

14.3.2. Frozen Materials. under no circumstances shall frozen earth, snow, or ice be placed in the levee. The Contracting Officer may require the wasting of frozen material in order that construction may proceed.

14.4. EMBANKMENT CONSTRUCTION

14.4.1. Semicompacted Fill. When, in the opinion of the Contracting Officer, the material used in constructing the levee is dry enough to permit layer construction, the method of placement shall be the semicompacted fill method hereinafter outlined. Materials shall be placed or spread in layers not more than eight (8) inches in thickness prior to compaction. Layers shall be started full out to the slope stakes and shall be carried substantially horizontal with sufficient crown or slope to provide satisfactory drainage during construction. When, in the opinion of the Contracting Officer, the surface of any compacted layer is too smooth to bond properly with the succeeding layer, it shall be scarified to the satisfaction of the Contracting Officer before the succeeding layer is placed thereon.

14.4.1.1. Moisture Control. In general, it is the intent of these specifications to secure an embankment having the maximum density obtainable with the natural moisture content of the embankment materials. However, if in the opinion of the Contracting Officer, the material is too dry for proper compaction, the Contractor will be required to pre-wet the material in the borrow area or to uniformly distribute sufficient moisture in each layer before rolling to permit the desired compaction.

14.4.1.2. Rolling Operations. When the moisture content and conditions of the spread layers are satisfactory, each layer shall be compacted by not less than four (4) complete passes of a tamper-type roller or by not less than two (2) complete passes of a rubber-tired roller. If tamping rollers are used in tandem not more than two rollers in tandem will be permitted and in such case, one trip of the tandem rollers over any surface will be considered as two (2) passes. When tamping rollers are used in tandem the tamper foot spacing shall be offset so that the circumferential rows on the rear drums are in line with the mid-pint of the circumferential rows on the forward drums. Each pass of the tamping roller shall overlap the proceeding or adjacent pass by not less than one (1) foot. Portions of the embankment which the roller cannot reach for any reason shall be compacted by any approved method to the density of the surrounding embankment.

14.4.2. Uncompacted Fill. Any section of embankment constructed of excessively wet material, approved for placement as uncompacted fill under the circumstances described in Paragraph 14.3.1 once started shall be completed to grade. It will, however, be permissible to place uncompacted fill on semicompacted fill base, in which event the allowance for shrinkage for each type of fill shall be as specified in Paragraph 14.8.1. Uncompacted fill shall be placed in approximately horizontal layers not exceeding three (3) feet in thickness. The layers so placed shall be spread, distributed, and otherwise manipulated during placement to the extent that individual loads of material deposited on the fill will not remain intact and large open voids in the fill will be eliminated. Appreciable drying of materials between lifts or the inclusion of dry materials in uncompacted fill will in no case be permitted and the Contractor may be required to add water to the material to obtain suitable moisture content.

14.4.3. Compaction. Embankment fills shall be compacted to at least 90 percent of maximum dry density, as determined by ASTM D 1557 (latest edition).

14.5. CROSS SECTIONS AND ZONING OF MATERIALS

14.5.1. Standard Levee Sections. Unless otherwise specified, the dimensions, slopes, and zoning of materials shall conform to the applicable "Standard Levee Sections" shown on the drawings.

14.5.2. Zoning of Materials.

(1) In general the levee section should be homogeneous. However, where materials of varying permeabilities are encountered in the borrow areas the more impervious material shall be placed toward the riverward slope and the more pervious material toward the landslide slope.

14.6. DITCHES AND DEPRESSION. All sloughs, old pits, ditches, or depressions beyond the limits of the levee and/or berm foundation within the permanent rights-of-way, when required by the Contracting Officer, be filled to the natural surface of the ground with approved embankment fill material. The material for the fill shall be placed in layers or lifts not to exceed 8 inches in thickness and the only compaction required will be that obtained by the necessary spreading and dumping operations, except that the equipment shall be so operated that the tracks are distributed evenly over the surface of each lift.

14.7. BACKFILL AT DRAINAGE STRUCTURE. After the completion of the installation of the drainage structures and the removal of all debris, the excavated area shall be backfilled with embankment fill for the unlined channel, for any fill beneath or within 10 feet of the FRB central structure or box culverts. The materials shall conform to the requirements for the materials as specified in Paragraphs 14.3. The material shall be so placed and compacted as to obtain a density of not less than 95 percent of the maximum dry density, as determined by ASTM D 1557 (latest edition).

14.8. GRADE TOLERANCES AND SHRINKAGE ALLOWANCES. All semicompacted levees shall be constructed to the net grade and cross section shown on the drawings.

14.8.1. Shrinkage Allowance. At locations where uncompacted fill is authorized or ordered by the Contracting Officer, the fill shall be overbuilt to a gross section allowing for anticipated shrinkage. the crest width and base width of the gross section shall remain unchanged from the widths of the net section.

(1) A shrinkage allowance of fifteen (15) percent shall be placed above the net grade shown on the drawings for that portion of the levee constructed by the uncompacted fill method.

14.9. SLIDES. In the event of the sliding of any part of the levee during its construction, or after its completion, but prior to its acceptance, the Contractor shall, upon written order of the Contracting Officer, cut out and remove the slide from the levee and then rebuild that portion of the levee. In case the slide is caused through fault of the Contractor, the foregoing operations shall be performed without cost to the Government.

15. TOPSOIL PLACING. All ground areas disturbed by construction under this contract and not built over, paved or otherwise surfaced shall be topsoiled.

15.1. CLEARING. Prior to placing topsoil, vegetation shall be removed from the area and the ground surface cleared of all other materials that would hinder proper grading, tillage or subsequent maintenance operations.

15.2. GRADING. Previously constructed grades shall be repaired if necessary so that the areas to be topsoiled shall conform to the section indicated on the drawings upon completion of topsoil placement.

15.3. TILLAGE. Subsequent to the above grading, the areas to be topsoiled shall be thoroughly scarified by approved means to a depth of at least 3 inches for bonding of topsoil with subsoil. The work shall be performed only during

periods when beneficial results are likely to be obtained. When conditions are such, by reason of drought, excessive moisture, or other factors, that satisfactory results are not likely to be obtained, the work will be stopped by the Contracting Officer and shall be resumed only when directed. Undulations or irregularities in the surface that would interfere with further construction operations or maintenance shall be leveled before the next specified operation.

