

# **SPECIFICATIONS**

**Fort Gibson National Cemetery  
Fort Gibson, OK**

**Subsurface Underdrain, Section 21  
Project 844-17-201**

Prepared by:

**NCA Continental District  
Department of Veterans Affairs**

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SECTION 00 01 15

LIST OF DRAWING SHEETS

The drawings listed below accompanying this specification form a part of  
the contract.

<u>Drawing No.</u>	<u>Title</u>
X-101	COVER SHEET & SHEET INDEX
L-101	EXISTING CONDITIONS
L-102	EXCAVATION AND DEMO PLAN
L-103	DRAINAGE PLAN
L-201	DRAINAGE DETAILS
L-202	ROADWAY AND STORM STRUCTURE DETAILS

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**SECTION 01 74 19**  
**CONSTRUCTION WASTE MANAGEMENT**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

- A. This section specifies the requirements for the management of non-hazardous building construction and demolition waste.
- B. Waste disposal in landfills shall be minimized to the greatest extent possible. Of the inevitable waste that is generated, as much of the waste material as economically feasible shall be salvaged, recycled or reused.
- C. Contractor shall use all reasonable means to divert construction and demolition waste from landfills and incinerators, and facilitate their salvage and recycle not limited to the following:
  - 1. Waste Management Plan development and implementation.
  - 2. Techniques to minimize waste generation.
  - 3. Sorting and separating of waste materials.
  - 4. Salvage of existing materials and items for reuse or resale.
  - 5. Recycling of materials that cannot be reused or sold.
- D. At a minimum the following waste categories shall be diverted from landfills:
  - 1. Soil.
  - 2. Inerts (eg, concrete, masonry and asphalt).
  - 3. Clean dimensional wood and palette wood.
  - 4. Green waste (biodegradable landscaping materials).
  - 5. Engineered wood products (plywood, particle board and I-joists, etc).
  - 6. Metal products (eg, steel, wire, beverage containers, copper, etc).
  - 7. Cardboard, paper and packaging.
  - 8. Bitumen roofing materials.
  - 9. Plastics (eg, ABS, PVC).
  - 10. Carpet and/or pad.
  - 11. Gypsum board.
  - 12. Insulation.
  - 13. Paint.
  - 14. Fluorescent lamps.

**1.2 RELATED WORK**

- A. Section 01 00 00, GENERAL REQUIREMENTS.

**1.3 QUALITY ASSURANCE**

- A. Contractor shall practice efficient waste management when sizing, cutting and installing building products. Processes shall be employed to ensure the generation of as little waste as possible. Construction /Demolition waste includes products of the following:
  - 1. Excess or unusable construction materials.
  - 2. Packaging used for construction products.
  - 3. Poor planning and/or layout.
  - 4. Construction error.
  - 5. Over ordering.

- 6. Weather damage.
- 7. Contamination.
- 8. Mishandling.
- 9. Breakage.

- B. Establish and maintain the management of non-hazardous building construction and demolition waste set forth herein. Conduct a site assessment to estimate the types of materials that will be generated by demolition and construction.
- C. Contractor shall develop and implement procedures to reuse and recycle new materials to a minimum of 50 percent.
- D. Contractor shall be responsible for implementation of any special programs involving rebates or similar incentives related to recycling. Any revenues or savings obtained from salvage or recycling shall accrue to the contractor.
- E. Contractor shall provide all demolition, removal and legal disposal of materials. Contractor shall ensure that facilities used for recycling, reuse and disposal shall be permitted for the intended use to the extent required by local, state, federal regulations. The Whole Building Design Guide website <http://www.wbdg.org> provides a Construction Waste Management Database that contains information on companies that haul, collect, and process recyclable debris from construction projects.
- F. Contractor shall assign a specific area to facilitate separation of materials for reuse, salvage, recycling, and return. Such areas are to be kept neat and clean and clearly marked in order to avoid contamination or mixing of materials.
- G. Contractor shall provide on-site instructions and supervision of separation, handling, salvaging, recycling, reuse and return methods to be used by all parties during waste generating stages.
- H. Record on daily reports any problems in complying with laws, regulations and ordinances with corrective action taken.

#### **1.4 TERMINOLOGY**

- A. Class III Landfill: A landfill that accepts non-hazardous resources such as household, commercial and industrial waste resulting from construction, remodeling, repair and demolition operations.
- B. Clean: Untreated and unpainted; uncontaminated with adhesives, oils, solvents, mastics and like products.
- C. Construction and Demolition Waste: Includes all non-hazardous resources resulting from construction, remodeling, alterations, repair and demolition operations.
- D. Dismantle: The process of parting out a building in such a way as to preserve the usefulness of its materials and components.

- E. Disposal: Acceptance of solid wastes at a legally operating facility for the purpose of land filling (includes Class III landfills and inert fills).
- F. Inert Backfill Site: A location, other than inert fill or other disposal facility, to which inert materials are taken for the purpose of filling an excavation, shoring or other soil engineering operation.
- G. Inert Fill: A facility that can legally accept inert waste, such as asphalt and concrete exclusively for the purpose of disposal.
- H. Inert Solids/Inert Waste: Non-liquid solid resources including, but not limited to, soil and concrete that does not contain hazardous waste or soluble pollutants at concentrations in excess of water-quality objectives established by a regional water board, and does not contain significant quantities of decomposable solid resources.
- I. Mixed Debris: Loads that include commingled recyclable and non-recyclable materials generated at the construction site.
- J. Mixed Debris Recycling Facility: A solid resource processing facility that accepts loads of mixed construction and demolition debris for the purpose of recovering re-usable and recyclable materials and disposing non-recyclable materials.
- K. Permitted Waste Hauler: A company that holds a valid permit to collect and transport solid wastes from individuals or businesses for the purpose of recycling or disposal.
- L. Recycling: The process of sorting, cleansing, treating, and reconstituting materials for the purpose of using the altered form in the manufacture of a new product. Recycling does not include burning, incinerating or thermally destroying solid waste.
  - 1. On-site Recycling - Materials that are sorted and processed on site for use in an altered state in the work, i.e. concrete crushed for use as a sub-base in paving.
  - 2. Off-site Recycling - Materials hauled to a location and used in an altered form in the manufacture of new products.
- M. Recycling Facility: An operation that can legally accept materials for the purpose of processing the materials into an altered form for the manufacture of new products. Depending on the types of materials accepted and operating procedures, a recycling facility may or may not be required to have a solid waste facilities permit or be regulated by the local enforcement agency.
- N. Reuse: Materials that are recovered for use in the same form, on-site or off-site.
- O. Return: To give back reusable items or unused products to vendors for credit.
- P. Salvage: To remove waste materials from the site for resale or re-use by a third party.
- Q. Source-Separated Materials: Materials that are sorted by type at the site for the purpose of reuse and recycling.

