1. Piping shall be installed in accordance with the manufacturer's published instructions, modified only as may be directed herein or by the Engineer. All pipe installations shall comply with applicable paragraphs contained as part of these construction specifications.
2. Pipe Bury Depth - normal laying depth shall be 48" of cover depth minimum regardless of pipe diameter. Where rock is encountered, the minimum cover over top of the pipe shall be 48". Where rock is encountered on the trench bottom at the normal laying depth, a minimum of 6 inches of granular bedding shall be required.
3. All piping shall be assembled in accordance with the layout shown on the plans with only such modifications as may be necessary to conform to the final detail dimensions or location of existing water mains, hydrants, existing utilities, tanks, valve vaults, booster stations, valves, county roads, highway and stream crossings, etc. In crossing under ditches and streams the minimum depth of the trench required for the project shall be maintained. Standard fittings shall be used if required to depress the pipe but in no case shall the approach to the crossing be laid at a steeper angle than forty-five (45) degrees with the horizontal.
4. All pipe installed under this contract shall be installed in accordance with the applicable sections of AWWA C600 or AWWA C605 for ductile iron and PVC pipe, respectively. Type B laying conditions shall be maintained for both ductile iron and PVC installations. Trench width at the top of the pipe shall not exceed the pipe diameter plus 2 feet unless approved by the Engineer. Minimum trench width shall be 1 foot greater than the maximum outside pipe diameter. Pipe shall be laid directly on a bedded trench bottom containing coupling or bell joint holes with trench shaped to provide continuous contact with the pipe between coupling or bell joint holes as recommended by the pipe manufacturer or as directed by the Engineer.

5. If, in the course of construction, ground water is encountered, the Contractor shall reduce the water level to the invert of the main or bottom of the structure. The Contractor shall maintain this dewatered condition until the area around the structure has been backfilled to existing grade. No pipe shall be laid in water, or when the trench conditions or the weather is unsuitable for such work, except by permission of the Engineer. At times when pipe installation is not in progress, the open ends of the pipe shall be closed by approved means and no trench water shall be permitted to enter the pipe. It shall be borne in mind that precautions must be taken to prevent empty pipe from floating, should the trench become flooded before backfilling has been completed.
6. Prior installation the interior of each piece of pipe and each fitting shall be inspected and any dirt and debris shall be removed. Swabbing may be required. After installation, inspect again and remove any accumulated dirt and debris.
7. Each piece of pipe shall be lowered into trench and installed separately. All pieces of pipe shall be laid in the trench so that it is firmly supported on the bedding material throughout its length.
8. As shown on the plans, or as directed by the Engineer, the Contractor shall provide concrete anchors or thrust blocks (against undisturbed earth), joint harness, and concrete encasement where required. This work shall be included in the unit prices bid for installing pipe, fittings, and appurtenances.
9. Pieces of pipe or fitting which are known to be defective shall not be laid or placed. Any defective piece of pipe or fitting discovered after the piping is laid shall be removed and replaced with satisfactory pipe or fitting. In case a length of pipe is cut to fit in a line, it shall be so cut as to leave a smooth end at right angles to the longitudinal axis of the pipe. Cuts shall be made with proper tools for cutting the pipe. In the event the pipe is damaged as a result of the pipe being cut, the affected joint shall be rejected.
10. Bed the pipe as indicated and specified in Section 02130.
11. Material used for backfilling trenches over the pipe shall be free from any rock or debris that may be a potential source of damage to the pipe. Where material originally excavated from the trench is deemed unsuitable, the contractor shall obtain other suitable material for use as backfill.
12. Contractor shall provide, operate and maintain all pumps or other equipment necessary to drain and keep all excavation pits and trenches and the entire subgrade area free from water under any circumstances that may arise.
13. All trees, shrubs and improved areas outside of the excavation shall be protected from damage.
14. Where indicated water line shall be installed with tracer wire.
15. Pipe must be kept clean of mortar, cement, clay, sand or other material. Prior to installation the interior of each piece of pipe and each fitting shall

be inspected and any dirt and debris shall be removed. Swabbing may be required. After installation, the pipe and fittings shall be inspected again and any accumulated dirt and debris removed.

