

CATEGORY 300

DRAINAGE

SECTION 301 - CLASS 3 EXCAVATION FOR INCIDENTAL CONSTRUCTION

301.01 DESCRIPTION. This work shall consist of excavation below the planned elevation as specified in the Contract Documents or as directed by the Engineer.

301.02 MATERIALS. Not applicable.

301.03 CONSTRUCTION. The area to excavated shall be of the size, depth and location as indicated in the Standard Details, unless otherwise authorized by the Engineer. Backfill shall conform to Section 302.

301.04 MEASUREMENT AND PAYMENT. Class 3 Excavation for Incidental Construction shall be measured and paid for at the Contract unit price per cubic yard. The payment shall be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

Backfill. Backfill will be measured and paid for as specified in 302.04.

SECTION 302 - SELECTED BACKFILL

302.01 DESCRIPTION. This work shall consist of placing selected backfill material as specified in the Contract Documents or as directed by the Engineer.

302.02 MATERIALS.

No. 57 Aggregate	901, Table 901 A
Crusher Run Aggregate CR-6	901, Table 901 A
Geotextile	921.09

302.03 CONSTRUCTION. Unsuitable foundation material shall be replaced as directed by the Engineer. Compaction may be achieved using tamped fill methods conforming to Section 210, acceptable to the Engineer. No. 57 Aggregate greater than 6 inches in thickness shall be completely protected with Class E Geotextile unless directed otherwise by the Engineer.

302.04 MEASUREMENT AND PAYMENT. Selected Backfill using No. 57 Aggregate, or Selected Backfill using Graded Aggregate Subbase required to replace Class 3 Excavation For Incidental Construction will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work. Geotextile shall be measured and paid for at the Contract unit price per square yard.

SECTION 303 - PIPE CULVERTS

303.01 DESCRIPTION. This work shall consist of placing pipe on a firm bed to the specified line and grade. The pipe shall be the size and type as specified in the Contract Documents.

303.02 MATERIALS.

No. 57 Aggregate	901, Table 901 A
Crusher Run Aggregate CR-6	901, Table 901 A
Concrete Mix No. 2	902.10.03
Pipe Materials	905
Roofing Paper	911.07
Asphalt Sealer for Concrete Pipe	911.09
Geotextile	921.09

303.03 CONSTRUCTION. Pipe lengths and gradients shall be verified by the Contractor and shall be acceptable to the Engineer before installation.

When a pipe is to be laid on existing ground on or under fill, the embank-

ment shall be constructed to a height of at least 9 in. (225 mm), but not more than 3 ft (0.9 m) above the top of the proposed pipe and then a trench is excavated to receive the pipe.

303.03.01 Excavation. The width of trench shall be sufficient to permit thorough tamping of the backfill under the haunches and around the pipe. See detail “Trench and Trench Payment Width” in the Standard Details.

303.03.02 Bedding. Where the bottom of the trench at subgrade is in rock, excavation shall be carried at least 6 inches below the specified subgrade with a minimum of 4 inches under bells. The trench bottom shall be restored to subgrade with earth or granular material (completely protected with geotextile if greater than 12 inches) as approved by the Engineer.

When directed by the Engineer to provide a bedding of 12 inches or greater the selected backfill shall be crusher run aggregate CR-6 or No. 57 stone completely protected with geotextile.

Culverts 48 in. (1220 mm) or more in nominal horizontal diameter shall be bedded in an approved foundation shaped by means of a template which will support the pipe for at least 10 percent of its overall height.

303.03.03 Installation. Pipes shall be laid with hubs up grade. A single lay hole through the shell of the pipe will be permitted with an approved lifting device. After installation, the lay hole shall be filled.

303.03.04 Joints. All joints shall be cemented or sealed. If mortar is used, it shall completely fill the joint and be used to form a bead around the outside of the joint. The inside of the joint shall be wiped and finished smooth. The mortar on the outside shall be protected from the air and sun for two days or until the backfill is placed around the pipe. Cold weather protection shall be furnished for mortar joints by maintaining a temperature of not less than 40 F (4 C) for three days. Materials shall be preheated when the air temperature is less than 35 F (2 C).

As an alternate to mortared joints, asphalt sealer, rubber type gaskets or resilient type material may be used. Care shall be exercised to insure the proper application of sealer on the underside of all joints. Unless otherwise

specified in the Contract Documents, these materials shall be installed as recommended by the manufacturer.

303.03.05 Pipe Connections. Pipe connections may be either prefabricated or constructed in the field. Corrugated pipe sections shall be butted together and the sections joined with an approved band. A field pipe connection shall include cutting a hole in one pipe, inserting and trimming the connecting pipe and placing a concrete collar at the connection. In the case of corrugated pipes, a welded connection may be substituted for the concrete collar.

303.03.06 Pipe Encasement. When specified in the Contract Documents or when directed by the Engineer, pipe shall be encased in concrete.

303.03.07 Backfill. Earth for backfill shall be free from large lumps, clods, and rocks and shall be placed along the side of the pipe for the full width of the trench in layers not exceeding 6 in. (150 mm) uncompacted depth. Compaction shall conform to Section 210. Each layer shall be compacted simultaneously on both sides of the pipe by means of an approved mechanical tamper. Special care shall be taken to compact the fill thoroughly under the haunches of the pipe. This method of filling and compaction shall continue until the embankment is completed to a height of not less than 9 in. (225 mm) above the top of pipe. The Contractor shall protect all pipe from damage due to construction equipment or other vehicular traffic passing over the pipe.

Backfill may be placed immediately after laying pipe, provided the mortar joints are protected with roofing paper or other approved material.

303.03.08 Removal of Existing Pipe Culverts. Where specified in the Contract Documents, existing pipe culverts 12 in. (300 mm) or larger shall be removed and shall become the property of the Contractor. Backfilling of trenches resulting from pipe removal shall conform to the pertinent backfilling provisions of Section 210.