- R. Solid Waste: Materials that have been designated as non-recyclable and are discarded for the purposes of disposal.
- S. Transfer Station: A facility that can legally accept solid waste for the purpose of temporarily storing the materials for re-loading onto other trucks and transporting them to a landfill for disposal, or recovering some materials for re-use or recycling.

#### **1.5 SUBMITTALS**

- A. Prepare and submit to the COTR a written demolition debris management plan. The plan shall include, but not be limited to, the following information:
  - 1. Procedures to be used for debris management.
  - 2. Techniques to be used to minimize waste generation.
  - 3. Analysis of the estimated job site waste to be generated:
    - a. List of each material and quantity to be salvaged, reused, recycled.
    - b. List of each material and quantity proposed to be taken to a landfill.
  - 4. Detailed description of the Means/Methods to be used for material handling.
    - a. On site: Material separation, storage, protection where applicable.
    - b. Off site: Transportation means and destination. Include list of materials.
      - 1) Description of materials to be site-separated and self-hauled to designated facilities.
      - 2) Description of mixed materials to be collected by designated waste haulers and removed from the site.
    - c. The names and locations of mixed debris reuse and recycling facilities or sites.
    - d. The names and locations of trash disposal landfill facilities or sites.
    - e. Documentation that the facilities or sites are approved to receive the materials.
- B. Designated Manager responsible for instructing personnel, supervising, documenting and administer over meetings relevant to the Waste Management Plan.
- C. Summary of construction and demolition debris diversion and disposal, quantifying all materials generated at the work site and disposed of or diverted from disposal through recycling.

#### **1.6 APPLICABLE PUBLICATIONS**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced by the basic designation only. In the event that criteria requirements conflict, the most stringent requirements shall be met.
- B. U.S. Green Building Council (USGBC):  
LEED Green Building Rating System for New Construction

## **1.7 RECORDS**

Maintain records to document the quantity of waste generated; the quantity of waste diverted through sale, reuse, or recycling; and the quantity of waste disposed by landfill or incineration. Records shall be kept in accordance with the LEED Reference Guide and LEED Template.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. List of each material and quantity to be salvaged, recycled, reused.
- B. List of each material and quantity proposed to be taken to a landfill.
- C. Material tracking data: Receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices, net total costs or savings.

## **PART 3 - EXECUTION**

### **3.1 COLLECTION**

- A. Hazardous wastes shall be separated, stored, disposed of according to local, state, federal regulations.

### **3.2 DISPOSAL**

- A. Contractor shall be responsible for transporting and disposing of materials that cannot be delivered to a source-separated or mixed materials recycling facility to a transfer station or disposal facility that can accept the materials in accordance with state and federal regulations.
- B. Construction or demolition materials with no practical reuse or that cannot be salvaged or recycled shall be disposed of at a landfill or incinerator.

### **3.3 REPORT**

- A. With each application for progress payment, submit a summary of construction and demolition debris diversion and disposal including beginning and ending dates of period covered.
- B. Quantify all materials diverted from landfill disposal through salvage or recycling during the period with the receiving parties, dates removed, transportation costs, weight tickets, manifests, invoices. Include the net total costs or savings for each salvaged or recycled material.
- C. Quantify all materials disposed of during the period with the receiving parties, dates removed, transportation costs, weight tickets, tipping fees, manifests, invoices. Include the net total costs for each disposal.

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**SECTION 03 30 53**  
**CAST-IN-PLACE CONCRETE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION:**

This section specifies cast-in-place structural concrete and material and mixes for other concrete.

**1.2 RELATED WORK:**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Concrete roads, walks, and similar exterior site work: Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS.

**1.3 TOLERANCES:**

- A. ACI 117.
- B. Slab Finishes: ACI 117, F-number method in accordance with ASTM E1155.

**1.4 REGULATORY REQUIREMENTS:**

- A. ACI SP-66 ACI Detailing Manual
- B. ACI 318 - Building Code Requirements for Reinforced Concrete.

**1.5 SUBMITTALS:**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Concrete Mix Design.
- C. Shop Drawings: Reinforcing steel: Complete shop drawings.
- D. Manufacturer's Certificates: Air-entraining admixture, chemical admixtures, curing compounds.

**1.6 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to extent referenced. Publications are referenced in text by basic designation only.
- B. American Concrete Institute (ACI):
  - 117R-06.....Tolerances for Concrete Construction and Materials
  - 211.1-91(R2002).....Proportions for Normal, Heavyweight, and Mass Concrete
  - 301-05.....Specification for Structural Concrete
  - 305R-06.....Hot Weather Concreting
  - 306R-2002.....Cold Weather Concreting
  - SP-66-04 .....ACI Detailing Manual
  - 318/318R-05.....Building Code Requirements for Reinforced Concrete
  - 347R-04.....Guide to Formwork for Concrete
- C. American Society for Testing And Materials (ASTM):
  - A615/A615M-08.....Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

A996/A996M-06.....	Standard Specification for Rail-Steel and Axle-Steel Deformed Bars for Concrete Reinforcement
C31/C31M-08.....	Making and Curing Concrete Test Specimens in the Field
C33-07.....	Concrete Aggregates
C39/C39M-05.....	Compressive Strength of Cylindrical Concrete Specimens
C94/C94M-07.....	Ready-Mixed Concrete
C143/C143M-05.....	Standard Test Method for Slump of Hydraulic Cement Concrete
C150-07.....	Portland Cement
C171-07.....	Sheet Material for Curing Concrete
C172-07.....	Sampling Freshly Mixed Concrete
C173-07.....	Air Content of Freshly Mixed Concrete by the Volumetric Method
C192/C192M-07.....	Making and Curing Concrete Test Specimens in the Laboratory
C231-08.....	Air Content of Freshly Mixed Concrete by the Pressure Method
C260-06.....	Air-Entraining Admixtures for Concrete
C330-05.....	Lightweight Aggregates for Structural Concrete
C494/C494M-08.....	Chemical Admixtures for Concrete
C618-08.....	Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete
D1751-04.....	Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types)
E1155-96(2008).....	Determining $F_F$ Floor Flatness and $F_L$ Floor Levelness Numbers

## **PART 2 - PRODUCTS**

### **2.1 FORMS:**

Wood, plywood, metal, or other materials, approved by the COR, of grade or type suitable to obtain type of finish specified.

### **2.2 MATERIALS:**

- A. Portland Cement: ASTM C150, Type I or II.
- B. Fly Ash: ASTM C618, Class C or F including supplementary optional requirements relating to reactive aggregates and alkalis, and loss on ignition (LOI) not to exceed 5 percent.
- C. Coarse Aggregate: ASTM C33, Size 67. Size 467 may be used for footings and walls over 12 inches thick. Coarse aggregate for applied topping and metal pan stair fill shall be Size 7.
- D. Fine Aggregate: ASTM C33.
- E. Lightweight Aggregate for Structural Concrete: ASTM C330, Table 1
- F. Mixing Water: Fresh, clean, and potable.
- G. Air-Entraining Admixture: ASTM C260.
- H. Chemical Admixtures: ASTM C494.
- I. Reinforcing Steel: ASTM A615 or ASTM A996, deformed. See structural drawings for grade.
- J. Expansion Joint Filler: ASTM D1751.
- K. Sheet Materials for Curing Concrete: ASTM C171.