E. Restrained Joints:

1. Except where noted or indicated, all bends, caps, plugs, tees and other fittings shall be restrained with flexible restrained joints. In addition, restrained joints shall be utilized for a minimum of one joint or 20 feet, whichever is greater, to each side of the fitting. Restrained joints shall be provided regardless of the use of concrete thrust blocking.
2. Mechanical joints for ductile iron pipe shall be restrained by Megalug 1100 or 1100SD Series by EBAA Iron Sales, Inc., a comparable product manufactured by Star Pipe Products, or an equal restraining system.
3. Ductile iron push-on joint pipe shall be restrained by Lok-Ring Joint by American Ductile Iron Pipe, TRFLEX by U.S. Pipe, or equal.
4. Joints in AWWA C900/C905 PVC pipe shall be restrained by Megalug 2800 Series by EBAA Iron Sales, Inc., a comparable product manufactured by Star Pipe Products, or an equal restraining system.
5. Joints between AWWA C900/C905 PVC pipe and mechanical joint ductile iron fittings shall be restrained by Megalug 2000PV Series by EBAA Iron Sales, Inc., a comparable product manufactured by Star Pipe Products, or an equal restraining system.

3.02 TESTING

- A. All testing must be witnessed by the Engineer. Non-witnessed testing will not be accepted. Contractor shall provide engineer with 48 hour notice prior to commencing with testing.
- B. The Contractor shall make all valves tight under their working pressure after they have been installed and before they are placed in operation. Any defective parts shall be replaced at the Contractor's expense.
- C. All valves shall be pressure tested in conjunction with their adjoining piping.
- D. All water lines shall be disinfection tested in accordance with AWWA C 651.
- E. Pressure Testing:
  1. A hydrostatic test as required in applicable sections of AWWA C600 or AWWA C605 for ductile iron or PVC pipe, respectively, shall be applied to the whole or individually isolated sections of the water lines and hydrant leads.

2. The test pressure shall be maintained at 150 psi or one and a half times the working pressure (whichever is greater), in any section being tested. The duration of each pressure test shall be at least 2 hours.
3. The Contractor shall furnish and Owner verifies gauges for the test. Furthermore, the Contractor shall furnish all materials, make all taps required and furnish a pump, piping, all other equipment and all assistance necessary for conducting the tests. Gauges provided by the Contractor shall only be used for potable water or be new.
4. Before applying the specified pressure, all air shall be expelled from the pipe. To accomplish this, taps shall be made by the Contractor at points of highest elevation or as required. Taps shall be of the sizes as shown on the drawings, or as directed by the Engineer.

F. Leakage Testing:

1. Leakage shall be defined as the quantity of water that must be supplied into the newly laid pipe, or any valved section thereof, to maintain pressure within 5 psi of the specified test pressure after the air in the pipeline has been expelled and the pipe has been filled with water.
2. No pipe installation will be accepted until this leakage (evaluated on a pressure basis of 150 psi) is less than 1.99 U.S. gallons per hour per 100 joints of 12-inch nominal diameter pipe and corrected for the other sizes of pipe as provided in the AWWA Specification.

- G. Any testing performed against existing valves shall be at the Contractor's risk and in strict compliance with the requirements of the Owner. If unable to achieve the required test, the Contractor shall disconnect from the existing valve, plug the line and retest until satisfactory results are obtained. Any damage caused to existing facilities shall be repaired at the Contractor's expense.

### 3.03 DISINFECTION

- A. After satisfactory hydrostatic testing, the completed pipe shall be chlorinated in accordance with AWWA C651, latest edition. All labor, material, and equipment including chlorination taps and blow-off taps necessary to complete the work shall be furnished and paid for by the Contractor. Taps shall include tapping valves, sufficient tubing or pipe to extend outside the trench, and operable valve above ground. Blow-offs shall be installed as required. The time and section of line to be chlorinated shall be approved by the Engineer.
- B. Upon completing the chlorination and the subsequent flushing of the line, the Contractor shall take the necessary water samples from the pipe for testing by an approved laboratory. Engineer must be present to witness the samples being taken. Testing shall be performed in accordance with Ohio

Environmental Protection Agency rules and regulations, copies of which are available from the Ohio Environmental Protection Agency. A certified copy of the test results shall be sent to the Owner. The cost of testing shall be borne by the Contractor.

### 3.04 CONNECTIONS

- A. Contractor is responsible for connecting to existing pipe where indicated in the Drawings.
- B. Expose and determine the type and diameter of existing pipe and ensure that the proper fittings gaskets necessary for interface are available in advance of initiating work on the connection.
- C. The Contractor shall be responsible for the valving off the existing main, flushing, and bleeding air from the existing line once the connection is made. The existing line shall not be valved off until the Contractor has all necessary equipment and materials at the site to make the proper connection. All work shall be performed in coordination with the Owner.
- D. Where designated, connections to existing water lines shall be made under pressure utilizing a tapping sleeve and valve.