15.4. PLACING TOPSOIL. The topsoil shall be uniformly distributed on the designated areas and evenly spread in 2 lifts to a minimum thickness of 12 inches. The spreading shall be performed in such manner that planting can proceed with little additional soil preparation or tillage. The surface resulting from topsoiling shall meet the finish surface requirements specified in the following paragraph: **FINISHED EXCAVATION, FILLS AND EMBANKMENTS.** Topsoil shall not be placed when the subgrade is frozen, excessively wet, extremely dry, or in a condition otherwise detrimental to proper grading or the proposed planting.

16. FINISHED EXCAVATION, FILLS AND EMBANKMENTS. All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be uniformly smooth graded. The finished surface shall be reasonably smooth, compacted, and free from irregular surface changes. The degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations, except as otherwise specified. The finished surface shall be not more than 0.15 foot above or below the established grade or approved cross section and shall be free of depressed areas where water would pond. All ditches shall be finished so as to drain readily. The surface of embankments or excavated areas for road construction or other areas to be paved on which a base course or pavement is to be placed shall not vary more than 0.05 foot from the established grade and approved cross section.

17. SUBGRADE AND EMBANKMENT PROTECTION. During construction, embankments and excavations shall be kept shaped and drained. Ditches and drains along the subgrade shall be maintained in such manner as to drain effectively at all times. Where ruts occur in the subgrade, the subgrade shall be brought to grade, reshaped if required, and recompact prior to the placing of surfacing. The storage or stockpiling of materials on the subgrade will not be permitted. No surfacing shall be laid until the subgrade has been checked and approved, and in no case shall any surfacing be placed on a muddy subgrade or on one containing frost.

18. EXISTING MANHOLES, VALVE BOXES, OR INLETS. All manholes, valve boxes and vaults, inlets and monitoring wells of any nature within the project that do not conform to the new finish grade in either surfaced or unsurfaced areas shall be adjusted to the new finish grade. The structure shall be adjusted as needed to fit the new conditions. All structures shall be of a type suitable for the intended use and shall conform to the requirements of the applicable section of these specifications.

ZERO ACCIDENTS

SECTION 02212

EXCAVATION, HANDLING AND DISPOSAL OF DRUMMED AND CONTAMINATED MATERIALS

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| 4. HANDLING OF DRUMMED AND CONTAMINATED MATERIALS | |

1. **SCOPE.** This section covers the Contractor's requirements for materials, equipment, and personnel associated with excavating, handling and disposal of drums containing hazardous materials encountered during construction activities. All activities conducted under this section shall be in accordance with SECTION: SAFETY, HEALTH, AND EMERGENCY RESPONSE REQUIREMENTS, and the Contractor's approved Safety, Health, and Emergency Response Plan (SHERP).

2. **DEFINITION.** For this project, hazardous materials are identified as any soils, solid waste materials, debris, liquid, sludge, or any other substance which meets any of the following requirements.

2.1 Material around a drum is or appears to have been contained in or is a portion of a drum that was used during previous disposal within the landfill.

2.2 The drummed material exhibits any reading above background levels when monitored with a direct reading total organics analyzing instrument.

2.3. Any material exhibiting RCRA hazardous characteristics including: ignitability, reactivity, corrosivity, and TCLP toxicity.

3. SUBMITTALS

3.1 CATEGORY I.

3.1.1 The Contractor shall submit for approval a written Drum and Contaminated Materials Handling Plan. The Drum and Contaminated Materials Handling Plan shall address, at a minimum:

3.1.1.1. Methods and equipment used for exhuming drums encountered during site preparation.

3.1.1.2. Methods and equipment proposed for removal, loading, and handling of drums and associated contaminated materials.

3.1.1.3. Storage provisions for drums and associated contaminated materials including specified areas to be excavated and used for drum staging.

3.1.1.4. Security provisions for drums and associated contaminated materials.

3.1.1.5. Protocol for sampling contents of buried drums.

3.1.1.6. Protocol for sampling contents of other materials.

3.1.1.7. Waste identification methods (e.g., labeling, marking containers) and procedures for identification and tracking.

3.1.1.8. Provisions for ensuring separation of incompatible materials.

3.1.1.9. Protocol for overpacking damaged or bulging drums.

3.1.1.10. Location of and construction methods for waste staging and storage areas.

3.1.1.11. Location of onsite waste disposal areas.

3.1.1.12. Provisions for minimizing offsite contamination associated with temporary storage of drums and contaminated materials onsite.

3.1.1.13. Location and names of offsite disposal facilities.

3.1.1.14. Manifesting procedures including applicable land ban notices.

3.1.1.15. Special safety precautions. The Drum and Contaminated Materials Handling Plan shall be developed in strict adherence with other Contractor generated plans (e.g., SHERP, CQCP, Spill Control Plan) and with all relevant and appropriate Federal, State, and local regulations associated with contaminated materials handling and disposal. The Drum and Contaminated Materials Handling Plan shall be submitted to the Contracting Officer concurrently with the Safety, Health, and Emergency Response Plan (SHERP). Sections of the Materials Handling Plan may refer directly to the SHERP.

3.1.1.16. On-site and off-site laboratory QA/QC plans. Include the name of off-site laboratory and a written commitment to provide analytical services for drum sample, soil sample, and air sample analyses.

3.1.1.17. Plans for handling liquids accumulated in bermed areas or from leaking drums.

3.1.1.18. Drum Sampling and Analytical Program (see Paragraph 6.0).

4. HANDLING OF DRUMMED AND CONTAMINATED MATERIALS.

4.1 DRUM EXCAVATION AND HANDLING. Prior to removing drums from the excavation area, visual assessment shall be made to define the integrity of the drums and any potential hazards. The contractor shall place leaking, damaged drums in overpacks and move from the work area to the preliminary staging area located next to the work place. Drums not requiring special handling shall be moved to the preliminary staging area also. If buried drums and containers are damaged in place or during removal and materials are released, the contractor shall collect those materials to the maximum extent possible practical and place the released materials in clean drums. The contractor shall log all drums and photograph any identification or markings on the drums prior to transporting the drums to the on-site drum accumulation area. A drum is considered empty if all wastes have been removed by using practices commonly employed to remove materials and no more than one inch of residue remain on the bottom of the drum, or no more than three percent by weight of the total capacity of the drum remains in the drum. This applies to drums less than 100 gallons in size. Drums containing solidified slag will not require sampling and analysis.

Drum screening for compatibility and stability shall be done at the preliminary staging area. Additional drum sampling can be done at the on-site accumulation area. The Contractor shall indicate on a Site Plan the general location of all drums excavated during grading operations.