303.03.09 Relaying Existing Pipe. When specified in the Contract Documents, removed culverts shall be salvaged and relaid in the same manner as described for new pipe.

303.04 MEASUREMENT AND PAYMENT. The payment for the items specified in the Contract Documents will be full compensation for all applicable excavation, sheeting, shoring, dewatering, hauling, invert paving, storing, rehandling of material, removal and disposal of excess and unsuitable material, tamped fill, forming bed or foundation, backfilling, compaction and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

303.04.01 New pipe culverts will be measured complete in place and paid for at the Contract unit price per linear foot.

303.04.02 Pipe connections and elbows will be measured and paid for at the Contract unit price per each. No deduction from the pipe measurement will be made for pipe connections.

303.04.03 Additional excavation required below the planned elevation will be measured and paid for as specified in Section 301. For bedding in rock subgrade (Section 303.03.02), excavation and refill to the 6-inch depth will be paid for as a Class 3 Excavation and Selected Backfill (by the template method).

303.04.04 Removal of Existing Pipe Culverts 12 inches in diameter or larger will be measured and paid for per the total number of linear feet removed, regardless of the condition. When a multiple pipe installation is removed, each pipe will be measured and paid for. Endwalls, etc. removed with the pipe will not be measured but the cost will be incidental to the Contract unit price per linear foot. Removal of Existing pipe culverts less than 12 inches in diameter will not be measured but the cost will be incidental to the Contract unit price per linear foot.

Where the proposed new pipe or new pipe arch culvert is at the location of an existing pipe culvert so as to interfere with the construction of the new culvert, the cost of removal and disposal of the entire existing culvert will be included in the cost per linear foot of the new pipe or new pipe arch culvert, except where shown on the plans or directed by the Engineer, only that portion of the existing culvert in the new pipe trench need be removed, and the cost of abandoning, brick bulkheading and/or filling with suitable mate-

rial will be included in the cost per linear foot of the new pipe or new pipe arch culvert.

303.04.05 Selected Backfill using No. 57 Aggregate or Selected Backfill using Crusher Run Aggregate CR-6 required to replace the Class 3 Excavation for Incidental Construction will be measured and paid for as specified in Section 302.

303.04.06 Relaid Existing Pipe Culverts will be measured and paid for as specified in 303.04.01 unless otherwise specified in the Contract Documents. Endwalls, end sections, etc. removed with the pipe will not be measured but the cost will be incidental to the Contract unit price per linear foot.

303.04.07 New Endwalls, End Sections etc., will be measured and paid for as specified in Section 305.

303.04.08 Removal of Existing Headwalls, etc., that are not incidental to the Contract unit price for the respective pipe items will be measured and paid for as specified in Section 207.

303.04.09 Encasement concrete will be measured and paid for at the Contract unit price per cubic yard for Mix No. 2 Concrete for Miscellaneous Structures.

SECTION 304 - STRUCTURAL PLATE PIPE AND STRUCTURAL PLATE PIPE ARCH CULVERTS

304.01 DESCRIPTION. This work shall consist of furnishing and installing structural plate pipe and structural plate pipe arch culverts that are composed of curved plates bolted together in the field as specified in the Contract Documents or as directed by the Engineer.

304.02 MATERIALS.

Concrete Mix No. 2	902.10.03
Structural Plate for Pipe and Pipe Arches	905

304.03 CONSTRUCTION.

304.03.01 Fabrication. The plates, including required holes, shall be shop fabricated to the required dimensions. The plates shall be shipped complete with proper markings and include all necessary connection devices such as bolts, nuts and washers. The Contractor shall provide working drawings, including erection diagrams and strutting tables acceptable to the Engineer. Erection diagrams shall include proposed lengths and lifting locations of preassembled sections. Fabrication shall not be performed until working drawings are approved by the Engineer.

The plate configurations shall have radii and curvature conforming to AASHTO Standard Specifications for Highway Bridges. When bottom plates are specified to be thicker than top and side plates, the thicker plates for circular pipes shall cover at least 25 percent of the periphery of the circle. For pipe arches, the thicker plates shall include corner plates as well as bottom plates. These culverts shall be laid on a firm bed true to line and grade as specified in the Contract Documents.

Bolt holes along those edges of the plates that will form longitudinal seams in the finished structure shall be staggered in rows 2 in. (50 mm) apart, with one row in the valley and one in the crest of the corrugations unless otherwise specified in the Contract Documents. Bolt holes along those edges of the plates that will form circumferential seams in the finished structure shall provide for a bolt spacing of not more than 12 in. (300 mm). The diameter of the bolt holes in the longitudinal seams shall not exceed the diameter of the bolt by more than 1/8 in. (3 mm).

Edges shall be shop cut to line and grade and shall be free from oxide and burrs. Connections shall be staggered so that no more than three plates come together at any one point. Plates shall be formed to provide lap joints.

304.03.02 Excavation. When a structural plate pipe or structural plate pipe arch is to be laid on existing ground on or under fill, embankment shall be constructed to a height of at least 18 in. (460 mm), but not more than 3 ft (0.9 m) above the proposed top of the pipe. The trench shall then be excavated to receive the pipe. The width of trench shall be sufficient to

permit thorough tamping of the backfill under the haunches and around the pipe. This width shall be twice the outside diameter of the pipe or the outside diameter plus 18 in. (460 mm) on each side, whichever is less.

304.03.03 Foundation Preparation. Bedding shall conform to the applicable requirements of 303.03.02. Rails shall be set and the foundation screeded to be coincidental with the exact shape of the bottom plates, and the screeding shall be done immediately prior to erection.

304.03.04 Erection. When strutting is required, it shall be uniform from end to end. Struts shall be left in place until backfills are completed. Nuts and bolts shall be tightened between 100 ft×lb(135 n×m) and 200 ft×lb (270 n×m) of torque.