### 3.05 VALVE TESTING

- A. The Contractor shall make all valves tight under their working pressure after they have been installed and before they are placed in operation. Any defective parts shall be replaced at the Contractor's expense.
- B. All valves shall be pressure tested in conjunction with their adjoining piping.

### 3.06 VALVE INSTALLATION AND STORAGE

- A. The valves and appurtenances shall be installed in accordance with the installation manual furnished by the valve manufacturer. Extreme care shall be used in the handling, storage and installation of these valves to prevent damage or distortion of the equipment and to insure proper performance.

### 3.07 TRACER WIRE INSTALLATION

- A. Tracer wire shall be installed with all waterline.
- B. Tracer wire shall be fastened to the top of each pipe joint in two locations with plastic tape.
- C. Tracer wire shall be wrapped around bolts on fittings.



D. Tracer wire shall be brought to the surface at all valves and curb stops.

E. Tracer wire shall be installed on hydrant laterals where the hydrants are located more than 50 feet from the main line or where the lateral changes direction.

### 3.08 UTILITY MARKING TAPE INSTALLATION

A. Install detectable utility marking tape above all plastic pipelines, twelve (12) to eighteen (18) inches below final grade.

### 3.09 SERVICE LINE INSTALLATION

A. Service line shall be installed where required to interface the pressure transducer installation at the tank to the inlet water line.

### 3.10 SPARE PARTS AND TOOLS

A. Repair or service parts for one of each type and size of valve and hydrant supplied shall be furnished and stored as directed by the Owner.

B. The equipment shall include, in general, the following items:

1. Special tools required for maintenance or operation of valves.
2. Gaskets, rings, seals, packing, lubricants, bolts, washers, operation manuals, drawings, etc., required to maintain valves in proper operating service.

END OF SECTION

## **SECTION 02936**

### **SEEDING AND MULCHING**

#### **PART 1 GENERAL**

##### **1.01 SECTION INCLUDES**

- A. Placing topsoil.
- B. Permanent seeding, hydro seeding, mulching and fertilizing.

##### **1.02 RELATED SECTIONS**

- A. Section 02130 – Trench Excavating, Bedding, and Backfill: Rough grading over cut.
- B. Section 02270 – Slope Protection and Erosion Control: Erosion control. Temporary seeding and mulching.

##### **1.03 REFERENCES**

- A. FS O-F-241 - Fertilizers, Mixed, Commercial.
- B. Lawn Mixture

1. Kentucky Bluegrass ( <i>Poa pratensis</i> )	3 lb./ 1000 ft <sup>2</sup>
2. Creeping Red Fescue ( <i>Festuca rubra</i> )	3 lb./ 1000 ft <sup>2</sup>
3. Annual Ryegrass ( <i>Lolium multiflorum</i> )	2 lb / 1000 ft <sup>2</sup>
4. Perennial Ryegrass, turf type ( <i>Lolium perenne</i> )	2 lb / 1000 ft <sup>2</sup>

- C. General Notes and any other related specifications.

##### **1.04 DEFINITIONS**

- A. Weeds: Include Dandelion, Jimsonweed, Quack grass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambs quarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nut grass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

##### **1.05 SUBMITTALS AT PROJECT CLOSEOUT**

- A. Section 01700 - Contract Closeout: Procedures for submittals.
- B. Maintenance Data: Include maintenance instructions, cutting method and

maximum grass height; types, application frequency, and recommended coverage of fertilizer.

#### 1.06 QUALITY ASSURANCE

- A. Provide seed mixture in containers showing percentage of seed mix, year of production, net weight, date of packaging, and location of packaging.

#### 1.07 REGULATORY REQUIREMENTS

- A. Comply with regulatory agencies for fertilizer and herbicide composition.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of seed mixture.

#### 1.08 DELIVERY, STORAGE, AND PROTECTION

- A. Section 01600 - Material and Equipment: Transport, handle, store, and protect products.
- B. Deliver grass seed mixture in sealed containers. Seed in damaged packaging is not acceptable.
- C. Deliver fertilizer in waterproof bags showing weight, chemical analysis, and name of manufacturer.

#### 1.09 MAINTENANCE SERVICE

- A. Maintain seeded areas immediately after placement until grass is well established and exhibits a vigorous growing condition for two cuttings.