In general, drum excavation will proceed from the downwind end of the area towards the upwind end. The excavation area will be monitored for volatile organic vapors using a flame ionization detector (FID), and/or a photoionization detector (PID). At this time a COE representative may also log materials and collect samples for chemical analysis. The Contractor's foreman will direct the

Contractor's personnel and equipment during the drum excavation. Other personnel, with the exception of the COE representative will stand clear of the immediate area during the drum excavation. All work will proceed in a slow controlled manner so as to minimize the potential dangers associated with excavation and extraction of buried drums or other forms of waste materials.

All drum excavation work shall be conducted in accordance with OSHA interim standard, 29 CFR 1910.120, (Hazardous Waste Site Operation and Emergency Response).

4.2. OTHER SITE ACTIVITIES. Contaminated materials may also be encountered in other site activities. Specifically, contaminated materials are expected to be encountered during:

- a. Preliminary site grading.
- b. Grubbing of tree stumps.
- c. Removal of onsite debris.
- d. Use of decontamination facilities.

This list is not complete. It is possible that contaminated materials may be encountered in any activity associated with this project. These activities exhibit the greatest likelihood of encountering contaminated materials.

4.2.1 SOILS AND SOLID WASTE HANDLING. All on-site bulk excavated soils and solid wastes shall be disposed under the topsoil cap. The Contractor is not required to characterize bulk excavated soils during site grading operations. The Contractor shall prevent erosion and offsite sedimentation of bulk soils and solid wastes in accordance with Section: ENVIRONMENTAL PROTECTION. Any contaminated materials encountered after placement of the topsoil layer of the cap shall be disposed of offsite in accordance with appropriate disposal regulations. Storage areas for these materials shall be lined and have covers.

5.0 INTERIM WASTE AND DRUM ACCUMULATION. The Contractor will be required to construct an interim on-site waste and drum accumulation area in a USACE-approved location for temporary storage. This area shall be lined and bermed to prevent possible off-site migration of contaminants and secured by a chain-link security fence and lockable gate. The storage area will also be sloped to a sump with a sump pump connected to a skid-mounted storage tank situated inside the storage area. At a minimum, this area will have capacity to accumulate up to 100 over-pack drums stacked two high on wooden pallets. Non-overpacked drums shall be stacked one high on pallets.

Following removal and off-site disposal of all wastes from the interim waste and drum accumulation area, the Contractor shall close this area. This closure shall include removal of berms and security fencing.

5.1 LABORATORY REQUIREMENTS. All laboratory procedures on and off-site must be approved by USACE prior to implementation by the Contractor. This includes on-site compatibility testing, additional on-site analyses utilizing GC or GC/MS instruments, and any off-site analyses.

5.1.1. The Contractor must notify the USACE Contracting Officer to request that the USACE laboratory validation process be initiated for each onsite or offsite laboratory that the Contractor proposes to use for chemical analysis of any Millcreek project samples. The laboratory must undergo a validation process prior to providing analytical services for this phase of the Millcreek project in accordance with SECTION: CHEMICAL QUALITY MANAGEMENT. The Contractor shall be aware that the laboratory evaluation process can be time consuming. To ensure that the laboratory evaluation procedure does not cause a delay in the

project schedule, the Contractor shall become familiar with the Contractor laboratory requirements and the laboratory validation timetable guidelines described in detail in SECTION: CHEMICAL QUALITY MANAGEMENT.

6.0 DRUM SAMPLING AND ANALYTICAL PROGRAM.

6.1. GENERAL. All sampling of liquids and solid materials from excavated drums shall be performed by the Contractor. Sampling procedures shall be in accordance with procedures set forth in the USEPA document EPA/600/2-86/013 "Drum Handling Procedures at Hazardous Waste Sites." The Contractor shall provide all sample containers and be responsible for sample collection, packing, preservation and transport. The Contractor shall maintain field log documentation of all drum sampling and chain of custody of sample handling.

6.2. FIELD QA/QC SAMPLES. Split samples (or duplicate samples for volatiles) shall be made available to the USACE on-site representative or representatives of regulatory agencies upon request. Analytical methods to be used and frequency of field QA/QC samples shall be determined during the laboratory validation process. The collection frequency of field QA/QC samples for analysis by the respective USACE QA laboratory and the Contractor's laboratory shall be in accordance with the Field QA/QC Program described in SECTION: CHEMICAL QUALITY MANAGEMENT.

6.3. SAMPLING AND ANALYTICAL PROGRAM OBJECTIVES. The Contractor shall include in the Drum and Contaminated Materials Handling Plan a detailed, site-specific sampling and analytical program for excavated drums. The objective of this plan shall be to characterize the wastes as required to:

- field screen excavated drums and contaminated soils for staging using appropriate instrumentation and field screening test kit;
- determine waste compatibility to insure safe drum staging and segregation, waste bulking, or recontainerization;
- determine if drummed material is hazardous;
- determine treatment and disposal requirements;
- allow transportation of wastes in accordance with regulatory requirements; and
- identify potential RCRA permitted disposal facilities.

6.4. HAZARDOUS WASTE DETERMINATION. Except for hazardous waste determination, the referenced drum handling procedures list all necessary parameters to be tested for to achieve the above objectives. Hazardous waste shall be characterized by the following:

- TCLP: metals, volatiles, semi-volatiles, pesticides,
- herbicides; and
- RCRA characteristics including corrosivity, ignitability and reactivity.

This analytical program shall be structured to provide data in a time frame that will allow expedient removal, off-site transportation and disposal of drums.

6.5. DRUM SAMPLING AND ANALYTICAL PROGRAM. All sampling and analytical procedures shall be performed in accordance with USEPA approved protocols. As a minimum, the Contractor's sampling and analytical program to be described in the Drum and Contaminated Materials Handling Plan shall address:

- sample identification and tracking procedures;
- waste compatibility testing procedures, protocols and analytical parameters;
- waste segregation criteria;
- waste sample collection procedures and methodology;

- information necessary to complete waste disposal application requirements for disposal facility;
- schedule of all activities including typical sample analysis response times (RCRA and disposal characterization), assessment of treatment/disposal options, waste consolidation if appropriate, and offsite disposal;
- analytical methods to be used and frequency of QA/QC samples shall be determined during the laboratory validation process;
- determination of sample schedules;
- methods and procedures for sampling and analysis of drums containing heterogeneous wastes (i.e., sample jars, refuse, miscellaneous wastes).

6.6. DATA REPORTING. The results of all analytical testing performed by the Contractor shall be made available to the USACE immediately upon completion of final data reports. All analytical data shall be made available to the USACE within 30 days of sampling and at least 14 days prior to transportation of wastes offsite.

6.7 OWNERSHIP OF EQUIPMENT. All chemical monitoring and testing equipment used to achieve the objectives of the sampling and analytical program shall become the property of the USACE at the completion of the project.