When washers are specified, they shall be placed under the turned element. Bolts shall first be distributed over the section being assembled and holes made to align by shifting the plates. For bottom plates, the nuts shall be inside the structure. Nuts shall not be drawn tight until the section is assembled. Before backfilling, all nuts shall be finally tightened and tested to assure compliance with torque requirements.

304.03.05 Backfill. Earth for backfill shall be free from large lumps, clods, and rocks and shall be placed along the side of the pipe for the full width of the trench in layers not exceeding 6 in. (120 mm) uncompacted depth. Compaction shall conform to Section 210. Each layer shall be compacted on both sides of the pipe by means of an approved mechanical tamper. Special care shall be taken to compact the fill thoroughly under the haunches of the pipe.

The backfill shall be elevated uniformly along each side of the structure to a height of not less than 18 in. (460 mm) above the top of the structure. For structures without headwalls, backfill shall start in the center of the structure. If the structure includes headwalls or spandrel walls, backfilling operations shall start at one wall and extend toward the opposite side. When batteries or multicell installations are specified, backfill between cells shall be elevated equally on each side of each cell.

No trucks or construction equipment shall be allowed to pass over any part of a structural plate pipe structure until the backfill has been completed and tamped up to a height of not less than 18 in. (460 mm) above the structure.

304.03.06 Concreting. When specified in the Contract Documents, the invert of structural plate pipe or pipe arch shall be paved using Concrete Mix No. 2. The concrete shall be placed and cured as specified in Section 414.

304.03.07 End Treatment. Ends of structural plate pipes and pipe arches shall be shop fabricated on a bevel to fit and be flush with the slope and alignment of the surface through which they protrude, except that where an end wall or masonry slope protection is specified, the ends of the structural plates shall then be shop fabricated to fit that construction. The ends of all structural plate pipes and pipe arches which require an end treatment (end wall or slope protection) shall contain hook bolts for anchorage into the concrete.

Headwalls for structural plate pipes and pipe arches shall conform to Section 305 and unless otherwise specified, shall be constructed parallel to the proposed outer edge of the roadway shoulder.

304.04 MEASUREMENT AND PAYMENT. The payment for the items specified in the Contract Documents will be full compensation for all applicable fabrication, assembly, excavation, sheeting, shoring, strutting, dewatering, hauling, invert paving, storing, rehandling of material, removal and disposal of excess and unsuitable material, tamped fill, forming bed or foundation, backfill, compaction and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

304.04.01 Structural Plate Pipe and Structural Plate Pipe Arch Culverts will be measured and paid for at the Contract unit price per linear foot. Measurement will be as follows: measure the top length and the bottom length and average. The average length will be the pay length for each pipe in the structure. For multiple pipes, the length will be totaled to obtain the total pay length.

304.04.02 Additional excavation required below the planned elevation will be measured and paid for as specified in Section 301.

304.04.03 Selected Backfill required to replace the Class 3 Excavation for Incidental Construction shall be placed as specified in the Contract Documents or as directed by the Engineer, and will be measured and paid for as specified in Section 302.

304.04.04 Headwalls will be measured and paid for as specified in Section 305.

SECTION 305 - MISCELLANEOUS STRUCTURES

305.01 DESCRIPTION. This work shall consist of constructing miscellaneous cast-in-place concrete or masonry structures and installing precast concrete structures as specified in the Contract Documents or as directed by the Engineer.

305.02 MATERIALS.

Mortar Sand	901.01, Table 901 A
Curing Materials	902.07
Concrete Mix No. 2 or Mix No. 6	902.10.03
Grout	902.11
Brick	903.02
Reinforcement Steel	908
Castings for Frames, Covers, Gratings and Steps	909.04
Zinc Coating	A 153
Precast Concrete Inlets and Manholes	M 199
CR-6	901.01

305.03 CONSTRUCTION. Construction shall conform to the following:

Portland Cement Concrete (PCC)	414
Brick Masonry	424

305.03.01 Construction Sequence. Underground drainage structures shall be completed before roadway surfacing is placed. Manholes, catch basins and inlets shall not be completed to final grade until the grading has been finished and all necessary arrangements have been made to insure suitable connections and tie-ins at proper grade and alignment with pavements, gutters and curbs.

305.03.02 Castings. Frames for grates and covers for inlets and manholes, unless shown otherwise on the Standard Details, shall be set in full beds of mortar and rigidly secured in place to proper grade and alignment as specified in the Contract Documents.

305.03.03 Pipe Connections. Inlet and outlet pipes at drainage structures shall be set or cut flush with the inside faces of the structures and shall extend a sufficient distance beyond the outside faces of these walls to provide ample room for making proper connections. The joint around the pipe in the structure wall shall be completely and neatly closed with mortar or other specified materials.

305.03.04 Inverts. Drainage structures containing two or more pipes shall have channeled inverts conforming to the Contract Documents.

305.03.05 Drainage Structures. Inlets and manholes shall contain two 6 in. (150 mm) minimum diameter underdrain stubs for future connection of underdrains or for erosion control. Precast drainage structures may substitute two precast knockouts as shown on the Standard Details for the underdrain stubs. The drainage structures shall be backfilled with CR-6 for a width of 1.5 ft (0.4 m) outside of the structure and extend from the bottom of the structure to the subgrade. Stone backfill and knockouts for underdrain are not required for precast manholes unless otherwise shown on the Plans or directed by the Engineer.

305.03.06 Precast Drainage Structures. Precast drainage structures shall conform to M 199 and/or the Contract Documents, whichever is the more restrictive. Working drawings for structures not detailed in the Contract Documents shall be submitted to the Engineer for approval prior to fabrication. Designs for precast drainage structures that vary in dimension or reinforcement from that shown on the Standard Details shall be submitted along with supporting design calculations to the Engineer for approval. The submission shall be signed and sealed by a Professional Engineer registered in the State of Maryland.