### **2.3 CONCRETE MIXES:**

- A. Design of concrete mixes using materials specified shall be the responsibility of the Contractor as set forth under Option C of ASTM C94.
- B. Compressive strength at 28 days shall be not less than 4000 psi.

- C. Establish strength of concrete by testing prior to beginning concreting operation. Test consists of average of three cylinders made and cured in accordance with ASTM C192 and tested in accordance with ASTM C39.
- D. Maximum slump for vibrated concrete is 4 inches tested in accordance with ASTM C143.
- E. Cement and water factor (See Table I):

**TABLE I - CEMENT AND WATER FACTORS FOR CONCRETE**

Concrete: Strength	Non-Air-Entrained		Air-Entrained	
Min. 28 Day Comp. Str. psi	Min. Cement lbs/c. yd	Max. Water Cement Ratio	Min. Cement lbs/c. yd	Max. Water Cement Ratio
4000	550	0.55	570	0.50

- 1. If trial mixes are used, the proposed mix design shall achieve a compressive strength 1200 psi in excess of f'c.
- 2. For concrete exposed to high sulfate content soils maximum water cement ratio is 0.44.
- 3. Determined by Laboratory in accordance with ACI 211.1 for normal concrete.

- F. Air-entrainment is required for all exterior concrete and as required for Section 32 05 23, CEMENT AND CONCRETE FOR EXTERIOR IMPROVEMENTS. Air content shall conform with the following table:

**TABLE I - TOTAL AIR CONTENT  
FOR VARIOUS SIZES OF COARSE AGGREGATES (NORMAL CONCRETE)**

Nominal Maximum Size of Coarse Aggregate	Total Air Content Percentage by Volume
3/8 in	6 to 10
1/2 in	5 to 9
3/4 in	4 to 8
1 in	3 1/2 to 6 1/2
1 1/2 in	3 to 6

#### **2.4 BATCHING & MIXING:**

- A. Store, batch, and mix materials as specified in ASTM C94.
  - 1. Ready-Mixed: Ready-mixed concrete comply with ASTM C94, except use of non-agitating equipment for transporting concrete to the site will not be permitted. With each load of concrete delivered to project, ready-mixed concrete producer shall furnish, in duplicate, certification as required by ASTM C94.

### **PART 3 - EXECUTION**

#### **3.1 FORMWORK:**

- A. Installation conform to ACI 347. Sufficiently tight to hold concrete without leakage, sufficiently braced to withstand vibration of concrete, and to carry, without appreciable deflection, all dead and live loads to which they may be subjected.

- B. Treating and Wetting: Treat or wet contact forms as follows:
  - 1. Coat plywood and board forms with non-staining form sealer. In hot weather cool forms by wetting with cool water just before concrete is placed.
  - 2. Clean and coat removable metal forms with light form oil before reinforcement is placed. In hot weather cool metal forms by thoroughly wetting with water just before placing concrete.
  - 3. Use sealer on reused plywood forms as specified for new material.
- C. Inserts, sleeves, and similar items: Flashing reglets, masonry ties, anchors, inserts, wires, hangers, sleeves, boxes for floor hinges and other items specified as furnished under this and other sections of specifications and required to be in their final position at time concrete is placed shall be properly located, accurately positioned and built into construction, and maintained securely in place.
- D. Construction Tolerances:
  - 1. Contractor is responsible for setting and maintaining concrete formwork to assure erection of completed work within tolerances specified to accommodate installation or other rough and finish materials. Remedial work necessary for correcting excessive tolerances is the responsibility of the Contractor. Erected work that exceeds specified tolerance limits shall be remedied or removed and replaced, at no additional cost to the Government.
  - 2. Permissible surface irregularities for various classes of materials are defined as "finishes" in specification sections covering individual materials. They are to be distinguished from tolerances specified which are applicable to surface irregularities of structural elements.

### **3.2 REINFORCEMENT:**

Details of concrete reinforcement, unless otherwise shown, in accordance with ACI 318 and ACI SP-66. Support and securely tie reinforcing steel to prevent displacement during placing of concrete.

### **3.3 PLACING CONCRETE:**

- A. Remove water from excavations before concrete is placed. Remove hardened concrete, debris and other foreign materials from interior of forms, and from inside of mixing and conveying equipment. Obtain approval of the COR before placing concrete. Provide screeds at required elevations for concrete slabs.
- B. Before placing new concrete on or against concrete which has set, existing surfaces shall be roughened and cleaned free from all laitance, foreign matter, and loose particles.
- C. Convey concrete from mixer to final place of deposit by method which will prevent segregation or loss of ingredients. Do not deposit in work concrete that has attained its initial set or has contained its water or cement more than 1 1/2 hours. Do not allow concrete to drop freely more than 5 feet in unexposed work nor more than 3 feet in exposed work. Place and consolidate concrete in horizontal layers not exceeding 12 inches in thickness. Consolidate concrete by spading, rodding, and mechanical vibrator. Do not secure vibrator to forms or reinforcement. Vibration shall be carried on continuously with placing of concrete.
- D. Hot weather placing of concrete: Follow recommendations of ACI 305R to prevent problems in the manufacturing, placing, and curing of concrete that can adversely affect the properties and serviceability of the hardened concrete.
- E. Cold weather placing of concrete: Follow recommendations of ACI 306R, to prevent freezing of thin sections less than 12 inches and to permit

concrete to gain strength properly, except that use of calcium chloride shall not be permitted without written approval from The COR.

#### 3.4 PROTECTION AND CURING:

Protect exposed surfaces of concrete from premature drying, wash by rain or running water, wind, mechanical injury, and excessively hot or cold temperature. Curing method shall be subject to approval by the COR.

#### 3.5 FORM REMOVAL:

Forms remain in place until concrete has a sufficient strength to carry its own weight and loads supported. Removal of forms at any time is the Contractor's sole responsibility.

#### 3.6 SURFACE PREPARATION:

Immediately after forms have been removed and work has been examined and approved by the COR, remove loose materials, and patch all stone pockets, surface honeycomb, or similar deficiencies with cement mortar made with 1 part portland cement and 2 to 3 parts sand.