7. DISPOSAL OF EXCAVATED MATERIALS.

7.1 ON-SITE DISPOSAL. With the exception of drums containing hazardous materials and wastes that have been bulk excavated subsequent to placement of the topsoil layer of the cap, excavated materials are to be disposed of on-site and covered by the topsoil cap. Wastes shall be deposited in lifts not to exceed six inches, with the exception of drums containing solidified slag, which will be buried intact. The location of on-site drum waste disposal on the site shall be proposed by the Contractor as part of the Contractor's Drum and Contaminated Materials Handling Plan.

7.2 OFFSITE DISPOSAL. All drums containing materials characterized as hazardous materials or wastes that do not meet the requirements of paragraph: ON-SITE DISPOSAL are to be disposed of offsite in an approved disposal facility. All drums containing materials characterized as hazardous material to be disposed offsite shall be disposed of in accordance with RCRA approved methods. Prior to selection of disposal facility, the candidate facility must submit compliance status reports, the name and location of the Contractor's selected disposal facility(s), and copies of all offsite disposal manifests to the Contracting Officer as part of the Drum and Contaminated Materials Handling Plan.

7.3 INCIDENTAL WASTE DISPOSAL.

7.3.1. Waste materials generated by construction activities resulting outside the Exclusion Zone and Contamination Reduction Zone shall be considered as uncontaminated solid wastes to be disposed of offsite. The following list includes typical waste streams which shall be disposed of offsite:

- a. Office waste.
- b. Lunch room waste.
- c. Concrete formwork.
- d. Material and equipment packing.
- e. Crate.
- f. Steel scrap.
- g. Containers.
- h. Wasted concrete.

Any materials taken offsite shall be handled in accordance with applicable RCRA regulations.

7.3.2. Waste materials generated by construction activities resulting within the Exclusion Zone and Contamination Reduction Zone shall be considered as contaminated solid wastes and shall be disposed of in accordance with paragraphs 7.1 and 7.2.

7.3.3. All waste materials associated with site grubbing shall be chipped in accordance with SECTION: CLEARING AND GRUBBING and shall be placed and compacted in accordance with the Contractor's Drum and Contaminated Materials Handling Plan in one 3-inch lift.

8. STAGING AREAS.

8.1 STAGING AREA. A preliminary drum staging area shall be located adjacent to the area being excavated. This area is used for the preliminary assessment of excavated drums.

8.2 COVERING AND SPILL CONTROL. The contractor shall keep all drums and other waste material covered to minimize precipitation coming in contact with waste material.

ZERO ACCIDENTS

SECTION 02215 GEOTEXTILE USED AS FILTERS

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| 3. SUBMITTALS | * 7. MEASUREMENT AND PAYMENT |
| 4. MATERIALS | ATTACHMENT: TABLE 1 - "PHYSICAL STRENGTH REQUIREMENTS" |

* Not used

1. **SCOPE.** The work provided for herein consists of furnishing all plant, labor, material, and equipment and performing all operations required for furnishing, hauling and placing the geotextile, complete, as specified herein and shown on the contract drawings, and maintaining the geotextile until placement of the granular drainage material, bedding material and/or riprap cover completed and accepted.

2. **APPLICABLE PUBLICATIONS:** The following publications of the current issues listed below, but referred to thereafter by basic designation only, form a part of this specification to the extent indicated by the references thereto:

2.1. American Society for Testing and Materials (ASTM):

- | | |
|------------|---|
| D 123-85 | Terminology Relating to Textiles Materials |
| D 1117-80 | Non woven Fabrics (Trapezoidal Tear Test) |
| D 1682-64 | Breaking Load and Elongation of Textile Fabrics
(Rev 1975) |
| D 1683-81 | Failure in Sewn Seams of Woven Fabrics |
| D 3787-80a | Bursting Strength of Knitted Goods: Constant-Rate-of
Traverse (CRT), Ball Burst Test |
| D 3884-80 | Abrasion Resistance of Textile Fabrics (Rotary
Platform, Double-Head Method) |
| D 4491-85 | Test Methods for Water Permeability of Geotextiles by
Permittivity |

3. SUBMITTALS: In accordance with SECTION: SPECIAL CLAUSES, the Contractor shall submit the following items required by this section:

3.1. Category I: None

3.2.3.2. Category II:

3.2.1. Samples (para 4.1)

3.2.2. Manufacturers Literature

3.2.3. Mill Certificate or Affidavit

4. MATERIALS:

4.1. Geotextile: The geotextile shall be a (non-woven) pervious sheet of plastic yarn as defined by ASTM D 123. The geotextile shall provide an Equivalent Opening Size (EOS) no finer than the U. S. Standard Sieve No. 120 and no coarser than the U. S. Standard Sieve No. 70.

The geotextile fiber shall consist of a long-chain synthetic polymer composed of at least 85 percent by weight of propylene, ethylene, ester, amide or vinylidene-chloride, and shall contain stabilizers and/or inhibitors added to the base plastic if necessary to make the filaments resistant to deterioration due to ultra-violet and heat exposure. The geotextile shall conform to the physical strength requirements in Table No. 1. The geotextile should be fixed so that the yarns will retain their relative position with respect to each other. The edges of the geotextile shall be finished to prevent the outer yarn from pulling away from the geotextile. (The geotextile shall be manufactured into a width not less than 10 feet.)

If requested by the Contracting Officer, the Contractor shall provide to the Government geotextile samples for testing to determine compliance with any or all of the requirements in this specification. When samples are to be provided, they shall be submitted a minimum of 60 days prior to the beginning of installation of the same geotextile material.

4.2. Seams: Sewing of seams is optional. If seams are not sewn, geotextile panels shall have a minimum overlap of 12 inches. The seams of the geotextile shall be sewn with thread of a material meeting the chemical requirements given above for geotextile yarn or shall be bonded by cementing or by heat. The sheets of geotextile shall be attached at the factory or another approved location to form sections not less than 10 feet wide. Seams shall be tested in accordance with method ASTM D 1683, using 1 inch square jaws and 12 inches per minute constant rate of traverse. The strengths shall be not less than 90 percent of the required tensile strength (Table 1) of the unaged geotextile in any principal direction.

4.3. Acceptance Requirements: All brands of geotextile and all seams to be used shall be accepted on the following basis. The Contractor shall furnish the Contracting Officer, in duplicate, a mill certificate or affidavit signed by a legally authorized official from the company manufacturing the geotextile. The mill certificate or affidavit shall attest that the geotextile meets the chemical, physical and manufacturing requirements stated in this specification.

4.4. Temporary Pins: Temporary securing pins shall be 3/16 inch in diameter, of steel, pointed at one end and fabricated with a head to retain a steel washer having an outside diameter of no less than 1.5 inches.