Certification from the manufacturer for each shipment of precast units shall be required. Each unit shall be marked showing station location and designation, the date of manufacture, the name or trademark of the manufacturer (this information shall be noted on the unit, near the top inside), and include a certification which shall contain a copy of the actual test results indicating that the inlet conforms to the Contract Documents.

No precast unit shall be shipped unless the unit has been tested and is shown to be in full compliance with the Contract Documents.

The placement and consolidation of the required bedding under the unit shall be a minimum 6 in. (150 mm) of No. 57 aggregate unless otherwise directed by the Engineer.

305.03.07 Encasement. Where specified in the Contract Documents or directed by the Engineer, the pipe shall be encased using Mix No. 2 Concrete.

305.03.08 Precast Structures - Lifting Devices. Lifting devices for precast concrete manholes, inlets and valve vaults shall be designed in accordance with ASTM Specification Designation C913, Section 5.8 which states:

Lifting Devices - Design of embedded lifting devices shall be for a load equivalent to three times the weight of the structure, assuming no more than three lifting devices are engaged. The loads imposed at the lifting points shall be considered in the design of the structure.

305.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all excavation, concrete, masonry, special or precast units, reinforcement, ladder rungs, drip stones, CR-6 or No. 57 aggregate, underdrain stubs, frames, grates and covers, grade and slope adjustments, backfill and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

305.04.01 Standard Inlets and Manholes specified in the Contract Documents will be measured and paid for at the Contract unit price per each. When a structure exceeds the standard minimum depth specified in the Contract Documents (3 feet unless shown otherwise on the Standard Details), an additional payment will be made for the excess vertical depth at the Contract unit price per linear foot of vertical depth.

305.04.02 Standard Endwalls, End Sections and Special Structures will be measured and paid for at the Contract unit price per each.

305.04.03 Nonstandard endwalls and other miscellaneous structures such as steps, spring boxes, junction boxes and pipe encasements, will be measured and paid for at the Contract unit price per cubic yard of brick masonry or concrete for the mix specified unless otherwise specified in the Contract Documents.

305.04.04 No separate or additional measurement will be made for any precast concrete units, metal or castings used in the construction of any of the items noted above.

SECTION 306 - UNDERDRAINS, SUBGRADE DRAINS AND SPRING CONTROL

306.01 DESCRIPTION. This work shall consist of constructing underdrains, subgrade drains, underdrain for spring control, underdrain pipe outlets and blind drains using pipe, geotextile, and granular material as specified in the Contract Documents or as directed by the Engineer.

306.02 MATERIALS.

Aggregate	901, Table 901 A
Mortar for Grout	902.11
Pipe Materials	905
Geotextile, Class as Specified	921.09

306.03 CONSTRUCTION.

306.03.01 Excavation. Trenches shall be excavated to the dimensions and grade specified in the Contract Documents or as directed by the Engineer. The sides and bottom of trenches shall be sufficiently smooth and uniform to prevent distortion or tearing of the geotextile when backfilling.

306.03.02 Geotextile. Geotextile shall be placed as specified in the Contract Documents. The longest fibers of the geotextile shall be parallel to the longitudinal direction of the trench.

The geotextile shall be placed tightly against native soil to eliminate voids behind the geotextile. Wrinkles and folds in the geotextile shall be avoided, except when changing trench direction. A 24 in. (610 mm) overlap at the geotextile joint ends or breaks shall be maintained.

The geotextile shall also be of sufficient width to completely enclose the underdrain trench including a 12 in. (300 mm) overlap at the top of the trench.

Damaged geotextile shall be replaced or repaired as directed by the Engineer at the Contractor's expense.

Geotextile shall be furnished and installed as shown on the Standard Details.

306.03.03 Perforated Pipes. Perforated pipes shall be placed with the perforations down and arranged symmetrically about the vertical axis.

306.03.04 Outlets. Outlets shall be constructed in the same manner as underdrains. All pipe used shall be as specified in Section 905. Flexible tube type PE or PVC pipe is prohibited. Geotextile shall not be used and

the entire depth of the trench shall be backfilled in conformance with the requirements of Section 210. The ends of trunk lines, wye, tee, or ell laterals shall be plugged as directed by the Engineer. The joints of concrete pipe outlets shall be cemented with mortar, and corrugated metal pipe sections of outlets shall be joined with standard connecting bands. Other outlet joints or connections shall be formed in conformance with the manufacturer's recommendations.

306.03.05 Backfill. Trenches shall be backfilled to the dimensions and grade specified in the Contract Documents.

(a) **Underdrain.** Aggregate backfill shall be screeded or raked to proper thickness and grade.

(b) **Outlets.** Backfill shall conform to Section 210.

306.03.06 Permanent Subgrade Drains. Permanent subgrade drains shall be required where specified in the Contract Documents or as directed by the Engineer. Subgrade drains shall consist of trenches excavated through the shoulder or median from the edges of the road pavement to a side ditch, embankment slope or other approved outlet and filled with approved aggregates. Locations, unless otherwise specified, shall be at low points and be spaced at 25 ft (8 m) intervals for a distance of 125 ft (38 m) on each side of the low point then at intervals of 100 ft (30 m) to within 125 ft (38 m) of the high point. After placing the road pavement and before completion of the shoulder paving or median areas, trenches shall be cut and shaped 24 in. (0.6 m) wide, backfilled to underside of shoulder material and to the underside of specified topsoil thickness in the median area using size No. 57 or 67 Aggregate. The bottom of the trench at the end adjacent to the road pavement shall be at least 2 in. (50 mm) below the subgrade wherever it is possible to provide a proper gradient and outlet for a drain at that elevation.

306.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all excavation, pipe, coupling bands, aggregate, backfill, geotextile, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

306.04.01 Underdrains, Subgrade Drains and Underdrain Pipe for Spring Control will be measured and paid for at the Contract unit price per linear foot.