### PART 2 PRODUCTS

#### 2.01 SEED MIXTURE

- A. Seed Mixture: ODOT; Item 659.09; Lawn Mixture

#### 2.02 SOIL MATERIALS

- A. Topsoil: Fertile, agricultural soil, typical for locality, capable of sustaining vigorous plant growth, taken from drained site; free of subsoil, clay or impurities, plants, weeds and roots; pH value of minimum 5.4 and maximum 7.0.

#### 2.03 ACCESSORIES

- A. Mulching Material:
  - 1. Oat or wheat straw, free from weeds, foreign matter detrimental to plant life, and dry. Hay or chopped cornstalks are not acceptable.
  - 2. Hemlock species wood cellulose fiber, dust or chip form, free of growth or germination inhibiting ingredients.
- B. Fertilizer: FS O-F-241, Type I, Grade A; recommended for grass, with fifty percent of the elements derived from organic sources; of proportion necessary to eliminate any deficiencies of topsoil, as indicated in analysis.
- C. Water: Clean, fresh and free of substances or matter, which could inhibit vigorous growth of grass.
- D. Erosion Fabric: Jute matting, open weave.
- E. Stakes: Softwood lumber, chisel pointed.
- F. String: Inorganic fiber.

### PART 3 EXECUTION

#### 3.01 EXAMINATION

- A. Verify that prepared soil base is ready to receive the work of this section.
- B. Soils must include enough fine-grained material to hold at least a moderate amount of available moisture.
- C. The soil must be free from material that is toxic or otherwise harmful to plant growth.
- D. Soils which do not meet the above minimum conditions shall receive topsoil to a depth of 4 inches.

#### 3.02 SITE PREPARATION

- A. Subsoiler, plow, or other implement shall be used to reduce soil compaction and allow maximum infiltration. (Maximizing infiltration will help control both runoff rate and water quality.) Subsoiling should be done when the soil moisture is low enough to allow the soil to crack or fracture. Subsoiling shall not be done on slip-prone areas where soil preparation should be limited to what is necessary for establishing vegetation.
- B. The site shall be graded as needed to permit the use of conventional equipment for seedbed preparation and seeding.

- C. Topsoil shall be applied where needed to establish vegetation.

### 3.03 PLACING TOPSOIL

- A. Prior to applying topsoil, the topsoil should be pulverized.
- B. To ensure bonding, grade the subsoil and roughen the top 3-4 in. by disking.
- C. Do not apply when site is wet, muddy, or frozen, because it makes spreading difficult, causes compaction problems, and inhibits bonding with subsoil.
- D. Apply topsoil evenly to a depth of at least 4 inches and compact slightly to improve contact with subsoil.
- E. After spreading, grade and stabilize with seeding or appropriate vegetation.

### 3.04 SEEDBED PREPARATION

- A. Lime—Agricultural ground limestone shall be applied to acid soil as recommended by a soil test. In lieu of a soil test, lime shall be applied at the rate of 100 pounds per 1,000-sq. ft. or 2 tons per acre.
- B. Fertilizer—Fertilizer shall be applied as recommended by a soil test. In place of a soil test, fertilizer shall be applied at a rate of 25 pounds per 1,000-sq. ft. or 1000 pounds per acre of a 10-10-10 or 12-12-12 analyses.
- C. The lime and fertilizer shall be worked into the soil with a disk harrow, spring-tooth harrow, or other suitable field implement to a depth of 3 inches. On sloping land, the soil shall be worked on the contour.

### 3.05 SEEDING DATES AND SOIL CONDITIONS

- A. Seeding should be done March 1 to May 31 or August 1 to September 30. If seeding occurs outside of the above-specified dates, additional mulch and irrigation may be required to ensure a minimum of 80% germination. Tillage for seedbed preparation should be done when the soil is dry enough to crumble and not form ribbons when compressed by hand. For winter seeding, refer to dormant seeding.

### 3.06 SEEDING

- A. Apply seed at a rate of 3 lbs per 1000 sq ft evenly in two intersecting directions. Rake in lightly.

- B. Do not seed areas in excess of that which can be mulched on same day.
- C. Planting Season: April to September.
- D. Do not sow immediately following rain, when ground is too dry, or during windy periods.
- E. Immediately following seeding, apply mulch as required herein. Maintain clear of shrubs and trees.
- F. Apply water with a fine spray immediately after each area has been mulched. Saturate to 4 inches.