5. SHIPMENT AND STORAGE: During all periods of shipment and storage, the geotextile shall be protected from direct sunlight, ultraviolet rays, temperatures greater than 140°F, mud, dirt, dust and debris. To the extent

possible, the geotextile shall be maintained wrapped in a heavy duty protective covering.

6. INSTALLATION OF GEOTEXTILE: The geotextile shall be placed in the manner and at the locations shown on the drawings. At the time of installation, geotextile shall be rejected if it has defects, rips, holes, flaws, deterioration or damage incurred during manufacture, transportation or storage. The surface to receive geotextile shall be prepared to a relatively smooth condition free of obstructions, depressions, debris, and soft or low density pockets of material. The geotextile shall be placed with the long dimension parallel to the centerline of the channel or trench and shall be laid smooth and free of tension, stress, folds, wrinkles or creases. The strips shall be placed to provide a minimum width of 6 inches of overlap for each joint.

The geotextile shall be placed by rolling a continuous length down the slope of the embankments. No horizontal seams shall be allowed on the geotextile.

Temporary pinning of the textile to help hold it in place until the bedding layer or riprap is placed shall be allowed. The temporary pins shall be removed as the bedding or riprap is placed to relieve high tensile stress which may occur during placement of material on the geotextile.

The placement procedure requires that the length of the geotextile be approximately 15 percent greater than the slope length. The Contractor shall adjust the actual length of the geotextile used based on initial installation experience.

Additional pins regardless of location shall be installed as necessary to prevent any slippage of the geotextile. The geotextile shall be placed so that the upstream/upper strip of geotextile will overlap the downstream/next lower strip. Each securing pin shall be pushed through the geotextile until the washer bears against the geotextile and secures it firmly to the foundation. The geotextile shall be protected at all times during construction from contamination by surface runoff and any geotextile so contaminated shall be removed and replaced with uncontaminated geotextile. Any damage to the geotextile during its installation or during placement of filter materials, bedding materials or riprap shall be replaced by the Contractor at no cost to the Government. The work shall be scheduled so that the covering of the geotextile with a layer of the specified material is accomplished within 7 days after placement of the geotextile. Failure to comply shall require replacement of geotextile. The geotextile shall be protected from damage due to the placement of riprap or other materials by limiting the height of drop of the material to less than 1 foot or by placing a cushioning layer of sand on top of the geotextile before dumping the material. Before placement of riprap, the Contractor shall demonstrate that the placement technique will prevent damage to the geotextile.

7. MEASUREMENT AND PAYMENT: Not used.

TABLE NO. 1 - PHYSICAL STRENGTH REQUIREMENTS (16 OZ./SY NONWOVEN GEOTEXTILE)

Physical Property	Test Procedure	**Acceptable Test Results
Tensile Strength +(unaged geotextile)	ASTM D4632-86 Grab Tensile Elongation Method	350 pound minimum in any principle direction.
Puncture Strength +(unaged geotextile)	ASTM D 4595-86 Wide Width Strip Tensile ASTM D 4833 Puncture Resistance Test with Ring Clamp except polished steel ball replaced with a 5/16 inch diameter solid steel cylinder with a hemispherical tip centered within the ring clamp.	145 pounds per inch. 200 pound minimum.
Abrasion Resistance	ASTM D 3786-87 Mullen Burst Test ASTM D 3884 Rotary Platform, Double Head Method; rubber-base abrasive wheels equal to CS-17 "Calibrase" by Taber Instrument Co.; 1 kilogram load per wheel; 1000 revolutions, determine residual breaking load.	700 pounds per square inch 55 pound minimum Residual Breaking Load in any principal direction.
Tear Strength	ASTM D 4533 Trapezoidal Tear Strength	110 pounds minimum in any principal directive.
Geotextile Permeability (KG)	ASTM D 4491 Test Methods for Water Permeability of Geotextiles By Permittivity.	The permittivity of the Geotextile shall be greater than 0.8 per second (0.8 sec ⁻¹)

** Acceptable test results strengths may be reduced 50 percent for geotextile to be used in drainage trenches, beneath concrete slabs or to be cushioned from rock placement by a layer of sand or by zero drop height placement.

+ Unaged geotextile is defined as geotextile in the condition received from the manufacturer or distributor.

October 1989

ZERO ACCIDENTS

SECTION 02221
EXCAVATION, TRENCHING, AND BACKFILLING
FOR UTILITIES SYSTEMS

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* NOT USED

PART 1 - GENERAL

1. **APPLICABLE PUBLICATIONS.** The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

1.1. **AMERICAN WOOD PRESERVER'S BUREAU (AWPB) STANDARD.**

LP-22 Softwood Lumber, Timber and Plywood Pressure
 Treated with Water Borne Preservatives for
 Ground Contact Use (Rev. March 1980)

1.2. **AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) PUBLICATIONS.**

D 1556-82	Density of Soil In Place by the Sand-Cone Method
D 1557-78	Moisture-Density Relations of Soils and Soil-Aggregate Mixtures Using 10-lb (4.54 kg) Rammer and 18-inch (457 mm) Drop
D 2487-85	Classification of Soils for Engineering Purposes
D 2922-81	Density of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
D 3017-78	Moisture Content of Soil and Soil-Aggregate in Place by Nuclear Methods (Shallow Depth)
E 548-84	Preparation of Criteria for Use in Evaluation of Testing Laboratories and Inspection Bodies

2. **DEFINITIONS.**

2.1. **SUITABLE MATERIALS.** Suitable materials shall consist of any material not included in the unsuitable materials definition.

2.2. **UNSUITABLE MATERIALS.** Unsuitable materials include but are not limited to those materials containing roots and other organic matter, trash, debris, frozen materials and stones larger than 3 inches, and materials classified in ASTM D 2487 as MH, PT, OH, and OL. Unsuitable materials also include landfill material, refuse material, debris from previous construction and materials too soft to properly support utility pipe, conduit, or appurtenance structures. Otherwise suitable material which is unsuitable due to excess moisture content will not be classified as unsuitable material unless it cannot be dried by manipulation, aeration, or blending with other materials.

2.3. COHESIONLESS AND COHESIVE MATERIALS. Cohesionless materials shall include materials classified in ASTM D 2487 as GW, GP, SW, and SP. Cohesive materials include materials classified as GC, SC, ML, CL, MH, and CH. Materials classified as GM and SM will be identified as cohesionless only when the fines are nonplastic.