306.04.02 Reserved

306.04.03 Reserved

306.04.04 Reserved

SECTION 307 - CONCRETE DITCHES

307.01 DESCRIPTION. This work shall consist of constructing concrete ditches and incidental toewalls as specified in the Contract Documents or as directed by the Engineer.

307.02 MATERIALS.

Curing Materials	902.07
Form Release Compounds	902.08
Concrete Mix No. 2	902.10.13
Joint Sealer	911.01
Preformed Joint Filler	911.02

307.03 CONSTRUCTION.

307.03.01 Excavation. Excavation and the preparation of the subgrade shall conform to Section 609.

307.03.02 Forms. Forms shall be steel or wooden and shall conform to Section 610.

307.03.03 Concrete. Concrete mixing and placing shall conform to Section 610.

307.03.04 Joints. Maximum joint spacing shall be 15 ft (4.6 m). The joints shall be either bulkhead or weakened plane construction joints. Weakened plane joints shall be either tooled or sawed to a minimum depth of 3/4 in. (19 mm). Expansion joints shall be spaced a maximum of 90 ft (27 m) and be sealed.

307.03.05 Cold Weather Construction and Curing. Refer to 520.03.02 for cold weather construction and to 520.03.12 for concrete curing.

307.03.06 Backfill. After the forms have been removed, backfill shall be placed and compacted as directed by the Engineer.

307.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all concrete, excavation, forms, backfill, curing, disposal of excess or unsuitable material, toewalls, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

307.04.01 Concrete Ditches will be measured and paid for at the Contract unit price per square yard.

307.04.02 The removal and disposal of unsuitable material below the subgrade will be measured and paid for at the Contract unit price per cubic yard for Class 3 Excavation. The payment will include the cost of replacing the unsuitable material with suitable material acceptable to the Engineer.

307.04.03 When Borrow or Selected Backfill using No. 57 Aggregate or Selected Backfill using Crusher Run Aggregate CR-6 is approved by the Engineer as replacement material for the Class 2 Excavation, it will be measured and paid for at the Contract unit price per cubic yard for the respective items as specified in the Contract Documents.

SECTION 308 - EROSION AND SEDIMENT CONTROL

308.01 DESCRIPTION. This work shall consist of the application of measures throughout the life of the project to control erosion and to mini-

mize the siltation of rivers, streams, and impoundments (lakes, reservoirs, bays and coastal waters) as specified in the Contract Documents or as directed by the Engineer.

308.01.01 EROSION AND SEDIMENT CONTROL MANAGER (ESCM). Unless otherwise specified, the Contractor shall assign to the project an employee to serve in the capacity of ESCM. This employee shall be thoroughly experienced in all aspects of construction and have satisfactorily completed an Erosion and Sediment Control Training Program either conducted by or authorized by the Maryland Department of the Environment pursuant to the appropriate article published in the Annotated Code for the State of Maryland. The ESCM shall have the primary responsibility and sufficient authority for the implementation of the approved erosion and sediment control schedules and methods of operation, including both on-site and off-site activities.

308.02 MATERIALS.

Aggregate on upstream side of stone outlet structure	901, Table 901, CA-PCC, Size No. 57.
Stone for Riprap	901.02 Stone for Riprap
Seed, Mulch, Fertilizer, Soil Conditioner and Other Materials for seeding, soil stabilization and matting	920
Straw Bales	921.08
Geotextiles	921.09
Fence Fabric, Tie Wires, & Posts	914
Lumber	921.05
Number 1 Stone	Table 901

308.03 CONSTRUCTION.

308.03.01 Schedule. Reserved

308.03.02 Preconstruction Conference. Prior to issuance of a grading permit, the project will have a complete set of Sediment and Erosion Control plans that have been approved and signed by the Baltimore County Soil Conservation District as meeting all applicable requirements. All plans will have an approved “Sequence of Construction” that will specify a sequence of clearing and grubbing operations, use of perimeter controls and sediment traps, road grading, placement and use of utilities, drains and storm water management facilities, final grading, stabilization, and removal of controls. A pre-Construction Conference will be held by the Engineer to discuss the approved Erosion and Sediment Control “Sequence of Operations” if the County requests such a conference.

308.03.03 Meetings. Reserved

308.03.04 Remove and Reset Geotextile Class F for Slope Silt Fence or Channel Silt Fence. When, in the opinion of the Engineer, the geotextile is not performing satisfactorily, it shall be removed and reset.

308.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

The cost for the Erosion and Sediment Control Manager will not be measured but will be incidental to the Contract unit price for the Erosion and Sediment Control items specified in the Contract Documents.

Erosion and Sediment control will be measured and paid for at the Contract unit price for one or more of the items listed below unless otherwise specified in the Contract Documents.

308.04.01 Erosion and Sediment Control Original Excavation. Original excavation and backfilling for temporary ditches, temporary sediment traps and basins and temporary stone outlet structures, and any other original excavation for sediment control per cubic yard.

308.04.02 Erosion and Sediment Control Cleanout Excavation. Any excavation required for removal of accumulated sediment from traps, basins, the area adjacent to silt fences and straw bales, and any other clean out excavation of accumulated sediment per cubic yard.

308.04.03 Temporary Pipe Used for Sediment Basins per linear foot.

308.04.04 Temporary Pipe Used for Slope Drains per linear foot.

308.04.05 Soil Stabilization Matting per square yard.

308.04.06 Geotextile Class F for Silt Fence per linear foot.

In the event the geotextile used for silt fence decomposes or becomes ineffective prior to one year after the installation date, the geotextile shall be replaced as directed by the Engineer. All costs to replace the geotextile shall be borne by the Contractor.

In the event the geotextile used for silt fence requires replacement one year after the installation date, the geotextile shall be replaced as directed by the Engineer. The geotextile will be measured installed and will be paid for at the Contract unit price per linear foot.