#### 3.7 FINISHES:

##### A. Slab Finishes:

1. Floating: Allow water brought to surface by float used for rough finishing to evaporate before surface is again floated or troweled. Do not sprinkle dry cement on surface to absorb water.
2. Broom Finish: Finish all exterior slabs, ramps, and stair treads with a bristle brush moistened with clear water after the surfaces have been floated.
3. Finished slab flatness (FF) and levelness (FL) values comply with the following minimum requirements:

Slab on grade	
Specified overall value	F <sub>F</sub> 25/F <sub>L</sub> 20
Minimum local value	F <sub>F</sub> 17/F <sub>L</sub> 15

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**SECTION 31 20 11**  
**EARTH MOVING**

**PART 1 - GENERAL**

**1.1:DESCRIPTION:**

This section specifies the requirements for furnishing all equipment, materials, labor and techniques for earthwork including excavation, fill, backfill and site restoration utilizing fertilizer, seed and/or sod.

**1.2 DEFINITIONS:**

- A. Unsuitable Materials:
  - 1. Fills: Topsoil, frozen materials; construction materials and materials subject to decomposition; clods of clay and stones larger than 3 inches; organic materials, including silts, which are unstable; and inorganic materials, including silts, too wet to be stable.
  - 2. Existing Subgrade (except footings): Same materials as above paragraph, that are not capable of direct support of slabs, pavement, and similar items, with the possible exception of improvement by compaction, proofrolling, or similar methods of improvement.
  - 3. Existing Subgrade (footings only): Same as Paragraph 1, but no fill or backfill.
- B. Earthwork: Earthwork operations required within the new construction area. It also includes earthwork required for auxiliary structures and buildings and sewer and other trenchwork throughout the job site.
- C. Degree of Compaction: Degree of compaction is expressed as a percentage of maximum density obtained by the test procedure presented in AASHTO T99 Method A.
- D. The term fill means fill or backfill as appropriate.

**1.3 RELATED WORK:**

- A. Safety Requirements: Section 00 72 00, GENERAL CONDITIONS, Article, ACCIDENT PREVENTION.
- B. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

**1.4 CLASSIFICATION OF EXCAVATION:**

- A. Unclassified Excavation: Removal and disposal of pavements and other man-made obstructions visible on the surface; utilities, and other items including underground structures indicated to be demolished and removed; together with any type of materials regardless of character of material and obstructions encountered.
- B. Classified Excavation: Removal and disposal of all material not defined as rock.
- C. Rock Excavation:
  - 1. Solid ledge rock (igneous, metamorphic, and sedimentary rock).
  - 2. Bedded or conglomerate deposits so cemented as to present characteristics of solid rock which cannot be excavated without blasting; or the use of a modern power excavator (shovel, backhoe, or similar power excavators) of no less than 1 cubic yard capacity, properly used, having adequate power and in good running condition.
  - 3. Boulders or other detached stones each having a volume of 1/2 cubic yard or more.

### **1.5 APPLICABLE PUBLICATIONS:**

- A. Publications listed below form a part of this specification to the extent referenced. Publications are referenced in the text by the basic designation only.
- B. American Nursery and Landscape Association (ANLA):  
2004.....American Standard for Nursery Stock
- C. American Association of State Highway and Transportation Officials (AASHTO):  
T99-01 (R2004).....Moisture-Density Relations of Soils Using a 2.5 kg (5.5 lb) Rammer and a 305 mm (12 inch) Drop  
T180-01 (2004).....Moisture-Density Relations of Soils Using a 4.54-kg [10 lb] Rammer and a 457 mm (18 inch) Drop
- D. American Society for Testing and Materials (ASTM):  
D698-07.....Laboratory Compaction Characteristics of Soil Using Standard Effort  
D1557-02.....Laboratory Compaction Characteristics of Soil Using Modified Effort
- E. Standard Specifications of (Insert name of local state) State Department of Transportation, latest revision.

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS:**

- A. Fills: Materials approved from on site and off site sources having a minimum dry density of 110 pcf, a maximum Plasticity Index of 6, and a maximum Liquid Limit of 30.
- B. Granular Fill:
  - 1. Under concrete slab, crushed stone or gravel graded from 1 inch to No. 4.
- C. Coarse Sand Backfill for drainage system: Sand to have an approximate particle size of between 1.0 and 2.0 mm. When passed over a sieve, very coarse sand will meet the following requirements:
  - 1. Less than 5% retained on a #10 US standard sieve.
  - 2. Less than 5% passing a #30 US standard sieve.
  - 3. In no case should more than 1% pass through a #50 US standard sieve.
- D. Sod: Match species with existing turfgrass with COR approval. Use State Certified or State Approved sod when available. Deliver sod to site immediately after cutting and in a moist condition. Thickness of cut must be 3/4 inch to 1 1/4 inches excluding top growth. There shall be no broken pads and torn or uneven ends.

## **PART 3 - EXECUTION**

### **3.1 SITE PREPARATION:**

- A. Clearing: Clearing within the limits of earthwork operations as described or designated by the COTR. Work includes removal of paving, debris, trash and any other obstructions. Remove materials from the Cemetery Property.
- B. Disposal: All materials removed from the property shall be disposed of at a legally approved site, for the specific materials, and all removals shall be in accordance with all applicable Federal, State and local regulations. No burning of materials is permitted onsite.
- C. Finished elevation of subgrade shall be as follows:
  - 1. Pavement Areas - bottom of the pavement or base course as applicable.

### **3.2 FILLING AND BACKFILLING:**

- A. General: Do not fill or backfill until all debris, unsatisfactory soil materials, obstructions, and deleterious materials have been removed from the excavation. Proof-roll exposed subgrades with a fully loaded dump truck.
- B. Compaction: Use approved equipment (hand or mechanical) well suited to the type of material being compacted. Do not operate mechanized vibratory compaction equipment within 10 feet of new or existing building walls without the prior approval of the COTR. Moisten or aerate material as necessary to provide the moisture content that will readily facilitate obtaining the specified compaction with the equipment used. Compact each layer until there is no evidence of further compaction to not less than 95 percent of the maximum density determined in accordance with the following test method AASHTO T99 Method A.

### **3.3 GRADING:**

- A. General: Uniformly grade the areas within the limits of this section, including adjacent transition areas. Smooth the finished surface within specified tolerance. Provide uniform levels or slopes between points where elevations are indicated, or between such points and existing finished grades. Provide a smooth transition between abrupt changes in slope.
- B. Place crushed stone or gravel fill under concrete slabs on grade tamped and leveled. The thickness of the fill shall be 6 inches, unless otherwise indicated.
- C. Finish subgrade in a condition acceptable to the COTR at least one day in advance of the paving operations. Maintain finished subgrade in a smooth and compacted condition until the succeeding operation has been accomplished. Scarify, compact, and grade the subgrade prior to further construction when approved compacted subgrade is disturbed by contractor's subsequent operations or adverse weather.

### **3.4 DISPOSAL OF UNSUITABLE AND EXCESS EXCAVATED MATERIAL:**

- A. Disposal: Transport surplus satisfactory soil to designated storage areas on Cemetery property. Stockpile or spread soil as directed by COTR.
  - 1. Remove waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Cemetery property.
- B. Place excess excavated materials suitable for fill and/or backfill on site where directed.
- C. Remove from site and dispose of any excess excavated materials after all fill and backfill operations have been completed.