2.4. ROCK. Not Used.

2.5. SELECT GRANULAR MATERIAL. Select granular material shall consist of well-graded sand, gravel, crushed gravel, crushed stone or crushed slag composed of hard, tough and durable particles, and shall not contain more than 10 percent by weight of material passing a No. 200 mesh sieve and no less than 95 percent by weight passing the 1-inch sieve, with a maximum allowable aggregate size of 1 inch or the maximum size recommended by the pipe manufacturer, whichever is smaller, unless otherwise specified.

2.6. DEGREE OF COMPACTION. Degree of compaction shall be expressed as a percentage of the maximum density obtained by the test procedure presented in ASTM D 1557.

PART 2 - EXECUTION

3. EXCAVATION. Excavation of every description and of whatever substances encountered shall be performed to the lines and grades indicated. Rock excavation shall include removal and disposition of material defined as rock in paragraph DEFINITIONS. Earth excavation shall include removal and disposal of material not classified as rock excavation. During excavation, material suitable for backfilling shall be stockpiled in an orderly manner at a distance from the banks of the trench sufficient to avoid overloading and to prevent slides or cave-ins. Adequate drainage shall be provided for the stockpiles and surrounding areas by means of ditches, dikes, or other approved methods. The stockpiles shall also be protected from contamination with unsuitable excavated material or other material that may destroy the quality and fitness of the suitable stockpiled material. If the Contractor fails to protect the stockpiles and any material becomes unsatisfactory as a result, such material, if directed, shall be removed and replaced with satisfactory on-site or imported material from approved sources at no additional cost to the Government. Excavated material not required or not satisfactory for backfill shall be disposed of in graded areas as fill shown on the drawings. Grading shall be done as may be necessary to prevent surface water from flowing into the excavation, and any water accumulating therein shall be removed so that the stability of the bottom and sides of the excavation is maintained. Unauthorized overexcavation shall be backfilled in accordance with paragraph BACKFILLING at no additional cost to the Government.

3.1. TRENCH EXCAVATION. The trench below the top of the pipe shall not be excavated wider than the outside diameter of the pipe plus 24 inches for pipes of less than 24 inch inside diameter and no wider than the outside diameter of the pipe plus 36 inches for larger sizes. Where trench widths are exceeded, redesign using stronger pipe or special installation procedures shall be necessary. Cost of this redesign and increased cost of pipe or installation shall be borne by the Contractor without additional cost to the Government. Trench walls below the top of the pipe shall be vertical or may be sloped as allowed by the pipe manufacturer's installation manual. Trench walls above the top of pipe may be sloped or widened as necessary for the proper performance of the work.

"NOT USED"

3.1.1. **Bottom Preparation.** Trench bottoms shall be over excavated to allow the installation of granular bedding as detailed on the drawings.

3.1.2. **Removal of Rock.** ~~Where rock is encountered in the bottom of the trench, such material shall be removed 6 inches below the required grade and replaced with suitable materials as provided in paragraph. BACKFILLING.~~

3.1.3. **Removal of Unsuitable Material.** Where unsuitable material is encountered in the bottom of the trench, such material shall be removed to the depth directed and replaced to the proper grade with select granular material as provided in paragraph BACKFILLING. When removal of unsuitable material is required due to the fault or neglect of the Contractor in his performance of work, the resulting material shall be excavated and replaced by the Contractor without additional cost to the Government.

3.2. **EXCAVATION FOR APPURTENANCES.** Excavation for manholes or similar structures shall be of sufficient size to permit the placement and removal of forms for the full length and width of structure footings and foundations as shown. Loose disintegrated rock and thin strata shall be removed. Removal of unsuitable material shall be as specified above. When concrete or masonry is to be placed in an excavated area, special care shall be taken not to disturb the bottom of the excavation. Excavation to the final grade level shall not be made until just before the concrete or masonry is to be placed.

3.3. **DEWATERING.** The Contractor shall provide and maintain adequate dewatering equipment to remove and dispose of all surface and ground water entering excavations, trenches, or other parts of the work. 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. All excavations for concrete structures or trenches which extend down to or below ground water shall be dewatered by lowering and keeping the ground water level beneath such excavations 12 inches or more below the bottom of the excavation. Surface water shall be diverted or otherwise prevented from entering excavated areas or trenches to the greatest extent practicable without causing damage to adjacent property. Dewatering water will be disposed of into on-site depressions. The Contractor shall maintain a depression(s) in fill areas for disposal of decon and dewatering water. The depression(s) shall be maintained until dewatering water and decon water disposal is no longer required. The depressions shall be backfilled with select fill to water level and off-site fill to subgrade levels.

3.4. **SHEETING AND SHORING.** Except where banks are cut back on a stable slope, excavation for structures and trenches shall be sheeted, braced, and shored, as necessary, to prevent caving or sliding, to provide protection for workmen and the work, and to provide protection for existing structures and facilities. Sheet piling, bracing, and shoring shall be designed and built to withstand all loads that might be caused by earth movement or pressure, and shall be rigid, maintaining shape and position under all circumstances.

4. **BACKFILLING.** Backfill material shall consist of suitable material. Backfill shall be placed in layers not exceeding 6 inches loose thickness for compaction by hand operated machine compactors, and 8 inches loose thickness for other than hand operated machines, unless otherwise specified. Each layer shall be compacted to at least 95 percent maximum density for cohesionless

soils and 90 percent maximum density for cohesive soils, unless otherwise specified.

4.1. TRENCH BACKFILL. Trenches shall be backfilled to the grade shown.

The trench shall not be backfilled until all specified tests are performed.

4.1.1. Not Used.

4.1.2. Replacement of Unsuitable Material. Unsuitable material removed from the bottom of the trench or excavation shall be replaced with select granular material placed in layers not exceeding 6 inches loose thickness.

4.1.3. Bedding. Bedding shall conform to the details shown on the drawings and specified below. Material shall be deposited in 6 inch loose layers and compacted with approved methods to at least 95 percent maximum density. Care shall be taken to ensure thorough compaction of the fill under the pipe haunches. Bedding shall consist of select granular material.

4.1.3.1. Class B Bedding. Class B bedding shall be used for all gravity sewer lines.

4.1.3.2. Class C Bedding. Class C bedding shall be used for all pressure pipe. A maximum allowable aggregate size of 1/2 inch shall be used for all plastic pressure pipe, ductile, or cast iron pipe.

4.1.4. Initial Backfill shall consist of suitable materials with a maximum stone size not exceeding the limits shown on the drawings. Initial backfill shall be placed in 6-inch loose thickness layers and compacted to at least 90 percent of maximum density at moisture contents that will facilitate compaction in granular materials and shall be within -1 and +4 percent of optimum for all other materials. Initial backfill shall be placed to a height of at least 1 foot above the top of the pipe. Care shall be taken to ensure thorough compaction of the fill under the haunches of the pipe.