308.04.07 Super Silt Fence per linear foot.

In the event the geotextile used for super silt fence decomposes or becomes ineffective prior to one year after the installation date, the geotextile shall be replaced as directed by the Engineer. All costs to replace the geotextile shall be borne by the Contractor.

In the event the geotextile used for super silt fence requires replacement one year after the installation date, the geotextile shall be replaced as directed by the Engineer. The geotextile will be measured installed and will be paid for at the Contract unit price per linear foot.

308.04.08 Remove and Reset Geotextile Class F for Silt Fence and Super Silt Fence per linear foot.

308.04.09 Straw Bales per linear foot measured along the approximate center line of the row of bales.

308.04.10 Placed Riprap for Sediment Control, including replacement of riprap due to damage by storm water, accumulation of silt, or construction traffic per ton.

308.04.11 Geotextile used for Erosion and Sediment control other than slope silt fence and channel silt fence per square yard.

308.04.12 Stabilized Construction Entrance and Rehabilitate Stabilized Construction Entrance per ton.

308.04.13 Temporary Straw Mulching as specified in 704.04.02.

308.04.14 Temporary Wood Cellulose Mulch as specified in 704.04.03.

308.04.15 Temporary Seeding as specified in 704.04.01.

308.04.16 Seeding Roadside Areas as specified in 705.04.01.

308.04.17 Seeding Median Areas as specified in 705.04.02.

308.04.18 Overseeding Roadside Areas as specified in 705.04.05.

308.04.19 Overseeding Median Areas as specified in 705.04.06.

308.04.20 Sodding as specified in 708.04.01.

SECTION 309 - CONCRETE SLOPE AND CHANNEL PROTECTION

309.01 DESCRIPTION. This work shall consist of protecting slopes and channels with cast-in-place concrete and cutoff walls as specified in the Contract Documents or as directed by the Engineer.

309.02 MATERIALS.

Curing Materials	902.07
Form Release Compounds	902.08
Concrete Mix No. 2	902.10.03
Welded Steel Wire Fabric	908.05
Joint Sealer	911.01
Preformed Joint Fillers	911.02
Roofing Paper	911.07

309.03 CONSTRUCTION.

309.03.01 Excavation. Excavation, including excavation for cutoff walls shall conform to Section 609.

309.03.02 Cast-In-Place Concrete. Cast-in-place concrete slope protection shall be constructed in alternate strips so that construction joints are all in one direction and that tooled joints run perpendicular to the construction joints. The result shall be a checkerboard pattern having squares not less than 3 ft (0.9 m) or more than 5 ft (1.5 m). The size of the squares and the size of squares around curved surfaces shall be as directed by the Engineer. Joints and cutoff walls shall be constructed as specified in the Contract Documents or as directed by the Engineer.

309.03.03 Forms. Forms shall conform to Section 610.

309.03.04 Concreting. Concrete mixing shall conform to 915.03.04. Volumetric batching and continuous mixing will be permitted on this work. Areas subject to the infiltration of water shall be dewatered by methods acceptable to the Engineer prior to placing the concrete. The concrete shall be spread, tamped or otherwise consolidated to secure maximum density as it is placed. It shall be struck off with an approved screed to the elevation of the top of the forms. The surface shall have a broomed finish. No plastering of the surface will be permitted. All edges and all joints shall be edged with a 1/4 in. (6 mm) edging tool.

309.03.05 Cold Weather Construction and Curing. Refer to 520.03.02 for cold weather construction and to 520.03.12 for concrete curing.

309.03.06 Backfill. After the forms have been removed, backfill shall be placed and compacted as directed by the Engineer.

309.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all concrete, forms, excavation, curing, joint sealer and filler, backfill, disposal of excess or unsuitable material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

309.04.01 Concrete Slope and Channel Protection and Concrete Slope Protection for Streams will be measured and paid for at the Contract unit price per square yard of finished surface.

309.04.02 Cutoff Walls will be measured and paid for at the Contract unit price per linear foot.

309.04.03 The removal and disposal of unsuitable material below the subgrade will be measured and paid for at the Contract unit price per cubic yard for Class 2 Excavation. The payment will include the cost of replacing the unsuitable material with suitable material acceptable to the Engineer.

309.04.04 When Borrow or Selected Backfill using No. 57 Aggregate or Selected Backfill using Crusher Run Aggregate CR-6 is approved by the Engineer as replacement material for the Class 2 Excavation, it will be measured and paid for at the Contract unit price per cubic yard for the respective items as specified in the Contract Documents.

SECTION 310 - RIPRAP DITCHES

310.01 DESCRIPTION. This work shall consist of constructing riprap ditches and riprap ditches with capping as specified in the Contract Documents or as directed by the Engineer.

310.02 MATERIALS.

Stone	901.02 and 901.03
Geotextile, Class as specified	921.09

310.03 CONSTRUCTION.

310.03.01 Excavation. Excavation shall conform to the line and grade specified in the Contract Documents. Ditch sides and bottom shall be smooth and firm, free from protruding objects that would damage the geotextile and constructed in a manner acceptable to the Engineer.

310.03.02 Geotextile Placement. Geotextile coverings shall be installed on prepared surfaces, with higher layers overlapping lower ones, in roofing fashion. The material must overlap by at least two feet. Torn or damaged geotextile covering shall be replaced or repaired at the Contractor's expense and in a manner acceptable to the Engineer.

310.03.03 Riprap Placement. Stones shall be placed by mechanical or other acceptable methods to produce a reasonably graded mass of stone. Placing the stones by methods that cause extensive segregation will not be permitted. The depth of the riprap shall be as specified in the Contract Documents.

310.03.04 Backfill. Any excavation voids existing along the edges and ends of the placed riprap shall be backfilled with suitable material to blend in with contiguous slopes, ditch lines or existing ground. Riprap placed in the clear recovery area shall be capped with a layer of 3 to 5 in. (75 - 125 mm) stone.