### **3.5 CLEAN-UP:**

Upon completion of earthwork operations, clean areas within contract limits, remove tools, and equipment. Provide site clear, clean, free of debris, and suitable for subsequent construction operations. Remove debris, rubbish, and excess material from the Cemetery Property.

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**SECTION 31 23 19**  
**DEWATERING**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies performance of dewatering work required to lower and control ground water table levels and hydrostatic pressures to permit excavation, backfill, and construction work to be performed in the dry. Control of surface water shall be considered as part of the work under this specification.

**1.2 SUMMARY**

- A. The work to be completed by the Contractor includes, but is not necessarily limited to the following:
  - 1. Implementation of the Erosion and Sedimentation Control Plan.
  - 2. Dewater excavations, including seepage and precipitation.
- B. The Contractor shall be responsible for providing all labor, materials, tools, equipment, power and services necessary for care of water and erosion control.

**1.3 REQUIREMENT**

- A. Dewatering system shall be of suitable facilities with sufficient size and capacity necessary to lower and maintain ground water table to an elevation at least 1 foot below lowest foundation subgrade or bottom of pipe trench and to allow material to be excavated in a reasonably dry condition. Materials to be removed shall be sufficiently dry to permit excavation to grades shown and to stabilize excavation slopes where sheeting is not required. Operate dewatering system continuously until backfill work has been completed.
- B. Reduce hydrostatic head below any excavation to the extent that water level in the construction area is a minimum of 1 foot below prevailing excavation surface and/or that localized excavations are dewatered sufficiently to conduct the work in dry conditions until the backfill has been completed at least 1-foot above the initial observed groundwater level .
- C. Prevent loss of fines, seepage, boils, quick conditions or softening of foundation strata.
- D. Maintain stability of sides and bottom of excavation.
- E. Construction operations are performed in the dry.
- F. Control of surface and subsurface water is part of dewatering requirements. Maintain adequate control so that:

1. The stability of excavated and constructed slopes are not adversely affected by saturated soil, including water entering prepared subbase and subgrades where underlying materials are not free draining or are subject to swelling or freeze-thaw action.
  2. Erosion is controlled.
  3. Flooding of excavations or damage to structures does not occur.
  4. Surface water drains away from excavations.
  5. Excavations are protected from becoming wet from surface water, or insure excavations are dry before additional work is undertaken.
- G. Permitting Requirements: The contractor shall comply with and obtain the required State and County permits where the work is performed.

#### **1.4 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Drawings and Design Data:
  1. Submit drawings and data showing the method to be employed in dewatering excavated areas 30 days before commencement of excavation.

#### **PART 2 - PRODUCTS (NOT USED)**

#### **PART 3 - EXECUTION**

##### **3.1 INSTALLATION**

- A. Install a dewatering system to lower and control ground surface water in order to permit excavation, construction of structure, and placement of backfill materials to be performed under dry conditions. Make the dewatering system adequate to pre-drain the water-bearing strata above and below the bottom of structure foundations, utilities and other excavations.
- B. In addition, reduce hydrostatic pressure head in water-bearing strata below structure foundations, utility lines, and other excavations, to extent that water levels in construction area are a minimum of 1 foot below prevailing excavation surface at all times.

##### **3.2 OPERATION**

- A. Prior to any excavation below the ground water table, place system into operation to lower water table as required and operate it continuously 24 hours a day, 7 days a week until utilities and structures have been satisfactorily constructed, which includes the placement of backfill materials and dewatering is no longer required.

- B. Place an adequate weight of backfill material to prevent buoyancy prior to discontinuing operation of the system.

### **3.3 WATER DISPOSAL**

- A. Dispose of water removed from the excavations in such a manner as:
  - 1. Will not endanger portions of work under construction or completed.
  - 2. Will cause no inconvenience to Government or to others working near site.
  - 3. Will comply with the stipulations of required permits for disposal of water.
  - 4. Will Control Runoff: The Contractor shall be responsible for control of runoff in all work areas including but not limited to: excavations, access roads, parking areas, laydown, and staging areas. The Contractor shall provide, operate, and maintain all ditches, basins, sumps, culverts, site grading, and pumping facilities to divert, collect, and remove all water from the work areas. All water shall be removed from the immediate work areas and shall be disposed of in accordance with applicable permits.
- B. Excavation Dewatering:
  - 1. The Contractor shall be responsible for providing all facilities required to divert, collect, control, and remove water from all construction work areas and excavations.
  - 2. Drainage features shall have sufficient capacity to avoid flooding of work areas.
  - 3. Drainage features shall be so arranged and altered as required to avoid degradation of the final excavated surface(s).
  - 4. The Contractor shall utilize all necessary erosion and sediment control measures as described herein to avoid construction related degradation of the natural water quality.
- C. Dewatering equipment shall be provided to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work during construction. Each excavation shall be kept dry during subgrade preparation and continually thereafter until the structure to be built, or the pipe to be installed therein, is completed to the extent that no damage from hydrostatic pressure, flotation, or other cause will result.

### **3.4 STANDBY EQUIPMENT**

Provide complete standby equipment, installed and available for immediate operation, as may be required to adequately maintain de-

watering on a continuous basis and in the event that all or any part of the system may become inadequate or fail.

### **3.5 CORRECTIVE ACTION**

If dewatering requirements are not satisfied due to inadequacy or failure of the dewatering system (loosening of the foundation strata, or instability of slopes, or damage to foundations or structures), perform work necessary for reinstatement of foundation soil and damaged structure resulting from such inadequacy or failure by Contractor, at no additional cost to Government.

### **3.6 DAMAGES**

Immediately repair damages to adjacent facilities caused by dewatering operations.

### **3.7 REMOVAL**

Insure compliance with all conditions of regulating permits and provide such information to the COR. Obtain approval from the COR before discontinuing operation of dewatering system.

----- E N D -----

**SECTION 33 40 00**  
**STORM SEWER UTILITIES**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies materials and procedures for construction of outside, underground storm sewer systems that are complete and ready for operation. This includes piping, structures and all other incidentals.

**1.2 DELIVERY, STORAGE, AND HANDLING**

- A. Do not store plastic manholes, pipe, and fittings in direct sunlight.
- B. Handle manholes according to manufacturer's written rigging instructions.

**1.3 COORDINATION**

- A. Coordinate connection to storm sewer main with the COR.

**1.4 SUBMITTALS**

- A. Manufacturers' Literature and Data shall be submitted, as one package, for pipes, fittings and appurtenances, including jointing materials, hydrants, valves and other miscellaneous items.