4.1.5. Final Backfill. The remainder of the trench, except for special materials for roadways, railroads and airfields, shall be backfilled with suitable material. Backfill material shall be deposited and compacted as follows:

4.1.5.1. Roadways. Backfill below the elevation at which the special requirements given in SECTION: GRADING shall be placed in 6-inch layers compacted to 95 percent maximum density. Backfill shall be placed up to the elevation of the base course in 6-inch layers and compacted to 95 percent maximum density. Water flooding or jetting methods of compaction will not be permitted.

4.1.6. Sidewalks, Turfed or Seeded Areas and Miscellaneous Areas. On-site derived fill shall be compacted with a minimum of three (3) passes using a 10,000-lb vibrating drum or sheepsfoot compactor. All off-site fill will be compacted to 90% of the Standard Proctor density. Surcharge loads from compaction and construction equipment, and fill placed to achieve desired grades will promote primary settlement, if any, of loosely compacted subfill. Should settlement occur during grading/filling operations, the Contractor will be required to place additional fill in settled area to achieve desired grades. Compaction by water flooding or jetting will not be permitted. This requirement shall also apply to all other areas not specifically designated above.

4.2. BACKFILL FOR APPURTENANCES. After the manhole or similar structure has been constructed and the concrete has been allowed to cure for 3 days, backfill shall be placed in such a manner that the structure will not

be damaged by the shock of falling earth. The backfill material shall be deposited and compacted as specified for final backfill, and shall be placed in such a manner as to prevent eccentric loading and excessive stress on the structure.

5. SPECIAL REQUIREMENTS. Special requirements for both excavation and backfill relating to the specific utilities are as follows:

5.1. WATER LINES. A temporary water line for the decontamination pad will be required. Trenches shall be of a depth to provide a minimum cover of 5 feet from the existing ground surface, or from the indicated finished grade, whichever is lower, to the top of the pipe.

6. TESTING. Testing shall be the responsibility of the Contractor and shall be performed at no additional cost to the Government.

6.1. DETERMINATION OF DENSITY. Density tests shall be performed by an approved commercial testing laboratory or may be tested by facilities furnished by the Contractor. Approval of testing facilities shall be based on compliance with ASTM E 548, and no work requiring testing will be permitted until the facilities have been inspected and approved by the Contracting Officer. Tests shall be performed in sufficient numbers to ensure that the specified density is being obtained for each lift. One test shall be made for each 200 linear feet or less for each layer of specified depth, except areas to receive pavements, for which one test shall be made for each 100 linear feet or less. Laboratory tests for moisture-density relations shall be determined in accordance with ASTM D 1557, Method B, C, or D. A mechanical tamper may be used, provided the results are correlated with those obtained by the referenced hand tamper. Field in-place density shall be determined in accordance with ASTM D 1556, ASTM D 2167, or ASTM D 2922. When ASTM D 2922 is used, the calibration curves shall be checked and adjusted using only the sand cone method as described in paragraph "Calibration" of ASTM D 2922. ASTM D 2922 results in a wet unit weight of soil and when using this method, ASTM D 3017 shall be used to determine the moisture content of the soil. The calibration curves furnished with the moisture gages shall be checked along with density calibration checks as described in ASTM D 3017. The calibration checks of both the density and moisture gages shall be made at the beginning of a job, on each different type of material encountered, at intervals as directed by the Contracting Officer. If ASTM D 2922 is used for field density control, there should be at least one test performed according to ASTM D 1556 per every ten tests performed according to ASTM D 2922 for correlation of test results. Copies of calibration curves and results of calibration tests shall be furnished to the Contracting Officer within 24 hours of conclusion of the tests. Trenches improperly compacted shall be reopened to the depth directed, then refilled and compacted to the density specified at no additional cost to the Government.

7. PAVEMENT AND WALK REMOVAL AND REPLACEMENT. Not used.

ZERO ACCIDENTS

SECTION 02222 GABION MATTRESSES

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| 1. SCOPE | 3. MATERIALS |
| 2. GENERAL | 4. INSTALLATION |

1. SCOPE.

1.1 Contractor shall furnish and place gabion mattresses at the locations indicated on the drawings.

1.2 Gabions shall be manufactured in such a manner that their sides, ends, lid and partition panels can be assembled to form rectangular units of the specified dimensions, and as shown.

1.3 Gabions shall be of a single unit construction. Front, base, back and lid shall be woven into a single unit. Ends and partition panels shall be factory connected to the base.

2. GENERAL.

2.1 Gabion mattress shall conform to the following typical dimensions 6'W x 9'to 12'L x 12" thick. Partition panels shall be spaced no greater than 3 feet apart.

2.2 Mesh openings shall be hexagonal in shape with 2 1/2" x 3 1/4" nominal mesh.

2.3 Mesh joints shall be flexible and triple twisted to prevent unravelling.

2.4 All perimeter edges of the mesh forming the gabion shall be securely selvaged so that the joints obtained have at least the same strength as the wire mesh itself.

2.5 All dimensions are subject to tolerance limit of $\pm 3\%$ or manufacturer's specified sizes.

3. MATERIALS.

3.1 Galvanized steel wire shall be in accordance with the following.

3.1.1 Mesh Wire. The diameter of the steel wire mesh shall be U.S. Steel Wire Gage No. 11 after galvanization.

3.1.2 Selvedge Wire. The diameter of the selvedge wire, running through all the edges (perimeter wire), shall be U.S. Steel Wire Gage No. 10 after galvanization.

3.1.3 Lacing Wire. The diameter of the wire, necessary for assembling and lacing the gabion units, shall be U.S. Steel Wire Gage No. 13 after galvanization.

3.2 All wire gauges are subject to a tolerance of $\pm 2.50\%$ of the manufacturer's stated specifications.

3.3 Tensile strength of all wire used for manufacturing gabion mattresses and lacing wire shall range from 60,000 to 85,000 psi in accordance with Federal Specifications (QQ-W-461g, Class 3).

3.4 Load Test and Elongation Test shall be conducted in accordance with Federal Specifications (QQ-W-461g, Class 3).

3.5 Steel wire used shall be galvanized having a minimum amount of zinc coating of 0.80 oz/sq.ft. of wire, complying with Federal Specification (QQ-W-461g, Class 3).

4. INSTALLATION.

4.1 GABION MATTRESS ASSEMBLY.

4.1.1 Gabions shall be supplied folded flat, ties in pairs and packed in bundles. Single gabions shall be removed from the bundle, unfolded flat on the ground and all kinks and bends flattened.