310.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all stone, excavation, geotextile, backfill, disposal of excess material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

310.04.01 Riprap Ditches and Riprap Ditches with Capping will be measured and paid for at the Contract unit price per square yard of finished surface. Area measurements will be actual surface measurements.

310.04.02 Bottom Cutoff Walls and Side Cutoff Walls for Riprap will be measured and paid for at the Contract unit price per linear foot.

SECTION 311 - RIPRAP SLOPE AND CHANNEL PROTECTION

311.01 DESCRIPTION. This work shall consist of protecting slopes and channels with a covering of geotextile and stone and an aggregate filter blanket as specified in the Contract Documents or as directed by the Engineer.

311.02 MATERIALS.

Aggregate Filter Blanket (Crusher Run Aggregate CR-6)	901, Table 901 A
Stone	901.02
Class C Geotextile	921.09

311.03 CONSTRUCTION.

311.03.01 Excavation. Excavation for riprap and cutoff walls shall conform to the lines and grades specified in the Contract Documents. The subgrade shall be smooth and firm, free from protruding objects that would damage the geotextile and constructed in a manner acceptable to the Engineer.

311.03.02 Geotextile. Geotextile coverings shall be installed on prepared surfaces, with higher layers overlapping lower ones, in roofing fashion. The material must overlap by at least two feet. Torn or damaged geotextile covering shall be replaced or repaired at the Contractor's expense and in a manner acceptable to the Engineer.

311.03.03 Aggregate Filter Blanket. When an aggregate filter blanket is specified, it shall conform to the lines and grades specified in the Contract Documents and shall be compacted in a manner acceptable to the Engineer.

311.03.04 Riprap Placement. The ground surface upon which the slope and channel protection is to be placed shall be free of brush, trees, stumps and shall be acceptable to the Engineer.

The first section of riprap placed shall consist of a minimum of 5 tons (4.5 Mg) and will be inspected by the Engineer for conformance to gradation and placement requirements. This section shall be used to evaluate quality control for the remainder of the project if it is approved by the engineer. If the material is rejected, it shall be removed from the project and additional sections, each consisting of a minimum of 5 tons (4.5 Mg), shall be placed.

The placement of the riprap shall begin with the bottom cutoff walls or toe sections. The larger stones shall be placed in the cutoff walls and along the outside edges of the limits of slope and channel protection. The riprap shall be placed with equipment which produces a uniformly graded mass of stones. Placing the stones by methods that cause segregation is prohibited.

The surface elevation of completed riprap installations shall be flush with adjacent channel bed or bank slope elevations, and shall not create an obstacle to the flow. The outer riprap surfaces shall be even and present a generally neat appearance. The plus or minus tolerance of the surface of the finished riprap installation shall be 3 inches (75 mm) for Class I Riprap and 5 inches (150 mm) for Class II and III Riprap from the lines and grades shown on the Contract Documents when measured perpendicular to the exterior surface of the stonework.

Placed material not conforming to the specified limits shall be removed and replaced as directed by the Engineer at no additional cost to the Administration.

The stone shall be placed and distributed so the resulting layer will contain a minimum of voids and there will be no pockets of same size material. The stone shall be placed to its full course thickness in one operation in a manner that the underlying material will not be displaced or worked into the course of riprap being placed. When an aggregate filter blanket is used, placement of the riprap shall proceed in a controlled manner to avoid disruption or damage to the layer of bedding material.

311.03.05 Backfill. Any excavation voids existing along the edges of the completed slope and channel protection shall be backfilled in a manner acceptable to the Engineer.

311.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all stone, excavation, geotextile, backfill, disposal of excess material, prewashing when required by the Engineer or the Contract Documents, preparation of quality control section, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

311.04.01 Riprap Slope and Channel Protection will be measured and paid for at the Contract unit price per square yard. Area measurements will be actual surface measurements.

311.04.02 Cutoff walls will be measured and paid for at the Contract unit price per linear foot.

311.04.03 Riprap For Scour Protection will be measured and paid for at the Contract unit price per ton for the item Class II Riprap For Scour Protection.

311.04.04 Aggregate Filter Blanket will be measured and paid for at the Contract unit price per square yard for the depth specified in the Contract Documents.

SECTION 312 - GABIONS

312.01 DESCRIPTION. This work shall consist of protecting slopes and channels with stone filled wire baskets as specified in the Contract Documents or as directed by the Engineer.

312.02 MATERIALS.

Stone	901.05
Wire for Gabions	906.01
Geotextile, Class as specified	921.09

PVC Coating for Gabions shall be in accordance with 906.01.02 and shall be of color as indicated on the Plans, except that if no color is indicated on the Plans, the color shall be gray color No. 26440, Federal Standard 595.

312.03 CONSTRUCTION.

312.03.01 Excavation. Excavation, including excavation for cutoff walls, shall conform to the lines and grades specified in the Contract Documents. The subgrade shall be smooth, firm and free from protruding objects or voids that would affect the proper placement of the wire baskets or damage the geotextile.

312.03.02 Geotextile. Geotextile shall be required for all gabions and shall be placed on the prepared subgrade. Adjacent strips shall be overlapped a minimum of 2 ft (0.6 m). Care shall be exercised in placing and anchoring the empty basket units to ensure proper alignment and to avoid damage to the geotextile. If the geotextile should be damaged, it shall be replaced or repaired at the Contractor's expense as directed by the Engineer.

312.03.03 Wire Baskets. Placement of the units shall begin with the cutoff walls. The empty units shall be set on the geotextile and the vertical ends bound together with wire ties or interlocking fasteners spaced to permit stretching of the units to remove kinks. Stretching methods will be optional with the Contractor. Stakes, pins or other approved methods shall be used to insure a proper alignment.