**1.5 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referenced in the text by the basic designation only.
- B. American Society for Testing and Materials (ASTM):
  - A185/A185M-07.....Steel Welded Wire Reinforcement, Plain, for Concrete
  - A536-84(2009).....Ductile Iron Castings
  - A615/A615M-09b.....Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement
  - C33/C33M-08.....Concrete Aggregates
  - C150/C150M-11.....Portland Cement
  - C443-10.....Joints for Concrete Pipe and Manholes, Using Rubber Gaskets
  - C478-09.....Precast Reinforced Concrete Manhole Sections
  - C857-07.....Minimum Structural Design Loading for Underground Precast Concrete Utility Structures
  - C891-09.....Installation of Underground Precast Concrete Utility Structures
  - C913-08.....Precast Concrete Water and Wastewater Structures
  - C923-08.....Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals
  - C990-09.....Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants

- C1103-03(2009).....Joint Acceptance Testing of Installed Precast Concrete Pipe Sewer Lines
- C1173-08.....Flexible Transition Couplings for Underground Piping Systems
- C1433-10.....Precast Reinforced Concrete Monolithic Box Sections for Culverts, Storm Drains, and Sewers
- C1479-10.....Installation of Precast Concrete Sewer, Storm Drain, and Culvert Pipe Using Standard Installations
- D448-08.....Sizes of Aggregate for Road and Bridge Construction
- D698-07e1.....Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lbf/ft<sup>3</sup> (600 kN-m/m<sup>3</sup>))
- D1056-07.....Flexible Cellular Materials—Sponge or Expanded Rubber
- D1785-06.....Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120
- D3034-08.....Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
- D3350-10.....Polyethylene Plastics Pipe and Fittings Materials
- D5926-09.....Poly (Vinyl Chloride) (PVC) Gaskets for Drain, Waste, and Vent (DWV), Sewer, Sanitary, and Storm Plumbing Systems
- F477-10.....Elastomeric Seals (Gaskets) for Joining Plastic Pipe
- F794-03(2009).....Poly(Vinyl Chloride) (PVC) Profile Gravity Sewer Pipe and Fittings Based on Controlled Inside Diameter
- F891-10.....Coextruded Poly(Vinyl Chloride) (PVC) Plastic Pipe With a Cellular Core
- F894-07.....Polyethylene (PE) Large Diameter Profile Wall Sewer and Drain Pipe
- F949-10.....Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe With a Smooth Interior and Fittings
- F1668-08.....Construction Procedures for Buried Plastic Pipe
- C. American Association of State Highway and Transportation Officials (AASHTO):
- M198-10.....Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants
- D. American Water Works Association(AWWA):
- C900-07.....Polyvinyl Chloride (PVC) Pressure Pipe and Fabricated Fittings, 4 In. Through 12 In. (100 mm Through 300 mm), for Water Transmission and Distribution
- M23-2nd ed.....PVC Pipe "Design And Installation"
- E. American Society of Mechanical Engineers (ASME):
- A112.36.2M-1991.....Cleanouts

## PART 2 - PRODUCTS

### 2.1 FACTORY-ASSEMBLED PRODUCTS

- A. Standardization of components shall be maximized to reduce spare part requirements. The Contractor shall guarantee performance of assemblies of components, and shall repair or replace elements of the assemblies as required to deliver specified performance of the complete assembly.

## 2.2 PE PIPE AND FITTINGS

- A. Corrugated PE drainage pipe and fittings, NPS 3 to NPS 10 (DN 80 to DN 250); ASTM F714, SDR 21 with smooth waterway for coupling joints.
  - 1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
  - 2. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.
- B. Corrugated PE pipe and fittings, NPS 12 to NPS 60 (DN 300 to DN 1500); ASTM F714, SDR 21 for pipes 3 to 24 inches (300 to 600 mm) // with smooth waterway for coupling joints. Pipe shall be produced from PE certified by the resin producer as meeting the requirements of ASTM D3350, minimum cell class 335434C.
  - 1. Silt-tight Couplings: PE sleeve with ASTM D1056, Type 2, Class A, Grade 2 gasket material that mates with tube and fittings.
  - 2. Soil-tight Couplings: AASHTO M252, corrugated, matching tube and fittings.
  - 3. Water tight joints shall be made using a PVC or PE coupling and rubber gaskets as recommended by the pipe manufacturer. Rubber gaskets shall conform to ASTM F477. Soil tight joints shall conform to requirements in AASHTO HB-17, Division II, for soil tightness and shall be as recommended by the manufacturer.

## 2.3 NONPRESSURE TRANSITION COUPLINGS

- A. Comply with ASTM C1173, elastomeric, sleeve-type, reducing or transition coupling, for joining underground non-pressure piping. Include ends of same sizes as piping to be joined, and corrosion-resistant-metal tension band and tightening mechanism on each end.
- B. Sleeve Materials
  - 1. For concrete pipes: ASTM C443, rubber.
  - 2. For plastic pipes: ASTM F477, elastomeric seal or ASTM D5926, PVC.
  - 3. For dissimilar pipes: ASTM D5926, PVC or other material compatible with pipe materials being joined.
- C. Unshielded, Flexible Couplings: Couplings shall be an elastomeric sleeve with // stainless-steel shear ring and // corrosion-resistant-metal tension band and tightening mechanism on each end.
- D. Shielded, flexible couplings shall be elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.
- E. Ring-Type, flexible couplings shall be elastomeric compression seal with dimensions to fit inside bell of larger pipe and for spigot of smaller pipe to fit inside ring.

## 2.4 CLEANOUTS

- A. Cast-Iron Cleanouts: ASME A112.36.2M, round, gray-iron housing with clamping device and round, secured, scoriated, gray-iron cover. Include gray-iron ferrule with inside calk or spigot connection and countersunk, tapered-thread, brass closure plug.

## 2.5 MANHOLES AND CATCH BASINS

### A. Standard Precast Concrete Manholes:

1. Description: ASTM C478 (ASTM C478M), precast, reinforced concrete, of depth indicated, with provision for sealant joints.
2. Diameter: 48 inches minimum unless otherwise indicated.
3. Ballast: Increase thickness of precast concrete sections or add concrete to base section as required to prevent flotation.
4. Base Section: 6 inch minimum thickness for floor slab and 4-inch (102 mm) minimum thickness for walls and base riser section, and separate base slab or base section with integral floor.
5. Riser Sections: 4 inch minimum thickness, and lengths to provide depth indicated.
6. Top Section: Eccentric-cone type unless concentric-cone or flat-slab-top type is indicated, and top of cone of size that matches grade rings.
7. Joint Sealant: ASTM C990 (ASTM C990M), bitumen or butyl rubber.
8. Resilient Pipe Connectors: ASTM C923 (ASTM C923M), cast or fitted into manhole walls, for each pipe connection.
9. Steps: If total depth from floor of manhole to finished grade is greater than 60 inches.
10. Adjusting Rings: Reinforced-concrete rings, 6 to 9 inch total thickness, to match diameter of manhole frame and cover, and height as required to adjust manhole frame and cover to indicated elevation and slope.