4.1.2 Contractor shall assemble each gabion unit individually by erecting the sides (front and back), ends and partition panels ensuring that all creases are in the correct position and the tops of all sides level.

4.1.3 The Contractor shall lace the four corners of the gabion unit first, followed by the edges or internal partition panels to the sides.

4.1.4 The lacing procedure consists of cutting a length of lacing wire (approximately 1-1/2 times the distance to be laced - not to exceed five feet). Secure the wire terminal at the corner by looping and twisting, then proceed to lace with alternating single and double loops at approximately five inch intervals. Securely fasten the other lacing wire terminal.

4.2 GABION MATTRESS INSTALLATION.

4.2.1 Assembled gabion units shall be carried to the job site and placed in their proper location. For structural integrity, all adjoining empty gabion mattresses shall be laced along the perimeter of their contact surfaces in order to obtain a monolithic mattress.

4.2.2 While under tension, gabion joints shall be carefully controlled against possible unravelling.

4.2.3 Gabion mattresses shall be filled with clean, hard, durable field or cobble stone, four to eight inches in size, or as approved by the Contracting Officer. Stones shall be free from soft rock, debris and soil.

4.2.4 Care shall be taken when placing fill material to assure that the sheathing on gabion mattresses will not be broken or damaged.

4.2.5 The cells in any row shall be filled in stages so that local deformation may be avoided.

4.2.6 Along all exposed gabion faces, the outer layer of stone shall be carefully placed and packed by hand, in order to ensure proper alignment and a neat, compact, square appearance.

4.2.7 The last layer of stone shall be leveled with the top of the gabion to allow proper closing of the lid and provide an even surface.

4.2.8 Well packed filling without undue bulging, and secure lacing, is essential in all structures.

4.2.9 Lids shall be stretched tight over the filling, using bars or lid closing tools, until the lid meets the perimeter edges or front and end panels.

4.2.10 Lids shall then be tightly laced along all edges, ends and diaphragm(s) in the same manner as described hereinbefore for assembling.

4.2.11 Where shown on the Drawings or otherwise directed by the Contracting Officer, gabion mesh shall be cut, folded and wired together to suit existing site conditions. Mesh must be cleanly cut and surplus mesh cut out completely, or folded back and neatly wired to an adjacent gabion face. Cut edges of mesh shall be securely laced together with lacing wire in the manner described above for assembling.

ZERO ACCIDENTS

SECTION 02223
RIPRAP AND BEDDING MATERIAL

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| 1. SCOPE | 3. DELIVERY, STORAGE AND HANDLING |
| 2. SUBMITTALS | 4. MATERIALS |

1. **SCOPE.** CONTRACTOR shall furnish all labor, equipment and materials necessary to place a protective covering of well-graded stone on drainage channels indicated on the drawings.

2. **SUBMITTALS.**

2.1. CATEGORY I. None.

2.2. CATEGORY II. Certificates of Compliance.

3. **DELIVERY, STORAGE AND HANDLING.** All aggregates shall be delivered and stored in such a manner and location to prevent contamination with sediment or debris. Stockpiles shall be clear of construction activities and contaminated materials handling areas.

4. **MATERIALS.**

4.1. Riprap shall consist of stones shaped as nearly as practicable in the form of right angular prism. Riprap shall have a d_{50} value of 3-inches, and shall conform to the following gradation requirements:

<u>Stone Size</u>	<u>Percent Lighter by Weight</u>
5 inches	100
3 inches	35 - 55
Smaller than No. 10 Sieve	0 - 10

4.2. The gradation of materials furnished for use as riprap will be accepted or rejected based on a visual examination of the material by the Contracting Engineer. Material shall contain less than 20 percent of stones with a ratio of maximum-to-minimum dimension greater than three, and a sufficient amount of stones smaller than the average stone size to fill the spaces between the larger stones.

Gradation for a 12" riprap layer is:

d_{100}	10 - 26 lbs
d_{50}	5 - 11 lbs
d_{15}	2 - 5 lbs

4.3. Bedding material shall consist of crushed gravel or stone and shall conform to the following gradation requirements:

<u>Sieve Size</u>	<u>Percent of Total by Weight</u>
2 inch	100
1/4 inch	25 - 60
No. 40	5 - 40
No. 200	0 - 10

4.4. A woven geotextile shall be placed under the bedding material and riprap. See SECTION: GEOTEXTILES USED AS FILTERS for material specifications.

5. PLACING

5.1. Minimum total thickness of the riprap layer shall be nine inches (9") and the minimum total thickness of the bedding layer shall be three inches (3").

5.2. The stones shall be placed so that the weight of the stone is carried by the underlying material and not by the adjacent stones. On slopes, the largest of stones shall be at the bottom. Riprap shall be of proper size to form a compact solid blanket to protect the slopes.

5.3. The ground surface on which the stone riprap is to be placed shall be free of brush, trees, stumps, and other objectionable material and shall be dressed to a smooth surface. All soft or spongy material shall be removed to the depth specified or as directed by the Contract Officer and replaced with select granular fill material and compacted in an approved manner.

5.4. Where soft or spongy material exists, it shall be removed to a depth of six inches (6") and replaced with bedding material. The bedding material shall be placed upon the prepared area to a minimum depth of six inches (6") using methods which will not cause segregation of the particle sizes. Bedding material shall be select granular fill as specified under Section 2D5. Bedding material that has become contaminated by natural soils or other materials shall be removed and replaced with uncontaminated bedding material at the Contractor's expense.

5.5. Geotextile underlayment shall be installed and anchored in accordance with manufacturer's recommendations.

5.6. Riprap shall be placed in a manner that will produce a reasonably well-graded mass of stone with smaller stone fragments filling the space between the larger ones, so as to result in the minimum practicable percentage of voids.

5.7. Riprap placed shall be in conformance with the lines, grades, and thicknesses shown on the plans.

5.8. Riprap used for bank or channel protection shall be placed to its full course thickness in one operation, unless other wise directed by the Contract Officer, and in such manner that the underlying material will not be displaced or worked into the layer of stone filling.

5.9. Placement of stone upon firm subgrade or finished bedding material shall be carefully controlled to avoid disruption and damage to the layer of bedding material.

5.10. The stone shall be so placed and distributed that there will be no pockets of uniform size material.

5.11. The desired distribution of the various sizes of stone throughout the mass shall be obtained by selective loading of the material at the quarry or

other source; by controlled dumping of successive loads during the final placing; or by other methods of placement which will produce the specified results.

5.12. Rearranging of individual stones by mechanical equipment or by hand will be required to the extent necessary to secure the specified results.

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