### 3.07 SEED PROTECTION

- A. Identify seeded areas with stakes and string around area periphery.
- B. Cover seeded slopes where grade is 1:3 or greater with erosion fabric. Roll fabric onto slopes without stretching or pulling.
- C. Lay fabric smoothly on surface, bury top end of each section in 6-inch (150 mm) deep excavated topsoil trench. Provide 12-inch (300 mm) overlap of adjacent rolls. Backfill trench and rake smooth, level with adjacent soil.
- D. Secure outside edges and overlaps at 36-inch (900 mm) intervals with stakes.
- E. Lightly dress slopes with topsoil to ensure close contact between fabric and soil.
- F. At sides of ditches, lay fabric laps in direction of water flow. Lap ends and edges minimum 6 inches (150 mm).

### 3.08 DORMANT SEEDINGS

- A. Seedings should not be made from October 1 through November 20. During this period, the seeds are likely to germinate but probably will not be able to survive the winter.
- B. The following methods may be used for "Dormant Seeding":
  1. From October 1 through November 20, prepare the seedbed, add the required amounts of lime and fertilizer, then mulch and anchor. After November 20, and before March 15, broadcast the selected seed mixture. Increase the seeding rates by 50% for this type of seeding.
  2. From November 20 through March 15, when soil conditions permit, prepare the seedbed, lime and fertilize, apply the selected seed mixture,

mulch and anchor. Increase the seeding rates by 50% for this type of seeding.

3. Apply seed uniformly with a cyclone seeder, drill, cultipacker seeder, or hydro-seeder (slurry may include seed and fertilizer) on a firm, moist seedbed.
4. Where feasible, except when a cultipacker type seeder is used, the seedbed should be firmed following seeding operations with a cultipacker, roller, or light drag. On sloping land, seeding operations should be on the contour where feasible.

### 3.09 MULCHING

- A. Mulch material shall be applied immediately after seeding. Dormant seeding shall also be mulched. 100% of the ground surface shall be covered with an approved material.
- B. Application rates:
  1. Straw—If straw is used it shall be unrotted small-grain straw applied at the rate of 2 tons per acre or 90 pounds (two to three bales) per 1,000-sq. ft. The mulch shall be spread uniformly by hand or mechanically applied so the soil surface is covered. For uniform distribution of hand-spread mulch, divide area into approximately 1,000-sq.-ft. sections and spread two 45-lb. bales of straw in each section.
  2. Hydroseeders—If wood cellulose fiber is used, it shall be applied at 2,000 lb./ac. or 46 lb./1,000 sq. ft.
  3. Other—Other acceptable mulches include rolled erosion control mattings or blankets applied according to manufacturer's recommendations or wood chips applied at 6 tons per acre.

### 3.10 MAINTENANCE

- A. Expect emergence within 4 to 28 days after seeding, with legumes typically following grasses. Check permanent seedlings within 4 to 6 weeks after planting. Growth should indicate:
  1. Vigorous seedlings;
  2. Uniform ground surface coverage with at least 30% growth density;
  3. Uniformity with legumes and grasses well intermixed;
  4. Green, not yellow, leaves. Perennials should remain green throughout the summer, at least at the plant bases.
- B. Permanent seeding shall not be considered established for at least one full year from the time of planting. Inspect the seeding for soil erosion or plant loss during this first year. Repair bare and sparse areas. Fill gullies. Re-fertilize, re-seed, and re-mulch if required. Consider no-till planting. A

minimum of 70% growth density, based on a visual inspection, must exist for an adequate permanent vegetative planting.

- C. If stand is inadequate or plant cover is patchy, identify the cause of failure and take corrective action: choice of plant materials, lime and fertilizer quantities, poor seedbed preparation, or weather. If vegetation fails to grow, have the soil tested to determine whether pH is in the correct range or nutrient deficiency is a problem.
- D. Depending on stand conditions, repair with complete seedbed preparation, then over-seed or re-seed.
- E. If it is the wrong time of year to plant desired species, over-seed with small grain cover crop to thicken the stand until timing is right to plant perennials or use temporary seeding.
- F. Satisfactory establishment may require re-fertilizing the stand in the second growing season.
- G. Consider mowing after plants reach a height of 6 to 8 inches. Mow grasses tall, at least 3 inches in height and minimizes compaction during the mowing process. Vegetation on structural practices such as embankments and grass-lined channels need to be mowed only to prevent woody plants from invading the stand.

END OF SECTION