### B. Manhole Frames and Covers:

1. Description: Ferrous; Include indented top design with lettering cast into cover, using wording equivalent to "STORM SEWER."

## 2.6 CONCRETE FOR MANHOLES AND CATCH BASINS

### A. General: Cast-in-place concrete according to ACI 318, ACI 350/350R, and the following:

1. Cement: ASTM C150, Type II.
2. Fine Aggregate: ASTM C33, sand.
3. Coarse Aggregate: ASTM C33, crushed gravel.
4. Water: Potable.

### B. Concrete Design Mix: 4000 psi minimum, compressive strength in 28 days.

1. Reinforcing Fabric: ASTM A185, steel, welded wire fabric, plain.
2. Reinforcing Bars: ASTM A615, Grade 60 deformed steel.

### C. Manhole Channels and Benches: Channels shall be the main line pipe material. Include benches in all manholes and catch basins.

1. Channels: Main line pipe material or concrete invert. Height of vertical sides to three-fourths of pipe diameter. Form curved channels with smooth, uniform radius and slope. Invert Slope: Same slope as the main line pipe. Bench to be concrete, sloped to drain into channel. Minimum of 6 inch slope from main line pipe to wall sides.

## PART 3 - EXECUTION

### 3.1 PIPE BEDDING

- A. The bedding surface of the pipe shall provide a firm foundation of uniform density throughout the entire length of pipe. Concrete pipe requirements are such that when no bedding class is specified, concrete pipe shall be bedded in a soil foundation accurately shaped and rounded



to conform with the lowest one-fourth of the outside portion of circular pipe. When necessary, the bedding shall be tamped. Bell holes and depressions for joints shall not be more than the length, depth, and width required for properly making the particular type of joint. Plastic pipe bedding requirements shall meet the requirements of ASTM D2321. Bedding, haunching and initial backfill shall be either Class IB or Class II material. Corrugated metal pipe bedding requirements shall conform to ASTM A798.

### **3.2 PIPING INSTALLATION**

- A. Drawing plans and details indicate general location and arrangement of existing underground storm drainage piping. Intercept existing piping as indicated, to extent practical. Where specific installation is not indicated, follow piping manufacturer's written instructions.
- B. Modify existing piping as necessary to install new manhole. Install gaskets, seals, sleeves, and couplings according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements.
  - 1. Do not lay pipe on unstable material, in wet trench or when trench and weather conditions are unsuitable for the work.
  - 2. Support pipe on compacted bedding material.
  - 3. Inspect pipes and fittings, for defects before installation. Defective materials shall be plainly marked and removed from the site. Cut pipe shall have smooth regular ends at right angles to axis of pipe.
  - 4. Clean interior of all pipe thoroughly before installation. When work is not in progress, open ends of pipe shall be closed securely to prevent entrance of storm water, dirt or other substances.
  - 5. Interior of each pipe shall be thoroughly wiped or swabbed to remove any dirt, trash or excess jointing materials.
  - 6. Do not walk on pipe in trenches until covered by layers of shading to a depth of 12 inches (300 mm) over the crown of the pipe.

### **3.3 GRADING**

- A. Raise or lower new manhole and structure frame and cover in area to finish grade.
- B. During periods when work is progressing, the Contractor shall install a temporary cover above the bench of the structure or manhole. The temporary cover shall be installed above the high flow elevation within the structure, and shall prevent debris from entering the wastewater stream.

### **3.4 MANHOLE INSTALLATION**

- A. Install manhole, complete with appurtenances and accessories indicated. Install precast concrete manhole sections with sealants according to ASTM C891.
- B. Set tops of frames and covers flush with finished surface of manholes. Set tops at grade.

### **3.5 IDENTIFICATION**

- A. Install green warning tape directly over piping and at outside edge of underground structures.

### 3.6 FIELD QUALITY CONTROL

- A. Inspect interior of piping to determine whether line displacement or other damage has occurred.
  - 1. Defects requiring correction include the following:
    - a. Alignment: Less than full diameter of inside of pipe is visible between structures.
    - b. Deflection: Flexible piping with deflection that prevents passage of ball or cylinder of size not less than 92.5 percent of piping diameter.
    - c. Damage: Crushed, broken, cracked, or otherwise damaged piping.
    - d. Infiltration: Water leakage into piping.
    - e. Exfiltration: Water leakage from or around piping.
  - 2. Replace defective piping using new materials, and repeat inspections until defects are within allowances specified.
  - 3. Reinspect and repeat procedure until results are satisfactory.

### 3.7 TESTING OF STORM SEWERS:

- A. Test new and parts of existing systems that have been altered, extended, or repaired, for leaks and defects.
  - 1. Do not enclose, cover, or put into service before inspection and approval.
- B. Replace leaking piping using new materials, and repeat testing until leakage is within allowances specified.

### 3.8 CLEANING

- A. Clean interior of piping of dirt and superfluous materials. Flush with water.

--- E N D ---

**SECTION 33 46 14**  
**SITE DRAINAGE**

**PART 1 - GENERAL**

**1.1 DESCRIPTION**

This section specifies providing and placing a drainage system comprised of a geo-composite, prefabricated, water collection system (collection system) and the associated water transport system (transport pipe) including installation, backfill, and cleanout extensions, to place of connection to existing storm sewer, as described in the plans. The drainage system shall be installed in accordance with these specifications and in close conformity with the locations and dimensions as shown on the plans or specified by the COR. The quantities of drainage system materials as shown on the plans may be increased or decreased at the discretion of the Contractor based on actual site conditions that occur during construction of the project. Such variations in quantity will not be considered as alterations in the details of construction or a change in the scope of the work.

**1.2 SUBMITTALS**

- A. Submit in accordance with Section 01 33 23, SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Samples: For each type of drainage system component, including collector, pipe, and fittings indicated.
- C. Product Data: Certifications from the manufacturers attesting that materials meet specification requirements.

**1.3 RELATED WORK**

- A. Materials testing and inspection during construction: Section 01 45 29, TESTING LABORATORY SERVICES.
- B. Protection of existing utilities, fire protection services, existing equipment, roads, and pavements: Section 01 00 00, GENERAL REQUIREMENTS.