312.03.04 Stone. The empty basket units shall be filled carefully with stone placed by hand or machine to assure good alignment with a minimum of voids between stones, avoiding bulging of the mesh. The maximum height from which the stone shall be dropped into the units shall be 36 in. (900 mm). The stone shall be placed so as to provide a minimum of two courses. Care shall be taken in placing the top layer of stone to assure a uniform surface to avoid any bulging of the lid mesh. After a basket unit has been filled, the lid shall be bent over until it meets the ends of the unit. The lid shall then be secured to the sides and ends with wire ties or interlocking fasteners. When a complete basket unit cannot be installed on slopes or channels because of space limitations, the basket unit shall be cut to fit as directed by the Engineer.

312.03.05 Backfill. Any excavation voids existing along the edges of the completed gabions shall be backfilled in a manner acceptable to the Engineer.

312.04 MEASUREMENT AND PAYMENT. Gabions, including cut-off walls will be measured and paid for at the Contract unit price per cubic yard of stone filled wire baskets complete in place. The payment will be full compensation for all stone, excavation, geotextile, ties or fasteners, backfill, disposal of excess material, and for all material, labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 313 - FLOWABLE BACKFILL FOR UTILITY CUTS

313.01 DESCRIPTION. This work shall consist of furnishing, hauling and placing a flowable cement stabilized backfill material as specified in the Contract Documents or as directed by the Engineer. The material shall be used as utility cut backfill and shall set up to a stabilized mass.

313.01.01 Restrictions.

Deleted

313.02 MATERIALS. The flowable backfill shall consist of a mixture of fly ash, cement and water and shall be certified by the manufacturer.

Cement	902.03
Fly Ash	902.06
Water	921.01

313.02.01 Fillers. Fillers, if required, shall be natural aggregates with a maximum size not to exceed 3/4 in. (19 mm) and may include sands. Bottom ash shall not be used as a filler.

313.02.02 Components. Toxic or deleterious components shall not be used in the backfill mixture. The mixture shall have a 28 day, unconfined compressive strength of 100 psi to 300 psi maximum based on the manufacturer's certification. Certification shall include the actual test data for each mixture to be used.

313.02.03 Analysis. Chemical analysis of the fly ash used in the mixture conducted by the Contractor shall conform to U.S. EPA EP Toxicity Standards. An analysis shall be conducted on fly ash from each stockpile whenever the coal source is changed, replenished or when fly ash from a different power station is used. The results of the analysis shall be submitted to the Engineer for approval prior to construction.

313.03 CONSTRUCTION. Placement of the flowable backfill material shall conform to the manufacturer's recommendations or as directed by the Engineer. Utility trenches shall be backfilled full depth to the top of the subgrade using the mixture as specified in the Contract Documents or as directed by the Engineer.

The mixture shall fill all voids during the backfill operation.

The backfilled utility cut shall be protected from freezing and traffic for 24 hours. Paving operations shall not begin for at least 24 hours after backfilling is completed and has been approved by the Engineer.

The Contractor shall keep detailed records of all flowable backfill placed. Records shall include the source of the fly ash, date placed, the location, depth and the amount used. These records shall be submitted to the Engineer.

313.04 MEASUREMENT AND PAYMENT. Flowable Backfill for Utility Cuts will be measured and paid for at the Contract unit price per cubic yard. The payment will be full compensation for all materials, labor, equipment, tools, and incidentals necessary to complete the work.

SECTION 314 - PREFABRICATED EDGE DRAINS

314.01 DESCRIPTION. This work shall consist of constructing a prefabricated edge drain system and underdrain pipe outlets as specified in the Contract Documents.

314.02 MATERIALS.

Outlet Pipe	905
Select Borrow	916
Prefabricated Edge Drain	922
Fittings	922

314.03 CONSTRUCTION. Prefabricated edge drains shall be installed in conformance with the manufacturer's recommendations. Drains with support on only one side shall have the support side placed away from the pavement edge.

314.03.01 Trenches For Prefabricated Edge Drains. Trenches shall be excavated with a trencher and shall be as narrow as possible yet wide enough to allow insertion of the prefabricated edge drains at the required elevation. The maximum width of the trench shall not exceed 10 in. (250 mm). The exposed edge of the pavement shall be free of soil to insure direct contact between the drain and pavement. The excavation of the trench, placement of the edge drain and placement of the first lift of backfill shall be accomplished in a single continuous operation, unless otherwise directed by the Engineer.

314.03.02 Splices. Splices shall be made prior to placement of the prefabricated edge drain in the trench and in conformance with the manufacturer's recommendations. All splices shall be approved by the Engineer.

Solid, Central Cores (nonconnected two sided flow). Crossover couplings shall be used at all splices and at 200 ft (61 m) intervals.

314.03.03 Connections to Outlets. The prefabricated edge drain shall be connected to the outlets using fittings recommended by the manufacturer.

Outlets shall be spaced at 200 ft (61 m) intervals and at the lowest elevation on all vertical curves. Outlets shall be constructed in conformance with 306.03.04.

314.03.04 Backfilling of Trenches. Unless otherwise specified in the Contract Documents, material for backfilling trenches shall be the material

generated from the trenching operation, as approved by the Engineer. Additional backfill material, if needed, shall conform to Select Borrow.

Backfilling shall be completed in two layers with the first layer being placed simultaneously with the drain, holding the drain flush against the side of the pavement. Backfill material shall be compacted using a vibratory shoe compactor.

314.04 MEASUREMENT AND PAYMENT. The payment will be full compensation for all material, labor, equipment, tools, and incidentals necessary to complete the work.

314.04.01 Prefabricated Edge Drains and Outlet Pipe will be measured and paid for at the Contract unit price per linear foot.

314.04.02 Additional backfill material authorized by the Engineer will be measured and paid for at the Contract unit price per cubic yard for Select Borrow Excavation.