**1.4 APPLICABLE PUBLICATIONS**

- A. The publications listed below form a part of this specification to the extent referenced. The publications are referred in the text by basic designation only.
- B. American Association of State Highway and Transportation Officials (AASHTO):
  - M006-08-UL.....Standard Specification for Fine Aggregate for Hydraulic Cement Concrete, Single User Digital Publication
- C. American Society for Testing and Materials (ASTM):
  - D448-08.....Standard Classification for Sizes of Aggregate for Road and Bridge Construction
  - D2321-08.....Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications
  - D2729-03.....Standard Specification for Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings

D3034-08.....	Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings
D4216-06.....	Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) and Related PVC and Chlorinated Poly (Vinyl Chloride) (CPVC) Building Products Compounds
F477-08.....	Standard Specification for Elastomeric Seals (Gaskets) for Joining Plastic Pipe
F758-95(2000)e1 .....	Standard Specification for Smooth-Wall Poly (Vinyl Chloride)(PVC)Plastic Underdrain Systems for Highway, Airport, and Similar Drainage.
F949-(2006a).....	Poly(Vinyl Chloride) (PVC) Corrugated Sewer Pipe with a Smooth Interior and Fittings

## **PART 2 - PRODUCTS**

### **2.1 MATERIALS**

- A. The collection system shall be of flexible, prefabricated, rounded rectangular shaped, composite product.
  1. The collection system shall be wrapped with a non-woven geotextile. The non-woven wrap shall be of a needle-punched construction consisting of long-chain polymeric fibers composed of polypropylene, polyethylene or polyamide. The fibers shall be oriented into a multi-directional stable network whereby they retain their positions relative with each other and allow the passage of water as specified. The fabric shall be free of any chemical treatment or coating, which reduces permeability and it shall be inert to chemicals commonly found in soil. The geotextile shall conform to the following minimum average roll values.
    - a. Weight ASTM D-3776 4.0
    - b. Tensile Strength ASTM D-4632 100
    - c. Elongation % ASTM D-4632 50
    - d. Puncture, lb ASTM D-751 50
    - e. Mullen Burst, psi ASTM D-3786 200
    - f. Trapezoidal Tear, lb ASTM D-4533 42
    - g. Coefficient of Permeability ASTM D-4491 .1 cm/sec
    - h. Flow Rate, gpm/ft<sup>2</sup> ASTM D-4491 100
    - i. Permittivity, 1/sec ASTM D-4491 1.8
    - j. Apparent Opening Size ASTM D-4751 70 Max US Std Sieve Opening
    - k. Seam Strength, lb/ft ASTM D-4595 100
    - l. Fungus ASTM G-21 No Growth
  2. The collection system core shall be made of a high-density polyethylene. The core shall be constructed using interconnected corrugated pipes that define and provide the flow channels and structural integrity of the collection system. The geotextile shall function only as a filter. The core of the collection system shall conform to the following physical property requirements.
    - a. Thickness, inches ASTM D-1777 1.0
    - b. Flow Rate, gpm/ft ASTM D-4716 29 (At gradient = 0.1, pressure = 10 psi for 100 hours)
    - c. Compressive Strength, psf ASTM D-1621 (modified sand method) 6000

3. The Multi-Flow drainage system product manufactured by Varicore Technologies meets or exceeds these specifications. Contact information: Varicore Technologies, P.O. Box 131, Prinsburg, MN 56281, Phone: (800)-978-8007, Website: [www.varicore.com](http://www.varicore.com), Email: [service@varicore.com](mailto:service@varicore.com)
- B. The fittings used with the collection system shall be of a snap together design. In no case shall any product be joined without the use of the manufacturer's connector designed specifically for the purpose.
- C. Transport pipe shall be smooth PVC pipe meeting the requirements of ASTM D-2729 or ASTM F-949. Fittings and couplings shall be PVC.
- D. Cleanout Extensions: ASTM A74, cast iron pipe or ASTM A746 ductile iron. Gravity Sewer pipes shall have a neoprene gasket joints and long sweep elbow fittings. Cleanouts shall be as indicated on the drawings and shall be set so as to not interfere with mowing operations. Plastic tops for the crypt field cleanouts shall be provided with concrete anchorage with all features set so as to not cause damage to the mowers.
- E. Drainage Materials:
  1. Collection System Backfill: Very Coarse Sand. Sand to have an approximate particle size of between 1.0 and 2.0 mm. When passed over a sieve, very coarse sand will meet the following requirements:
    1. Less than 5% retained on a #10 US standard sieve.
    2. Less than 5% passing a #30 US standard sieve.
    3. In no case should more than 1% pass through a #50 US standard sieve.
  2. Bedding for transport piping: Crushed stone, 3/4 inch to No. 4 per ASTM D448.
  3. Fill to 1 foot above transport piping: Crushed stone, 3/4 inch to No. 4 per ASTM D448.

## **PART 3 - EXECUTION**

### **3.1 INSTALLATION**

- A. Trenching and Excavation

Perform required trenching and excavation in accordance with Section 31 00 00 EARTHWORK. Keep trenches dry during installation of drainage system. Changes in direction of drain lines shall be made with 1/8 bends.
- B. Drainage System Collector Installation:
  1. The amount of trench excavated at any time shall not exceed the amount of drain that can be set and backfilled completely in one working day. The trench shall be a minimum of 4.5 inches wide and at the depth specified in the plans. The collection system shall be centered in the trench, and backfilled with clean very coarse sand.
  2. The trench excavations for the collection system and transport pipe shall be to the lines and grades shown on the plans. Over excavation in the bottom of the excavation shall be backfilled to the proper grade with excavated material or sand prior to the placement of the collection system.

3. Fittings shall be installed in accordance with the manufacturer's recommendations.
4. Backfill shall be consolidated in accordance with the plans.
5. Any damaged collection system or transport pipe shall be replaced or repaired by splicing in an undamaged section of like material.

C. Transport Pipe Laying (Smooth PVC piping)

1. Lay drain lines to true grades and alignment with a continuous fall in the direction of flow. Bells of pipe sections shall face upgrade. Clean interior of pipe thoroughly before being laid. When drain lines are left open for connection to discharge lines, the open ends shall be temporarily closed and the location marked with wooden stakes. Any length that has had its grade or joints disturbed shall be removed and relaid at no additional cost to the Government. Piping with physical imperfections shall not be installed.
2. Prior to installation of bedding materials or piping, examination of excavation and subgrades are to be observed by the COR. Lay drain lines and firmly bed in granular material a minimum of 3 inches below invert to top of pipe to true grades and alignment with bells facing upgrade, and to slope uniformly between elevations shown on drainage drawings. Keep trenches dry until pipe is in place and granular material backfill is completed to 1 foot above top of pipe, unless otherwise noted.
3. Bedding: Place graded bedding, minimum 6 inches in depth, in the bottom of trench for its full width and length compacted as specified prior to laying of foundation drain pipe. Each section shall rest firmly upon the bedding, through the entire length, with recesses formed for bell joints. Except for recesses for bell joints, the bedding shall fully support the lower quadrant of the pipe.
4. Install gaskets, seals, sleeves, and couplings according to manufacturers written instructions and per the applicable standard:
  - a. PVC pipe installation shall be per ASTM D2321 and ASTM F758.
  - b. PVC joint construction shall be per ASTM D3034 with elastomeric seals gaskets per ASTM D2321.
5. Install cleanout extensions where shown on the Contract Documents.
6. Prior to backfilling, check drain lines to assure free flow. Remove obstructions and recheck lines until satisfactory.

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